

Vanderbilt University Graduate School

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VANDERBILT

Archived 2019/2020
Graduate School Catalog





Graduate School Catalog

Vanderbilt
University
2019/2020

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Containing general information
and courses of study for the
2019/2020 session corrected
to 20 June 2019 Nashville

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The university reserves the right, through its established procedures, to modify the requirements for admission and graduation and to change other rules, regulations, and provisions, including those stated in this catalog and other publications, and to refuse admission to any student, or to require the withdrawal of a student if it is determined to be in the interest of the student or the university. All students, full- or part-time, who are enrolled in Vanderbilt courses are subject to the same policies. Policies concerning noncurricular matters and concerning withdrawal for medical or emotional reasons can be found in the *Student Handbook*, which is on the Vanderbilt website at vanderbilt.edu/student_handbook.

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Graduate School Calendar 2019/2020

FALL SEMESTER 2019

Classes begin / Wednesday 21 August

Last day to withdraw from courses without academic penalty / Friday 18 October

Fall break (classes do not meet) / Thursday 24 October–Friday 25 October

Last day to submit Intent to Graduate forms for December graduation / Friday 1 November

Final day for submission of theses and dissertations to the Graduate School for graduation in December / Monday 18 November

Thanksgiving holidays / Saturday 23 November–Sunday 1 December

Fall classes end / Thursday 5 December

Fall semester ends / Saturday 14 December

SPRING SEMESTER 2020

Classes begin / Monday 6 January

Last day to submit Intent to Graduate forms for May graduation / Friday 28 February

Spring holidays (classes do not meet) / Saturday 29 February–Sunday 8 March

Last day to withdraw from courses without academic penalty / Friday 13 March

Final day for submission of theses and dissertations to the Graduate School for graduation in May / Tuesday 24 March

Spring classes end / Monday 20 April

Commencement / Friday 8 May

SUMMER SESSION 2020

Last day to submit Intent to Graduate forms for August graduation / Friday 12 June

Final day for submission of theses and dissertations to the Graduate School for graduation in August / Friday 17 July

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Graduate Study at Vanderbilt

GRADUATE education has held a central place in the program of Vanderbilt University since it opened in 1875. The first doctor of philosophy degree was granted in 1879; the 2,000th in 1975, the university's centennial year. The 3,000th was given in 1985. As of 2018, more than 8,000 doctor of philosophy degrees have been awarded. By way of comparison, the first Ph.D. given by an American university was awarded in 1861, and the second American institution to offer the degree did so in 1870.

A separate Graduate School was established at Vanderbilt in 1935 by action of the Board of Trust, with an official faculty selected from various schools of the university. Selection is based on the individual faculty member's administrative responsibility or substantial participation in graduate instruction.

Vanderbilt offers to able and serious students a faculty that is active in research and deeply committed to the development of scholars. Students participate in classroom, tutorial, and collegial modes of learning and in systematic independent inquiry, in a setting that allows them to see scholars at work, day in and day out, as an important means of learning the scholar's art. Students are in situations in which they are known personally and well, and concern for what happens to them is very strong.

Vanderbilt is a member of the Association of American Universities, a sixty-two-member organization of research-intensive universities. The doctor of philosophy especially, but also the master of arts and master of science, are research degrees, offered by a faculty of research scholars.

The objectives of the Graduate School are to train scholars and to promote research. The faculty seeks to provide every student with thorough knowledge of a particular field and a mastery of the methods of productive scholarship. Wherever feasible, the faculty intends to provide opportunity for all Ph.D. candidates to have supervised teaching experiences.

The Graduate School enrolls about 2,100 students. About 50 percent are women, and 29 percent are international students. The Graduate School is located in Alumni Hall on campus.

The University

Commodore Cornelius Vanderbilt, who gave a million dollars to build and endow Vanderbilt University in 1873, expressed the wish that it "contribute . . . to strengthening the ties which should exist between all geographical sections of our common country."

A little more than a hundred years later, the Vanderbilt Board of Trust adopted the following mission statement: "We reaffirm our belief in the unique and special contributions that Vanderbilt can make toward meeting the nation's requirements for scholarly teaching, training, investigation, and service, and we reaffirm our conviction that to fulfill its inherited responsibilities, Vanderbilt must relentlessly pursue a lasting future and seek highest quality in its educational undertakings."

Today as Vanderbilt pursues its mission, the university more than fulfills the Commodore's hope. It is one of a few independent universities with both a quality undergraduate program and a full range of graduate and professional programs. It has a strong faculty of more than 4,200 full-time members and a diverse student body of more than 12,800.

Students from many regions, backgrounds, and disciplines come together for multidisciplinary study and research.

The 334-acre campus is about one and one-half miles from the downtown business district of the city of Nashville, combining the advantages of an urban location with a peaceful, parklike setting of broad lawns, shaded paths, and quiet plazas.

The schools of the university offer the following degrees:

College of Arts and Science. Bachelor of Arts.

Blair School of Music. Bachelor of Music, Bachelor of Musical Arts.

Divinity School. Master of Divinity, Master of Theological Studies, Master of Theology.

School of Engineering. Bachelor of Engineering, Bachelor of Science, Master of Engineering.

Graduate School. Master of Arts, Master of Fine Arts, Master of Liberal Arts and Science, Master of Science, Doctor of Philosophy.

Law School. Master of Laws, Doctor of Jurisprudence.

School of Medicine. Master of Education of the Deaf, Master of Genetic Counseling, Master of Public Health, Master of Science in Clinical Investigation, Master of Laboratory Investigation, Master of Science in Medical Physics, Master of Science (Applied Clinical Informatics, Speech-Language Pathology), Doctor of Audiology, Doctor of Medical Physics, Doctor of Medicine.

School of Nursing. Master of Science in Nursing, Doctor of Nursing Practice.

Owen Graduate School of Management. Master of Accountancy, Master of Business Administration, Master of Management in Health Care, Master of Marketing, Master of Science in Finance.

Peabody College. Bachelor of Science, Master of Education, Master of Public Policy, Doctor of Education.

Mission, Goals, and Values

Vanderbilt University is a center for scholarly research, informed and creative teaching, and service to the community and society at large. Vanderbilt will uphold the highest standards and be a leader in the

- quest for new knowledge through scholarship,
- dissemination of knowledge through teaching and outreach,
- creative experimentation of ideas and concepts.

In pursuit of these goals, Vanderbilt values most highly

- intellectual freedom that supports open inquiry,
- equality, compassion, and excellence in all endeavors.

Accreditation

Vanderbilt University is accredited by the Southern Association of Colleges and Schools Commission on Colleges to award bachelor's, master's, professional, and doctoral degrees. Contact the Southern Association of Colleges and Schools Commission on Colleges at 1866 Southern Lane, Decatur, Georgia 30033-4097, call (404) 679-4500, or visit sacscoc.org for questions about the accreditation of Vanderbilt University.

Please contact the commission only in relation to Vanderbilt's noncompliance with accreditation requirements. Normal inquiries about admission requirements, educational programs, and financial aid should be directed to the university.

University Courses

By tackling pressing real-world problems and addressing big questions, University Courses educate the whole student and promote lifelong learning. The courses leverage the natural synergies across Vanderbilt's ten schools and colleges, giving students the opportunity to reach beyond their area of study and interact with faculty at the intersection of disciplines. Each course promotes transinstitutional learning while providing opportunities to embrace diverse perspectives. For more information, visit vu.edu/university-courses.

Equity, Diversity, and Inclusion

Excellence at Vanderbilt is inextricably tied to the university's commitment to fostering an inclusive community where people of all identities, backgrounds, and perspectives can thrive. The Vice Provost for Strategic Initiatives and the Vice Chancellor for Equity, Diversity and Inclusion and Chief Diversity Officer work in partnership with students, faculty, and staff to identify and implement best practices that advance equity, diversity, and inclusion across campus in pursuit of building and supporting an inclusive community enriched by a broad variety of experiences and knowledge. Visit vanderbilt.edu/diversity for more information.

Facilities

Alumni Hall is home for the Graduate School, and newly renovated space on the first floor is designed to be a robust hub for student life within the Graduate School community. This inviting space provides opportunities for graduate students not only to study and socialize, but also to explore potential collaborations across diverse disciplines.

Vanderbilt has many special facilities for study and research in particular areas, as well as the traditional classroom and laboratory facilities associated with graduate instruction.

Graduate instruction in the humanities, the biological sciences, and the social sciences is conducted in Benson, Buttrick, Calhoun, Furman, Garland, and Wilson halls. Graduate work in religion uses the full facilities of Vanderbilt Divinity School. The E. Bronson Ingram Studio Arts Center, opened in fall 2005, has studios for sculpture, ceramics, photography, computer arts, painting, and drawing. Gallery space is designated for exhibits primarily of students' work.

The Stevenson Center for the Natural Sciences, a complex of seven connected buildings, includes laboratory and lecture facilities for biological sciences, chemistry, geology, mathematics, and physics.

Classrooms and laboratories of Peabody College are used for graduate instruction in education and psychology and human development.

Laboratories for the biomedical sciences—biochemistry, bioinformatics, cancer biology, cell and developmental biology, cellular and molecular pathology, microbiology and immunology, molecular physiology and biophysics, and pharmacology—are in the Vanderbilt University Medical Center in Medical Center North, Light Hall, Preston Research Building, Robinson Research Building, and Medical Research Building IV. The A. B. Learned Laboratories and Medical Research Building III provide additional facilities for biological sciences.

Graduate students in neuroscience use facilities across campus with a home in the Vanderbilt Brain Institute.

Graduate work in engineering uses the laboratories of the School of Engineering, including those in the Olin Hall of Engineering, Featheringill Hall, Jacobs Hall, the Stevenson Center, and the new Engineering and Science Building.

The facilities of Owen Graduate School of Management are used for graduate study in management. Graduate students in nursing science use the facilities of Godchaux and Frist Halls, and those in hearing and speech sciences use classrooms and laboratories in the Vanderbilt Bill Wilkerson Center.

The Jean and Alexander Heard Libraries

The Jean and Alexander Heard Libraries system at Vanderbilt University houses nearly five million items and provides access to millions more resources through its nine campus libraries: Central Library (A&S); Peabody Library; Annette and Irwin Eskind Family Biomedical Library and Learning Center; Walker Management Library; Wilson Music Library; Massey Law Library; Stevenson Science and Engineering Library; the Divinity Library; and the Special Collections Library. These libraries share an online presence that provides access to an integrated catalog of print and e-resources, as well as information about library services, workshops, programs, exhibitions, research guides, and librarian subject specialists.

Library staff teach students to be information literate and help them develop research skills in an increasingly complex information environment. Students can connect with a librarian in person or ask questions through the library website. Library spaces across campus offer quiet individual study spaces, group study, and instructional rooms, as well as learning commons and cafes. Faculty- and student-curated exhibitions throughout the libraries offer intellectual and creative insights that encourage students to think critically and see their own work in new ways. Students, faculty, and staff come to the library to read in a cozy nook, meet friends for group study, grab a quick meal, or attend an author's talk. Even if you are off campus, digital library resources are at your fingertips via your phone, laptop, or computer.

The oldest items in the library date from ca. 2500 BCE, and new publications are being added every day. Among the collection strengths are: Latin American history, politics, and culture; the History of Medicine Collections; the W. T. Bandy Center for Baudelaire and Modern French Studies; the Southern Literature and Culture Collections; the United States Playing Card Collection; and the Vanderbilt Television News Archive, the world's most extensive archive of television news covering 1968 to present. The libraries are also involved in digital scholarship, publishing and partnering with faculty on the *Revised Common Lectionary*, one of the first published web-based resources of scriptural readings for the liturgical year, *Ecclesiastical and Secular Sources for Slave Societies*, a digital preservation program for endangered documents related to slave societies, the *Global Music Archive*, a multimedia archive for traditional and popular song, music, and dance of Africa and the Americas, and *Syriaca*, a digital project for the study of Syriac literature, culture, and history.

Get to know your libraries and your librarians early in your career at Vanderbilt. They have the information you need—and can help you transform that information into knowledge, creativity, and success.

Information Technology

Vanderbilt University Information Technology (VUIT) offers voice, video, data, computing, and conferencing services to Vanderbilt students, faculty, and staff. VUIT provides free antivirus downloads and malware prevention in many campus areas.

VUIT maintains and supports VUNet, the campuswide data network that provides access to the internet, and AccessVU, the authentication service that enables Vanderbilt users to securely identify themselves to many services on VUNet. Those services include YES (Your Enrollment Services), Brightspace, and Vmail, the university's email system for faculty, staff, and graduate students.

VUIT also partners with Sprint, Verizon, and AT&T to offer discounts for cellular phone service. For discount information see it.vanderbilt.edu/cellphone.

It is important to note that many wireless consumer electronic devices interfere with VUNet, and in worst-case circumstances, could even cause degradation to network service. These devices are prohibited and include, but are not limited to, routers, access points (APs), or AirPorts manufactured by companies such as Apple, Belkin, D-Link, and Linksys. Additionally, settings for smartphone hotspots and wireless connectivity for printers and other devices must be disabled to prevent interference with university wireless APs.

Vanderbilt offers all students low-cost and free-of-charge software, including Microsoft Office and Microsoft Windows. See softwarestore.vanderbilt.edu for a complete product catalog and more information.

Furthermore, VUIT provides various conferencing and collaboration services for students, including audio and video conferencing via a desktop or a Polycom bridge. Vanderbilt's blog service offers WordPress Blogs at my.vanderbilt.edu. See it.vanderbilt.edu/services/collaboration for more information.

The Tech Hub is the help desk at Vanderbilt that provides information to students, faculty, and staff about VUNet and VUNet services. Its locations, hours, contacts, and other information can be found at it.vanderbilt.edu/techhub.

For more information on IT services and computing at Vanderbilt, go to it.vanderbilt.edu.

Official University Communications

Certain federal statutes require that information be delivered to each student. Vanderbilt delivers much of this information via email. Official electronic notifications, including those required by statutes, those required by university policy, and instructions from university officials, will be sent to students' Vanderbilt email addresses: user.name@vanderbilt.edu. Students are required to be familiar with the contents of official university notifications, and to respond to instructions and other official correspondence requiring a response. Some messages will include links to the YES Communications Tool, which is a secure channel for official communication of a confidential nature.

The university makes every effort to avoid inundating students with nonessential email (often called "spam"), and maintains separate lists from which students may unsubscribe for announcements of general interest.

Interdisciplinary Centers, Institutes, and Research Groups

Vanderbilt's many centers and institutes bring together faculty from a broad range of disciplines to conduct cutting-edge research, address major challenges, and meet important societal needs. Below is a sampling of Vanderbilt's interdisciplinary initiatives. For more information, see research.vanderbilt.edu/researchadministration/centers-and-institutes-at-vanderbilt.

The Center for Integrative and Cognitive Neuroscience investigates the relationship between brain function, behavior, and cognition, and promotes the development of new technologies like advanced prosthetics and autonomous robots. cicn.vanderbilt.edu

The Center for Latin American Studies works to advance knowledge about and understanding of the region's history, culture, political economy, and social organization. as.vanderbilt.edu/clas

The Center for Medicine, Health, and Society studies the social and societal dimensions of health and illness. Scholarship, teaching, and wide-ranging collaborative projects explore medicine and science in a wide array of cultural contexts, while at the same time fostering productive dialogue across disciplinary boundaries. vanderbilt.edu/mhs

The Frist Center for Autism and Innovation at Vanderbilt University School of Engineering brings engineers, business scholars, and disabilities researchers together with experts in neuroscience and education to understand, maximize, and promote neurodiverse talent and to respond to opportunities for innovation in technology and in workplace practices. With engagement across academia, government, business, and nonprofit organizations, as well as the clinical, vocational, and self-advocacy domains, the center works to build a true community-based approach that improves lives, organizations, and society. my.vanderbilt.edu/autismandinnovation

The Max Kade Center for European and German Studies fosters an international perspective on issues relating to Europe and transatlantic relations and seeks to prepare students for international careers or advanced study. as.vanderbilt.edu/europeanstudies

The National Center on School Choice conducts scientific, comprehensive, and timely studies on school choice to inform policy and practice. peabody.vanderbilt.edu/research/pro/about_peabody_research/funded_projects

The Robert Penn Warren Center for the Humanities promotes interdisciplinary research and study in the humanities, social sciences, and natural sciences. Members of the Vanderbilt community representing a wide variety of specializations take part in the center's programs, which are designed to intensify and increase interdisciplinary discussion of academic, social, and cultural issues. vanderbilt.edu/rpw_center

The Vanderbilt Brain Institute promotes and facilitates the discovery efforts of Vanderbilt neuroscientists, the training of undergraduate and graduate students, and the coordination of public outreach in brain sciences. Research endeavors in the VBI include more than five hundred faculty, students, and staff from departments, centers, and institutes across campus who engage in neuroscience-directed research, training, and clinical service. medschool.vanderbilt.edu/brain-institute

The Vanderbilt Institute for Surgery and Engineering creates, develops, implements, and evaluates solutions to complex interventional problems. Physicians, engineers, and computer scientists work together to improve patient care with surgical innovation through engineering. Central to the mission of the institute is the translation of methods, techniques, and devices from the laboratory to the patient. vanderbilt.edu/visc

The Vanderbilt Institute for Energy and Environment elucidates the relationships among individual, institutional, and societal choices for energy production and use, and the impacts and benefits of these choices on the environment and health through links with climate, water quality, economics, social psychology, and natural resources. A crucial part of its mission is to

train the next generation of leaders in the energy and environmental arena. vanderbilt.edu/vie

The Vanderbilt Institute for Global Health builds capacity through interdisciplinary global health education and training programs, conducts implementation science and research, and provides technical assistance service to government and civil sector organizations in other countries. As a leader in international education and research, VIGH seeks to improve health and well-being of people living in low-resource settings. vumc.org/global-health

The Vanderbilt Institute for Integrative Biosystems Research and Education fosters and enhances interdisciplinary research in the biophysical sciences and bioengineering at Vanderbilt, integrated with a strong focus on undergraduate, graduate, and postdoctoral education. VIIBRE's mission is to invent the tools and develop the skills that are required to understand biological systems across spatiotemporal scales. vanderbilt.edu/viibre

The Vanderbilt Institute of Chemical Biology provides research and training in the application of chemical approaches to the solution of important biomedical problems, harnessing the power of chemistry to improve human health. vanderbilt.edu/vicb

The Vanderbilt Institute of Nanoscale Science and Engineering engages in theoretical and experimental research in science and engineering at the nanoscale (from one millionth to one billionth of a meter in size). VINSE supports an extensive infrastructure of materials fabrication and analytical facilities for research in nanoscale science and engineering. vanderbilt.edu/vinse

The Vanderbilt Kennedy Center for Research on Human Development facilitates discoveries and best practices that make positive differences in the lives of persons with disabilities and their families through research, training, services, and dissemination. Nationally, it is among fourteen Eunice Kennedy Shriver Intellectual and Developmental Disabilities Research Centers, sixty-seven national University Centers for Excellence in Developmental Disabilities, fifty-two Leadership Education in Neurodevelopmental Disabilities training programs, and includes the Treatment and Research Institute for Autism Spectrum Disorders. Research, practice, and clinical experiences are available to trainees. vkc.vumc.org/vkc

The Vanderbilt University Institute of Imaging Science aims to support and integrate advances in physics, engineering, chemistry, computing, and other basic sciences for the development and application of new and enhanced imaging techniques to address problems and stimulate new research directions in biology and medicine, in health and disease. vuiis.vumc.org

The Wond'ry supports immersive experiences for students and interdisciplinary projects for faculty—from all schools and colleges—who are interested in innovation and entrepreneurship. In addition to connecting various resources across the university, the center serves as a common space for students to develop and test ideas alongside their peers with mentorship from faculty, alumni, corporate partners, the Nashville entrepreneurial community, and beyond. Programming, seminars, and workshops help students from all disciplines grow their ventures at any stage of development. vanderbilt.edu/thewondry

Other initiatives include:

- Advanced Computing Center for Research and Education
- Bill Wilkerson Center for Otolaryngology and Communication Studies
- Center for Biomedical Ethics and Society
- Center for Bone Biology
- Center for Cognitive Medicine
- Center for Constructive Approximation
- Center for Entrepreneurship
- Center for Environmental Management Studies
- Center for Experiential Learning and Assessment
- Center for Health Services Research
- Center for Healthcare Market Innovation
- Center for Innovative Technology

- Center for Intelligent Mechatronics and Biomechanics and Assistive Technology Laboratory
- Center for Matrix Biology
- Center for Neuroscience Drug Discovery
- Center for Noncommutative Geometry and Operator Algebras
- Center for Research on Men's Health
- Center for Science Outreach
- Center for Structural Biology
- Center for the Digital Humanities
- Center for the Study of Democratic Institutions
- Center on the Social and Emotional Foundations of Early Learning
- Clinical Research Center (Vanderbilt Institute for Clinical and Translational Research)
- Diabetes Research and Training Center
- Digestive Disease Research Center
- Epithelial Biology Center
- Financial Markets Research Center
- Institute for Medicine and Public Health
- Institute for Software Integrated Systems
- Institute for Space and Defense Electronics
- IRIS Center
- John A. Oates Institute for Experimental Therapeutics
- Lamb Center for Pediatric Research
- Mass Spectrometry Research Center
- Multiscale Modeling and Simulation Center
- National Center on Performance Incentives
- National Center on Scaling Up Effective Schools
- Peabody Research Institute
- Skin Diseases Research Core Center
- Tennessee Center for AIDS Research
- The Curb Center for Art, Enterprise, and Public Policy
- The Frist Center for Autism and Innovation
- Turner Family Center for Social Ventures
- Vanderbilt Biophotonics Center
- Vanderbilt Breast Center
- Vanderbilt Center for Addiction Research
- Vanderbilt Center for Child Development
- Vanderbilt Center for Human Nutrition
- Vanderbilt Center for Immunobiology
- Vanderbilt Center for Kidney Disease
- Vanderbilt Center for Knowledge Management
- Vanderbilt Center for Precision Medicine
- Vanderbilt Center for Quantitative Sciences
- Vanderbilt Center for Research and Innovation in Systems Safety
- Vanderbilt Center for Space Physiology and Medicine
- Vanderbilt Center for Stem Cell Biology
- Vanderbilt Center for Transportation and Operational Resiliency
- Vanderbilt Clinical Trials Center
- Vanderbilt Data Science Institute
- Vanderbilt Epidemiology Center
- Vanderbilt Eye Institute
- Vanderbilt Genetics Institute
- Vanderbilt George O'Brien Renal Center
- Vanderbilt Heart Institute
- Vanderbilt Institute of Infection, Immunology, and Inflammation
- Vanderbilt Mouse Metabolic Phenotyping Center
- Vanderbilt Quantitative Systems Biology Center
- Vanderbilt Sleep Center
- Vanderbilt Transplant Center
- Vanderbilt Tuberculosis Center
- Vanderbilt Vaccine Center
- Vanderbilt Vision Research Center
- Vanderbilt-Ingram Cancer Center
- W. T. Bandy Center for Baudelaire and Modern French Studies

Life at Vanderbilt

VANDERBILT provides a full complement of auxiliary services to meet the personal needs of students, to make life on the campus comfortable and enjoyable, and to provide the proper setting for academic endeavor.

Graduate School Resources

Russell G. Hamilton Graduate Leadership Development Institute

As part of the Graduate School's mission to train the next generation of leaders, the Russell G. Hamilton Graduate Leadership Development Institute (GLDI) offers training to graduate students to broaden their academic and professional skills. Through funding opportunities, seminars, and workshops, the GLDI provides students with a greater understanding of critical leadership skills, including interpersonal dynamics, operations and management, resilience, teamwork, strategic and innovative problem solving, ethics, and communications, creating a skill set students can use in their time at Vanderbilt and beyond. Through these activities the GLDI fosters connections between the graduate student population, the greater Nashville community, and the robust network of Vanderbilt alumni.

Career Development for Graduate School Students

Students with graduate degrees enter careers in a wide variety of sectors: government, business/industry, nonprofit, and academic. The Graduate School Career Development Office supports students' successful transitions from degree to career, in the form of individual advising, workshops, seminars, and web-based resources. Topics range from creating an effective CV/resume, to interviewing skills, to establishing professional connections: my.vanderbilt.edu/gradcareer. From a student's first year in a graduate program through their last, these resources will help students explore and prepare for their future career.

For Ph.D.'s in the biomedical disciplines, the Office of Biomedical Research Education and Training (BRET) offers similar career services medschool.vanderbilt.edu/career-development. Additional resources for particular career interests are available through a campus partnership with the Vanderbilt Career Center.

Graduate Life Coach

Graduate students often face challenges during their time at Vanderbilt. The Graduate Life Coach supports graduate students through individual coaching and group programming around effective time and stress management, resilience, conflict resolution, navigating academic relationships, and juggling work/life responsibilities.

The Graduate Life Coach works in collaboration with the Student Care Network and can connect students to appropriate resources that best meet their needs. For additional information on Graduate Life Coach services, visit gradschool.vanderbilt.edu/gradlife.

Graduate Student Council

The Graduate Student Council promotes the general welfare and concerns of the Graduate School student body. This is achieved through creating new programs to provide opportunities for growth and interaction, as well as through communication with the Vanderbilt faculty and administration on behalf of graduate students. The GSC consists of elected representatives from each Graduate School department, committees, and an annually elected executive board. In the recent past, the GSC has helped change policies involving space allocation for teaching assistants, stipend reviews, parking, student health insurance, mental health initiatives, and allocation of student service fees. The GSC is also a member of the National Association of Graduate-Professional Students.

In addition to its representative function, the GSC organizes, hosts, and sponsors events and projects during the year, including seminars and panels with individual departments, the Vanderbilt 3 Minute Thesis competition, the Graduate Student Honor Council, community outreach activities, and social opportunities. The GSC also awards travel grants to graduate students who wish to present their research at conferences throughout the year. All Vanderbilt Graduate School students are welcome and encouraged to attend GSC's monthly meetings and to get involved. For more information, visit studentorg.vanderbilt.edu/gsc.

The Center for Teaching

The mission of the Center for Teaching is to promote university teaching that leads to meaningful student learning. The services of the center are available to all graduate students, including those teaching at Vanderbilt as teaching assistants (TAs) and instructors of record, as well as those who anticipate that teaching will be a part of their future careers.

Fall TA Orientation (TAO) introduces participants to teaching at Vanderbilt, focusing on the information and skills necessary to take on TA roles in the classroom. Workshops and practice teaching sessions are led by experienced graduate student teaching assistants.

The Certificate in College Teaching has been designed to assist graduate students who wish to develop and refine their teaching skills. The certificate focuses on the research on how people learn and best teaching practices, and supports the university's pursuit of excellence in teaching and learning. The certificate is ideal for graduate students whose goals are to become more effective educators and who want to prepare for future careers in higher education teaching.

The Blended and Online Learning Design (BOLD) Fellows Program helps graduate students partner with faculty members to design and develop online modules for integration into a course. The teams implement these modules in existing classes and investigate their impact on student learning.

The Certificate in Humanities Teaching & Learning is a program for humanities graduate students that comprises a sequential seminar and practicum in which participants explore humanistic pedagogies and teaching historically underrepresented populations.

The Graduate Teaching Fellows and Teaching Affiliates Program provides graduate students the opportunity to work

at the center, facilitating the programs offered to graduate students, consulting with TAs, and collaborating on teaching-related projects.

For more information and other services, please visit the Center for Teaching website at cft.vanderbilt.edu or call (615) 322-7290.

Other Campus Resources

Student Care Network

The Student Care Network is a holistic network of services and resources pertaining to health and wellness available to all Vanderbilt University students. Primary offices include the Office of Student Care Coordination, the University Counseling Center, the Student Health Center, and the Center for Student Wellbeing. Students also have access to a wide range of additional on-campus and community resources through the Student Care Network—from the David Williams II Student Recreation and Wellness Center to the Project Safe Center to a variety of community providers. To facilitate finding resources, students may refer to the Student Care Network website, or contact the Office of Student Care Coordination, vanderbilt.edu/studentcarenetwork.

Office of Student Care Coordination

The Office of Student Care Coordination is committed to supporting undergraduate, graduate, and professional students in successfully navigating life events related to academic stress and/or medical, mental health, and/or other personal concerns that may interfere with a student's ability to achieve their academic and personal goals. This team of "care coordinators" is the central and first point of contact for students to help identify needs and determine the most appropriate resources in Vanderbilt's Student Care Network and in the Nashville community to address concerns. Student Care Coordinators work collaboratively with students to develop a student success plan, share education about and facilitate connections to appropriate on- and off-campus resources, and provide accountability through supportive follow-up meetings. Our goal is for students to have the right support, in the right place, at the right time. In addition, the Office of Student Care Coordination coordinates support for students returning from medical leaves of absence. Though staff typically have a background in mental health services, it is important to understand that work with a Student Care Coordinator is not counseling or therapy.

Many students face challenges during their educational experiences and each situation is unique. The Office of Student Care Coordination is the first step to determine where to go for the most appropriate support for your needs. Students are encouraged to visit vanderbilt.edu/carecoordination to complete an initial assessment and schedule an appointment to meet with a Student Care Coordinator. Students may also call (615) 343-WELL (9355) or drop in to see a Student Care Coordinator, Monday–Friday, 8 a.m. to 5 p.m., Sarratt Student Center|Rand Hall, Suite 305

University Counseling Center

As a key component of the Vanderbilt Student Care Network, the UCC provides mental health assessment, support, and treatment for all students enrolled at Vanderbilt, including undergraduate, graduate, and professional students.

Highly skilled and multidisciplinary teams of professionals offer crisis intervention, substance abuse counseling, short-term individual counseling, group therapy, biofeedback, ADHD and learning disorder assessments, and psychiatric assessment and pharmacological treatment. Treatment plans are tailored to each individual's unique background and needs. UCC professionals support the university's mission of fostering inclusive excellence through cultural awareness and competence. In addition to regular hours and evening/weekend crisis response, the UCC offers various "Let's Talk" locations.

To access UCC services, visit vanderbilt.edu/ucc or the Office of Student Care Coordination's website at vanderbilt.edu/carecoordination or call the OSCC at (615) 343-WELL (9355). For immediate crisis support or to speak with someone at the UCC after business hours, call the UCC at (615) 322-2571.

Student Health Center

The Student Health Center provides primary care services for students and is staffed by physicians, nurse practitioners, nurses, and lab technicians. The Student Health Center provides services similar to those provided in a private physician's office or HMO, including routine medical care, specialty care (e.g. nutrition and sports medicine), and some routine lab tests. Most of the services students receive at the Student Health Center are pre-paid, but those services that are not are the responsibility of students to coordinate with their health insurance.

When the university is in session, during fall and spring semesters, the Student Health Center is open Monday through Friday from 8:00 a.m. to 4:30 p.m. Students should call ahead to schedule an appointment at (615) 322-2427 or online at vumc.org/student-health/online-appointments. Students with urgent problems will be seen on a same-day basis. They will be given an appointment that day, or "worked in" on a first-come, first-served basis, if no appointments are available.

Emergency consultation services are available from on-call professionals at (615) 322-2427 when the Student Health Center is closed. For more detailed information on the services available at the Student Health Center and information on other health-related topics, please visit the Student Health Center website at vumc.org/student-health.

Immunization Requirements

The State of Tennessee requires certain immunizations for all students on university campuses. As such, Vanderbilt University will block student registration for those who are not in compliance with the requirements.

The requirements include:

1. *Varicella vaccine (two injections)* is required for all students who have not had documented chickenpox history. Positive titer results are also accepted.
2. *Measles, mumps, and rubella (2 injections)* for all incoming students. Positive titer results are also accepted.

The Student Health Center requires all incoming students to complete a Health Questionnaire that includes further information regarding the state-mandated vaccinations, as well as information on other strongly recommended vaccinations.

Information regarding this Health Questionnaire is communicated to students by email after admission to Vanderbilt University. This Health Questionnaire must be returned to the Student Health Center by May 15 with vaccination information.

Students should go to vumc.org/student-health/immunization-requirements-new-students in order to access more

information regarding the immunization requirements and information on how to upload their documentation via the secure student health portal.

Student Health Insurance Plan

All students registered in degree programs for 4 or more credit hours, or who are actively enrolled in research courses (including but not limited to dissertation or thesis courses) that are designated by Vanderbilt University as full-time enrollment are required to have health insurance coverage. The university offers a sickness and injury insurance plan that is designed to provide hospital, surgical, and major medical benefits. A brochure explaining the limits, exclusions, and benefits of insurance coverage is available to students online at gallagherstudent.com/vanderbilt or vumc.org/student-health/student-health-insurance.

The annual premium is in addition to tuition and is automatically billed to the student's account. Coverage extends from August 12 until August 11 of the following year, whether a student remains in school or is away from the university.

A domestic student who does not want to subscribe to the insurance plan offered through the university must complete an online waiver process at gallagherstudent.com/vanderbilt. This process must be completed by August 1 for students enrolling in the fall for annual coverage. Newly enrolled students for the spring term must complete the online waiver process by January 1. The online waiver process indicating comparable coverage **must be completed every year by August 1** in order to waive participation in and the premium for the Student Injury and Sickness Insurance Plan.

Family Coverage: Students who want to obtain coverage for their families (spouse, children) may do so at gallagherstudent.com/vanderbilt. Additional premiums are charged for family health insurance coverage and cannot be put on a student's VU account.

International Student Coverage

International students and their dependents residing in the United States are required to purchase the university's international student injury and sickness insurance. This insurance is required for part-time as well as full-time students.

Center for Student Wellbeing

The Center for Student Wellbeing seeks to create a campus culture that supports students in cultivating lifelong wellbeing practices. The center offers individual coaching appointments to help students develop and maintain skills that will contribute to personal and academic success, and provides workshops on a variety of topics, including resiliency, time management, alcohol and other drug education, and healthy living. Students may use the center's meditation room for yoga, meditation, and mindfulness classes, or for self-guided practice. The center also works closely with many campus partners, including the University Counseling Center, the Student Health Center, the Office of Housing and Residential Experience, and the academic deans to provide resources and support for students who may be facing personal or academic challenges.

The Center for Student Wellbeing is centrally located on campus at 1211 Stevenson Center Lane, across from the Student Health Center, and is open Monday through Friday, 8:00 a.m. to 5:00 p.m. For more information, please call (615) 322-0480 or visit vanderbilt.edu/healthydores.

Project Safe Center

The Project Safe Center partners with students, faculty, and staff to create a campus culture that rejects sexual violence and serves as a resource for all members of the Vanderbilt community. The Project Safe Center provides support to survivors of intimate partner violence and engages the campus community in prevention of sexual assault, dating violence and domestic violence, and stalking.

Bystander intervention training, an online education module addressing sexual violence, and a variety of programs and presentations on consent, healthy relationships, and violence prevention are available through the Project Safe Center. A 24-hour support hotline answered by Project Safe's victim resource specialists is available at (615) 322-SAFE (7233).

The Project Safe Center located at 304 West Side Row is open Monday through Friday, 8:00 a.m. to 5:00 p.m. For more information, please call (615) 875-0660 or visit vanderbilt.edu/projectsafe.

Barnes & Noble at Vanderbilt

Barnes & Noble at Vanderbilt, the campus bookstore located at 2525 West End Avenue, offers textbooks (new, used, digital, and rental), computers, supplies, dorm accessories, licensed Vanderbilt merchandise, and best-selling books. The bookstore features extended hours of operation and hosts regular special events. Visitors to the bookstore café can enjoy Starbucks coffees, sandwiches, and desserts while studying. Free customer parking is available in the 2525 garage directly behind the bookstore. For more information, visit vubookstore.com, follow twitter.com/BN_Vanderbilt, find the bookstore on Facebook at facebook.com/VanderbiltBooks, or call (615) 343-2665.

The Commodore Card

The Commodore Card is the Vanderbilt student ID card. It can be used to access debit spending accounts, VU meal plans, and campus buildings such as residence halls, libraries, academic buildings, and the David Williams II Student Recreation and Wellness Center.

ID cards are issued at the Commodore Card Office, 184 Sarratt Student Center, Monday through Friday from 8:30 a.m. to 4:00 p.m. For more information, go to vanderbilt.edu/cardservices.

Eating on Campus

Vanderbilt Campus Dining operates several restaurants, cafés, and markets throughout campus that provide a variety of food. The two largest dining facilities are Rand Dining Center in Rand Hall (connected to Sarratt Student Center) and The Ingram Commons dining hall. E. Bronson Ingram College offers all-you-care-to-eat dining and is open to all Vanderbilt University students. Five convenience stores on campus offer grab-and-go meals, snacks, beverages, and groceries. The convenience stores located at Kissam Center and Highland Munchie offer hot and cold food bars which are open for breakfast, lunch, and dinner. All units accept the Commodore Card and meal plans. Graduate student meal plans are offered at a discount. For more information about meal plans, hours, and menus, please visit campusdining.vanderbilt.edu.

Housing

To support the housing needs of new and continuing graduate and professional students, the Office of Housing and Residential Experience provides a web-based off-campus referral service (offcampushousing.vanderbilt.edu). The referral service lists information about housing accommodations off campus. Cost, furnishings, and conditions vary greatly. For best choices, students seeking off-campus housing should consult the website as early as possible. The website includes listings by landlords looking specifically for Vanderbilt-affiliated tenants. Listings are searchable by cost, distance from campus, number of bedrooms, and other parameters. Students may also complete a profile to assist in finding a roommate. On-campus university housing for graduate or professional students is not available.

Change of Address

Students who change either their local or permanent mailing address are expected to notify the Office of the University Registrar immediately. Candidates for degrees who are not in residence should keep the school and the Office of the University Registrar informed of current mailing addresses. To change or update addresses, go to registrar.vanderbilt.edu/academic-records/change-of-address.php.

English Language Center

Students wishing to focus on improving their English language use for the context of the U.S. academic setting may take classes and participate in programming at the ELC to support their academic success. The ELC's courses include Academic Writing, Academic Speaking, Pronunciation, and International Teaching Assistant Communication. Throughout the academic year, academic workshops and one-to-one consultations for speaking and writing are also available through the ELC. The ELC is located at 1208 18th Avenue South. For more information, please visit vanderbilt.edu/elc.

International Student and Scholar Services

ISSS provides immigration advising and services, including the processing of immigration paperwork, to more than 1,952 international students and scholars. The office works with admission units, schools, and departments to generate documentation needed to bring nonimmigrant students and scholars to the U.S. Further, ISSS keeps abreast of the regulations pertaining to international students and scholars in accordance with the Departments of Homeland Security and State. ISSS advising staff are available to support students' and scholars' requests through email, phone calls, daily drop-in hours (1:30–3:30 p.m., Monday–Friday), and private appointments. ISSS puts a strong emphasis on providing employment workshops to inform international students about professional development and employment options while enrolled and after graduation. ISSS conducts regular workshops on Curricular Practical Training (CPT), Optional Practical Training (OPT), and Academic Training (AT). ISSS also supports more than 300 alumni international students who have already graduated and are either on OPT or AT work permission. For additional information on ISSS services, visit vanderbilt.edu/iss.

Obtaining Information about the University

Notice to current and prospective students: In compliance with applicable state and federal law, the following information about Vanderbilt University is available:

Institutional information about Vanderbilt University, including accreditation, academic programs, faculty, tuition, and other costs, is available in the catalogs of the colleges and schools on the Vanderbilt University website at vanderbilt.edu/catalogs.

Information about financial aid for students at Vanderbilt University, including federal and other forms of financial aid for students, is available from the Office of Student Financial Aid and Scholarships on the Vanderbilt University website at vanderbilt.edu/financialaid. The Office of Student Financial Aid and Scholarships is located at 2309 West End Avenue, Nashville, Tennessee 37240-7810, (615) 322-3591 or (800) 288-0204.

Information about graduation rates for students at Vanderbilt University is available on the Vanderbilt University website at virg.vanderbilt.edu. Select “Factbook,” then “Student,” then “Retention/Graduation Rates.” Paper copies of information about graduation rates may be obtained by writing the Office of the University Registrar, Vanderbilt University, PMB 407701, 110 21st Avenue South, Suite 110, Nashville, Tennessee 37240-7701 or by calling (615) 322-7701.

The Vanderbilt University Annual Security Report on university-wide security and safety, including related policies, procedures, and crime statistics, is available from the Vanderbilt University Police Department on the university website at police.vanderbilt.edu/pdfs/annual-security-report.pdf. A paper copy of the report may be obtained by writing the Vanderbilt University Police Department, 2800 Vanderbilt Place, Nashville, Tennessee 37212 or by calling (615) 343-9750. For more information, see “Vanderbilt University Police Department” in the following section of this catalog.

A copy of the annual Equity in Athletics Disclosure Act Report on the Vanderbilt University athletic program participation rates and financial support data may be obtained by writing the Vanderbilt University Office of Athletic Compliance, 2601 Jess Neely Drive, P.O. Box 120158, Nashville, Tennessee 37212 or by calling (615) 322-7992.

Information about your rights with respect to the privacy of your educational records under the Family Educational Rights and Privacy Act is available from the Office of the University Registrar on the Vanderbilt University website at registrar.vanderbilt.edu/ferpa. Paper copies of this information about educational records may be obtained by writing the Office of the University Registrar, Vanderbilt University, PMB 407701, 110 21st Avenue South, Suite 110, Nashville, Tennessee 37240-7701 or by calling (615) 322-7701. For more information, see “Confidentiality of Student Records” in the following section of this catalog.

The Writing Studio

The Writing Studio offers graduate students personal writing consultations, fifty-minute interactive discussions about writing. Trained writing consultants can act as sounding boards and guides for the development of arguments and the clarification of ideas. The focus of a consultation varies according to the individual writer and project. In addition to the standard fifty-minute consultations, the Writing Studio also offers dissertation writers the possibility of having extended appointments with the same consultant on an ongoing basis.

Fifty-minute appointments can be scheduled online at vanderbilt.edu/writing. Extended appointments must be arranged in advance through writing.studio@vanderbilt.edu and are available on a first-come, first-served basis. Information about other programs for graduate students, like the journal article writing workshop and the annual dissertation writer's retreat, can also be found at vanderbilt.edu/writing.

Inclusive Excellence

Diversity, inclusion, and community engagement are essential cornerstones of Vanderbilt's commitment to equity and trans-institutional discovery and learning. The Office for Inclusive Excellence has as its mission to work in partnership with members of the Office of the Provost and Vanderbilt colleges and schools to ensure that we advance the success and affirmation of all students and faculty. The Office for Inclusive Excellence oversees and establishes strategic initiatives to promote academic success, professional and cultural education, and inclusivity and belonging. Visit vanderbilt.edu/inclusive-excellence for more information.

Bishop Joseph Johnson Black Cultural Center

The Bishop Joseph Johnson Black Cultural Center provides educational and cultural programming designed to highlight the history and cultural experiences of African Americans. The center was established in 1984 and named in honor of the first African American student admitted to Vanderbilt University in 1953, Bishop Joseph Johnson (B.D. '54, Ph.D. '58). The BCC activities focus on providing student support and development, campus enrichment, and community engagement.

Student Support and Development (Inclusion)

One of the major aims of the BCC is student support and development. To accomplish this objective, the BCC offers student-driven programming, mentoring initiatives, organizational meeting spaces, service opportunities, and leadership skills training. The BCC also serves as a haven for students, with opportunities for informal fellowship with other students of all levels and backgrounds as well as with faculty and staff.

Campus Enrichment (Diversity)

With campus programming focused on Africans and African Americans, the BCC enriches the overall campus environment by promoting intercultural competence. Specifically, the BCC works with numerous campus partners to sponsor lectures, musical performances, art exhibitions, films, and discussions on African and African American history and culture.

Community Engagement (Equity)

Additionally, the BCC engages in community outreach and service by working with various civic and cultural groups in the Nashville area. Through community programs and by supporting students as they tutor and mentor young people from underserved areas in the city, the BCC advocates for social justice and equity on campus and in the larger community.

The BCC is located in the center of campus directly behind Buttrick Hall and across from the main campus mailroom. For more information, please call (615) 322-2524 or visit vanderbilt.edu/bcc.

Margaret Cuninggim Women's Center

The Margaret Cuninggim Women's Center leads co-curricular campus initiatives related to women's and gender issues. The center partners with many departments, programs, and individuals across campus to raise awareness about the ways in which gender shapes and is shaped by our lived experiences. Because its aim is to make the Vanderbilt community more inclusive and equitable, the center encourages all members of the Vanderbilt community to take part in its events and resources.

The Women's Center celebrates women and their accomplishments and fosters empowerment for people of all identities. The center offers individual support and advocacy around a variety of issues, including gender stereotyping, gender equity, leadership, parenting, body image, disordered eating, pregnancy and reproduction, sexual health, and more. The Women's Center is open Monday through Friday, 9:00 a.m. to 5:00 p.m. and is located at 316 West Side Row. For more information, please call (615) 322-4843 or visit vanderbilt.edu/womenscenter.

Office of LGBTQI Life

The Lesbian, Gay, Bisexual, Transgender, Queer, and Intersex Life office is a welcoming space for individuals of all identities and a resource for information and support about gender and sexuality. LGBTQI Life serves the entire Vanderbilt community through education, research, programming, support, and social events. The office also serves as a comfortable study and socializing space, as well as a connection point to the greater Nashville LGBTQI community. In addition, LGBTQI Life conducts tailored trainings and consultations for the campus and community. The Office of LGBTQI Life is located in the K. C. Potter Center, Euclid House, 312 West Side Row. For more information, please visit vanderbilt.edu/lgbtqi.

Office of the University Chaplain and Religious Life

The Office of the University Chaplain and Religious Life provides opportunities to explore and practice religion, faith, and spirituality and to more deeply understand one's personal values and social responsibility via educational programming, encounters with various faith perspectives, and engagement with religious and spiritual communities. The office welcomes and serves all students, faculty, and staff and provides an intellectual home and ethical resource for anyone in the Vanderbilt community seeking to clarify, explore, and deepen understanding of their lives and/or faith.

Recognizing the importance of exploring one's faith in community, the office facilitates opportunities for individuals of a shared faith to worship/practice their particular religious tradition. Whether guided by one of our affiliated chaplains or a student-run religious organization, these groups foster a sense of community and common values. For a complete listing of campus religious groups, resources, services, and programming opportunities, visit vanderbilt.edu/religiouslife.

Schulman Center for Jewish Life

The 10,000-square-foot Ben Schulman Center for Jewish Life is the home of Vanderbilt Hillel. The goal of the center is to provide a welcoming community for Jewish students at Vanderbilt and to further religious learning, cultural

awareness, and social engagement. Vanderbilt Hillel is committed to enriching lives and enhancing Jewish identity. It provides a home away from home, where Jews of all denominations come together, united by a shared purpose. The Schulman Center is also home to Grin's Cafe, Nashville's only kosher and vegetarian restaurant. For further information about the Schulman Center, please call (615) 322-8376 or email hillel@vanderbilt.edu.

Vanderbilt Child and Family Center

Vanderbilt Child and Family Center provides support and resources to the community of Vanderbilt families across the spectrum of life. As reflected in our provision of new parent support, early childhood education, family life resources, and elder care support, VCFC values the university's commitment to the education of the whole person and cultivation of lifelong learning. Visit vanderbilt.edu/child-family-center.

Parking, Vehicle Registration, and Alternative Transportation

Parking space on campus is limited. Motor vehicles operated on campus at any time by students, faculty, or staff must be registered with VUPS Parking Services located at 2800 Vanderbilt Place. A fee is charged. Parking regulations are published annually and are strictly enforced. More information is available at vanderbilt.edu/parking.

Bicycles must be registered with Vanderbilt University Public Safety.

All Graduate School students can ride to and from the Vanderbilt campus free of charge on Nashville's Metropolitan Transit Authority buses. To utilize this service, a valid student ID card is required for boarding the bus.

Services for Students with Disabilities

Vanderbilt is committed to the provisions of the Rehabilitation Act of 1973 and Americans with Disabilities Act as it strives to be an inclusive community for students with disabilities. Students seeking accommodations for any type of disability are encouraged to contact Student Access Services. Services include, but are not limited to, extended time for testing, assistance with locating sign language interpreters, audio textbooks, physical adaptations, notetakers, reading services, and reasonable accommodations for housing and dining. Accommodations are tailored to meet the needs of each student with a documented disability. Specific concerns pertaining to services for people with disabilities or any disability issue should be directed to the Disability Program Director, Student Access Services, PMB 407726, 2301 Vanderbilt Place, Nashville, Tennessee 37240-7726; phone (615) 343-9727; fax (615) 343-0671; vanderbilt.edu/student-access.

Nondiscrimination, Anti-Harassment, Anti-Retaliation, and Sexual Misconduct

The Title IX and Student Discrimination Office (vanderbilt.edu/title-ix) and/or the Equal Employment Opportunity Office (vanderbilt.edu/eoo) investigate allegations of prohibited discrimination, harassment, and retaliation involving members of the Vanderbilt community. This includes allegations of sexual misconduct and other forms of power-based personal violence.

Director of Title IX and Student Discrimination Molly Zlock is Vanderbilt's Title IX coordinator.

If you believe that a member of the Vanderbilt community has engaged in prohibited discrimination, harassment, or retaliation, please contact the Title IX and Student Discrimination Office and/or the Equal Employment Opportunity Office. If the offense is criminal in nature, you may file a report with Vanderbilt University Police Department.

The Title IX and Student Discrimination Office also facilitates interim accommodations for students impacted by sexual misconduct and power-based personal violence. Some examples of interim accommodations include no contact orders, adjusted course schedules, and housing changes.

Specific concerns pertaining to prohibited discrimination, harassment, or retaliation, including allegations of sexual misconduct and other forms of power-based personal violence, should be directed to the Title IX and Student Discrimination Office at (615) 343-9004.

Vanderbilt University Police Department

The Vanderbilt University Police Department, (615) 322-2745, is a professional law enforcement agency dedicated to the protection and security of Vanderbilt University and its diverse community (police.vanderbilt.edu).

The Vanderbilt University Police Department comes under the charge of the Office of the Vice Chancellor for Administration. As one of Tennessee's larger law enforcement agencies, the Vanderbilt University Police Department provides comprehensive law enforcement and security services to all components of Vanderbilt University including the academic campus, Vanderbilt University Medical Center, Vanderbilt Health at One Hundred Oaks, and a variety of university-owned facilities throughout the Davidson County area.

The Police Department includes a staff of more than one hundred people, organized into three divisions under the Office of the Associate Vice Chancellor and Chief of Police: Operations Division (Main Campus, Medical Center, and 100 Oaks Precincts), Administrative Division, and Auxiliary Services Division. All of Vanderbilt's commissioned police officers have completed officer training at a state-certified police academy and are required to complete on-the-job training as well as attend annual in-service training. Vanderbilt police officers hold Special Police Commissions and have the same authority as that of a municipal law enforcement officer, while on property owned by Vanderbilt, on adjacent public streets and sidewalks, and in nearby neighborhoods. When a Vanderbilt student is involved in an off-campus offense, police officers may assist with the investigation in cooperation with local, state, or federal law enforcement. The department also employs non-academy-trained officers called community service officers (commonly referred to as CSOs) who lend assistance 24/7 to the Vanderbilt community through services that include providing walking escorts, providing jump starts, and unlocking cars. For non-emergency assistance from a community service officer, dial (615) 322-2745 (2-2745 from an on-campus extension).

The Vanderbilt University Police Department provides several services and programs to members of the Vanderbilt community:

Vandy Vans—The Vanderbilt University Police Department administers the Vandy Vans escort system at Vanderbilt University. The Vandy Vans escort system provides vehicular escorts to designated locations on campus. The service consists of vans that operate from 6:00 p.m. to 3:30 a.m. GPS

technology allows students to track Vandy Vans on their route via computer or mobile phone using the VandySafe app, setting up text message alerts to let them know when a van will be arriving at their stop. Please visit police.vanderbilt.edu/services/vandysafe.php to download the app.

Stop locations were chosen based on location, the accessibility of a secure waiting area, and student input. Signs, freestanding or located on existing structures, identify each stop. A walking escort can be requested to walk a student from his/her stop to the final destination. A van is also accessible to students with mobility impairments. For complete information about the Vandy Vans service, including routes, stops, and times, please visit vandyvans.com or call (615) 322-2554.

As a supplement to the Vandy Vans van service, walking escorts are available for students walking to and from any location on campus during nighttime hours. Walking escorts are provided by VUPD officers. The telephone number to call for a walking escort is either (615) 322-2745 (2-2745 from a campus phone) or (615) 421-8888 (1-8888 from a campus phone), after which a representative from VUPD will be dispatched to the caller's location, or to a designated meeting point to accompany the caller to his or her destination.

Emergency Phones—Emergency telephones (Blue Light Phones) are located throughout the university campus, Medical Center, and 100 Oaks.

Each phone has an emergency button that when pressed automatically dials the VUPD Communications Center. An open line on any emergency phone will activate a priority response from an officer. An officer will be sent to check on the user of the phone, even if nothing is communicated to the dispatcher. Cooperation is essential to help us maintain the integrity of the emergency phone system. These phones should be used only for actual or perceived emergency situations.

An emergency response can also be activated by dialing 911 from any campus phone. Cellphone users can dial (615) 421-1911 to summon an emergency response on campus. Cellphone users should dial 911 for off-campus emergencies. Callers should be prepared to state the location from which they are calling.

Exchange Area—The Vanderbilt University Police Department has designated the lobby of the Police building located at 2800 Vanderbilt Place as an "Exchange Area." The Exchange Area is for Vanderbilt University students, faculty, and staff to trade legal items bought and sold online on various secondhand applications in a safe environment. The building/lobby is located next to the Vandy Van stop in lot 72C near Vanderbilt Stadium. Either the seller or buyer must be Vanderbilt affiliated (student, faculty, or staff). The affiliated person must complete the online registration form at police.vanderbilt.edu/safedeal prior to the actual trade.

Security Notices—In compliance with the U.S. Department of Higher Education and the Jeanne Clery Act, Security Notices are issued to provide timely warning information concerning a potentially dangerous situation on or near Vanderbilt University. This information is provided to empower our students and employees with the information necessary to make decisions or take appropriate actions concerning their own personal safety. Security Notices are distributed throughout Vanderbilt to make community members aware of significant crimes that occur at the university. They are distributed through Vanderbilt email lists and through the department's webpage, police.vanderbilt.edu/crimeinfo/securitynotices.php.

Educational and Assistance Programs—The Crime Prevention Unit of Vanderbilt University Police Department offers programs addressing issues such as sexual assault, domestic

violence, workplace violence, personal safety, RAD (Rape Aggression Defense) classes, and victim assistance. VUPD provides additional services including property registration (for bikes, laptops, etc.), lost and found, weapons safekeeping, and Submit a Crime Tip. For further information on available programs and services, call (615) 322-7846 or visit police.vanderbilt.edu/services.

Additional information on security measures and crime statistics for Vanderbilt is available from the Vanderbilt University Police Department, 111 28th Avenue South, Nashville, Tennessee 37212. Information is also available at police.vanderbilt.edu.

Annual Security Report—The *Vanderbilt University Annual Security Report* is published each year to provide you with information on security-related services offered by the university and campus crime statistics in compliance with the Jeanne Clery Disclosure of Campus Security Policy and Campus Crime Statistics Act and the Tennessee College and University Security Information Act.

This booklet is prepared with information provided by the Nashville Metropolitan Police Department, the Department of Student Athletics, Office of the Dean of Students, the Office of Housing and Residential Experience, and the Vanderbilt University Police Department. It summarizes university programs, policies, and procedures designed to enhance personal safety for everyone at Vanderbilt.

A copy of this report may be obtained by writing or calling the Vanderbilt University Police Department, 111 28th Avenue South, Nashville, Tennessee 37212 or by telephone at (615) 875-9157. A PDF copy of this report may also be obtained on the website at police.vanderbilt.edu/pdfs/annual-security-report.pdf.

Student Records (Family Educational Rights and Privacy Act)

Vanderbilt University is subject to the provisions of federal law known as the Family Educational Rights and Privacy Act (also referred to as FERPA). This act affords matriculated students certain rights with respect to their educational records. These rights include:

1. The right to inspect and review their education records within 45 days of the day the University receives a request for access. Students should submit to the Office of the University Registrar written requests that identify the record(s) they wish to inspect. The Office of the University Registrar will make arrangements for access and notify the student of the time and place where the records may be inspected. If the Office of the University Registrar does not maintain the records, the student will be directed to the University official to whom the request should be addressed.
2. The right to request the amendment of any part of their education records that a student believes is inaccurate or misleading. Students who wish to request an amendment to their educational record should write the University official responsible for the record, clearly identify the part of the record they want changed, and specify why it is inaccurate or misleading. If the University decides not to amend the record as requested by the student, the student will be notified of the decision and advised of his or her right to a hearing.
3. The right to consent to disclosures of personally identifiable information contained in the student's education records to third parties, except in situations that FERPA allows disclosure without the student's consent. These exceptions include:
 - Disclosure to school officials with legitimate educational interests. A "school official" is a person employed by the University in an administrative, supervisory, academic or research, or support-staff position (including University law enforcement personnel and health staff);

contractors, consultants, and other outside service providers with whom the University has contracted; a member of the Board of Trust; or a student serving on an official University committee, such as the Honor Council, Student Conduct Council, or a grievance committee, or assisting another school official in performing his or her tasks. A school official has a legitimate educational interest if the official needs to review an education record in order to fulfill his or her professional responsibility.

- Disclosure to parents if the student is a dependent for tax purposes.
- Disclosure to appropriate individuals (e.g., parents/guardians, spouses, housing staff, health care personnel, police, etc.) where disclosure is in connection with a health or safety emergency and knowledge of such information is necessary to protect the health or safety of the student or other individuals.
- Disclosure to a parent or legal guardian of a student, information regarding the student's violation of any federal, state, or local law, or of any rule or policy of the institution, governing the use or possession of alcohol or a controlled substance if the University has determined that the student has committed a disciplinary violation with respect to the use or possession and the student is under the age of 21 at the time of the disclosure to the parent/guardian.
- Disclosure to various authorized representatives of government entities (such as, compliance with Student and Exchange Visitors Information System [SEVIS], Solomon Amendment, etc.).

FERPA provides the university the ability to designate certain student information as "directory information."

Directory information may be made available to any person without the student's consent unless the student gives notice as provided for, below. Vanderbilt has designated the following as directory information: the student's name, address, telephone number, email address, student ID photos, major field of study, school, classification, participation in officially recognized activities and sports, weights and heights of members of athletic teams, dates of attendance, degrees and awards received, the most recent previous educational agency or institution attended by the student, and other information that would not generally be considered harmful or an invasion of privacy if disclosed. Any student who does not wish disclosure of directory information should notify the Office of the University Registrar in writing. No element of directory information as defined above is released for students who request nondisclosure except as required by statute.

The request for nondisclosure does not apply to class rosters in online class management applications, or to residential rosters—or rosters of groups a student may join voluntarily—in online, co-curricular engagement applications, or rosters of other information on the websites of student organizations that a student may join. Neither class rosters in online class management applications, nor residential rosters in online co-curricular engagement applications, are available to the public.

As of January 3, 2012, the U.S. Department of Education's FERPA regulations expand the circumstances under which students' education records and personally identifiable information (PII) contained in such records—including Social Security Numbers, grades, or other private information—may be accessed without consent. First, the U.S. Comptroller General, the U.S. Attorney General, the U.S. Secretary of Education, or state and local education authorities ("Federal and State Authorities") may allow access to student records and PII without consent to any third party designated by a Federal or State Authority to evaluate a federal- or state-supported education program. The evaluation may relate to any program that is "principally engaged in the provision of education," such as early childhood education and job training, as well as any program that is administered by an education agency or institution.

Second, Federal and State Authorities may allow access to education records and PII without consent, to researchers performing certain types of studies, in certain cases even when the University objects to or does not request such research. Federal and State Authorities must obtain certain use-restriction and data security promises from the third parties that they authorize to receive PII, but the Authorities need not maintain direct control over the third parties.

In addition, in connection with Statewide Longitudinal Data Systems, State Authorities may collect, compile, permanently retain, and share without student consent, PII from education records, and may track student participation in education and other programs by linking such PII to other personal information that they obtain from other Federal or State data sources, including workforce development, unemployment insurance, child welfare, juvenile justice, military service, and migrant student records systems.

If a student believes the university has failed to comply with FERPA, he or she may file a complaint using the Student Complaint and Grievance Procedures as outlined in the *Student Handbook*. If dissatisfied with the outcome of this procedure, students may file a written complaint with the Family Policy Compliance Office, U.S. Department of Education, 400 Maryland Avenue SW, Washington, DC 20202-5920.

Questions about the application of the provisions of the Family Educational Rights and Privacy Act should be directed to the Office of the University Registrar or to the Office of General Counsel.

Vanderbilt Directory

Individual listings in the online People Finder Directory consist of the student's full name, Vanderbilt email address, and campus mailing address (if available). Students may elect to add additional contact information to their listings, including school, academic classification, local phone number, local address, permanent address, cellphone, pager, and fax numbers. Student listings in the People Finder Directory are available to the Vanderbilt community via logon ID and e-password. Students may choose to make their online People Finder listings available to the general public (i.e., viewable by anyone with access to the internet), or to block individual directory items. Students who have placed a directory hold with the Office of the University Registrar will not be listed in the online directory.

Directory information should be kept current. Students may report address changes, emergency contact information, and missing person contact information via the web by logging in to YES (Your Enrollment Services) <https://yes.vanderbilt.edu> and clicking on the Personal Information link.

Extracurricular Activities

Student Centers

A variety of facilities, programs, and activities are provided in six separate student center locations—Alumni Hall, The Commons Center, E. Bronson Ingram College, Kissam Center, Sarratt Student Center|Rand Hall, and the Student Life Center.

Sarratt Student Center|Rand Hall is the main student center hub, housing a 300-seat cinema, art gallery, art studios, multicultural space, rehearsal rooms, large lounge spaces, large and small meeting spaces, and a courtyard. The facility is also home to Vanderbilt Student Communications, radio

station, TV station, Local Java, and the Pub at Overcup Oak restaurant. Rand Hall houses the Rand Dining Center, campus store, a multipurpose venue, meeting and seminar rooms, plus large, open lounge space. Some of the offices located in Sarratt Student Center|Rand Hall include the Dean of Students, Greek Life, Student Leadership, Arts and Campus Events, Student Organizations and Governance, Student Care Coordination, Student Accountability, Community Standards and Academic Integrity, and the Student Center for Social Justice and Identity. Also included in this facility is a United States Postal Service office.

The Vanderbilt Student Life Center is the university's large event space. It is both the fulfillment of students' vision to have a large social space on campus and a wonderful complement to Sarratt Student Center|Rand Hall. The Student Life Center has more than 18,000 square feet of event and meeting space, including the 9,000-square-foot Commodore Ballroom, which is one of the most popular spaces to have events on campus. The center is also home to the Career Center, Global Education Office, Office of Immersion Resources, and Office of Active Citizenship and Service.

The Commons Center is the community crossroads of The Ingram Commons living and learning community. It has it all: the Dining Hall and great food; a living room with a concert-grade grand piano, and the occasional live musical performance; a small rec room with cardio equipment, free weights, and weight machines; meeting and study rooms; and academic support services like the Writing Studio, the Career Center, and the CASPAR premajor advising center. The third floor of The Commons Center is the home of the Department of Political Science.

Alumni Hall was the original student center on campus when the building opened in 1925. Re-opened in fall 2013 after a yearlong renovation that transformed every space in the facility, Alumni Hall has returned to its role as a student center after serving other purposes over the years. In the renovated Alumni Hall, students have access to an exercise room as well as several new meeting and event spaces. The Vanderbilt Graduate School calls Alumni Hall home, and lounge space on the first floor serves as a robust hub for student life within the Graduate School community.

Opened in fall 2014 and fall 2018, respectively, Kissam Center and E. Bronson Ingram College are both part of the Vanderbilt residential college system. Kissam Center is home to meeting and event spaces, the Kissam Market, and Kissam Kitchen. E. Bronson Ingram College offers a dining facility, including the award-winning Bamboo Bistro pho concept.

Recreation and Wellness Center

More than two-thirds of Vanderbilt University students participate in club sports, intramurals, group fitness classes, or other programs offered at the David Williams II Student Recreation and Wellness Center, known by students as "the Rec." The large variety of programs available for meeting students' diverse interests include: more than thirty club sports teams; more than thirty intramural sports (softball, flag football, basketball, table tennis, and soccer); and an aquatics program offering swim lessons for all ages and abilities. Red Cross lifeguarding and CPR classes are also available. If being outside is more your style, you can choose from one of the many adventure trips offered each semester or create your own adventure trip with tips and gear from the Outdoor Recreation staff. There are more than sixty group fitness classes a week and a variety of wellness offerings from "learn to box" to healthy eating through Vandy Cooks in the Teaching Kitchen, Personalized Nutrition Coaching, and Nutrition Minute grab-and-go information on a variety of nutrition topics.

The Rec is a 289,000-square-foot facility that houses a 25-yard, 15-lane swimming pool; four courts for basketball, volleyball, and badminton; five racquetball and two squash courts; a four-lane bowling alley; five group fitness classrooms, more than 14,000 square feet of weight/fitness room space; rock-climbing wall; seven multipurpose rooms; locker rooms; and a 120-yard turf field surrounded by a 300-meter track in the indoor field house. The Rec's exterior spaces include more than seven acres of field space including three natural grass fields and one turf field.

All students pay mandatory student service fees which support the facilities, fields, and programs (see the chapter on Financial Information). Spouses must also pay a fee to use the facilities.

For additional information, please visit vanderbilt.edu/recreationandwellnesscenter.

Academic Programs

THE Graduate School accepts candidates for advanced degrees in more than fifty fields. Courses of study on the graduate level are offered in a number of areas in which graduate degrees are not offered. Such courses are available as minor work and are described in this catalog's Courses of Study section. Vanderbilt also offers professional degrees in business administration, divinity, education and human development, engineering, law, management, medicine, nursing, and public policy. Descriptions of these programs may be found in other Vanderbilt catalogs.

Special Programs

Graduate Program in Economic Development

The Graduate Program in Economic Development is a professionally oriented master's program in economics preparing students for both domestic and international careers in economic development. The curriculum contains five courses—microeconomics, macroeconomics, statistics, econometrics, and a one-semester research project—and five electives. The program offers courses on a wide range of subjects including: international trade, project evaluation, policy analysis, and development economics. Students may also take courses in other areas of economics, business, finance, and public policy.

Center for Latin American Studies

The university offers a program of graduate instruction and specialized research that relates the disciplines of the social sciences and humanities to Latin America, with emphasis on Brazil, Colombia, Venezuela, Peru, and Mexico. Latin American Studies offers three dual degree programs: M.A./MPH, M.A./MBA, and M.A./M.Ed. in IEPM. Applicants must apply independently to and be accepted by both the Graduate School and the appropriate professional school. The LAS component requires 30 credit hours of course work and a thesis. For further information, see Latin American Studies in the Courses of Study section.

Master of Fine Arts in Creative Writing

The English department's M.F.A. in creative writing is a three-year program, offering writing workshops and supervision in the composition of creative work. Students are required to take a complement of literature courses along with their workshops. The goal of the M.F.A. program is to produce creative writers with a broad and deep knowledge of their genres.

Applicants for the M.F.A. must submit an official college transcript, a manuscript of creative work, a statement of purpose, and three letters of recommendation. For more details see Vanderbilt's M.F.A. website: vanderbilt.edu/creativewriting.

Requirements for the M.F.A. include 48 hours of course work completed in the first two years, a thesis of creative work (a novel, a book of short stories, a collection of poems, or a collection of personal essays), plus an oral defense of the thesis. The course work includes graduate workshops (one per semester for four semesters) and seminars in the craft of writing and in literary studies. With guidance and approval

of faculty, M.F.A. students may enroll in relevant courses in other departments, programs, or schools

Master of Liberal Arts and Science

The master of liberal arts and science (M.L.A.S.) degree offers part-time adult students the intellectual stimulation of post-baccalaureate course work at a time in their lives when they can contemplate great ideas and enduring questions and measure them against their own life experiences. In discussion with other adult students under the leadership of distinguished faculty members, they are encouraged to look beyond disciplinary boundaries and explore connections that more specialized undergraduate degrees and focused career responsibilities may have obscured. Students often discover important professional and career benefits as well as personal development in earning a master of liberal arts and science degree. The requirements and curriculum provide flexibility in program design and course selection, and the tuition, scheduling, admission, and registration procedures acknowledge the special circumstances of the part-time adult student.

Courses are taught by distinguished Vanderbilt faculty members (and, occasionally, distinguished emeritus faculty) carefully selected for their recognized abilities as teachers and their special interest in the M.L.A.S. program. Each course meets one evening a week throughout the semester. Classes are limited in size to encourage optimal student-student and student-faculty interaction.

The master of liberal arts and science is awarded by the Graduate School and administered by the Dean's Office of the College of Arts and Science. For more information contact the director of the M.L.A.S. program in the College of Arts and Science or visit the M.L.A.S. website at as.vanderbilt.edu/mlas.

Medical Scientist Training Program (M.D./Ph.D.)

A combined course of study leading to the M.D. and Ph.D. degrees is offered through Vanderbilt School of Medicine and Vanderbilt Graduate School. The program facilitates the development of teachers and medical investigators in clinical and basic medical sciences. Six to seven calendar years are usually required for completion of the combined degree program.

All candidates must meet both School of Medicine and Graduate School requirements for matriculation and graduation. Candidates are admitted into the program by the deans of the two schools upon the recommendation of the Medical Scientist Training Program Committee. After their acceptance in the program, students must select and be accepted into the graduate program of an affiliated department. The graduate programs currently affiliated with the Medical Scientist Training Program are biochemistry, biological sciences, biomedical engineering, cancer biology, cell and developmental biology, cellular and molecular pathology, microbiology and immunology, molecular physiology and biophysics, neuroscience, and pharmacology.

M.D./Ph.D. students must pass the qualifying examination for the Ph.D. degree and present an acceptable dissertation within their field of study in the usual manner. Most M.D./Ph.D. students begin full-time study and research for the Ph.D. degree after the second year in medical school and complete

the dissertation research before entering the third year of medical study.

Courses in Professional Degree Programs

Students may include in their programs of study certain professional degree courses offered by other schools in the university. They register for these courses through the Graduate School and often do additional work appropriate for a research degree. Six hours of such credit may be applied to a master's degree program and 12 hours to a Ph.D. program. Students must obtain written approval from their adviser, from the other school, and from the Graduate School. The courses may constitute part of the major or minor field, as approved by the student's adviser.

Individualized Programs

Students with special course goals should inquire in the Graduate School office about the possibility of individualized, interdisciplinary programs of study leading to the master's and Ph.D. degrees. The Graduate School may permit programs that combine several disciplines in unique ways. Financial support for individualized programs must be arranged with specific faculty members as there are no program or departmental financial awards available.

Master's and Ph.D. students may not apply for admission to the individualized program until they have been admitted to and enrolled in a department currently offering that degree. Except under extraordinary circumstances, interested students will be expected to apply, or make preliminary inquiry, to the Graduate School during their first year of graduate studies.

Combined B.A./M.A. (4+1) Program

The College of Arts and Science in collaboration with the Graduate School offers students in most departments and programs the opportunity to earn both the bachelor's degree and the master's degree in a shorter period of time and at less cost than is normally the case. Exceptional students in the College of Arts and Science can obtain both degrees in an expedited period, typically within but not less than five years.

The usual period of study for both the bachelor's and the master's degree is six years. Through the 4+1 option, the student and her or his adviser plan a five-year program of study. It is important to note that there is no provision for obtaining both degrees in a period shorter than five years. The program is intended for selected students for whom the master's degree is sufficient preparation for their career goals, is desirable as a goal in itself, or is viewed as additional preparation before pursuing a doctorate or a professional degree.

The areas of study available for the Combined B.A./M.A. (4+1) option within Arts and Science are determined by individual departments and programs, who also determine the policies and guidelines to be followed. Students will be admitted to the Combined B.A./M.A. program only by approval of the department or program.

Programs of Study

The 4+1 option is currently available in the following departments and programs: English; French; German; history; history of art; Latin American studies; mathematics; medicine, health, and society; philosophy; political science; and psychology. Students are welcome to discuss the Combined B.A./M.A. (4+1) option with any of these departments and programs.

Admissions Overview

The Integrated B.A./M.A. program allows Vanderbilt University students to study for both degrees often, but not necessarily, in the same department. Undergraduates with strong academic records may apply for admission to the program after the first semester of their junior year. Qualifying students are normally accepted into the program in the second semester of the junior year.

To apply for admission, students will first consult with Dean C. André Christie-Mizell, and then submit to the prospective graduate department or program a "Petition to Apply to the Combined B.A./M.A. (4+1) Degree Program" (available at as.vanderbilt.edu/academics/specialdegree/4plus1.php), a statement of purpose, a formal application to the Graduate School, a preliminary program proposal, two letters of recommendation from Vanderbilt faculty, and a current transcript. Application forms can be completed online at apply.vanderbilt.edu. GRE scores or other admissions requirements may be specified by the prospective department. Admission to the 4+1 option is highly selective. An accomplished academic record, a demonstrated commitment to pursue graduate study, and a strong endorsement from Vanderbilt faculty are key elements to the successful applicant. Students will be provisionally accepted as Graduate School students, pending completion of all undergraduate requirements. Graduate student status will apply in the fifth year.

Scholarships and Financial Aid

Students who are receiving scholarships or other forms of financial aid as a Vanderbilt undergraduate are advised that such aid applies in most cases only toward the completion of the bachelor's degree or the first four years of their studies (which may include their taking some graduate courses during their senior year). Students wishing to pursue the 4+1 option should seek support for their fifth year of study through student loans and other financial aid.

For additional information, consult the website as.vanderbilt.edu/academics/specialdegree/4plus1.php.

Accelerated Graduate Program in Engineering

Students who enter Vanderbilt with a significant number of credit hours (20 to 30 hours), earned either through Advanced Placement tests or in college courses taken during high school, may be eligible for the Accelerated Graduate Program in Engineering. Through this program, a student is able to earn both a bachelor's degree and a master of science in about the same time required for the bachelor's degree, or slightly longer.

To be eligible for the program, a student must complete 86 hours (senior standing) by the end of the sophomore year with at least a 3.5 grade point average. With the approval of the student's adviser, the director of graduate studies in the student's major department, and the senior associate dean, students apply through the associate dean for graduate studies for admission to this accelerated dual degree program.

Upon admission to this program, a second "career" will be set up for the student which will allow the student to start taking graduate courses (course numbers > 5000) during the junior and senior years. These courses will be credited toward the master of science. Note that no double counting of courses is allowed (i.e., the student must meet the degree requirements for each degree independent of the other degree).

The student receives the bachelor's degree at the end of the fourth year and typically spends the summer finishing a master's thesis to complete the master of science. Further information can be obtained from the director of graduate studies of the student's major department.

Online Master's Program in Computer Science

The Graduate School offers an online program for a master of science in computer science. This program requires completion of 30 credit hours over three terms which, depending on the course schedules, students can expect to complete in twelve to twenty-one months. Students meet weekly for HD-streaming live classes, group work, and discussions, and can meet with faculty in online office hours. In addition to online learning, students can attend campus events, including career-building workshops and the Vanderbilt Entrepreneur Conference. Upon completion of the program, students may participate in the Vanderbilt Commencement ceremony on campus to receive their Vanderbilt diplomas.

Online students have full access to Vanderbilt libraries, the Office of Student Financial Aid and Scholarships, veterans educational benefits, and Student Access Services (disability services). The rest of student services are offered in partnership with online program partner 2U or by 2U, which include Career Service, Student Success, and WeWork Membership. Except where noted, online students are subject to the policies outlined in this catalog.

Complete information on this program is available at engineeringonline.vanderbilt.edu/computer-science.

Certificate Programs Overseen by the Graduate School

A number of departments/programs offer graduate certificates. These are open to students already enrolled in a Vanderbilt University post-baccalaureate-degree program. Each certificate requires at least 12 credit/semester hours of interrelated graduate-level course work supporting a specified theme. The courses form an intellectually cohesive whole. The certificate programs include: Global Health; Latin American Studies; Jewish Studies; Latino and Latina Studies; Asian Studies; Women's and Gender Studies; American Studies; African American and Diaspora Studies; Second Language Studies; Mobile Cloud Computing; Surgical and Interventional Engineering; Technology Entrepreneurship; Medicine, Health, and Society; Carpenter Certificate in Religion, Gender, and Sexuality; Kelly Miller Smith Institute Certificate in Black Church Studies; Religion in the Arts and Contemporary Culture; Biomedical Ethics; Medical Student Certificate in Lesbian, Gay, Bisexual, and Transgender Health; Post-Master's Certificates in Nursing Program; and Law and Business Certificate. If interested in one of these certificate programs, a student should contact the director of the program to be sure that the appropriate requirements have been met, and if so, then submit to the Graduate School an "Intent to Enroll" in the certificate program.

Additional information on the available certificate programs is available at vanderbi.lt/gradcertificates.

Summer Session

Information concerning the summer session may be found on the Graduate School webpages at vanderbilt.edu/gradschool and at vanderbilt.edu/summer. A summer session announcement in mid-March of each year will describe the registration procedures. Students may log in to YES (Your Enrollment Services) to view the schedule which lists the limited course offerings.

Admission

QUALIFIED applicants with bachelor's or comparable non-U.S. degrees are eligible for admission to the Graduate School. Applications from international students with three-year bachelor's degrees will also be considered. Admission is competitive and students are selected on the basis of their scholastic preparation and intellectual capacity.

Generally, minimum requirements for admission are these: an applicant should have completed or soon will complete a course of study equivalent to that required for the bachelor's degree at an accredited institution, maintained a minimum of a *B* average in undergraduate work, and maintained a *B* average in the field of expected graduate concentration. Individual programs in the Graduate School have additional requirements for admission.

Applications for admission are made electronically through the Graduate School website (vanderbilt.edu/gradschool).

Applicants must upload an unofficial copy of transcripts from prior undergraduate and graduate work as part of their online application for admission. Official transcripts are required only after an offer of admission is made and accepted. All admitted graduate students must submit all official transcripts prior to beginning their enrollment at Vanderbilt University. An official final transcript is required from all previously attended institutions of higher education (i.e., beyond high school). Incoming graduate students who do not provide all official transcripts prior to initial enrollment will have a registration hold placed on their records prohibiting registration until all official transcripts have been received.

Deadlines for fall applications range between December and January 15. Applicants should verify the deadline for the program to which they wish to apply by checking the website for that department or program. Typically, admission decisions for fall semester will be communicated by March 31 to all applicants whose files are complete by January 15.

The deadline for responses to offers of financial award and admission is April 15. If your reply is not received by April 15, the department may rescind the offer of admission and financial award.

Most programs do not admit students for the spring semester. Please check with the program in which you are interested before applying for spring semester admission.

Students seeking admission for the spring semester should file applications no later than November 1. Decisions are usually announced before December 1.

Further information regarding the application and admissions process is available at vanderbilt.edu/gradschool.

Graduate Record Examination

Submission of scores on the General Test of the Graduate Record Examination (GRE) is typically required as part of the application to the Graduate School, although some programs have now waived the GRE requirement. Refer to the appropriate department or program to confirm their GRE requirements. Some departments also require a report of the score on the Subject Test of the GRE before an application will be considered.

Information concerning the GRE may be obtained from Graduate Record Examinations, Educational Testing Service, Box 6000, Princeton, New Jersey 08541-6000, U.S.A., or the GRE website at gre.org.

Prior Degrees

It is the policy of Vanderbilt University to verify prior educational credentials for all admitted students who intend to matriculate. All matriculated students must provide official copies of transcripts and any other required supporting documentation to Vanderbilt University as part of the prior degree verification process. The Office of the University Registrar will review transcripts and other supporting documentation for authenticity and to confirm degrees earned prior to matriculation at Vanderbilt. Offers of admission are contingent on a student's providing the required documentation. Students who are not able to provide evidence of prior degrees will not be permitted to register for subsequent terms and may be subject to dismissal from the university.

Master of Liberal Arts and Science

Candidates for admission to the M.L.A.S. degree program must present to the Graduate School a formal application, three letters of recommendation, a Statement of Purpose, and a transcript indicating a completed course of study equivalent to that required for a bachelor's degree at an accredited institution, with a minimum of a *B* average in all undergraduate work (or significant life/work achievement that could compensate for a lower grade point average). Graduate Record Examination scores are not required. After receipt of all materials, the director of the program will interview all prospective students. For additional information regarding the M.L.A.S. requirements, visit as.vanderbilt.edu/mlas/application.

International Students

Vanderbilt has a large international community representing more than 117 countries. The university welcomes the diversity that international students bring to the campus and encourages academic and social interaction at all levels. International applicants who are offered admission will be contacted by the Vanderbilt Office of International Student and Scholar Services (ISSS) with instructions for initiating the visa process.

English Language Proficiency. Proficiency in written and oral English is required for enrollment in an academic program. Applicants whose first language or language of instruction is not English are required to submit the results of the Test of English as a Foreign Language (TOEFL) with the application, unless they have earned a degree from an American or English-speaking institution. International students transferring from unfinished degree programs of other universities in the United States should present TOEFL scores.

The minimum acceptable score on the TOEFL PBT (paper-based test) is 570, and for the TOEFL iBT (internet-based test), 88. Many programs, however, require a considerably higher level of proficiency.

Although International English Language Testing System (IELTS) test scores are not required, applicants who have taken the IELTS can report their scores in the online application.

English Language Instruction. Students wishing to focus on improving their English language use for the context of the U.S. academic setting may take classes and participate in programming at the Vanderbilt English Language Center to support their academic success. The ELC's courses include Academic Writing,

Academic Speaking, Pronunciation, and International Teaching Assistant Communication. Throughout the academic year, academic workshops and one-to-one consultations for speaking and writing are also available through the ELC. Entering students may be required to take language support courses concurrently with their academic courses at the ELC. The ELC is located at 1208 18th Avenue South. For information about the ELC's programming, see the "English Language Center" section in the Life at Vanderbilt chapter of this catalog or visit vanderbilt.edu/elc.

Financial Resources. To meet requirements for entry into the United States for study, applicants must demonstrate that they have sufficient financial resources to meet expected costs of their educational program. Applicants must provide documentary evidence of their financial resources before visa documents can be issued.

United States laws and regulations restrict the opportunity for international students to be employed. International students may work up to twenty hours per week on campus. Students may be allowed to work off campus only under special circumstances. Many spouses and dependents of international students are not allowed to be employed while in the United States.

Student Health Insurance Plan. International students are required to purchase the university's international student injury and sickness insurance. Information concerning the limits, exclusions, and benefits of this insurance coverage may be obtained from Student Health Services.

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Graduate School Catalog

Financial Information

TUITION in the Graduate School for 2019/2020 is charged at the rate of \$2,026 per semester hour with a minimum tuition charge of \$200 per semester.

Tuition and fees are set annually by the Board of Trust and are subject to review and change without further notice.

Students who have completed the hours required and who are conducting research full time, register for thesis or dissertation research without hourly credit and are subject to a minimum tuition charge of \$200 per semester.

Master of Liberal Arts and Science Courses

Students in the M.L.A.S. program pay one-half of the regular graduate tuition rate for M.L.A.S. courses and full tuition for courses selected from the regular curriculum. M.L.A.S. course tuition for 2019/2020 is \$3,042 per 3-hour course.

Supplemental Tuition and Continuous Registration

Continuous registration is required of all full-time degree candidates until the required number of course work hours have been completed. Responsibility to maintain registration rests with the student. To retain student status, individuals must register each fall and spring semester or secure an approved leave of absence. A person is in student status only if:

- registered, or
- on authorized leave of absence

A student who has completed the formal course work required for the degree may, with approval of the student's department and the Graduate School, conduct full-time thesis or dissertation research away from the university and register for research hours needed for the degree. Tuition is charged at the current rate per semester hour, or \$200 per semester if the student has completed the hours required for the degree.

In general, individuals who have completed the number of hours required for the degree and who are employed full time are not eligible to register as full-time students. Such persons pursuing the Ph.D. degree may register as half-time students if they are devoting a minimum of 20 hours per week to dissertation research and their program offers the half-time research course (3995) for a \$200 per semester fee.

A former student wanting to re-enter the Graduate School must apply for reinstatement, which is granted only on the recommendation of the student's graduate program and with approval of the Graduate School.

Other Fees

Student health insurance	3,650
Student service fees	
per academic year (estimate)	500
Transcript fee (one time only)	100
Late registration	30
Audit fee for regular students (nonrefundable)	10
Ph.D. dissertation electronic publishing through ProQuest UMI	
<i>Traditional publishing</i>	0
<i>Open Access Publishing Plus</i>	95

Thesis or dissertation binding (per copy)	19
Copyright fee for Ph.D. dissertation (optional)	55

Payment of Tuition and Fees

Tuition, fees, and all other university charges incurred prior to or at registration are due and payment must be received by August 31 for the fall semester and January 2 for the spring semester. If courses are added AFTER the initial billing period, it is the student's responsibility to contact the Office of Student Accounts for due dates and amounts related to tuition in order to avoid any holds and/or late payment penalties. All other charges incurred after classes begin are due and payment must be received in full by the last business day of the month in which they are billed to the student. If payment is not made within that time, Commodore Cash may not be available and your classes may be canceled. Visit vanderbilt.edu/stuaccts for payment options.

Students/Guarantors will be responsible for payment of all costs, including reasonable attorney fees and collection agency fees, incurred by the university in collecting monies owed to the university. The university will assess a \$25.00 fee for any check or e-payment returned by the bank and reserves the right to invoke the laws of the State of Tennessee governing bad check laws.

E-Billing and Access to a Student's Vanderbilt Account

Vanderbilt exclusively uses convenient and secure electronic billing (e-bills) for student account charges. **Students may need to take action** to enable parents, guardians, and other "invited payers" to receive e-bill notices and access to the e-bill website. Students may access their online invoices from their YES landing page at yes.vanderbilt.edu. Once they have signed in to YES, they may view invoices under the Billing Portal link.

Students are responsible for granting access to parents, guardians, or other payers who should receive email billing notifications. To do this, students log in to YES and click the "billing portal link." On your CashNet Account page, click "Add New" in the "Other Payers" section. Enter the information that is requested, and click "OK." (You must enter the "login name" that your authorized payer will use as a username—the logon and password will be sent to your authorized payer in an email.) Tutorials are located online at vanderbilt.edu/stuaccts/ebill.html.

Any month in which there is activity on the student's account, an e-bill will be generated and an email notification sent to the student's Vanderbilt email address, as well as to the email addresses of others they have invited (and have completed the activation process). The email notification will have the subject line "Your E-Bill Is Now Available for Viewing" and will contain a link to the secure e-bill website.

Payments may be made electronically, or for those wishing to mail a payment, a payment coupon can be printed. When an electronic payment is made, a confirmation email will be sent. **It remains the responsibility of the student to ensure that bills are paid on or before the due date.**

The Office of Student Accounts can be contacted at (615) 322-6693, toll-free at (800) 288-1144, or via email at student.accounts@vanderbilt.edu. For additional information, please visit the Student Accounts website at vanderbilt.edu/stuacct.

Refunds of Tuition Charges

University policy for the refund of tuition charges provides a percentage refund based on the time of withdrawal. Students who withdraw officially or are dismissed from the university for any reason may be entitled to a partial refund. Fees are non-refundable. The refund schedules may be viewed at vanderbilt.edu/stuacct.

Payment Options

Direct Payment: Tuition, fees, and all other charges are paid directly to the university. Payment for the fall semester is due by August 31. Payment for the spring semester is due by January 2. Students can pay online after viewing their e-bill at vanderbilt.edu/stuacct. There is no further action required for this option.

Interest-Free Monthly Payment Plan: Students can spread payment over five monthly installments for each semester (fall and spring), interest free, by enrolling in the VANDYPlan, currently administered by Higher One. The deadline to enroll in the VANDYPlan is August 31 for the fall semester (payments begin May 15) and January 31 for the spring semester (payments begin October 15).

The current estimated charges for the academic year are available at vanderbilt.edu/stuacct to assist students in determining their annual expenses. For further information, please contact the Office of Student Accounts at (615) 322-6693 or (800) 288-1144.

Late Payment of Fees

All charges not paid by the specified due dates will be assessed a late payment fee of \$1.50 on each \$100 owed (minimum late fee of \$5).

Financial Clearance

No transcript (official or unofficial) will be issued for a student who has an outstanding balance. Diplomas of graduating students will not be released until all indebtedness to the university is cleared.

Student Service Fees

The required student service fees entitle degree-seeking students to use the facilities of Sarratt Student Center and the David Williams II Student Recreation and Wellness Center. The fees also cover admission to certain social and cultural events and subscriptions to certain campus publications. The student service fees for graduate students also include funding for activities sponsored by the Graduate Student Council. Specific information on these fees is published annually in the *Student Handbook*. By payment of an additional fee, students and their spouses may use their identification cards for admission to athletic events.

Transcripts

Official academic transcripts are supplied by the Office of the University Registrar on authorization from the student. Transcripts are not released for students with financial or other university holds.

Honor Scholarships

University Graduate Fellowships

Each year several University Graduate Fellowships are awarded to students entering a Ph.D. program for the first time. Based solely on merit, they are offered to students nominated by departments or programs in recognition of exceptional promise for research and academic excellence.

These premier fellowships provide a stipend of up to \$5,000 in addition to a departmental award (fellowship or assistantship). Faculty committees review nominations from all graduate programs and make recommendations to the Graduate School which then selects the recipients.

Provost's Graduate Fellowships

Each year the Graduate School awards Provost's Graduate Fellowships to outstanding students from under-represented groups showing academic promise who want to study for the Ph.D. These fellowships carry a stipend of up to \$5,000 in addition to a departmental award.

Normally these awards run concurrently with the departmental awards.

Other Awards and Assistantships

The university intends, within its resources, to provide adequate financial assistance to students with high academic potential who need help in meeting expenses. Some support is service free; most requires assigned service to the university. Duties are compatible with the student's development and progress.

All M.F.A. and Ph.D. applicants to the Graduate School are considered for awards and assistantships available in their proposed area of study if they request such consideration and if the application for admission is complete by the application deadline.

University Fellowships

University fellowships with stipends ranging up to \$16,500 for nine months or \$32,000 are available in some programs. A full Tuition Scholarship is normally provided in addition to the stipend. The fellowships are service-free and the student is expected to devote full time to graduate study and to have no other occupation.

Graduate Assistantships

These awards provide a stipend up to \$30,000 for the calendar year and normally receive an additional service-free full tuition scholarship. Duties are assigned by the program director and may include teaching and/or research responsibilities. Appointments are made for one year with renewal in subsequent years dependent upon satisfactory performance of assigned duties, as evaluated by the program director and school deans.

All persons who have responsibility for instruction are subject to university policies as outlined in the *Faculty Manual*, and any additional school and departmental policies that govern instruction. Graduate teaching assignments with major instructional responsibilities must have a master's degree or the equivalent.

Research Assistantships

Research assistantships ranging up to \$31,500 for twelve months are available in certain graduate programs. The holder is expected to assist an individual faculty member in research. Full or partial tuition scholarships may accompany a research assistantship.

Traineeships

Traineeships ranging up to \$31,500 for twelve months are available in certain graduate programs. The recipient is expected to carry out research with an individual faculty member. Full or partial tuition scholarships usually accompany a traineeship.

The Graduate School awards Russell G. Hamilton scholarships to highly qualified students intending to pursue a Ph.D. degree. These are service-free, full-tuition scholarships with the recipients designated as Russell G. Hamilton Scholars.

Tuition Scholarships

Some departments or programs offer service-free full or partial tuition scholarships without an accompanying fellowship or assistantship. Programs offering such tuition scholarships include Biostatistics, Chemistry, Economic Development, Political Science, the Graduate Department of Religion, and Nursing Science.

Other Graduate Awards

Various types of financial assistance other than university assistantships and fellowships are available. A number of private foundations and business and industrial firms support fellowships. The U.S. Government provides training grants for Ph.D. programs through the U.S. Public Health Service, the National Institutes of Health, the National Science Foundation, and other agencies. Awards are allocated to specific departments and to interdepartmental graduate programs of study. Traineeships and fellowships provide stipends and cover tuition and fees.

Loan Assistance

Loan assistance is available for graduate students in the form of the Federal Direct Unsubsidized Loan program, the Federal Graduate PLUS Loan program, and certain alternative/private loan programs. The Federal Direct Unsubsidized Loan is available regardless of need. The Federal Graduate PLUS Loan is not based on demonstrated need, but the student must be credit worthy. Alternative/private loans are available from private sources that are not based on financial need and must be credit approved.

Under the Federal Direct Loan program, a student may borrow up to a maximum annual limit of \$20,500 a year, all of which is unsubsidized. The maximum aggregate amount of Federal Direct Loans an eligible student may borrow is \$138,500 including any Federal Direct Subsidized/Unsubsidized Loans borrowed for undergraduate and graduate/professional study. Under the Federal Graduate PLUS Loan program, a graduate/professional student may borrow up to the annual cost of attending Vanderbilt minus any other aid for which the student is eligible. There is no maximum aggregate limit.

In order to be considered for the Federal Direct Loan programs and/or the Federal Work-Study program, students must complete the Free Application for Federal Student Aid (FAFSA). The FAFSA application and additional information may be found on the Office of Student Financial Aid webpage, vanderbilt.edu/financialaid.

Academic Regulations

VANDERBILT'S students are bound by the Honor System inaugurated in 1875. Fundamental responsibility for the preservation of the system inevitably falls on the individual student. It is assumed that students will demand of themselves and their fellow students complete respect for the Honor System. All work submitted as a part of course requirements is presumed to be the product of the student submitting it unless credit is given by the student in the manner prescribed by the course instructor. Cheating, plagiarizing, or otherwise falsifying results of study are specifically prohibited under the Honor System. The system applies not only to examinations but also to written work and computer programs submitted to instructors. The student, by registration, acknowledges the authority of the Graduate Honor Council.

The university's Office of Student Accountability has original jurisdiction in all cases of non-academic misconduct involving graduate and professional students.

Students are expected to become familiar with the Rules Governing the Graduate Honor Council of Vanderbilt University, available at the time of registration. It contains the constitution and bylaws of the Graduate Student Honor Council, Appellate Review Board, and related regulations.

Detailed descriptions of Honor System violations and procedures are also available on the web at studentorg.vanderbilt.edu/gsc/honor-council.

Academic Requirements

Candidates for graduate degrees must have satisfactorily completed all residency, academic course, and thesis or dissertation requirements, have passed all prescribed examinations, and be free of indebtedness to the university at the time of graduation.

The academic requirements described on the following pages have been established by the Graduate faculty and are applicable to all graduate students at Vanderbilt.

Individual degree programs may have additional requirements. Students are advised to refer to the various program descriptions listed in this catalog and to consult their major advisers for requirements in the specialty of interest.

Students who were completing undergraduate or advanced degrees at the time of their admission must provide to the Graduate School, before initial registration, an official final transcript showing that the degree has been received and the date it was granted.

Responsible Conduct in Research

Vanderbilt University has an obligation to model, teach, and actively promote the responsible conduct of research in scholarship and science. Research integrity is fundamental to good research and crosses all disciplines and areas of focus. Vanderbilt's approach incorporates online and discussion-based content based on the individual's experience level and discipline. In addition to online education, individuals are expected to participate in discussion-based sessions to further explore the issues and challenges in conducting ethical research and scholarship.

Intent to Graduate

An Intent to Graduate form must be submitted during the semester in which the student expects to receive a degree. Graduation dates are available at the Graduate School website, vanderbilt.edu/gradschool. Students can access the forms for the end-of-term conferral dates at the student's landing site in YES, three weeks after the start of the semester. These forms are submitted electronically and should be submitted within eight weeks of the start of the semester. If a student plans to graduate "IntraTerm" (January 31, February 28, March 31, May 31, June 30, August 31, September 30, October 31), these forms can be found at the Graduate School website and are to be submitted to the Graduate School at least fifteen days prior to the conferral date.

Requirements for the Master's Degree

The following master's degrees are awarded in the Graduate School: master of arts, master of science, master of fine arts, and master of liberal arts and science. Students should check regulations of their particular program; many have requirements in addition to those listed here.

Residence

The candidate for the master's degree shall spend at least one academic year of graduate study at Vanderbilt. Students enrolled in the online master of science in computer science program are exempt from the residency requirement.

Course Work

A minimum of 30 semester hours is required for the master's degree. This includes enrollment in at least 24 semester hours of formal didactic course work plus enrollment in 6 additional hours of didactic course work or 6 credit hours of research. All requirements for the master's degree must be completed within a six-year period calculated from the student's first semester of enrollment in the Graduate School. Online master of science in computer science students must complete their program requirements within twenty-one months of initial enrollment. International students should contact the Office of International Student and Scholar Services concerning time limitations for completion of master's degrees.

On recommendation of the student's program and approval of the Graduate School, credit up to 6 semester hours toward the master's degree may be transferred from graduate schools in accredited institutions, or other schools of the university.

An incoming graduate student deficient in areas the major department considers prerequisite to a graduate program shall take such course work without graduate credit, in addition to the courses required for the advanced degree.

Thesis

Electronic submission is expected. The document is converted to a PDF and uploaded on the ETD (Electronic Theses and Dissertations) website (etd.library.vanderbilt.edu). Links on the Graduate School webpage outline the process. (See "Theses and Dissertations" under "Academics.") There are no fees associated with electronic submission.

Two copies of the thesis are required, if the printed option is elected. Both copies will be placed in the Vanderbilt University library system. There is a binding fee of \$19 per copy. Whether submitting electronically or as printed copies, the student must provide the Graduate School with two hard copies of the title page and one copy of the abstract. Both copies of the title page must contain the original signatures of at least two graduate faculty members in the student's program. The abstract must contain the original signature of the thesis adviser. Specifications about required format, including the quality of paper to be used, are available at vanderbilt.edu/gradschool.

Due dates are listed on page 6.

Some programs require an examination or defense in addition to the thesis.

Non-Thesis Programs

Certain programs offer non-thesis master's degree programs and specify additional course work up to at least 30 hours. Some programs require an examination in addition to the 30 hours in lieu of a thesis. Not later than fourteen days prior to the end of the term, the student's department will verify that all degree requirements have been completed.

Master's Degree in Passing

Certain programs offering the Ph.D. degree will award a master's degree in passing. The minimum requirements are 30 hours of graduate study and a GPA of 3.0 or better. Students should check with their program to determine if this option is available and if additional course work and/or a thesis are required.

Final Examination

The candidate for the master's degree may, at the discretion of the program faculty, be required to take a final examination in the field of specialization. Such examination shall be completed not later than fourteen days before the end of the term in which the degree is to be granted.

Requirements for the M.L.A.S. Degree

A minimum of 30 semester hours of academic credit (ten courses) is required, including a Core Course (MLAS 6700) and a Capstone (MLAS 7340). Students must complete at least eight M.L.A.S. courses (24 hours) with the option of selecting the remaining two courses (6 hours) from the regular course offerings available to graduate students. Students normally take only one course each semester. All work must be completed within six years of the initial registration. A maximum of 6 credit hours may be transferred from graduate schools of other accredited universities and will count as part of the 6-hour non-M.L.A.S. course work. (M.L.A.S. discount tuition does not apply to the courses from the regular schedule.)

Curriculum

A range of seminars is offered in the humanities, social sciences, and natural sciences as well as core courses for beginning students and capstone workshops for advanced students.

Requirements for the Ph.D. Degree

The degree of doctor of philosophy is awarded in recognition of high attainment in a special field of knowledge, as evidenced by examination and by a dissertation presenting the results of independent research. General requirements are listed below. In many programs there are additional requirements, and students should carefully check regulations in their particular programs.

Admission to Candidacy

Admission to the Graduate School does not imply admission to candidacy for the Ph.D. degree. To be admitted to candidacy the student must satisfy the language requirements, if any, in the program, and must pass a qualifying examination. The examination must be scheduled and passed within four years of the student being admitted to the program. Upon petition to the Graduate School, a one-year extension may be granted to complete this requirement. The examination will be administered by the student's Ph.D. committee, which will supervise subsequent work toward the degree. Upon completion of these requirements the Ph.D. committee will recommend to the Graduate School that the student be admitted to candidacy.

Residence and Course Work

The Ph.D. degree requires at least three academic years of graduate study. A student must complete 72 hours of graduate work for credit, of which a minimum of 24 hours in formal, didactic course and seminar work in the Vanderbilt Graduate School is required. In most programs students are required to present considerably more hours in formal course work than the 24-hour minimum. The remainder of the 72 hours, above the program requirements in formal course hours, may be in dissertation research hours, in special readings, and in transfer credit if applicable. Performance in dissertation research does not affect the grade point average.

"Formal, didactic course work" is approved courses taken for credit other than thesis and dissertation research courses. Students should check departmental regulations for the number of "formal course" hours required for their particular program.

All students working full time toward the Ph.D. must register each fall and spring semester. When the required 72 hours of course work have been completed, registration for dissertation research without hourly credit applies; this reflects full-time effort on research and confers full-time student status. The minimum tuition of \$200 is charged.

Qualifying Examination

The purpose of the qualifying examination is to test the student's knowledge of the field of specialization, to assess familiarity with the published research in the field, and to determine whether the student possesses those critical and analytic skills needed for a scholarly career.

The examination is conducted by a Ph.D. committee appointed by the Graduate School on advice of the chair or director of graduate studies of the program. The committee consists of not fewer than four members of the Graduate faculty. Three of the members must be graduate faculty from within the student's department/program and one from outside the program. Any variation of the committee makeup must be approved by the Graduate School. The committee must

be appointed by the Graduate School no less than two weeks before the time the student expects to take the qualifying examination.

Graduate faculty include all full-time tenured and tenure-track Vanderbilt University faculty members with primary appointments in departments or programs offering the M.A., M.S., and/or Ph.D. degrees. Those tenured or tenure-track faculty having secondary appointments in departments offering the M.A., M.S., and/or Ph.D. degrees will also be considered Graduate faculty members.

Appointment of other faculty members to the Graduate faculty can occur upon recommendation by the faculty member's department and with the approval of the Graduate School. Such appointment would require a majority vote by the Graduate faculty of the department/program, plus the recommendation of the chair/director of graduate studies and approval by the Graduate School. Such appointments are restricted to full-time faculty members with the rank of assistant professor or above, with a primary or secondary appointment in programs offering the M.A., M.S., and/or Ph.D. degree. Faculty members appointed to the Graduate faculty in this manner have all the privileges of Graduate faculty, including supervising graduate students' research.

Other faculty can be assigned some duties normally reserved for Graduate faculty on the recommendation of the chair and/or director of graduate studies of the department and with the approval of the Graduate School. The duties assigned must be specified and time-limited, e.g. membership on a Ph.D. committee or teaching a graduate-level class/seminar in a particular semester. On occasion, these duties within a program or department may be specified without a specific time limit, e.g. standard graduate teaching duties or membership on any Ph.D. committee in the program. Faculty with limited responsibilities will not be permitted to direct theses or dissertations.

Faculty members, or others carrying out research or scholarship from outside universities, may also be appointed to serve on a specific student's Ph.D. committee without being considered for Graduate faculty status, e.g., a faculty member from outside of Vanderbilt, a faculty member from a professional school such as law or medicine, or a scientist working in a national laboratory, with the approvals of the director of graduate studies or chair of the student's department and of the Graduate School. The request to appoint someone in this manner must be accompanied by a short letter of justification explaining what expertise this person brings to the student's committee along with a copy of the faculty member's curriculum vitae.

The functions of the Ph.D. committee are (a) to administer the qualifying examination, (b) to approve the dissertation subject, (c) to aid the student and monitor the progress of the dissertation, and (d) to read and approve the dissertation and administer the final oral examination.

The qualifying examination may be administered at any time during the school year and shall be completed within a period of four weeks. Before a qualifying examination can be scheduled, the student must have completed at least 24 hours of graduate work (to include all course work required for the degree) and the language requirement, if any. In some programs the student may be required to demonstrate basic competence in the discipline through a written preliminary examination prior to the actual qualifying examination.

All departments and other units offering Ph.D. programs must set a maximum time limit within which a student, under

normal circumstances, is required to take the qualifying examination. That maximum time limit must not exceed four years.

The qualifying examination may be written or oral, or both. The Graduate School must be notified of the time and place of the qualifying examination at least two weeks in advance. The qualifying examination is not a public examination, and voice recordings of it are not permitted. A student is allowed only two opportunities to pass the qualifying examination. The qualifying examination results form, signed by the committee members and the director of graduate studies for the program, shall be forwarded to the Graduate School immediately after the examination.

When the student has passed the qualifying examination, the Ph.D. committee shall recommend to the Graduate School that the student be admitted to candidacy for the degree.

Dissertation

A candidate for the Ph.D. degree must present an acceptable dissertation. The dissertation demonstrates that the candidate has technical competence in the field and has done research of an independent character. It must add to or modify what was previously known, or present a significant interpretation of the subject based upon original investigation. The subject of the dissertation must be approved by the student's faculty adviser and Ph.D. committee.

The dissertation must be completed within four years after a student has been admitted to candidacy for the degree. Upon petition to the Graduate School, a one-year extension of candidacy may be granted. If such a period has expired without successful completion of the dissertation, the student may be dismissed from the Graduate School. Readmission to the Graduate School, and to candidacy, requires application to the Graduate School, with approval of the program faculty. In such cases the student may be required, by the Graduate School or by the Ph.D. committee, to demonstrate competence for readmission by taking a qualifying examination or additional course work.

The candidate should submit a copy of the completed dissertation to the Ph.D. committee at least two weeks prior to the dissertation defense. The committee reviews the dissertation and conducts the final examination.

Final copies of the approved dissertation may be submitted to the Graduate School in electronic or printed form. Electronic submission is expected. Style specifications, paper requirements, fees, and further details are listed at *vanderbilt.edu/gradschool*. With either option, one copy of the title page, with the original signatures of not less than a majority of the Ph.D. committee, and one copy of an abstract of not more than three hundred fifty words, signed by the student's adviser, must be turned in to the Graduate School by the date specified on page 6. Students who submit their dissertations electronically revise the title page, convert the documents to a PDF file, and upload the document on the Electronic Theses and Dissertations (ETD) website, *etd.library.vanderbilt.edu*.

Dissertations are intended to be of benefit to the academic community and to society in general, and thus are required to be publicly available. This is accomplished by placing a copy in the Vanderbilt Heard Library, posting an electronic version on the library website, and by filing with UMI/ProQuest authorization for inclusion in an accessible database. In some instances, students may request a delay in the release or posting of their dissertations for a limited time period. This can be done, for example, to protect intellectual property, to allow time to

file a patent application, or to coordinate with the timing of publication in another form. In no circumstance will the release of the dissertation be delayed for more than two years. Unless requested for a shorter period of time, any request to delay public release will expire at the end of two years and the Graduate School will proceed with the public release through the library.

For students who choose to register the copyright with the U.S. Copyright Office, the Graduate School will help facilitate the process. Registration is not required to ensure copyright protection for your work, but certain additional rights are gained by virtue of registration. All applicable fees must be paid at the time the dissertation is turned in to the Graduate School. The abstract is published in *Dissertation Abstracts*, which publicizes the completion of the dissertation and announces its availability on microfilm.

Final Examination

The candidate must pass his or her dissertation defense at least fourteen days before the end of the term in which the degree is to be conferred, or by April 1 for May graduation. The final oral examination is administered by the student's Ph.D. committee and is on the dissertation and significant related material; the student is expected to demonstrate an understanding of the larger context in which the dissertation lies. The public is invited to attend the final examination, which is announced in advance in Vanderbilt's electronic calendar.

The chair of the Ph.D. committee or the director of graduate studies of the program, after consultation with the candidate, shall notify the Graduate School in advance of the place and time of the examination and the title of the dissertation. This should be done no later than two weeks prior to the examination. The Graduate School then formally notifies the Ph.D. committee and submits the defense notice to Vanderbilt's electronic calendar. The dissertation defense results form, signed by the committee members and the director of graduate studies for the program, should be forwarded immediately to the Graduate School.

Further Requirements

It should be understood that the requirements stated above are minimum and that individual programs may add others. Students are urged to consult individual program entries in this catalog and departmental chairs and directors of graduate studies to learn the requirements of programs in which they are interested.

Language Requirements for the Master's and Ph.D. Degrees

The language requirements, if any, for the master's and Ph.D. degrees in each graduate program are determined by the program faculty, and are set forth in this catalog in the section devoted to program descriptions and course offerings.

Foreign language requirements are usually met by demonstration of proficiency in one or more of the following: French, German, or Spanish. Certain programs either permit or require proficiency in other languages; and some others restrict the choice to certain combinations within this group. Students should refer to the various program statements in this catalog and should consult their advisers regarding specific requirements.

Examinations in languages are usually administered by the appropriate language faculty by arrangement with the

program. As an alternative to certification of proficiency by examination, the Graduate School may accept certification from the program that the minimum requirement in a language has been met if the student is able to present an acceptable academic record of the equivalent of at least 12 semester hours in the language.

A student who has fulfilled the language requirement at another graduate school prior to entering Vanderbilt may, at the discretion of the program and the Graduate School, transfer the certification if the student does so within three years after having received it.

International students may petition the Graduate School through the program to substitute their native language for one of the usual languages required for the Ph.D. degree.

Registration

The normal academic load for full-time registration is 9 to 13 hours in the fall and spring semesters. Students registered for 9 or more credit hours in fall or spring are defined as full time. Those registered for 7 or 8 hours in fall or spring are considered three-quarter time, those registered for 6 hours in fall or spring are half time, and those registered for less than 6 hours in fall or spring are less than half time. In the summer term, 6 or more hours is defined as full time, 5 hours is three-quarter time, 3 to 4 hours is half time, and less than 3 hours is less than half time. After completing the hourly requirements for the degree, full-time students register for master's (7999) or Ph.D. (8999, 9999) research without hourly credit to reflect full-time effort on research. Certain programs offer a half-time Ph.D. research course (9995) for students who are able to devote only half-time effort to dissertation research.

During each semester currently enrolled students are asked to meet with their advisers and directors of graduate studies to plan their schedules for the coming semester. All students must later complete official registration at the appropriate time using YES (Your Enrollment Services).

All full-time graduate students, including those receiving scholarship, assistantship, fellowship, or traineeship support through the university, must register each fall and spring semester with no breaks in registration to remain in good standing.

Changes in Registration

Changes in registration may be made through YES during the change period (the first ten class days of the semester) with consent of the major department. A student is not permitted to add or drop a course, change the number of hours in a variable-credit course, or change from audit to credit status after the end of the change period. A student may formally withdraw from a course after the end of the change period with the permission of the department, and a grade of *W* will be given. A student is not permitted to withdraw from the course after the Last Day to Withdraw (see Graduate School calendar) except under certain circumstances. Failing the course is not considered one of the circumstances. Students should note, in the section on tuition and fees, the regulations concerning tuition obligations for courses dropped after the first week of the term.

Courses in which there is a significant change in subject matter each semester (e.g., special topics courses) may be repeated for credit within limits noted in the course listings of this catalog.

Grading System

The grading system in the Graduate School includes the letter grades *A*, *B*, *C*, and *F*. A student will not be granted graduate credit for any course in which a grade less than *C-* is received. Courses not designated as eligible to be repeated for credit may be repeated for grade replacement purposes. If a course was failed the last time it was taken, credit is awarded when the course is repeated with a passing grade. If a course was previously passed, no new credit will be earned. If a course previously passed is repeated and failed, credit originally earned for it is lost. In any case all grades earned are shown on the transcript. The most recent grade in a course replaces the previous grade in determining credit, in computing the grade point average, and in verifying the completion of degree requirements and progress toward the degree. Passed courses may be repeated only once. Failed courses may be repeated any number of times until passed. The letter *I* may be used at the discretion of the instructor in those cases in which the student is not able to complete work in the normal time. The notation *W* is entered onto the transcript when a student withdraws from a course or from the Graduate School. A grade point average of 3.0 is required for graduation.

Letter grades are assigned grade point values as follows:

A+	= 4.0	B-	= 2.7
A	= 4.0	C+	= 2.3
A-	= 3.7	C	= 2.0
B+	= 3.3	C-	= 1.7
B	= 3.0	F	= 0.0

S/U grades are given every semester for all research courses (7999, 8999, and 9999), regardless of the number of hours registered. The accumulation of three (3) *U* grades over the course of study will lead to dismissal from the program and the Graduate School. No credit will be granted for courses in which a grade of *U* is received.

Students receive grades in all courses except those approved for credit/non-credit, audits, and some seminars. An *I* that is not replaced by a letter grade within one year may be changed to the grade *F* at the discretion of the instructor; otherwise, the *I* may become permanent and remain on the transcript as such.

Certain courses approved by the graduate faculty for credit/non-credit or Pass/Fail count toward total hours. Courses that are strictly no-credit, however, do not count toward total hours or in calculating grade point average, although grades for such courses are entered on the student's record.

With the instructor's permission, students are permitted to audit certain courses. Students who audit are expected to attend the course regularly. Students must be registered for regular courses in order to audit. Audits are listed on the student's transcript. Audits are limited to two per semester.

Grade Change Policy

For a student enrolled in the Graduate School, a grade recorded in the Office of the University Registrar may be changed only upon the written request of the instructor, endorsed by the appropriate official (usually an associate dean) within the school/college that offered the course, and then the approval of the associate dean of the Graduate School. An instructor's petition to change a grade must include a brief rationale for the change. Changing a recorded grade is a serious matter and, in general, petitions will be approved only upon certification that the original grade was in error or, in the case of an Incomplete, that the outstanding requirement(s)

have been completed. Request for exceptions to this policy should be directed to the associate dean of the Graduate School and will be considered on an individual basis; these may require additional certifications and approvals.

Academic Probation

A grade point average of 3.0 is necessary for graduation. Students who fall below an average of 3.0 are placed on probation for one semester. If the student's performance does not improve during that semester, the Graduate School and the appropriate department chair will decide whether to dismiss the student or to allow the continuation of probation. If at the end of the second semester the grade point average is still below 3.0, the student may be advised to withdraw or face dismissal. Students who earn a grade point average of 2.0 or less during their first semester of residence are subject to dismissal at the end of that semester. Accumulation of three *U* grades in research courses can lead to dismissal.

Student Grievances and Appeals

Students who believe their academic performance has not been judged reasonably or fairly, or who believe their intellectual contributions have not been fairly acknowledged, should discuss their concerns with the director of graduate studies in their program or, as necessary, the chair of the department. If the student's concerns cannot be resolved at the program or departmental level, the student may then request a further review of the issues in question by the associate dean for graduate studies or similar official in their school dean's office. The student may appeal the outcome of the school-level review to the Graduate School.

Credit

Courses not listed in this catalog that are numbered from 5000 to 9999 may be taken for credit by graduate students on the recommendation and consent of the faculty adviser and the director of graduate studies, unless some limit is noted in the description. Not all courses offered by various divisions of the university have been approved by the Graduate faculty for graduate credit. In these cases, students should complete a "Request for Graduate Credit" form. In arranging schedules, students should consult their advisers and carefully check the Graduate School catalog for approved courses.

Students may register for graduate courses or other courses in the university on a non-credit basis—either to fulfill their own interests or to meet certain prerequisites and requirements. The designation "no-credit" presupposes the student's participation in the course, including written assignments and examinations. Grades are received and recorded in no-credit courses and tuition is billed at the regular hourly rate.

Credit Policy

Credit hours are semester hours; e.g., a three-hour course carries credit of 3 semester hours. One semester credit hour represents at least three hours of academic work per week, on average, for one semester. Academic work includes, but is not necessarily limited to, lectures, laboratory work, homework, research, class readings, independent study, internships, and practica. Some Vanderbilt courses may have requirements that exceed this definition.

Transfer Credit

Graduate credit may be transferred from graduate schools in accredited institutions. Transfer is made only on the recommendation of the chair or director of graduate studies of the major department and approval of the Graduate School.

A maximum of 6 semester hours of transfer credit may be applied toward the master's degree and 48 hours toward the Ph.D. (See requirements for the master's degree and Ph.D. degree elsewhere in this catalog.)

Only those hours in which the student has achieved the grade *B* or its equivalent will be considered for transfer. Grades earned on transferred credit do not affect the student's Graduate School average unless such courses are to be counted as didactic hours.

Students who want to transfer to the Graduate School from professional degree programs offered by other schools at Vanderbilt must submit a formal application for admission and are expected to do so not later than the end of their first year of graduate-level studies at Vanderbilt.

Credits earned through the Division of Unclassified Studies cannot generally be used toward a graduate degree at Vanderbilt University.

Special Non-Degree Students

Special non-degree student status is reserved for limited circumstances. It is not intended for students who seek regular admission or to be admitted later as degree-seeking students. Examples appropriate for special non-degree status include a student enrolled in an accredited university but will be in residence at Vanderbilt for up to one year, such as a student participating in an approved exchange program. Another example is a student enrolled for a degree at another accredited university and whose adviser becomes a faculty member at Vanderbilt. In those instances, the special student status at Vanderbilt is to maintain a connection to that faculty member and/or receive financial support while at Vanderbilt and completing the degree at their home university. Other circumstances may be considered on a case by case basis.

Students admitted as non-degree students may register for selected courses in areas where they are qualified. Such students must submit an application and transcript(s) of their previous academic work with the Graduate School. Approval of the instructor, the department in which the course is offered, and the Graduate School is required. GRE scores are not required. Status as a non-degree student is expected to last no longer than one year. No more than 6 semester hours earned as a non-degree graduate student may be applied to graduate degrees at Vanderbilt.

Leave of Absence

The Graduate School requires continuous registration except for summer sessions. Students who want to interrupt their graduate study must petition the department, who on their behalf apply to the Graduate School for an authorized leave of absence. Leave of absence is granted for a maximum of one year. Those without authorized leave who do not register are dismissed from the Graduate School and are not considered students. If they want to resume graduate study at Vanderbilt, they must petition for reinstatement.

Parental Leave

All students enrolled full-time in the Graduate School and supported by funding from either internal or external sources are covered by this policy. This includes students with funding through stipends, such as training grants or service-free fellowships, and students compensated for services, such as teaching or research assistants. Prior to and/or following childbirth or adoption of an infant, the primary caregiver (whether mother or father) will be allowed to take six weeks of parental leave. During this period, the student's current stipend, and, if applicable, funding for health insurance and tuition, will be continued without interruption. The student's enrollment status will be continued during this period as well.

Withdrawal

Students who intend to withdraw from the university should inform the department, who then informs the Graduate School in writing. Improper notification may result in academic and financial penalties.

Credit for Graduate Courses Taken as an Undergraduate

A qualified Vanderbilt University senior undergraduate may enroll in graduate courses and receive credit which, upon the student's admission to the Graduate School, may be applicable toward a graduate degree. Undergraduate seniors interested in this option should review the regulations appearing in the Undergraduate Catalog and consult their advisers and the Graduate School. Undergraduates should note that those wanting to take 5000-level courses or above, whether under this option or not, must obtain the written approval of their academic adviser, the instructor of the course, and the Graduate School.

In certain special cases, credit may be transferred for graduate-level course work completed during undergraduate degree studies by a student at another accredited institution. The course hours must be in excess of the minimum required for the undergraduate degree and the course(s) must not be a required part of the undergraduate degree or major. Requests for such transfer of credit must be carefully justified by the student's major department and approved by the Graduate School.

Commencement

The university holds its annual Commencement ceremony following the spring semester. Degree candidates must have completed successfully all curriculum requirements and have passed all prescribed examinations by the published deadlines to be allowed to participate in the ceremony. A student completing degree requirements in the summer or fall semester will be invited to participate in Commencement the following May; however, the semester in which the degree was actually earned will be the one recorded on the diploma and the student's permanent record. Students unable to participate in the graduation ceremony will receive their diplomas by mail. Please refer to the Commencement webpage at vanderbilt.edu/commencement for complete information on the May ceremony.

Programs of Study

African American and Diaspora Studies

CHAIR Tracy D. Sharpley-Whiting
 DIRECTOR OF GRADUATE STUDIES Gilman W. Whiting
 PROFESSORS Victor Anderson, Houston Baker, David Ikard, Hector F. Myers, Alice Randall, Tracy D. Sharpley-Whiting, Paul Taylor, Rhonda Williams
 ASSOCIATE PROFESSORS Tiffany Ruby Patterson, Gilman W. Whiting
 SENIOR LECTURER Claudine Taaffe
 WRITER-IN-RESIDENCE Alice Randall

VANDERBILT University's African American and Diaspora Studies program offers an interdisciplinary, cross-cultural, and comparative curriculum of study of the histories, literatures, music, visual cultures, and politics of people of African descent around the world. To that end, the African American and Diaspora Studies program focuses on several geographic areas: Africa, Europe, the Americas, and the Caribbean. The certificate in diaspora studies has been designed to complement students' disciplinary training, expose them to the interdisciplinary trends in the academy, and broaden their career possibilities.

The diaspora studies certificate provides graduate students with access to interdisciplinary scholarship in the dynamic and continually evolving field of studies in the worldwide African diaspora. The certificate also gives students a competitive edge and interdisciplinary training for the still robust career outlook for specialists in pan-black studies as well as in the search for postdoctoral fellowships in the humanities and social sciences.

The certificate in diaspora studies is open to any student enrolled in graduate study at Vanderbilt University. Acceptance to the program requires the approval of the African American and Diaspora Studies program graduate studies committee, comprising the director of graduate studies, the chair of African American and Diaspora Studies, and one other faculty member from African American and Diaspora Studies.

Students must also submit as part of the application to the certificate program: 1) a one-page description of their interests in African diaspora studies and how it relates to their graduate program of study; and 2) complete an Intent to Enroll form, which must be signed by the student, the AADS director of graduate studies, and the director of graduate studies for the degree program in which the student is enrolled. A signed copy of the form should be submitted to the Graduate School (richard.hoover@vanderbilt.edu), to the Office of the University Registrar (URO) (university.registrar@vanderbilt.edu), and to the AADS program administrator (lennita.tate@vanderbilt.edu).

For more detailed information on the diaspora certificate, please go to vu.edu/aads or contact the director of graduate studies in the Department of African American and Diaspora Studies.

Requirements for the Graduate Certificate in Diaspora Studies

1. 12 credit hours of course work, which includes:
 - a. 3 credit hours of African American and Diaspora Studies 5002, an interdisciplinary introduction to materials, teaching methods, debates, and theoretical terms of scholarly research in diaspora studies. A three-week section devoted to course design and development will also be taught in conjunction with the Center for Teaching. Students will be required to prepare a syllabus for the introductory course in African Diaspora Studies, AADS 1010.
 - b. 9 credit hours of interrelated graduate-level course work on race and its intersection with gender, class, religion, power, and/or sexuality, which are appropriate to the student's graduate program of study. Students may also take African American and Diaspora Studies 5654 Memoirs and Biographies as well as African American and Diaspora Studies 5095 Directed Study with a faculty member in African American and Diaspora Studies to fulfill 6 credit hours. No more than 6 credit hours of specifically named courses required for the primary degree may be applied toward the certificate. All courses must be approved by the African American and Diaspora Studies program graduate committee and must form an intellectually cohesive whole. Students will be required to provide a copy of course syllabi to the graduate committee so that the committee may determine whether the courses taken or proposed to be taken by the student are indeed appropriate for certificate credit.
2. Participation in a minimum of five extracurricular activities sponsored by the Callie House Research Center for the Study of Global Black Cultures and Politics. A short paper reflecting on the insights gained from participating must be submitted to the director of graduate studies before conferral of the certificate.
3. The conferral of the certificate requires a cumulative GPA of 3.3, satisfactory performance of 3.3 or better in AADS 5002, and completion of all the aforementioned requirements.

Graduate courses successfully completed at Vanderbilt University prior to admission to the program may be counted toward the certificate requirements with the approval of the chair of the department if the course can satisfy one of the curriculum requirements of the program. Or if the program doesn't require the permission of the chair: Graduate courses successfully completed at Vanderbilt University prior to admission to the program may be counted toward the certificate requirements if the course can satisfy one of the curriculum requirements of the program.

An undergraduate course may be substituted for a graduate course required by the program's curriculum with the approval of the chair of the program and the Graduate School.

Approved List of Courses

AFRICAN AMERICAN AND DIASPORA STUDIES: 5002 (300), Theories of Diaspora; 5095 (395a), Directed Study; 5654 (265) Memoirs and Biographies.

ANTHROPOLOGY: 8220 (349), The Historical Archaeology of Latin America.

ENGLISH: 8137 (337a), Introduction to Literary Theory; 8150 (350), Special Problems in English and American Literature; 8155 (355), Special Topics in English and American Literature; 8430 (325), Seminar in Modern British and American Literature; 8450 (320), Studies in American Literature; 8455 (321), Studies in Southern Literature.

FRENCH: 8070 (388), Seminar in Francophone Literature.

GERMAN: 5795 (395), The Racial Imagination.

HISTORY: 6400 (302a), Readings in American History; 6410 (302b), Readings in American History; 6500 (303a), Readings in Early Latin American History; 6510 (303b), Readings in Modern Latin American History; 8050 (305), Studies in Comparative History; 8600 (358), Comparative Slavery in the Colonial Americas; 8610 (359), Atlantic World History, Fifteenth to the Nineteenth Century; 8620 (361), Studies in Latin American History; 8630 (365), Research Seminar in Latin American History; 8700 (371), Studies in Early American History to 1783; 8710 (372), Studies in the Middle Period of American History, 1783–1861; 8720 (373), Studies in U.S. History, 1861–1900; 8730 (374), Studies in Recent American History; 8732, Religion and the Civil Rights Movement; 8740 (375), Research Seminar in Recent American History; 8745 U.S. and the World; 8750 (381), Studies in American History.

PHILOSOPHY: 9000 (353), Figures in Philosophy (must be AADS-related); 9020 (352), Topics in Philosophy (must be AADS-related).

POLITICAL SCIENCE: 8305 (305), Feminist Social and Political Thought; 8330 (330), Studies in American Politics; 8332 (332), Electoral Behavior and Public Opinion.

RELIGIOUS STUDIES: 3442, African American Political Theology; 3535, Black Islam in America; 3538, The Black Church in America; 3822, The Amarna Period; 3852, Slave Thought; 3882, African American Biblical Hermeneutics; 7131 (3415), Feminist/Womanist Ethics.

SOCIOLOGY: 6302, Contemporary Theory; 8331, Survey Seminar on Collective Behavior and Social Movements; 8333, Survey Seminar on Cultural Sociology; 8345, Survey Seminar on Social Stratification.

SPANISH: 8200, Seminar: Studies in Colonial Literature; 8345, Introduction to Latin American Colonial Studies; 9240, Ordering and Disrupting Fictions in Latin America; 9270, The Politics of Identity in Latino U.S. Literature; 9520, Special Topics in Spanish American Literature.

WOMEN'S AND GENDER STUDIES: 8301, Gender and Sexuality: Feminist Approaches; 8302, Gender and Pedagogy.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 78.

American Studies

DIRECTOR Sarah E. Igo (History)

ASSISTANT DIRECTOR Gabriel A. Torres Colón

PROFESSORS C. André Christie-Mizell (Sociology), Dan Cornfield (Sociology), Colin Dayan (English), Marshall C. Eakin (History), Ted Fischer (Anthropology), Vivien Fryd (History of Art), Joni Hersch (Law and Economics), Sarah E. Igo (History), Larry Isaac (Sociology), Dana Nelson (English), Cecelia Tichi (English)

ASSOCIATE PROFESSORS Vanessa Beasley (Communication Studies), Teresa A. Goddu (English), Leah Lowe (Theatre), Ifeoma Kiddoe Nwankwo (English), Richard Pitt (Sociology), Paul Stob (Communication Studies)

ASSISTANT PROFESSOR Aimi Hamraie (Medicine, Health, and Society)

SENIOR LECTURERS Alexander Jacobs, Gabriel A. Torres Colón

LECTURERS Sarah Gorham, Susan Kevra (French)

VANDERBILT University's Program in American Studies offers a graduate certificate designed to complement students' disciplinary training, expose them to larger interdisciplinary traditions and academic literatures, and enhance their professional careers. The certificate offers a structured introduction to the questions and methods of American Studies. It provides students with a valuable credential and strengthens their ability to compete for jobs as well as national fellowships and postdoctoral awards.

The certificate in American Studies is open to any student enrolled in graduate study at Vanderbilt University. Students wishing to enroll must complete an Intent to Enroll form, which must be signed by the student, the director of the program, and the director of the graduate program (DGS) for the degree program in which the student is enrolled. A signed copy of the form should then be submitted to the Graduate School (richard.hoover@vanderbilt.edu) and to the Office of the University Registrar (university.registrar@vanderbilt.edu).

Acceptance to the program requires the approval of both the graduate director of the student's home department and the director of the Program in American Studies. Students must also submit an application that includes (1) a one-page rationale for their course of study to the American Studies graduate committee for approval and (2) a plan of study focused on a specific theme, forming an intellectually coherent whole.

Graduate courses successfully completed at Vanderbilt University prior to admission to the program may be counted toward the certificate requirements with the approval of the director of the program if the course can satisfy one of the curriculum requirements of the program. An undergraduate course may be substituted for a graduate course required by the program's curriculum with the approval of the director of the program and the Graduate School.

The awarding of a certificate requires a cumulative GPA of 3.3, of B+ or better in AMER 8000, completion of all course requirements, and satisfactory completion of the practicum project requirement. Please contact the American Studies program for more information at american-studies@vanderbilt.edu.

Requirements for Graduate Certificate in American Studies

1. American Studies 8000: Graduate Workshop in American Studies.
2. Four additional graduate-level American Studies courses appropriate to the student's program of study. Courses

must be approved by the graduate committee for credit and should include at least two courses outside the student's home discipline. One course may be devoted to the practicum project and can be satisfied through an independent study with a faculty member affiliated with the American Studies program, with the approval of the director of the American Studies program.

3. Participation in the monthly meetings of the Graduate Working Group.
4. A practicum project submitted to the graduate committee for evaluation. The project must demonstrate the application of an American Studies approach to research, teaching, or fieldwork in the context of the student's primary field and can take the form of an American Studies Salon, a detailed American Studies Road Trip or City Walk plan, an article draft, a conference paper for a regional or national American Studies Association meeting, or an annotated syllabus for an introductory American Studies course.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 78.

Anthropology

CHAIR Beth A. Conklin
 ACTING CHAIR William R. Fowler Jr.
 DIRECTOR OF GRADUATE STUDIES William R. Fowler Jr.
 PROFESSORS EMERITI Thomas A. Gregor, Ronald Spores
 PROFESSORS Arthur A. Demarest, Tom D. Dillehay, Edward F. Fischer, Lesley Gill
 RESEARCH PROFESSOR Charles E. Orser Jr.
 ASSOCIATE PROFESSORS Jada Benn Torres, Beth A. Conklin, Markus Eberl, William R. Fowler Jr., T. S. Harvey, John Janusek, Norbert Ross, Tiffany A. Tung, Steven A. Wernke
 RESEARCH ASSOCIATE PROFESSOR Patricia J. Netherly
 ASSISTANT PROFESSOR Carwil Bjork-James
 RESEARCH ASSISTANT PROFESSORS Teresa Franco, Anna Guengerich, Jacob S. Sauer

DEGREE OFFERED: *Doctor of Philosophy*

THE graduate program in anthropology is designed to prepare students for careers in teaching and research, especially with an emphasis on specializations in the anthropology of Central America, Mexico, and South America. The graduate enrollment of approximately thirty graduate students assures a close tutorial relationship with faculty and ample student opportunities for field research, lab research, and publishing.

Students are admitted to the Ph.D. program in anthropology and may earn a master of arts (M.A.) in anthropology en route to the Ph.D. The M.A. is awarded to students who earn a minimum of 36 credit hours of graduate study, complete the foreign language requirement, and pass the comprehensive exams. Four semesters of residency are required.

The Ph.D. program requires at least 45 hours of formal course work (i.e., 9 more credit hours after the M.A. is achieved). Doctoral candidates must pass comprehensive examinations, present and defend a dissertation proposal (i.e., complete the qualifying exam), complete a dissertation on original field or archival research, and defend the dissertation.

Subject to the approval of the director of graduate studies, students entering the program with a master's degree or with studies elsewhere may transfer up to 18 hours of graduate credit. Additional information about the Department of Anthropology Ph.D. program can be found at this website: as.vanderbilt.edu/anthropology/graduate/phd.php.

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Course descriptions begin on page 78.

Arabic

Course descriptions begin on page 82.

Archaeology

See Anthropology and Classical and Mediterranean Studies

Asian Studies

DIRECTOR Gerald Figal
 PROFESSORS Robert Campany, Gerald Figal (Joint with History)
 ASSOCIATE PROFESSOR Ben Tran
 ASSISTANT PROFESSORS We Jung Yi, Guojun Wang
 PRINCIPAL SENIOR LECTURER Xianmin Liu
 SENIOR LECTURERS Seok Bae Jang, Elliott McCarter, Hideko Shimizu
 LECTURERS Divya Chaudhry, Yinghui Guo, Nozomi Imai, Jing Liu, Asami Nakano, Qing Wei

Affiliated Faculty
 PROFESSORS Yoshikuni Igarashi (History), Tony K. Stewart (Religious Studies)
 ASSOCIATE PROFESSORS Brett Benson (Political Science), Peter Lorge (History), Tracy Miller (History of Art), Ruth Rogaski (History), Samira Sheikh (History), Lijun Song (Sociology and Medicine, Health, and Society), Tariq Thachil (Political Science)
 ASSISTANT PROFESSORS Akshya Saxena (English), Haerin Shin (English), Heeryon Shin (History of Art), Anand V. Taneja (Religious Studies)
 SENIOR LECTURER EMERITUS James Auer (Center for U.S.-Japan Studies)
 LECTURER Piyali Bhattacharya (English)

VANDERBILT University's Program in Asian Studies offers a graduate certificate in the interdisciplinary study of the societies and cultures of Asia. The certificate offers graduate students a perspective on Asia that goes beyond the student's particular disciplinary specialization, and signals that the student has achieved competence in an Asian language. The certificate offers a valuable credential for students who wish to undertake career opportunities in Asia, or work in a field related to Asian countries, institutions, or populations. An

Asian Studies certificate will also allow students in professional schools to take advantage of the many global opportunities opening up in business, law, education, and health care.

The certificate in Asian Studies is open to any student enrolled in graduate study at Vanderbilt University. The certificate is awarded upon fulfillment of the following three categories of requirements:

- 1) Completion of at least 12 credit hours of interrelated graduate-level course work (see below);
- 2) Demonstrated language competency in an Asian language; and
- 3) Attendance at a minimum of five academic events.

Courses may include those offered directly by the Asian Studies program, as well as graduate courses from other departments that have been approved by the director of the Asian Studies program. Course work must be focused on a specific theme and together form an intellectually coherent whole. Up to 6 credit hours of specifically named required courses of a student's primary degree program may count toward the certificate. At least 6 credit hours must come from outside the student's home discipline. Graduate courses successfully completed at Vanderbilt University prior to admission to the program may be counted toward the certificate requirements with the approval of the director of the program. An undergraduate course may be substituted for a graduate course required by the program's curriculum, with the approval of the director of the program and the Graduate School.

Students wishing to enroll must complete an Intent to Enroll form, which must be signed by the student, the director of the Asian Studies Certificate Program, and the director of the graduate program (DGS) for the degree program in which the student is enrolled. A signed copy of the form must be submitted to the Graduate School (richard.hoover@vanderbilt.edu) and to the Office of the University Registrar (university.registrar@vanderbilt.edu).

A number of courses are available in Asian languages, social sciences, and humanities for graduate credit. A partial listing of relevant courses follows. See departmental listings for courses offered in the current academic year.

ASIAN STUDIES: 5151, The Third World and Literature; 5210W, Hollywood Hanoi; 5508, Chinese Drama: 13th to 20th Centuries; 5511, Popular Culture in Modern Japan; 5512, Explorations of Japanese Animation; 5560, Current Japan–U.S. Relations; 5605, Romancing the Nation in Modern Chinese Literature; 5606, Martial Tradition in Chinese Literature; 5607, Self & Society in Pre-modern Chinese Literature; 5609, Writing and Gender in Traditional China; 5633, Self-Cultivation in Ancient China; 5851–5852, Independent Study; 5891–5892, Special Topics.

CHINESE: 5101, Elementary Chinese I; 5102, Elementary Chinese II; 5201, Intermediate Chinese I; 5202, Intermediate Chinese II; 5231, Calligraphy; 5301, Advanced Chinese I; 5302, Advanced Chinese II; 5401, Business Chinese I; 5402, Business Chinese II; 5403, Readings in Modern Chinese Media; 5404, Readings in Modern Chinese Media; 5405, Classical Chinese Literature and Philosophy; 5406, Readings in Modern Literary Chinese.

HISTORY: 5115, Play and Pleasure in Early Modern Japan; 5120, Post-WWII Japan; 5140, The Mughal World; 5150, India and the Indian Ocean.

HISTORY OF ART: 5112, The Arts of China during the Liao-Song Period.

JAPANESE: 5101, Elementary Japanese I; 5102, Elementary Japanese II; 5201, Intermediate Japanese I; 5202, Intermediate Japanese II; 5301, Advanced Japanese I; 5302, Advanced Japanese II; 5891, Special Topics in Advanced Japanese.

POLITICAL SCIENCE: 5216, The Chinese Political System.

RELIGIOUS STUDIES: 5665, Mythologies and Epics of South Asia; 5666, Devotional Traditions of South Asia: Hindu, Muslim, Sikh; 5669, Sacred Space in the Tibetan World; 5753, East Asian Buddhism; 5775, Chinese Religions through Stories.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 83.

Astronomy

See **Astrophysics and Physics and Astronomy**

Astrophysics

CHAIR M. Shane Hutson
 DIRECTOR OF GRADUATE STUDIES Andreas A. Berlind
 PROFESSORS Kelly Holley-Bockelmann, Robert J. Scherrer, Keivan G. Stassun, David A. Weintraub
 ASSOCIATE PROFESSOR Andreas A. Berlind
 ASSISTANT PROFESSORS Jessie C. Runnoe, Stephen R. Taylor
 DISTINGUISHED RESEARCH PROFESSOR C. Robert O'Dell

Affiliated Faculty
 PROFESSORS Thomas Kephart, Thomas Weiler

DEGREE OFFERED: *Doctor of Philosophy*

ASTROPHYSICS is the study of the universe on all physical scales—from nuclear reactions inside stars to the expansion of the universe as a whole—generally focusing on objects and physical phenomena beyond our own solar system. Areas of study include: stars (stellar astrophysics), their birth (star formation) and their death (stellar evolution); the discovery and characterization of other solar systems (exoplanetary science); the material between the stars (interstellar medium); large ensembles of stars (star clusters) and their interactions (stellar dynamics); our Milky Way galaxy and its local group of galaxies (galactic astrophysics); other galaxies (extragalactic astrophysics), their birth (galaxy formation) and their evolution (galactic evolution); the structure of the universe as a whole (large-scale structure); and the origin and evolution of the universe itself (cosmology). Astrophysics also includes the study of fundamental physics—forces, particles, the nature of matter and energy—in the astronomical context, including: particle astrophysics (e.g., solar neutrinos), gravity-wave physics, the extreme physics of compact objects (e.g., black holes), dark matter, and dark energy. Astrophysics involves experimental techniques (observational astrophysics), generally involving images or spectra from telescopes on the ground and/or space, or analysis of archival datasets (data mining); theory, which includes the application of physics first-principles to derive fundamental physical laws or relationships; modeling techniques (computational astrophysics), which generally involves use of massive computing resources to simulate complex objects and phenomena; and information science (astro-informatics), which includes development and

application of algorithms for the analysis, deployment, and curation of large datasets (data-intensive astrophysics).

The master of arts in astrophysics is awarded to students who earn a *B* average in a minimum of 30 credit hours of graduate study and complete the formal course requirements for the Ph.D. in astrophysics.

The Ph.D. degree in astrophysics requires 72 hours of graduate work, including 28 hours of formal course work, including 16 credit hours of core graduate courses in astrophysics, and 12 credit hours of elective graduate courses in astrophysics and/or physics or an approved field. A student must earn a grade of *B* or higher in every course that counts toward these 28 hours. The remaining credit hours may be earned through some combination of dissertation research and approved lecture courses. In addition to satisfying these requirements, a student must take a minimum of two semesters of ASTR 8002 Teaching Practicum and four semesters of ASTR 8003 Astrophysics Seminars, which are both zero credit courses.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 83 for Astrophysics and page 145 for Physics.

Biochemistry

CHAIR John D. York

DIRECTOR OF GRADUATE STUDIES Manuel Ascano Jr.

PROFESSORS Brian Bachmann, Richard Breyer, Richard Caprioli,

Bruce Carter, Walter Chazin, David Cortez, Brandt Eichman, Martin

Egli, Ron Emeson, Stephen Fesik, F. Peter Guengerich, Scott W.

Hiebert, Billy Hudson, Tina M. Iverson, D. Borden Lacy, Craig W.

Lindsley, Lawrence J. Marnett, Houra Merrikh, Neil Osheroff, Cathleen

Pettepher, Jennifer A. Pietenpol, Ned A. Porter, Vito Quaranta, W.

Kimryn Rathmell, Carmelo J. Rizzo, Charles R. Sanders, Samuel A.

Santoro, Kevin L. Schey, Michael Stone, John D. York

ASSOCIATE PROFESSORS Lourdes Estrada, Andrew Link

ASSISTANT PROFESSORS Manuel Ascano Jr., Raymond D. Blind,

Breann Brown, James Dewar, Emily C. Hodges, Lauren Parker

Jackson, Carlos Lopez, Adrian Olivares, Yi Ren, Marija Zanic

DEGREE OFFERED: *Doctor of Philosophy*

STUDENTS interested in this program participate in the Interdisciplinary Graduate Program or Quantitative and Chemical Biology Program in the Biomedical Sciences during their first year (see Biomedical Sciences). The second year of study comprises required and elective course work that may include Biochemistry 8300, 8301, 8302, 8303, 8323, 8325, 8327, 8336, 8337, 8343, 8349, and 8352 for a total of at least 24 hours of formal course work toward the Ph.D. degree (including 16 hours in the first year). A thesis-based master's degree is awarded only under special circumstances.

The program offers students fundamental training in biochemical principles and an opportunity to apply such knowledge to vital biological and medical problems.

The intent of the department is to maintain a graduate program that emphasizes quality of experience, academic scholarship, and professional achievement. All faculty members are involved in active research programs. Thirty-five to forty-five graduate students are generally enrolled.

Major research efforts are concerned with studies on: regulation of expression and mechanisms of detoxification by cytochrome P450 enzymes; oxygenase and arachidonic acid biochemistry; cancer drug development; biophysics of the cytoskeleton; proteinase inhibitor structure and regulation; lipid-based signaling; nucleic acid structure and interactions with carcinogens; DNA-binding proteins; mass spectrometric tissue imaging, proteomics, DNA topoisomerase; biochemistry and endocrinology of hypertension; human genetics; intracellular signaling in growth and development; molecular mechanisms of Alzheimer's disease; RNA-binding proteins; post-transcriptional regulation of gene expression; ion channels; neoplastic transformation by oncogenic transcription factors; cellular responses to DNA damage; bacterial toxins; innate immune mechanisms; host-pathogen interactions; chromatin structure and histone modifications; epigenetics and gene regulation; membrane protein-linked disease mechanisms, genome surveillance, nuclear RNA transport; DNA replication termination, replication, and transcriptional conflicts; force transduction involving the nuclear membrane; calcium-binding proteins; and one-carbon metabolism. These studies use state-of-the-art technology including molecular biology and high-throughput sequencing, mass spectrometry, NMR spectroscopy, cryo-electron microscopy, and X-ray crystallography.

Faculty of the department also participate in interdisciplinary training programs, supported by National Institutes of Health training grants, that offer specialized biochemical training in the areas of molecular toxicology, chemical biology, biochemical nutrition, molecular biophysics, infectious disease, cancer research, and molecular endocrinology.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 84.

Biological Sciences

CHAIR Brandt F. Eichman

DIRECTOR OF GRADUATE STUDIES Julian Hillyer

PROFESSORS EMERITI Burton J. Bogitsh, Clint E. Carter, Robert Kral, Wallace M. LeSturgeon, Terry L. Page, Charles K. Singleton, Gerald J. Stubbs, Dean P. Whittier, Robley C. Williams Jr.

PROFESSORS Seth R. Bordenstein, Kendal S. Broadie, Kenneth C. Catania, Brandt F. Eichman, Todd R. Graham, Carl H. Johnson, Douglas G. McMahon, James G. Patton, Antonis Rokas, Laurence J. Zwiebel

RESEARCH PROFESSOR Hans-Willi Honegger

ASSOCIATE PROFESSORS D. Kilpatrick Abbot, John Anthony Capra, Larisa R. G. DeSantis, Katherine L. Friedman, Daniel J. Funk, Julian F. Hillyer

RESEARCH ASSOCIATE PROFESSOR Yao Xu

ASSISTANT PROFESSORS Nicole Creanza, Lauren Parker Jackson, Jared T. Nordman, Maulik Patel, Lars Plate, Ann Thomas Tate

RESEARCH ASSISTANT PROFESSORS Dominic Didiano, Tetsuya Mori, Shuqun Shi, Peng Xu

DEGREE OFFERED: *Doctor of Philosophy*

RESEARCH activities in the Department of Biological Sciences encompass the study of biology at the molecular, subcellular, cellular, organismal, population, and community levels. The faculty have primary research interests in the areas of biological

clocks, evolutionary genomics, genome maintenance, small RNAs, protein trafficking, vector biology, symbiosis, social evolution, microbiomes, speciation, synapse formation and plasticity, mitochondrial function, immunity, behavioral genomics, development, regeneration, visual, and olfactory sensory systems.

Students interested in this program may apply for direct admission in the Biological Sciences graduate program, or they may enter through the Interdisciplinary Graduate Program (IGP) in Biomedical Sciences or the Quantitative and Chemical Biology (QCB) program, and choose Biological Sciences as their home department by the end of the second semester. (See IGP and QCB sections in this catalog.)

The program is designed to lead to the Ph.D. degree; however, M.S. degrees are granted under special circumstances and require a research thesis or successful completion of the qualifying exam. The Ph.D. degree requires 72 hours of credit for graduation, including at least 24 credit hours of formal course work with the remainder earned through dissertation research. Credit hours earned in the first-year IGP program will be counted toward the required 24 hours of formal course work.

Desirable backgrounds for graduate study in the Department of Biological Sciences, depending upon the specific interests of the student, would be undergraduate programs emphasizing biological sciences, chemistry, mathematics, or physics course work, but students from other disciplines are also eligible.

Visit the departmental website at as.vanderbilt.edu/biosci for more information.

Note: The following courses (described in the course listing) are usually not available for graduate credit for students in the Biological Sciences program: 2201, 2205, 2210, 2520.

Graduate students in biological sciences may take graduate courses in School of Medicine departments by arrangement.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 85.

Biomedical Engineering

CHAIR Michael R. King
 DIRECTOR OF GRADUATE STUDIES Cynthia A. Reinhart-King
 DIRECTOR OF GRADUATE RECRUITING Mark D. Does
 DIRECTOR OF UNDERGRADUATE STUDIES Craig Duvall
 PROFESSORS EMERITI Robert L. Galloway Jr., Thomas R. Harris,
 Paul H. King, Robert J. Roselli, Richard G. Shiavi
 PROFESSORS Adam W. Anderson, Mark D. Does, Craig L. Duvall,
 Todd D. Giorgio, John C. Gore, Frederick R. Haselton, E. Duco
 Jansen, Anita Mahadevan-Jansen, Michael R. King, W. David
 Merryman, Michael I. Miga, Knowles A. Overholser, Cynthia A.
 Reinhart-King, John P. Wikswo
 ASSOCIATE PROFESSORS Franz Baudenbacher, Audrey K. Bowden,
 William A. Grissom, Cynthia B. Paschal
 ASSISTANT PROFESSORS Jonathan Brunger, Brett C. Byram, Mikhail
 Rubinov, Yuankai K. Tao

BIOMEDICAL engineering as a research discipline is concerned with the development of new physical and mathematical concepts applicable to problems in biology, medicine, and the organization of health care. Biomedical engineering also deals with more pragmatic problems, such as biomedical use of information systems and development of advanced biomedical instrumentation. The vision of the BME graduate program is to provide the best advanced education to our graduate students such that they are optimally prepared for successful careers in academia, industry, and related fields. The goal of the program is to provide advanced education and research training in quantitative biology, biomaterials, cellular bioengineering, biomedical photonics, medical imaging, biomedical instrumentation, and the scientific principles underlying the origination of diagnostic and therapeutic devices and processes. The program is specifically concerned with the interface between biology, medicine, and the engineering, physical, computing, and mathematical sciences.

Candidates for the master of science (M.S.) degree must complete 30 hours of graduate-level credit, approved by the faculty, with the following minimum distribution of didactic hours: 12 hours in biomedical engineering, 3 hours in an approved life sciences course, and 9 hours in advanced life science, physical science, or engineering. At least 6 of the BME hours and 3 of the advanced science or engineering hours must be 6000+ level courses. One (1) hour of BME seminar and 6 hours of thesis research credit hours can count toward the total of 30 hours necessary for the M.S. degree. In addition, the candidate must submit a research thesis for faculty approval and give a final oral presentation.

Candidates for the Ph.D. degree must complete a minimum of 27 semester hours of graduate-level didactic courses approved by the program faculty, excluding seminar, research, and teaching hours. Candidates must complete 15 hours in biomedical engineering courses (required: BME 6110 or equivalent), 3 hours in an approved life sciences course, and 9 hours in advanced life science, physical science, or engineering. At least 9 of the BME hours and 3 of the advanced science or engineering hours must be 6000+ level courses. The remainder of the 72 hours required for a Ph.D. will primarily consist of dissertation research, but may also include seminar and other approved (didactic) courses. In addition, students must pass a qualifying examination consisting of written and oral presentations of a proposal for doctoral research, present a dissertation showing the results of original research in biomedical engineering, and successfully defend the dissertation results in an oral examination.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 86.

DEGREES OFFERED: *Master of Science, Doctor of Philosophy*

Biomedical Informatics

CHAIR Kevin B. Johnson

DIRECTOR OF GRADUATE STUDIES Cynthia S. Gadd

PROFESSOR EMERITUS Randolph A. Miller

PROFESSORS Joshua C. Denny, Mark E. Frisse, Cynthia S. Gadd, Nunzia B. Giuse, Paul A. Harris, Kevin B. Johnson, Christoph U. Lehmann, Nancy M. Lorenzi, Bradley A. Malin, William W. Stead, Adam Wright

PROFESSOR OF CLINICAL Karl Misulis

ADJUNCT PROFESSORS Bing Zhang, Zhongming Zhao

ASSOCIATE PROFESSOR EMERITUS Edward K. Shultz

ASSOCIATE PROFESSORS Steven H. Brown, Stephany N. Duda, Dario A. Giuse, Thomas A. Lasko, Michael E. Matheny, Josh F. Peterson, S. Trent Rosenbloom, Stuart T. Weinberg, Asli Weitkamp, Martin C. Were

ADJUNCT ASSOCIATE PROFESSORS Dominik Aronsky, Mia Levy, Hua Xu

ADJOINT ASSOCIATE PROFESSOR Yevgeniy Vorobeychik

ASSISTANT PROFESSORS S. Toufeeq Ahmed, Cosmin A. Bejan,

Robert J. Carroll, You Chen, Robert M. Cronin, Daniel Fabbri, Elliot Fielstein, Jacob Hughey, Yaa Kumah-Crystal, Allison McCoy, Dara Eckerle Mize, Scott D. Nelson, Laurie L. Novak, Travis Osterman, Sharidan Parr, Ruth Reeves, Shane P. Stenner, Kim M. Unertl, Colin G. Walsh, Wei-Qi Wei, Zhijun Yin

RESEARCH ASSISTANT PROFESSORS Lisa Bastarache, Aize Cao, Fern FitzHenry, Glenn Gobbel

ADJUNCT ASSISTANT PROFESSORS William S. Bush, William Lancaster, Russell Leftwich, Siddharth Pratap, Laura Wiley

INSTRUCTOR Joshua C. Smith

ADJUNCT INSTRUCTOR Judith Dexheimer

DEGREES OFFERED: *Master of Science, Doctor of Philosophy*

BIOMEDICAL informatics studies the structure, discovery, acquisition, integration, management, and optimal use of biomedical information. The field involves multidisciplinary research in all aspects of health care delivery, biomedical research, computational biology, and public health. Biomedical informatics applies, evaluates, and expands results from a variety of disciplines including information and computer science, library science, cognitive science, business management and organization, statistics and biometrics, data science, mathematics, artificial intelligence, operations research, economics, and of course, basic and clinical health sciences. Biomedical informatics has both “knowledge and methods” and “application domain” components. It expands beyond biomedical computer systems design, application, and evaluation to provide theory, tools, and systems that address today’s most urgent challenges in health care delivery, biomedical research, and health professions education.

The curriculum offers concentration areas: Clinical Informatics, the application of informatics to direct patient care, such as advanced decision support and person-centered health records; Translational Bioinformatics, the application of informatics to support basic research in such areas as genomics, proteomics, and systems biology; and a new Data Science Track in the Ph.D. program, which integrates courses and faculty from across the institution to ensure that the students are well-versed in the foundational competencies of computation, statistics, and biomedical science that are necessary to achieve reproducible success in the data science field.

Students typically enter with a background in one of the health professions (e.g., M.D., R.N., D.D.S., Ph.D. in a health-related area such as psychology or biostatistics), or with a

background in computing, engineering, biology, or mathematics. After graduation they pursue careers as full-time academic researchers, part-time academic researchers/part-time clinicians, scientific managers or advanced scientists in industry, information managers in health care settings, consultants, or entrepreneurs.

All students take the five core biomedical informatics courses: Foundations of Biomedical Informatics, Foundations of Bioinformatics, Methodological Foundations of Biomedical Informatics, Scientific Communication, and Research Rotation in Biomedical Informatics. In addition, M.S. degree students take two selectives (advanced courses in biomedical informatics); two courses in each of two competency areas (unless satisfied by prior education or experience): Computer/Information Science, Biology/Medicine, and Research Methods; and take one additional elective. Ph.D. students take three selectives; two courses in each of three competency areas (unless satisfied by prior education or experience), depending on background; and three additional electives. The curriculum is adapted to students’ backgrounds and concentration areas. The new Data Science Track has specific requirements. Thus, a minimum of 30 course credit hours and a thesis are required for the M.S. degree, and a minimum of 72 credit hours is required for the Ph.D. degree. Ph.D. students must earn the M.S. degree, pass a qualifying examination, and successfully propose and defend a dissertation. Waivers for the M.S. degree requirement may be granted in selected cases. A teaching practicum is strongly recommended.

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Course descriptions begin on page 87.

Biomedical Sciences

DIRECTOR James G. Patton

DEGREE OFFERED: *Master of Science*

THIS graduate program is designed for students seeking to increase their knowledge base as it relates to the biomedical discipline and their competitiveness for admission to graduate and professional schools. The program will cater to the individual needs of students as they prepare for careers in medicine and the biomedical sciences. There are two curricular tracks that the student may follow: CHANGE and EDGE.

The curriculum for CHANGE students is designed to provide students coming from diverse academic backgrounds the ability to change their career direction. Didactic training will facilitate growth of knowledge of the basic biomedical foundations; individualized attention from research mentors will build biomedical research exposure; physician shadowing will provide exposure to the medical realm; and interview preparation will be strategically selected in consultation with one-on-one advisers.

The EDGE track is for students seeking to increase their foundation of knowledge prior to admission into health profession programs. Specific course work will build the student’s didactic knowledge base in preparation for entry into a biomedical or medical field. Accompanying critical skill

development and experience will give applicants an edge in preparation for entry into their program of choice.

Successful completion of the Master's Program in Biomedical Sciences will require 30 credit hours, 24 of which must be didactic hours.

Course descriptions begin on page 89.

Biophysics

See Molecular Physiology and Biophysics, Physics and Astronomy

Biostatistics

CHAIR Yu Shyr

DIRECTOR OF GRADUATE STUDIES Robert Greevy

PROFESSOR EMERITUS Charles F. Federspiel

PROFESSORS Jeffrey D. Blume, William D. Dupont, Frank E. Harrell Jr., Christopher Lindsell, Jonathan S. Schildcrout, Bryan Shepherd, Yu Shyr

ASSOCIATE PROFESSORS Qingxia (Cindy) Chen, Leena Choi, Robert Greevy, Robert Johnson, Tatsuki Koyama, Matt Shotwell, Chris Slaughter, Fei Ye, Chang Yu

ASSISTANT PROFESSORS Rameela Chandrasekhar, Mario Davidson, Amber Hackstadt, Hakmook Kang, Dandan Liu, Andrew Spieker, Thomas Stewart, Ran Tao, Simon Vandekar, Yaomon Xu

RESEARCH ASSISTANT PROFESSORS Heidi Chen, Lauren Samuels, Derek Smith

DEGREES OFFERED: *Master of Science, Doctor of Philosophy*

BIostatISTICS is the branch of statistics responsible for the proper interpretation of scientific data generated in the biology, public health, and biomedical sciences. As such, biostatisticians must be trained as apt mathematicians and cogent scientists. Our program features rigorous classroom training, real-world apprenticing, exceptional computational preparation, and one-to-one mentoring in the theory, methods, and applications of biostatistics in biomedical research. This program is unique in integrating a curriculum that is non-denominational with respect to the foundations of statistical inference, modern in its emphasis on computing and teaching of statistical principles, progressive in regression modeling strategies, aggressive in involving students in biomedical research early in their career, and *sui generis* in its emphasis on communication skills.

Both Ph.D. and M.S. curricula are proposed to meet the range of biostatistical career opportunities in academia, industry, and government. The program also features an interdisciplinary research rotation for all second-year students and summer chalk talk sessions with faculty. Students must demonstrate competency or strong proficiency in five generic skill areas of statistics: (1) theory, (2) application, (3) critical thinking, (4) communication (oral and written), and (5) computing.

Doctor of Philosophy

Candidates for the Doctor of Philosophy (Ph.D.) must complete a minimum of 72 semester hours of course work

and dissertation research. A minimum of ten core biostatistics courses and five elective classes are required for the Ph.D. degree. The core Ph.D. curriculum consists of two probability courses, two statistical inference courses, four courses on statistical methods, and two courses of signature training. Ph.D. candidates must also pass the first-year and second-year comprehensive examination, complete the second-year interdisciplinary research rotation, pass the doctoral qualifying oral examination, submit and defend a doctoral dissertation detailing original research and methodological contributions that advance the knowledge of the discipline of biostatistics, and present their dissertation in a departmental seminar.

Master of Science

Candidates for the master of science (M.S.) must complete a minimum of 24 semester hours of graduate-level courses in biostatistics. The core M.S. curriculum consists of one probability course, one statistical inference course, five courses on statistical methods, and one course of signature training. A minimum of eight core biostatistics courses and four elective courses is required for the M.S. degree. Students who are currently Ph.D. candidates in other departments may be eligible for a waiver of the elective course requirement. M.S. candidates must also pass the first-year comprehensive examination, complete the second-year interdisciplinary research rotation, submit a master's thesis detailing an original investigation in an area of biostatistics, and present their thesis in a departmental seminar. A minimum of 30 semester hours is required for the master's degree. This includes enrollment in at least 24 semester hours of formal didactic course work plus enrollment in 6 additional hours of didactic course work or 6 credit hours of research.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 89.

Cancer Biology

PROGRAM DIRECTOR Ann Richmond

DIRECTOR OF GRADUATE STUDIES Jin Chen

PROFESSOR EMERITUS Harold Moses

PROFESSORS Daniel Beauchamp, Timothy Blackwell, Mark Boothby,

Stephen Brandt, Jin Chen, Dai Chung, Robert Coffey, Michael Freeman, Todd Giorgio, David Gorden, Volker Haase, Rizwan Hamid, Walter Gray Jerome, Sebastian Joyce, Young Jun Kim, Deborah Lannigan, Ethan Lee, Pierre Massion, Robert Matusik, Andrea Page-McCaw, Ben Ho Park, Richard Peek, Jennifer Pietenpol, Ambra Pozzi, Vito Quaranta, Jeffrey Rathmell, Kimryn Rathmell, Al Reynolds, Ann Richmond, Yu Shyr, Alissa Weaver, Christopher Williams, Keith Wilson, Roy Zent, Mary Zutter

ASSOCIATE PROFESSORS Rebecca Cook, Barbara Fingleton, Patrick Hu, Christine Lovly, Michael Savona, Linda Sealy, Jeffrey Smith, Julie Sterling, Takamune Takahashi, Fiona Yull, Ming-Zhi Zhang, Andries Zijlstra, Sandy Zinkel

ASSISTANT PROFESSORS Justin Balko, Anthony Daniels, Brent Ferrell, Jeremy Goettel, Rebecca Ihrle, Jonathan Irish, Rachelle Johnson, Carlos Lopez, Aron Parekh, Mary Philip, Marjan Rafat, Vivien Weiss, John Wilson

DEGREE OFFERED: *Doctor of Philosophy*
(*Cancer Biology does not offer a master of science degree program; however, if a student's goals change during the course of the Ph.D. program, an M.S. degree can be awarded provided the criteria as outlined in the program guidelines are met.*)

STUDENTS interested in this program participate in the Interdisciplinary Graduate Program within the Division of Biomedical Sciences (see Biomedical Sciences) or in the Quantitative and Chemical Biology Program during the first year. The second year of study encompasses two required courses in Cancer Biology (8340 and 8342) and electives to complete a total of at least 24 hours of formal course work toward the Ph.D. degree (this includes the 16 hours completed in the first year). Additional requirements are: successful completion of the two-phase qualifying exam; regular meetings, initially with a mentoring committee and then biannual meetings with a dissertation committee; an annual presentation at the program's weekly "Science Hour Seminar Series," starting in the spring of the third year of study. Attendance at the program's weekly "Science Hour Seminar Series," the annual Vanderbilt-Ingram Cancer Center retreat, and the annual student-led Cancer Research retreat is encouraged. Most Cancer Biology students participate in the Cancer Biology Student Association (CBSA), which organizes a variety of events each year to enhance the quality of student experience in the Cancer Biology program.

The program offers focused and comprehensive training in the discipline of cancer biology. Modern cancer research is based on a broad range of technical skills, including molecular biology, cell biology, genetics, biochemistry, biostatistics, and bioinformatics, all of which the student will learn through course work and laboratory training. Further training includes exercises designed to develop independent thinking, skills in oral and written presentation, analysis of data and information, and dissemination of information through teaching. The program prepares students with the necessary theoretical and practical skills to succeed in an increasingly wide range of available careers, including academic research, undergraduate teaching, science writing, and basic or applied science in the biotechnology and pharmaceutical industry.

Major research efforts include studies on tumor immunity, angiogenesis, growth factor and cytokine signaling, oncogenes, tumor suppressors, matrix and matrix degradation, cell adhesion, metastasis, development and translation of new therapeutics for cancer, as well as systems biology as applied to cancer growth, metastasis, and response to drugs. These studies use state-of-the-art technologies, including all aspects of molecular and cell biology, biochemistry, genetically modified mice, "omics," mathematical modeling, and others.

Faculty within the department also participate in interdisciplinary training programs in cancer research supported by the National Cancer Institute of the National Institutes of Health.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 91.

Cell and Developmental Biology

CHAIR Ian G. Macara
DIRECTOR OF GRADUATE STUDIES Andrea Page-McCaw
PROFESSORS EMERITI Arthur F. Dalley II, Steven Hanks, James McKanna, Jeanette Norden, Gary Olson
PROFESSORS Chin Chiang, Kathleen L. Gould, Irina N. Kaverina, Ethan Lee, Ian G. Macara, David M. Miller III, Andrea Page-McCaw, William P. Tansey, Matthew J. Tyska, Alissa Weaver, Susan R. Wentz, Christopher V. E. Wright
ASSOCIATE PROFESSORS Rebecca Cook, Guoqiang Gu, Ken Lau
ASSISTANT PROFESSORS Kristopher J. Burkewitz, Dylan T. Burnette, Vivian Gama, Rebecca Ihrie, Jonathan Irish, Jason A. MacGurn, Marija Zanic

DEGREE OFFERED: *Doctor of Philosophy*

GRADUATE study in cell and developmental biology at Vanderbilt emphasizes an interdisciplinary approach to biological research. Ongoing research programs bridge a wide range of scales, from single molecules to whole organisms, with exciting opportunities in both basic and disease-oriented biomedical science. Faculty are affiliated with several centers (Center for Matrix Biology, Center for Stem Cell Biology, Center for Structural Biology, Digestive Disease Research Center, Vanderbilt Diabetes Research and Training Center, Vanderbilt Kennedy Center for Research on Human Development, the Epithelial Biology Center, and the Vanderbilt-Ingram Cancer Center), and there are significant collaborative interactions with the trans-institutional Program in Developmental Biology.

The department provides specialized training in basic cellular and organismal processes with the goal of solving fundamental biological problems as a foundation for addressing questions of biomedical significance. In each research area, multidisciplinary approaches in genetics, proteomics, and imaging are employed; key model systems include yeast, *C. elegans*, *Drosophila*, *Xenopus*, zebrafish, chick, mice, and cultured cell lines. Research areas include cell-cycle progression, cell signaling, motility and polarity, vesicle trafficking, gene regulation, cytoskeletal dynamics and molecular motors, apoptosis, cell differentiation and cell fate decisions, tissue patterning, embryogenesis, morphogenesis, organogenesis, and tumorigenesis. Graduate studies in each of these areas may also include inter-departmental courses from Cell and Developmental Biology, Biochemistry, Pharmacology, Psychology, Biological Sciences, Neuroscience, and Molecular Physiology and Biophysics. The program is designed to lead to the Ph.D. degree.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 92.

Chemical and Biomolecular Engineering

CHAIR G. Kane Jennings

DIRECTOR OF GRADUATE RECRUITING Jamey D. Young

DIRECTOR OF GRADUATE PROGRAM Jamey D. Young

DIRECTOR OF UNDERGRADUATE PROGRAM Paul E. Laibinis

PROFESSORS EMERITI Kenneth A. Debelak, Thomas R. Harris,

M. Douglas LeVan, Robert J. Roselli, John A. Roth, Karl B. Schnelle Jr., Robert D. Tanner

PROFESSORS Peter T. Cummings, Scott A. Guelcher, Todd D. Giorgio,

G. Kane Jennings, David S. Kosson, Paul E. Laibinis, Matthew J.

Lang, Clare McCabe, K. Arthur Overholser, Peter N. Pintauro,

Sandra J. Rosenthal

PROFESSORS OF THE PRACTICE Russell F. Dunn, Julie E. Sharp

ASSOCIATE PROFESSORS Bridget R. Rogers, Jamey D. Young

ASSISTANT PROFESSORS Rizia Bardhan, Kelsey Hatzell, Piran Kidambi,

Shihong Lin, Ethan S. Lippmann, Marjan Rafat, Carlos Silvera Batista,

John T. Wilson, Marija Zanic

DEGREES OFFERED: *Master of Science, Doctor of Philosophy*

CHEMICAL engineers play key roles in the development and production of commodity chemicals, pharmaceuticals and bioengineered materials, high-strength composites and specialty polymers, semiconductors and microelectronic devices, and a wide range of ultrapure fine chemicals. Indeed, chemical and biomolecular engineering is essential for the operation of contemporary society. The solutions to many of the problems that we face today—e.g., energy, the environment, development of high-performance materials—will involve chemical engineers.

Graduate study in chemical and biomolecular engineering provides a unique opportunity for students and faculty to work together toward advancing knowledge through innovative research. Graduate research opportunities are provided in the areas of biotechnology and biomolecular engineering, computational science and engineering, energy and sustainability, and materials and nanotechnology. Formal course work provides exposure to advanced chemical engineering and scientific principles that are designed to enhance the research and analytical skills of students. Additionally, students are provided numerous professional development opportunities, including attendance at conferences, professional workshops, career services, and teaching programs for those interested in academic careers.

Programs leading to the M.S. and Ph.D. degrees are offered through the Graduate School. Both require a combination of course work and a thesis. There is no language requirement for any degree.

Candidates for the master of science must complete 30 semester hours of work beyond the bachelor's degree. At least 24 of these hours are graduate-level courses (12 hours in chemical engineering core courses, with the remaining hours selected from courses in the major or from related areas of interest approved by the research adviser). Each degree candidate conducts research under the supervision of a faculty adviser (this will comprise at least 6 additional semester hours), prepares a written thesis, and presents it orally to the faculty.

Candidates for the doctor of philosophy complete a minimum of 72 semester hours of work beyond the bachelor's degree. At least 24 of these hours are course work including 12 hours in required chemical and biomolecular engineering courses. Of the remaining 12 hours at least 3 hours must be

taken outside the department (and cannot be for a co-listed course). These courses should complement the student's research interests. The remaining hours are Ph.D. dissertation research. The course load is designed to allow students to spend the majority of their studies on original research. Up to 24 hours of graduate course work with an equivalent of A or B grade may be transferred to Vanderbilt and applied to the Ph.D. At the end of the first year in residence, students complete a departmental examination. Admission to candidacy in the Ph.D. program is based upon this departmental examination, as well as the Ph.D. qualifying examination, which consists of written and oral presentations of a proposal for doctoral research. Following the examinations and at least 24 semester hours of dissertation research, the student prepares and publicly defends a dissertation presenting results of original research.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

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Chemical and Physical Biology

DIRECTOR Bruce M. Damon

DIRECTOR OF GRADUATE STUDIES Bruce M. Damon

PROFESSORS Chris Aiken, Adam Anderson, Darryl Bornhop, Alan

Brash, Richard Caprioli, Walter Chazin, Alan Cherrington, David Cliffl,

David Cortez, James Crowe, Bruce M. Damon, Mark Does, Manus

Donahue, Brandt Eichman, Martin Eglji, Stephen Fesik, John Gore, Fred

Guengerich, Heidi Hamm, Billy Hudson, Shane Hutson, Tina Iverson,

Carl Johnson, Jeff Johnston, D. Borden Lacy, Matthew Lang, Terry

Lybrand, Charles Manning, Lawrence Marnett, Hassane Mchaourab,

John McLean, Jens Meiler, Richard O'Brien, Neil Osheroff, Ned Porter,

Vito Quaranta, Carmelo Rizzo, Sandra Rosenthal, Charles Sanders,

Kevin Schey, Eric Skaar, Michael Stone, Gary Sulikowski, Matthew

Tyska, Alissa Weaver, John Wikswo, David Wright

ASSOCIATE PROFESSORS Brian Bachmann, Li Min Chen, Ronald Cowan,

Suman Das, Sean Davies, Lourdes Estrada, Ivelin Georgiev, Daniel

Gochberg, William Grissom, David Jacobson, Ken Lau, Andrew Link,

Victoria Morgan, Kevin Niswender, Todd Peterson, Wellington Pham,

Seth Smith, Ben Spiller, Jamey Young, Bing Zhang

RESEARCH ASSOCIATE PROFESSOR Eric Hustedt

ASSISTANT PROFESSORS Dylan Burnett, Tony Capra, Charles Caskey,

Nicole Creanza, Jacob Houghton, Jacob Hughey, Jonathan Irish,

Lauren Parker Jackson, Erkan Karakas, Bingshan Li, Ethan Lippmann,

Carlos Lopez, Gregor Neuert, Adrian Olivares, Jason MacGurn, Gregor

Neuert, Lars Plate, Yi Ren, Claus Schneider, Junzong Xu, Marija Zanic,

Qi Zhang, Andries Zijlstra

DEGREE OFFERED: *Doctor of Philosophy*

THE Ph.D. degree in chemical and physical biology is available to all students who enter the trans-institutional QCB or IGP graduate admissions programs, the MSTP, or through direct admission. The Ph.D. training program is designed to provide rigorous integrated training at the interface of the chemical and/or physical sciences and the biological sciences. The course work and research components of the program prepare students for research careers in which they can bring state-of-the-art tools of the modern chemical and physical sciences, mathematics, statistics and informatics, and computer science to bear on cutting-edge biological problems.

The curriculum prepares students for research careers at the chemistry-biology interface, in imaging science, in structural biology, or in systems biology. Research opportunities are available in a broad range of areas including: biological mass spectroscopy, biomagnetics and nonlinear dynamics, computational biology and molecular modeling, protein-protein interactions, NMR and EPR, cryo-electron microscopy, chemical biology, fluorescence spectroscopy and microscopy, in vivo imaging, protein-nucleic acid interactions, structural biology, nanocrystals, macromolecular structure and dynamics, mechanistic enzymology, proteomics, molecular toxicology, and mathematical modeling of biological systems.

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Course descriptions begin on page 95.

Chemistry

CHAIR John A. McLean

DIRECTOR OF GRADUATE STUDIES Carmelo J. Rizzo

DIRECTOR OF UNDERGRADUATE STUDIES Tara Decuir Todd

PROFESSORS EMERITI Robert V. Dilts, Larry C. Hall, Thomas M. Harris, David M. Hercules, Melvin D. Joesten, Joel Tellinghuisen, David L. Tuleen

PROFESSORS Brian O. Bachmann, Darryl J. Bornhop, Richard M. Caprioli, Walter J. Chazin, David E. Cliffl, Stephen W. Fesik, Timothy P. Hanusa, Frederick R. Haselton, B. Andes Hess Jr., Jeffrey N. Johnston, Craig W. Lindsley, Terry P. Lybrand, H. Charles Manning, Lawrence J. Marnett, Clare McCabe, Hassane S. Mchaourab, John A. McLean, Jens Meiler, Prasad L. Polavarapu, Carmelo J. Rizzo, Sandra J. Rosenthal, Sean B. Seymore, Michael P. Stone, Gary A. Sulikowski, David W. Wright

ADJUNCT PROFESSORS Natalie Arnett, Glenroy Dean Martin

ADJOINT PROFESSORS Norma Dunlap, Amy-Joan Ham, Rongson Pongdee, Lidia Smentek

ASSOCIATE PROFESSORS Andrew Link, Renā Robinson, C. David Weaver

ASSISTANT PROFESSORS Lauren E. Buchanan, Janet E. Macdonald, Lars Plate, Nathan D. Schley, Steven D. Townsend

DEGREE OFFERED: *Doctor of Philosophy*

RESEARCH programs are offered in analytical, biological, inorganic, organic, and physical chemistry along with interdisciplinary research programs in chemical biology, molecular toxicology, materials chemistry, nanoscale science, structural and computational biology, and chemical physics. Excellent research facilities, modern instrumentation, and external funding support a wide range of research.

The program emphasizes doctoral studies. However, an M.S. degree may be granted under special circumstances and normally requires a research thesis. A research thesis of at least 6 hours is required for the master's degree. Specific requirements for the Ph.D. degree are defined in the Ph.D. program document that is available upon request from the Department of Chemistry. Both the master's and Ph.D. degrees require a minimum of 24 hours of formal course work.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 95.

Chinese

CHINESE LANGUAGE PROGRAM COORDINATOR

AND PRINCIPAL SENIOR LECTURER Xianmin Liu

LECTURERS Yinghui Guo, Jing Liu, Qing Wei

STUDENTS should consult with the director of Asian Studies and their home department advisers about the acceptability of Chinese courses for their program of study. Courses are not designed for advanced native speakers.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 96.

Civil Engineering

CHAIR Douglas E. Adams

ASSOCIATE CHAIR Florence Sanchez

DIRECTOR OF GRADUATE STUDIES Dan Work

DIRECTOR OF GRADUATE RECRUITING Hiba Baroud

DIRECTOR OF UNDERGRADUATE STUDIES Robert E. Stammer Jr.

PROFESSORS EMERITI Peter G. Hoadley, Frank L. Parker, Richard E.

Speece, Robert E. Stammer Jr., Edward L. Thackston

PROFESSORS Mark D. Abkowitz, Douglas E. Adams, Prodyot K.

Basu, George M. Hornberger, David S. Kosson, Eugene J. Leboeuf,

Sankaran Mahadevan, Caglar Oskay

PROFESSORS OF THE PRACTICE Curtis D. Byers, Sanjiv Gokhale,

Steven L. Krahn, Robert E. Stammer Jr., Lori A. Troxel

RESEARCH PROFESSOR Craig E. Philip

ADJUNCT PROFESSORS Gregory L. Cashion, Ann N. Clarke, Allen G.

Croff, James P. Dobbins IV, Boualem Hadjerioua, Ofra Klein-BenDavid,

Vic L. McConnell, Janette Meyer, Michael B. Nye, Michael T. Ryan, L.

Hampton Turner IV, Hans A. van der Sloot, Raymond G. Wymer

ASSOCIATE PROFESSORS Alan R. Bowers, Florence Sanchez,

Dan Work

RESEARCH ASSOCIATE PROFESSORS Kevin G. Brown, Janey S.

Camp, Andrew G. Garrabrants

ASSISTANT PROFESSORS Hiba Baroud, Ravindra Duddu, Jesús

Gomez-Velez, Shihong Lin

ASSISTANT PROFESSOR OF THE PRACTICE Mazita Mohd Tahir

RESEARCH ASSISTANT PROFESSOR Pranav Karve

ADJUNCT INSTRUCTORS J. Robin Barrick, Kenneth Church, David

Livingston, Keith Loiseau, Said el Said, Bryan Tharpe

LECTURERS Phillip Collins, Paul Litchy, Ross Muirhead, Christopher

Prichard

AFFILIATED Matt Weinger

DEGREES OFFERED: *Master of Science, Doctor of Philosophy*

DEGREE programs at the M.S. and Ph.D. level are offered in two areas of concentration: (1) Civil and Infrastructure Systems

Engineering and (2) Materials and Structural Engineering.

The M.S. degree has two options: (1) 24 hours of graduate-level course work (5000 level or higher) and a research thesis of at least 6 semester hours, or (2) 30 hours of graduate-level course work. Course work requirements also include 12 hours of didactic course work (i.e., excluding directed/independent study) from the relevant area of concentration core curriculum completed at Vanderbilt and 6 hours of didactic course work taken in the major area (i.e., with CE designation) completed at Vanderbilt.

The Ph.D. degree requires completion of 72 hours of graduate-level course work plus a dissertation. A minimum of 24 course credit hours must be completed at Vanderbilt. Course work requirements also include a minimum of 30 hours of graduate course work that include 12 hours of didactic course work from the relevant area of concentration core curriculum completed at Vanderbilt and 6 hours of didactic course work taken in the major area (i.e., with CE designation) completed at Vanderbilt. The remaining credit hours can be fulfilled with courses or research hours. In addition, all Ph.D. students must pass the Civil Engineering Graduate Program preliminary exam, must complete the university-required qualifying exam, and must write and defend a dissertation.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 97.

Classical and Mediterranean Studies

DIRECTOR Joseph L. Rife

PROFESSORS EMERITI Robert Drews, F. Carter Phillips, Jack M. Sasson,
Barbara Tsakirgis, Susan Ford Wiltshire

PROFESSORS William Caferro, David J. Wasserstein

ASSOCIATE PROFESSORS Kathy L. Gaca, Joseph L. Rife, Betsey A.
Robinson

ASSISTANT PROFESSORS Scott F. Aikin, Ari Bryen, Elsa Filosa, Mireille
Lee, David A. Michelson, Monica Park

DEGREE OFFERED: CLASSICS. *Master of Arts*

Note: The department is presently not accepting applications to its M.A. program.

THE Department of Classical and Mediterranean Studies offers a selective M.A. program that provides a solid basis for either of two important goals in the field of Classics. First, the department trains promising M.A. candidates who aspire to apply to and enter a nationally ranked Ph.D. program in classical languages or in other recognized fields of Classics, such as ancient history and classical art and archaeology. The department also trains M.A. candidates who aspire to become effective teachers of Latin and/or Greek. The program, as broadly defined, involves a minimum of 36 hours and a maximum of 48 hours of course work over a two-year period. During the two years, the Classics M.A. student is also required to pass proficiency examinations in Greek and Latin and either proficiency examinations

or course requirements in history and art. The student must also demonstrate reasonable proficiency in reading classical scholarship in German or French, or in another Romance language (e.g., Italian or Spanish). Applicants should be able to read both Latin and Greek, though not necessarily both at the same level of proficiency, and they also should have completed an elementary course in German, French, or another Romance language.

On entering, every student takes diagnostic examinations in Greek and Latin prose and poetry. The examinations are not graded and are intended only to determine a student's proficiency in the languages at the time of matriculation and for placement in courses. The examinations test familiarity with language and with scansion.

Each semester each student takes at least three and no more than four courses for credit. It is expected that all classics M.A. students will take both graduate seminars regularly offered in Greek and Latin each semester and that they will strive to produce first-rate master's seminar papers in these graduate courses. When their papers attain an A+ level of excellence, they are encouraged to present their papers to the Classics faculty and to submit their papers to professional academic conferences, such as the American Philological Association (APA), the Archaeological Institute of America (AIA), and the Classical Association of the Middle West and South (CAMWS). The proficiency examinations in Greek and Latin are made up of passages taken from the M.A. reading list. The two examinations test familiarity with language and scansion. The proficiency examinations are offered regularly over the course of the M.A. program.

Classics M.A. students are required to take at least one course each in the areas of ancient history and the history of art, and both courses must be in either the Greek or the Roman tradition. Students may fulfill their Greek or Roman history of art requirement in several possible ways, including: (1) undergraduate courses in Greek or Roman art history, (2) graduate seminars in Greek or Roman art and archaeology, or (3) summer participation in the summer program of the American School of Classical Studies at Athens, Greece, or of the American Academy in Rome, Italy. To fulfill the requirement for ancient history, M.A. students can either (1) take a regular course in Greek history (CLAS 2110 or CLAS 2120) or Roman history (CLAS 2150 or CLAS 2160), or (2) take an examination. In order to fulfill the requirement with course work, a student must earn a B+ or better in each of the two courses in the given areas. If the student chooses to fulfill the requirement with an examination, the examination of two hours' length is taken at the very beginning of the fourth semester. One re-take of each examination is allowed.

A distinguished feature of Vanderbilt's M.A. program in Classics is the anticipation that in the summer following the first year in residence, M.A. candidates will study in the Mediterranean. Students in good standing are urged to apply for the summer programs offered by the American School of Classical Studies in Athens (ASCSA) and the American Academy in Rome (AAR) in the hope of being accepted into one of these two summer programs. They also generally receive Rankin Fellowship funding from the department to support this study abroad in either the AAR or ASCSA summer program.

Because students pursuing a graduate degree in Classics normally do so with aims that include teaching Latin, Greek, or Classics, the department makes every effort to provide each student with some teaching experience. In the second year of residence, an M.A. candidate may expect to gain experience as a teaching assistant, primarily as an instructor in an

elementary Latin section or, secondarily, as an assistant in a Greek, Latin, or Classics course.

Successful students in the Classics M.A. program are encouraged to pursue Classics Ph.D. studies in a nationally ranked doctoral program that is well positioned to help its Classics doctoral recipients to find a rewarding professional appointment. Faculty in the department are eager to support this aspiration, such as by advising the student about which Classics Ph.D. programs are best suited to his or her interests, and by doing their best to facilitate the student's successful entry into such a doctoral program.

If they so choose, Classics M.A. students with interdisciplinary interests are also welcome to apply for, and may be accepted into, an interdisciplinary Ph.D. program at Vanderbilt that promotes further graduate study in Classics, such as history, religious studies, Greek philosophy, English, and art history.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 99 for Classics, on page 116 for Greek, and on page 127 for Latin.

Community Research and Action

CHAIR Paul Speer

DIRECTOR OF GRADUATE STUDIES Brian Christens
PROFESSORS EMERITI Joseph Cunningham, Paul Dokecki, Craig Anne Heflinger

PROFESSORS Sandra Barnes, Bradley Erford, Velma Murry, Douglas Perkins, Marybeth Shinn, Paul Speer

RESEARCH PROFESSOR Mark Lipsey

ASSOCIATE PROFESSORS Brian Christens, Maury Nation

ASSOCIATE PROFESSOR OF THE PRACTICE Kimberly Bess

ASSISTANT PROFESSORS Ashley Carse, David Diehl, Anjali Forber-Pratt, Yolanda McDonald, Jessica Perkins, Sara Safransky

ASSISTANT PROFESSOR OF THE PRACTICE Sarah Suiter

DEGREE OFFERED: *Doctor of Philosophy*

THE graduate program in community research and action is an interdisciplinary program combining community psychology, urban sociology, human geography, applied anthropology, and human and community development. It trains action-researchers committed to promoting social justice in rigorous theoretical analysis and research methods to prepare them for careers in academia, research, and public policy.

The Ph.D. degree includes (a) a core set of courses covering inequality, diversity and social justice, community intervention and change, community inquiry (social research methods), public policy and advocacy, and organizational theory and change; (b) advanced research methodology covering quantitative, qualitative, and critical methods, action research, field research, and program evaluation; and (c) minor concentrations that are designed individually, drawing from Human and Organizational Development Department courses (in community organizing and development, community health, human development and prevention science) and from other departments and specializations within Peabody College (e.g., quantitative methods, urban education) and throughout the

university (e.g., anthropology, divinity, global health, political science, sociology, women's and gender studies). Planning is done with the major professor and approved by the student's committee. Students receive practical training and experience in teaching, grant-writing and applied research, and program or policy work in collaboration with nonacademic partners. Students entering without a relevant master's degree or with a nonempirical master's must complete an empirical study or thesis (and receive the master of science in CRA as part of the Ph.D. program).

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 123 for Human and Organizational Development.

Comparative Media Analysis and Practice

DIRECTOR Lutz Koepnick (German; Cinema and Media Arts)

Affiliated Faculty

PROFESSORS Clifford Anderson (Religious Studies; Associate University Librarian for Research and Learning), Joy Calico (Music), Jay Clayton (English; Curb Center for Art, Enterprise, and Public Policy; Cinema and Media Arts), Jennifer Fay (Cinema and Media Arts; English), Douglas Fisher (Computer Science), Rogers Hall (Peabody College of Education and Human Development), Lutz Koepnick (German; Cinema and Media Arts), Daniel Levin (Psychology and Human Development), Kevin Murphy (History of Art), John Sloop (Communication Studies), Helmut Smith (History), Mark Wallace (Neuroscience; Vanderbilt Brain Institute), Mel Ziegler (Art)

ASSOCIATE PROFESSORS Laura Carpenter (Sociology), Claire Sisco King (Communication Studies; Cinema and Media Arts), Stan Link (Music), Christopher Loss (History), James McFarland (German; Cinema and Media Arts), Tracy Miller (History of Art; Asian Studies), Vesna Pavlovic (Art), Lynn Ramey (French), Betsey Robinson (History of Art), Steven Wernke (Anthropology), Christoph Zeller (German)

ASSISTANT PROFESSORS Aimi Hamraie (Medicine, Health, and Society), Mireille Lee (History of Art), Ole Molvig (History), Jonathan Rattner (Cinema and Media Arts; Art), Haerin Shin (English; Cinema and Media Arts; Asian Studies), Rebecca VanDiver (History of Art)

LECTURERS Derek Bruff (Center for Teaching; Mathematics), Madeleine Casad (Center for Digital Humanities; Cinema and Media Arts)

DEGREE OFFERED: *COMPARATIVE MEDIA ANALYSIS AND PRACTICE. Joint Ph.D.*

THE Comparative Media Analysis and Practice joint-Ph.D. program advances the critical investigation of modern media culture and the innovative making of digital objects. Open to Ph.D. students from all units of the university, the program adds intellectual perspectives and project-driven learning experiences in an interdisciplinary and collaborative framework. It enhances the preparedness of Ph.D. students with diverse backgrounds for academic or non-academic careers alike. Students completing the program will receive degrees such as Ph.D. in anthropology and comparative media analysis and practice or Ph.D. in English and comparative media analysis and practice.

Aside from taking the required courses in their home program, joint-Ph.D. students are required to take four core

seminars (CMAP 8001–8004) sequenced over two years. CMAP students are also required to participate in two series of workshops (CMAP 8010–8011), specially designed to build more advanced skills in making creative media objects and handling digital information, offered in alternating years during the month of May. CMAP doctoral students will take their qualifying exams as stipulated by their primary departments. Doctoral students enrolled in CMAP write just one dissertation to fulfill the requirements for the joint-Ph.D. However, the CMAP program strongly encourages new and experimental formats of the dissertation. The candidate's Ph.D. committee for the dissertation must include at least one member of the CMAP affiliated faculty. In addition to satisfying all necessary expectations and requirements of their primary degree department, joint-degree dissertations typically incorporate perspectives that reflect a student's participation in CMAP core seminars and digital practice workshops. Additionally, during the semester leading up to their dissertation defense, students are required to design two online media presentations featuring their dissertation. One of these presentations should address specialized audiences, the other a general lay public.

CMAP students are required to carry out forty hours of internship work at some point in their graduate studies. These internships offer opportunities to probe one's knowledge and media skills within non-academic settings. During one semester of their fourth or fifth year of graduate study at Vanderbilt, CMAP students will use their expertise in the theory, analysis, and making of digital objects to serve as a TA in a select course on campus or contribute to the creative project of one or several undergraduate students in their respective home departments. Operating within the context of the Immersion Vanderbilt project, this latter contribution may take many different forms and will be closely coordinated between the CMAP student's home department and the CMAP program director.

Detailed information is available upon request from the program director.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 101.

Computer Science

CHAIR Daniel M. Fleetwood
 ASSOCIATE CHAIR Xenofon D. Koutsoukos
 DIRECTOR OF GRADUATE STUDIES Akos Ledeczki
 PROFESSORS EMERITI Charlotte F. Fischer, J. Michael Fitzpatrick, Stephen R. Schach
 PROFESSORS Gautam Biswas, Benoit Dawant, Aniruddha S. Gokhale, Gabor Karsai, Xenofon D. Koutsoukos, Akos Ledeczki, Bradley Malin, Padma Raghavan, Douglas C. Schmidt, Nabil Simaan, Keivan Stassun, Janos Sztipanovits
 RESEARCH PROFESSOR Robert Laddaga
 PROFESSOR OF THE PRACTICE Gerald H. Roth
 ASSOCIATE PROFESSORS Robert E. Bodenheimer, Douglas H. Fisher, Ivelin S. Georgiev, Bennett Landman, Jeremy P. Spinrad, Jules White
 ASSOCIATE PROFESSOR OF THE PRACTICE Julie L. Johnson
 ASSISTANT PROFESSORS Matt Berger, Corey Brady, Catie Chang, Abhishek Dubey, J. Anthony Capra, Daniel Fabbri, Taylor T. Johnson, Maithilee Kunda, Jack Noble, Ipek Oguz, Mikail Rubinov

RESEARCH ASSISTANT PROFESSORS Himanshu Neema, Hongyang Sun
 ASSISTANT PROFESSORS OF THE PRACTICE Uttam Ghosh, Graham S. Hemingway, Vikash Singh, Robert Tairas
 ADJUNCT ASSISTANT PROFESSOR Zhiao Shi

DEGREES OFFERED: *Master of Science, Doctor of Philosophy*

THE graduate program in computer science is structured around four primary research areas: (1) computing foundations, (2) computer and network systems, (3) information and intelligent systems, and (4) medical image computing. A variety of advanced graduate courses are offered in each of these areas.

Doctoral candidates are required to complete a minimum of 36 hours of formal course work, which may include at most 6 hours of independent study. The distribution of courses must contain three 6000-level courses or above in three primary research areas. All students must take CS 6310, which can be used to satisfy the distribution requirements above.

The master's degree in computer science may be earned through (a) the regular program that includes a thesis or (b) a non-thesis program requiring 30 hours of formal course work. For option (a), up to 6 hours of M.S. thesis research may be applied to the 30 hour total. Under either plan at least 12 hours must be in 6000-level (or above) computer science courses. A master's degree in passing option is available to students who have passed the Ph.D. qualifying exam and completed at least 42 hours of graduate studies.

An online master of science in computer science is also available. For information, please refer to Special Programs in the Academic Programs section of this catalog, or visit engineeringonline.vanderbilt.edu/computer-science.

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Course descriptions begin on page 101.

Creative Writing

See English

Data Science

DIRECTORS Andreas Berlind, Doug Schmidt
 DIRECTOR OF GRADUATE STUDIES Jeffrey Blume

DEGREE OFFERED: *Master of Science*

DATA science is an interdisciplinary field whose goal is to extract knowledge and enable discovery from complex data. The field applies a fusion of principles from the disciplines of statistics and computer science to perform data-intensive tasks in domain-specific contexts. The program's goal is to train analysts who are knowledgeable about a broad spectrum of computational and statistical techniques for handling data-intensive tasks in a variety of quantitative, computational, and

scientific disciplines. Additionally, students are taught how to work effectively and efficiently in teamwork environments.

Students will learn how to work with complex and large data sets, analyze data with appropriate statistical and computational tools to extract relevant knowledge, make effective displays and visualizations of the data, effectively communicate results to both experts and nonexperts, understand and communicate the scientific generalizability of their models, and respect relevant ethical/legal issues pertaining to data analytics.

The program's learning objectives are: (1) be able to acquire, clean, and manage (massive) data, (2) design computational pipelines to collect and process large-scale data, (3) visualize data and highlight data patterns graphically, (4) build and interpret a statistical model for large-scale data, (5) explain the advantages and limitations of competing statistical models, (6) implement machine learning algorithms to make predictions and optimize decisions, (7) understand and explain the difference between inference and prediction goals, (8) generate reproducible code and analyses, and work in a reproducible manner, (9) communicate data science methods and results in a clear and concise manner to variable audiences, and (10) recognize the ethical, policy, and privacy implications of data science research.

Master of Science

The Vanderbilt master of science in data science is a four-semester, sixteen-course (48 credit hours) program, which includes the completion and presentation of a capstone project. Curriculum is organized in three core sequences (Computation, Data-analysis, Practice); the computation and data-analysis sequences consist of four courses each, while the practice sequence has five courses. The curriculum is rounded out with two electives and a capstone course. Students must maintain an overall grade point average (GPA) of 3.0 (*B*) in order to graduate. To graduate with honors, students must complete 48 credit hours (four semesters) with an overall GPA of 3.5 (*B+*) or better and complete the capstone project.

For additional information, visit vanderbilt.edu/datascience.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 103.

Earth and Environmental Sciences

CHAIR Steven L. Goodbred
 DIRECTOR OF GRADUATE STUDIES David J. Furbish
 PROFESSORS EMERITI Leonard P. Alberstadt, Calvin F. Miller, Molly Fritz Miller, Arthur L. Reesman, William G. Siesser, Richard G. Stearns
 PROFESSORS John C. Ayers, Ralf Bennartz, David J. Furbish, Steven L. Goodbred, George M. Hornberger
 ADJOINT PROFESSORS Mark S. Ghiorso, David White
 ASSOCIATE PROFESSORS Larisa R. G. DeSantis, Jonathan M. Gilligan, Guilherme A. R. Gualda
 ASSISTANT PROFESSORS Simon A. F. Darroch, Kristen E. Fauria, Maria Luisa S. P. Jorge, Neil P. Kelley, Jessica L. Oster

RESEARCH ASSISTANT PROFESSORS Garrett W. Tate, Christopher P. Vanags
 SENIOR LECTURERS Lily L. Claiborne, Daniel J. Morgan, Garrett W. Tate

DEGREES OFFERED: *Master of Science and Doctor of Philosophy in Earth and Environmental Sciences, and Doctor of Philosophy (Environmental Science option) in Environmental Engineering*

A STUDENT earns the master's degree in earth and environmental sciences by completing 24 hours of formal course work and submitting an approved research thesis of at least 6 credit hours. The doctoral degree requires at least 36 hours of formal course work and a total of 72 hours of total credits (research and course work combined); completion of the Ph.D. degree requires approval in a preliminary exam (Ph.D. in earth and environmental sciences) or comprehensive exam (Ph.D. in environmental engineering), approval in the qualifying exam, as well as submission and defense of a research thesis. Fields of study include sedimentology, geochemistry, geomorphology, transport processes, igneous and metamorphic petrology, volcanology, environmental geology, paleoclimate, paleobiology and paleoecology, atmospheric chemistry and physics, and climate dynamics.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 104.

Economics

CHAIR Peter L. Rousseau
 VICE CHAIR Joel Rodrigue
 DIRECTOR OF GRADUATE STUDIES Mattias Polborn
 DIRECTOR OF THE GRADUATE PROGRAM IN ECONOMIC DEVELOPMENT Kathryn H. Anderson
 PROFESSORS EMERITI Jeremy Atack, William W. Damon, T. Aldrich Finegan, C. Elton Hinshaw, Cliff J. Huang, Andrea Maneschi, Clifford S. Russell, John J. Siegfried, George H. Sweeney, Anthony M. Tang, Fred M. Westfield
 PROFESSORS Kathryn H. Anderson, Eric W. Bond, Christopher (Kitt) Carpenter, William J. Collins, John Conley, Mario Crucini, Andrew F. Daughety, Robert A. Driskill, Benjamin Eden, Kevin X. D. Huang, Gregory Huffman, Atsushi Inoue, Tong Li, Mattias Polborn, Jennifer F. Reinganum, Peter L. Rousseau, Kamal Saggi, W. Kip Viscusi, John A. Weymark, Myrna Wooders
 ASSOCIATE PROFESSORS Malcolm Getz, Andrea Moro, Joel Rodrigue, Yuya Sasaki
 ASSISTANT PROFESSORS Andrew Dustan, Andrew Goodman-Bacon, Federico H. Gutierrez, Eun Jeong Heo, Gregory Leo, Michelle Marcus, Alejandro Molnar, Hyunseung Oh, Pedro Sant'Anna, Diana N. Weymark, Matthew Zaragoza-Watkins, Ariell Zimran

DEGREE OFFERED: *Doctor of Philosophy*

DOCTORAL study in economics at Vanderbilt prepares students for research and teaching careers in universities and for leadership positions in government, international agencies, and business. The curriculum emphasizes economic theory, econometrics, and the use of theory and measurement in understanding economic phenomena and policy issues. Students have been attracted to the program from all parts of

the United States and from more than sixty countries.

A master's degree (without thesis) may be awarded after completion of 42 hours of Ph.D. course work with an average of at least *B* or better.

For the Ph.D. degree, which requires 72 hours and a thesis, the student normally takes required courses in microeconomics and macroeconomics, economic history, statistics, and econometrics. There is a mathematics requirement, normally satisfied by taking Economics 8000, Selected Topics in Mathematics for Economists. There is no foreign language requirement.

All doctoral students must pass written examinations based on the first-year core courses in microeconomics, macroeconomics, and econometrics. Each year the department offers a variety of doctoral-level courses beyond the core, in areas such as Advanced Economic Theory, Econometrics, Economic Development, Economic History, Health Economics, Industrial Organization, International Economics, Labor Economics, Money and Financial Institutions, and Public Economics. After fulfilling the paper requirement in the third year, students turn to their thesis work.

Entering students are expected, at a minimum, to have completed one year of calculus and courses in intermediate microeconomic and macroeconomic theory, statistics, and linear algebra. Detailed information is available on the department webpage.

Graduate Program in Economic Development

The GPED is intended for students seeking a master's degree in economics primarily with an interest in international development. Students who meet the academic requirements of 30 hours of course work, with at least a *B* average, receive the master of arts degree in economics. Students typically complete the program in sixteen to twenty-one months. Prospective students with an undergraduate background in economics, competency in calculus, and a good command of English are encouraged to apply. The program is described under Special Programs.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 105.

Electrical Engineering

CHAIR Daniel M. Fleetwood
 ASSOCIATE CHAIR Xenofon D. Koutsoukos
 DIRECTOR OF GRADUATE STUDIES Robert A. Reed
 DIRECTOR OF GRADUATE RECRUITING Bennett A. Landman
 DIRECTOR OF UNDERGRADUATE STUDIES W. Timothy Holman
 PROFESSORS EMERITI Alfred B. Bonds, Arthur J. Brodersen, James A. Cadzow, George E. Cook, Jimmy L. Davidson, J. Michael Fitzpatrick, Kenneth F. Galloway, Dennis G. Hall, Robert W. House, L. Ensign Johnson, Kazuhiko Kawamura, Richard G. Shiavi, Robert A. Weller, Francis M. Wells, Edward J. White, James E. Wittig
 PROFESSORS Bharat L. Bhuva, Benoit M. Dawant, Mark Does, Philippe M. Fauchet, Daniel M. Fleetwood, Michael Goldfarb, Weng Poo Kang, Gábor Karsai, Xenofon D. Koutsoukos, Akos Ledeczi, Lloyd W. Massengill, Sokrates T. Pantelides, Robert A. Reed, William H. Robinson, Ronald D. Schrimpf, Janos Sztpanovits, Robert J. Webster III, Sharon M. Weiss

PROFESSOR OF THE PRACTICE Ralph W. Bruce
 RESEARCH PROFESSORS Michael L. Alles, Sandeep Neema
 ASSOCIATE PROFESSORS Robert E. Bodenheimer, Audrey Bowden, Joshua Caldwell, Bennett Landman, Richard Alan Peters II, Jason Valentine, Greg Walker, D. Mitchell Wilkes, Yaqiong Xu
 RESEARCH ASSOCIATE PROFESSORS Theodore A. Bapty, Zhaohua Ding, W. Timothy Holman, Arthur F. Witulski, Enxia Zhang
 ASSISTANT PROFESSORS Catie Chang, William A. Grissom, Yuankai Huo, Taylor T. Johnson, Justus Ndukaife, Jack Noble
 RESEARCH ASSISTANT PROFESSORS Pierre-François D'Haese, Jeffrey S. Kauppila, Brian D. Sierawski

DEGREES OFFERED: *Master of Science, Doctor of Philosophy*

PROGRAMS in electrical engineering are offered in the areas of analog and digital circuits, computer engineering, intelligent systems, solid state devices, signal and image processing and analysis, robotics, microelectronics, photonics, nanotechnology, and related areas in biomedical engineering.

The master of science degree program requires 30 credit hours, including 18 hours in the major area (within EECE) and 6 hours in a minor area. At least 12 hours in the major area must be taken at or above the 6000 level. The courses taken must also include one of the gateway courses in each of two of the following areas: electronics, computer, and signals and systems. Gateway courses are graduate-level courses with senior-level prerequisite, the list of which is maintained by the DGS. The remainder of the course work in the major must be taken at or above the 5000 level. The minor will be 6 hours of graduate-level course work, typically outside of EECE. A maximum of 3 hours of independent study may be applied to the 18 hours required in the major area. The student's adviser must approve all courses. A research thesis is required. A non-thesis option is also offered, which requires an additional 6 hours of independent study constituting one single unit of research work.

A total of 72 hours is required for the Ph.D. Of these, 36 hours must be in course work with at least 24 of the 36 hours in EECE (exceptions can be made to this rule based on the recommendation of the student's adviser if the student's research topic requires taking additional courses outside EECE). The courses taken must also include one of the gateway courses in each of the three following areas: electronics, computers, and signals and systems. Gateway courses are graduate-level courses with senior-level prerequisites, the list of which is maintained by the EE director of graduate studies, and posted on the EECS department website. Up to 6 hours of independent studies may be taken to fulfill the 36 hours requirement. Up to 24 hours of course work toward the master's degree or in transfer credit will normally be applied to this total on approval by the committee. Up to 12 total hours of course work in the range 5000–5999 are allowed. CS courses in the student's area of research can also be taken for EECE graduate program credit with written approval of the student's adviser. The remainder of the 72 hours may be in dissertation research hours and in additional course work or independent study classes applicable to the student's program of study. Students must complete at least 24 hours while in residence at Vanderbilt. At least 12 of these hours must be in formal course work.

Specific and current degree requirements (including course selection, committee selection, preliminary examination, thesis/dissertation, and dissertation defense policies) are detailed in the Graduate Policy Document. A copy of this document should be obtained from the program office.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 108.

English

CHAIR Dana Nelson
 DIRECTOR OF GRADUATE STUDIES Vera Kutzinski
 DIRECTOR OF CREATIVE WRITING Kate Daniels
 PROFESSORS EMERITI Vereen M. Bell, Paul Elledge, Roy K. Gottfried,
 R. Chris Hassel Jr., Michael Kreyling, Leah Marcus, John F.
 Plummer III, Harold Lerow Weatherby Jr.
 PROFESSORS Houston Baker, Jay Clayton, Kate Daniels, Colin (Joan)
 Dayan, Tony Earley, Lynn E. Enterline, Sam B. Girgus, Mark Jarman,
 Vera Kutzinski, Jonathan Lamb, Lorraine Lopez, Lorrie Moore, Dana
 Nelson, Mark Schoenfield, Kathryn Schwarz, Hortense Spillers, Cecelia
 Tichi, Mark A. Wollaeger
 ASSOCIATE PROFESSORS Christin Essin, Jennifer Fay, Teresa A.
 Goddu, Rick Hilles, Emily Lordi, Ifeoma Nwankwo, Bridget Orr,
 Anthony Reed, Nancy Reisman, Allison Schachter, Rachel Teukolsky,
 Ben Tran
 ASSISTANT PROFESSORS Candice Amich, Jessie Hock, Marzia Milazzo,
 Akshya Saxena, Haerin Shin
 WRITERS IN RESIDENCE Beth Bachmann, Piyali Bhattacharya, Camille
 Dungy, Sheba Karim, Amanda Little, Sandy Solomon
 PRINCIPAL SENIOR LECTURERS Julie Fesmire, Scott Juengel,
 Roger Moore
 SENIOR LECTURERS Pavneet Aulakh, Gabriel Briggs, Elizabeth
 Covington, Alex Dubilet, Andrea Hearn, Elizabeth Meadows,
 Justin Quarry

DEGREES OFFERED: *Master of Arts, Master of Fine Arts, Doctor of Philosophy*

THE graduate program in English offers course work and research supervision in all areas of British and American literature, Anglophone literature from other countries, film and media studies, cultural studies, and literary theory. The goal of the Ph.D. program is to produce scholars, critics, and teachers of literature and culture for colleges and universities.

Requirements for the master's degree en route to the Ph.D. are 30 hours of course work and a thesis at the end of the M.A. year.

Requirements for the M.F.A. are 42 to 48 hours of course work, a thesis of creative work (a novel, a book of short stories, a collection of poems, or a collection of personal essays), plus an oral defense of the thesis.

Requirements for the Ph.D. are at least 52 hours of course work, Ph.D.-level proficiency in a foreign language, comprehensive examinations, and a dissertation.

Through the combined B.A./M.A. (4+1) option, the Department of English offers exceptional students the opportunity to earn both the B.A. and the M.A. in five years. Students are admitted to the 4+1 program only by approval of the Graduate Faculty of the English Department. Further information about the program is available from the director of graduate studies.

Other regulations governing graduate work are available from the director of graduate studies. For more information on the M.F.A., see the Academic Programs chapter of this catalog.

Graduate seminars in creative writing may be repeated for credit with the program director's approval. Other graduate

seminars may be repeated for credit if topics are not duplicated.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 110.

Environmental Engineering

CHAIR Douglas E Adams
 ASSOCIATE CHAIR Florence Sanchez
 DIRECTOR OF GRADUATE STUDIES Florence Sanchez
 DIRECTOR OF GRADUATE RECRUITING Shihong Lin
 DIRECTOR OF UNDERGRADUATE STUDIES Robert E. Stammer Jr.
 PROFESSORS EMERITI Paul Harrawood, Peter G. Hoadley, Frank L.
 Parker, John A. Roth, Karl B. Schnelle Jr., Richard E. Speece, Robert
 E. Stammer Jr., Edward L. Thackston
 PROFESSORS Mark D. Abkowitz, Douglas E. Adams, John Ayers,
 Prodyot K. Basu, David J. Furbish, George M. Hornberger, David S.
 Kossori, Eugene J. Leboeuf, Sankaran Mahadevan, Caglar Oskay
 PROFESSORS OF THE PRACTICE Curtis D. Byers, Sanjiv Gokhale,
 Steven L. Krahn, Judson Newbern, Robert E. Stammer Jr., Lori A.
 Troxel
 RESEARCH PROFESSOR Craig E. Philip
 ADJUNCT PROFESSORS Gregory L. Cashion, Ann N. Clarke, James
 H. Clarke, Allen G. Croff, James P. Dobbins IV, Boualem Hadjerioua,
 Ofra Klein-BenDavid, Janette Meyer, Vic L. McConnell, Michael B.
 Nye, Michael T. Ryan, L. Hampton Turner IV, Hans A. Van der Sloot,
 Raymond G. Wymer
 ASSOCIATE PROFESSORS Alan R. Bowers, Jonathan Gilligan, Florence
 Sanchez, Daniel B. Work
 RESEARCH ASSOCIATE PROFESSORS Kevin G. Brown, Janey S. Camp,
 Andrew G. Garrabrants
 ASSISTANT PROFESSORS Hiba Baroud, Ravindra Duddu, Jesus Gomez-
 Velez, Shihong Lin
 ASSISTANT PROFESSOR OF THE PRACTICE Mazita Mohd Tahir
 RESEARCH ASSISTANT PROFESSOR Pranav Karve

DEGREES OFFERED: *Master of Science, Doctor of Philosophy*

THE graduate program in environmental engineering provides opportunities for study and cutting-edge research that have an immediate impact on society and that are at the nexus of energy, water, smart cities, and the environment, with an emphasis on long-term sustainability and resilience. Areas of research include water resources, quality, and treatment; resilience and sustainability; nuclear environmental engineering; and environmental materials and materials durability.

The master of science (M.S.) degree in environmental engineering requires completion of 30 hours of graduate credit (5000 level or higher) and may be earned through: (1) 24 hours of didactic graduate course work, including at least 15 hours of graduate-level courses at Vanderbilt in the major area (i.e., within Environmental Engineering graduate program) and a research thesis of at least 6 semester hours—*Thesis M.S. Degree* or (2) 30 hours of didactic graduate course work, including at least 15 hours of graduate-level courses at Vanderbilt in the major area (i.e., within Environmental Engineering graduate program) and a substantive report of 3 semester hours of independent study—*Non-Thesis M.S. Degree*.

The Ph.D. degree requires completion of 72 hours of graduate credit (5000 level or higher), a minimum of which must be

30 hours of didactic graduate course work with a minimum of 24 course credit hours to be completed at Vanderbilt and 6 hours of didactic graduate course work (excluding directed study) in the major area (i.e., within Environmental Engineering graduate program). The remaining credit hours can be fulfilled with courses or research hours. During the fall semester, entering graduate students are required to take a one-hour, zero credit seminar to orient them to how critical review of a topic is conducted and how research proposals are prepared. In addition, all Ph.D. students must pass the Environmental Engineering Graduate Program preliminary examination, must complete the university-required qualifying exam, and must write and defend a dissertation.

As part of the required 24 credit hours (thesis M.S. degree) or 30 credit hours (non-thesis M.S. degree and Ph.D. degree) of didactic graduate course work, students must demonstrate competency in four areas—(i) quantitative mechanisms and theory, (ii) experimental methods, (iii) data analysis techniques, and (iv) computation, simulation, and applied mathematics—by taking at least one course in each of the four areas selected from an approved list. Specific and degree requirements (including list of competency courses, Ph.D. committee selection, preliminary examination, thesis/dissertation, and dissertation defense policies) are available from the director of graduate studies.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 111.

Epidemiology

DIRECTOR OF GRADUATE STUDIES Katherine E. Hartmann
 ASSOCIATE DIRECTOR OF GRADUATE STUDIES Peter F. Rebeiro
 PROFESSORS William Blot, Peter Buerhaus, Qiuyin Cai, Nancy Cox, Qi Dai, Robert Dittus, Wes Ely, Matthew Freiberg, Marie Griffin, Joseph McLaughlin, David Penson, Wayne Ray, Russell Rothman, Xiao-Ou Shu, Flora Ukoli, Wei Zheng
 RESEARCH PROFESSORS John Boice, Loren Lipworth, Martha Shrubsole, Gong Yang
 ADJUNCT PROFESSOR Maureen Sanderson
 ASSOCIATE PROFESSORS Todd Edwards, Tom Elasy, Jay Fowke, Debra Friedman, Jirong Long, Harvey Murff, Kristin Archer Swygert, Digna Velez-Edwards
 RESEARCH ASSOCIATE PROFESSORS Hui Cai, Wanqing Wen
 ASSISTANT PROFESSORS Melinda Aldrich, Alicia Beeghly-Fadiel, Cecilia Chung, Stephen Deppen, Ayush Giri, April Pettit, Cassianne Robinson-Cohen, Yaomin Xu
 RESEARCH ASSISTANT PROFESSOR Natalia Jimenez-Truque
 ADJUNCT RESEARCH ASSISTANT PROFESSOR Sandra Deming-Halverson

DEGREE OFFERED: *Doctor of Philosophy*

THE unique focus of the Ph.D. program in epidemiology is training epidemiologists with unparalleled excellence in advanced quantitative methods who have a strong grasp of causal logic, inference, probability, and other theoretical aspects of study design and data analysis, in addition to content area expertise. The curriculum features classroom, computing, and experience-based teaching. The program integrates training and research across clinical, laboratory, and

quantitative disciplines. At the completion of the program, graduates will be prepared to develop an independent research portfolio in academia, research, or industry. Our goal is to train critical thinkers prepared to make fundamental advances using rigorous and cutting-edge approaches to research. Graduates will be able to contribute across a wide spectrum of content areas and research foci.

Students admitted to the program are required to complete a total of 72 credit hours, including course work and research. Selected core courses will be shared with the biostatistics graduate program. In addition to the required methods curriculum, students will take content area and advanced methods electives. Students are eligible to take relevant course work, for which they meet the prerequisites, in any Vanderbilt department. Requirements for program completion include a comprehensive examination at the end of the second year, an oral defense of the dissertation proposal, and the doctoral dissertation. The program is expected to take four years to complete. Students can accelerate their studies to complete the program in three years.

Students will be matched shortly after acceptance with research preceptor teams. These established multidisciplinary teams include epidemiology faculty, clinical experts and clinical researchers, biostatisticians, and experienced research staff. The research preceptor team commits to involving the student as a co-investigator from the beginning of the student's graduate studies. Students will use data from their research teams in their course work. The goal is to create a mutually beneficial partnership that produces synergy between education, professional development, and the conduct of research.

Strong candidates for admission will have a master's degree in epidemiology, biostatistics, or another quantitative discipline; experience in the conduct of research and independent data analysis; and strong quantitative preparation and aptitude, including high GRE scores. Top applicants will have an expenses-paid, on-campus interview during which they will meet with research teams. Both students and research teams will then have the opportunity to rank whom they feel would be the best match(es).

For further information, please visit our website at vumc.org/epi-phd.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 112.

French and Italian

CHAIR Meike Werner
 DIRECTOR OF GRADUATE STUDIES Nathalie Debrauwere-Miller
 PROFESSORS EMERITI Barbara C. Bowen, Dan M. Church, Marc Froment-Meurice, Virginia M. Scott, Patricia A. Ward, Ruth G. Zibart
 PROFESSORS Robert Barsky, William Franke, Lynn Ramey, Tracy Sharpley-Whiting, Holly A. Tucker
 ASSOCIATE PROFESSORS Nathalie Debrauwere-Miller, Paul B. Miller, Andrea Mirabile, Letizia Modena, Anthère Nzabatsinda
 ASSISTANT PROFESSORS Elsa Filosa, Raisa Rexer

DEGREES OFFERED: *FRENCH. Master of Arts, Doctor of Philosophy*

REQUIREMENTS for the Ph.D. degree include a total of 42 credit hours of course work, taken in the Department of French and Italian and in other departments with the approval of the director of graduate studies. An M.A. qualifying exam, based on a departmental reading list, must be taken no later than before the beginning of classes in the student's fourth semester of study, and students who successfully pass the exam enter the Ph.D. stage.

Students are expected to begin to register for research credit no later than the beginning of classes in the student's fourth semester of study. Up to 33 credit hours may be taken as research credit. In addition to French and English, doctoral candidates must demonstrate a reading knowledge of an additional language to be determined in consultation with the student's dissertation adviser. Other regulations governing graduate work are available from the director of graduate studies.

After completing the M.A. exam, the student identifies an area of specialization (including, but not limited to, the subject of the dissertation). During the fourth semester, the student prepares an extensive reading list on this area of specialization. The Ph.D. qualifying exam is taken in the sixth semester upon completion of course work.

Upon successful completion of the Ph.D. exam, the student submits the dissertation proposal. After its approval by the Ph.D. committee, the student writes and defends the dissertation to complete the requirements for the Ph.D.

The Jean and Alexander Heard Libraries' rich collection of French materials makes research possible in all periods of French literature. The library's special collections department also houses the W. T. Bandy Center for Baudelaire and Modern French Studies, the Pascal Pia collection (nineteenth- and twentieth-century literary criticism), the Gilbert Sigaux collection (twentieth-century French literature), and the Wachs collection (eighteenth-century fiction and almanacs). In 2016 the W. T. Bandy Center acquired the Hervé Velez collection of Paul Verlaine materials, one of the finest collections of Verlaine works ever amassed.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 113 for French and on page 125 for Italian.

Gender Studies

See Women's and Gender Studies

German, Russian and East European Studies

CHAIR Lutz Koepnick
 DIRECTOR OF GRADUATE STUDIES Meike G. Werner
 PROFESSORS EMERITI Konstantin V. Kustanovich, John A. McCarthy, Richard Porter, Peggy Setje-Eilers
 PROFESSORS Barbara Hahn, Lutz Koepnick
 PROFESSORS (JOINT APPOINTMENTS) Celia Applegate (History), Helmut Smith (History), Frank Wcislo (History), David Wood (Philosophy)
 PROFESSORS (SECONDARY APPOINTMENTS) David Blackburn (History), Jennifer Fay (Cinema and Media Arts), Joel Harrington (History)
 ASSOCIATE PROFESSORS Emily Greble, James McFarland, Meike G. Werner, Christoph Zeller
 ASSOCIATE PROFESSORS (SECONDARY APPOINTMENTS) Alexander Jaskowicz (Jewish Studies), Allison Schachter (Jewish Studies)
 ASSISTANT PROFESSOR Bradley Gorski
 ASSISTANT PROFESSOR (SECONDARY APPOINTMENT) Karen Ng (Philosophy)
 RESEARCH ASSISTANT PROFESSOR Wout Cornelissen
 MELLON ASSISTANT PROFESSOR Irina Denischenko

DEGREES OFFERED: *GERMAN. Master of Arts, Doctor of Philosophy*

Master of Arts

The program leading to the M.A. degree is designed to deepen and broaden the student's knowledge of German culture, literature, and media from its beginnings to the present day, with special emphasis on major areas not usually covered in-depth in an undergraduate course of study.

In order to be admitted to candidacy for the master of arts degree, a student is required to prove ability in writing and speaking German to the satisfaction of the department.

Candidates for the master's degree must meet three separate requirements: complete 30 credit hours of formal course work, submit written evidence of research abilities, and pass an oral examination based on course work and the departmental core reading list. Nine of the 30 credit hours are to be at the 3000 level and above in the department, and a minimum of 3 credit hours should be in a graduate seminar. The oral examination is normally taken at the end of the student's third semester. As a rule, independent study will not fulfill the requirement of formal course work. Evidence of research abilities will usually take the form of a research paper of twenty-five to thirty pages that is based on a term paper and is to be submitted no later than the end of the student's fourth semester at Vanderbilt. As an alternative, students may choose to complete 24 credit hours of formal course work and to write a master's thesis. The latter is a research paper of sixty to eighty pages in length that gives evidence of scholarly competence and independent, critical thought. The research-writing requirement for this latter option is satisfied after the formal course work and the oral examination have been completed.

The department expects candidates to meet all formal course requirements for the master's degree within three semesters. The student must maintain a minimum *B* average, provide evidence of scholarly research abilities, and pass the oral examination to receive her/his degree. The M.A. examination committee consists of three faculty members drawn from

the department; usually—but not necessarily—the chair or the director of graduate studies serves as one of the examiners.

All candidates awarded a Teaching Assistantship will enroll in Foreign Language Teaching Theory and Practice during their first term of teaching. The student arranges her/his program in consultation with the director of graduate studies and in recognition of departmental objectives.

Through the combined B.A./M.A. (4+1) option, the department offers exceptional students the opportunity to earn both the B.A. and the M.A. in five years. Students will be provisionally admitted to the 4+1 program only by approval of the department. Further information about the program is available from the director of graduate studies.

Doctor of Philosophy

Admission to the program does not imply acceptance for candidacy in the Ph.D. program. Performance well above the minimum Graduate School requirement of a B is expected for admission to the Ph.D. program. Candidates normally obtain the M.A. before going on for the Ph.D. The purpose of the doctoral degree at Vanderbilt is to develop the talented candidate's capacity to make independent contributions to the field of German literature, media, and cultural studies. Transfer students should consult the Graduate School requirements for the doctorate.

The Ph.D. degree requires a total of 72 credit hours to graduate. Students who enter the program with a B.A. are required to take 60 credit hours of formal course work; students who enter the program with an M.A. are required to take 42 credit hours of formal course work. Courses that count toward the formal course work requirement include the 6 core courses listed below and all of the other graduate courses listed in the catalog for the German Ph.D., with the exception of credit hours taken for non-candidate research and dissertation research. In addition to taking required and non-required seminars within the department, graduate students are expected to enroll in at least two seminars on relevant materials taught by members of the German Studies faculty outside of the department. Students are typically also allowed to take at least two additional courses (6 credit hours) outside of the department with other faculty members to enrich their interdisciplinary training. All formal course work needs to be completed in order to pass the Qualifying Exam. Students entering the program with an M.A. may transfer up to 6 credit hours in consultation with the DGS after the end of their first year; such transfer credits, however, cannot be used to offset any of the required formal course work. Remaining credit hours to complete the mandated 72 credit hours include non-candidate and dissertation research. Each student is required to take the following courses (18 credit hours) as part of their required 60/42 credit hours of formal course work:

- GER 7101 *Foundations I: Transition Points of Modern German Culture* [3]
- GER 7102 *Foundations II: Theories of Literary and Cultural Analysis* [3]
- GER 7103 *Foundations III: Modes of Scholarly Work and Writing* [3]
- GER 7104 *Pre-Exam Colloquium* [3]
- SLS 6030 *Foreign Language Learning and Teaching* [3]
- GER 8301 *Pre-Dissertation Colloquium* [3]

The director of graduate studies in German assists in devising related areas of concentration so that the student, at

this stage, can be narrowing her/his focus for a dissertation topic. Faculty members actively assist students to determine the most promising topics for innovative research by pointing out interesting knowledge gaps, theoretical issues, or interdisciplinary questions.

A reading knowledge of French is usually expected, but another language may be substituted with the approval of the examination committee if it is felt that this language is relevant to the candidate's area of concentration or dissertation research. The second language requirement must be fulfilled before the candidate may take the comprehensive examination.

The teaching program option offers up to 12 credit hours in the area of teaching methodology (courses, research projects, and teaching internships). Work in this area does not count toward minimum degree requirements; 4 credit hours are normally the minimum in this program. Students opting for the full program should expect to add at least one semester to their course of study.

Students with strong interests in modern media culture and media studies are encouraged to apply for the joint-Ph.D. program in Comparative Media Analysis and Practice (CMAP), typically at the end of their first year of doctoral studies at Vanderbilt. Students fulfilling all requirements for both German and CMAP will receive the Ph.D. in German and Comparative Media Analysis and Practice.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 114 for German and on page 174 for Russian.

Hearing and Speech Sciences

CHAIR Anne Marie Tharpe

VICE CHAIR OF GRADUATE STUDIES Todd A. Ricketts

ASSOCIATE DIRECTOR OF GRADUATE STUDIES, PH.D. PROGRAM

Melissa C. Duff

PROFESSORS EMERITI Edward G. Conture, D. Wesley Grantham,

R. E. Stone Jr., Robert T. Wertz

PROFESSORS Daniel H. Ashmead, Fred H. Bess, James W. Bodfish, Stephen M. Camarata, René H. Gifford, Troy Hackett, Linda J. Hood, Gary P. Jacobson, Todd A. Ricketts, Anne Marie Tharpe, Mark T.

Wallace

ASSOCIATE PROFESSOR EMERITA Judith Rassi

ASSOCIATE PROFESSORS Michael de Riesthal, Melissa C. Duff, P. Lynn Hayes, Benjamin W. Y. Hornsby, Barbara H. Jacobson, Ellen Kelly, C. Melanie Schuele, Stephen M. Wilson

RESEARCH ASSOCIATE PROFESSOR Alexandra Key

ASSISTANT PROFESSORS Lea Helen Evans, Mary Sue Fino-Szumski, Charles Hausman, Melissa Henry, Robin Jones, Antje Mefferd, Jennifer Pilkington, Ramnarayan Ramachandran, Marcy Sipes, Wanda G.

Webb, Tiffany Woynaroski

RESEARCH ASSISTANT PROFESSORS Erin Picou, Hatun Zengin-Bolatkale

ADJUNCT ASSISTANT PROFESSORS Barbara Peek, Mia Rosenfeld

DEGREE OFFERED: *Doctor of Philosophy*

THE Ph.D. degree normally requires four to five years of study with a minimum of 72 graduate credit hours (24 of which can be by transfer). There are no foreign language requirements.

The student must complete two research projects and 12 hours of course work in statistics and research methodology prior to the dissertation. Laboratory work throughout the program and a teaching experience are also required as part of training. Doctoral candidates also present a minor of not less than 12 hours taken outside the department or from another subject area in hearing, speech, and language. The final year of the program is typically devoted to the dissertation.

This department also offers the doctorate of audiology (Au.D.), master of education of the deaf (M.D.E.), and the master of science in speech-language pathology (M.S.) through the School of Medicine (vanderbilt.edu/catalogs/medical).

The teaching, clinical, and research programs of the department are housed primarily in Vanderbilt's Bill Wilkerson Center. For further information, visit <https://www.mc.vanderbilt.edu/ghss>.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 116.

History

CHAIR Edward Wright-Rios

VICE CHAIR Michael D. Bess

DIRECTOR OF UNDERGRADUATE STUDIES Lauren Clay

DIRECTOR OF UNDERGRADUATE STUDIES FOR LAW, HISTORY, AND SOCIETY Lauren Clay

DIRECTOR OF GRADUATE STUDIES Samira Sheikh

PROFESSORS EMERITI Richard J. M. Blackett, David Lee Carlton, Paul K.

Conkin, James A. Epstein, Jimmie L. Franklin, Matthew Ramsey,

V. Jacque Voegeli, Donald L. Winters

PROFESSORS Celia Applegate, Lauren Benton, Michael D. Bess,

David Blackburn, William Caferro, Jefferson Cowie, Katherine B.

Crawford, Dennis C. Dickerson, Marshall C. Eakin, Gerald Figal, Joel

F. Harrington, Yoshikuni Igarashi, Sarah Igo, Peter Lake, Jane Gilmer

Landers, Thomas McGinn, Moses Ochon, Thomas Alan Schwartz,

Helmut Waiser Smith, Arleen M. Tuchman, Daniel H. Usner Jr., David J.

Wasserstein, Rhonda Y. Williams, Edward Wright-Rios

ASSOCIATE PROFESSORS Celso Castilho, Lauren Clay, Julia Phillips

Cohen, Emily Greble, Leor Halevi, Paul A. Kramer, Peter Lorge,

Catherine Molineux, Ruth Rogaski, Samira Sheikh, Francis W. Wcislo

ASSISTANT PROFESSORS Ari Bryen, Brandon Byrd, Ole Molvig, Tasha

Rijke-Epstein, Frank Robinson, Kimberly Welch

RESEARCH ASSISTANT PROFESSOR Jordan Downs

SENIOR LECTURER Yollette T. Jones

DEGREES OFFERED: *Master of Arts, Doctor of Philosophy*

Master of Arts

The Department of History does not accept external applications for a terminal master's degree. The M.A. is usually earned en route to the Ph.D. It is also available to Vanderbilt undergraduates who enroll in Vanderbilt's 4+1 program.

Doctor of Philosophy

The Ph.D. requires 72 hours of graduate credit, including 45 quality hours.

All candidates for the Ph.D. must demonstrate a reading knowledge of a foreign language or languages. In U.S. and British history, one language is required. In all other fields, the minimum is two. Students are expected to develop proficiency in any languages required for their dissertation research.

The first two years in the Ph.D. program are devoted to taking classes, writing two substantial research papers, passing the necessary language examination(s), and preparing for the qualifying examination. A full list of graduate history courses is available in the courses section of this catalog. All first-year students take a two-semester introduction to methods and research, History 6100 and 6110. These courses are designed to familiarize students with a range of theoretical and methodological approaches. Each second-year student, in consultation with his or her adviser and the director of graduate studies, chooses a Ph.D. Committee, consisting of the dissertation director, two other members of the Graduate Faculty from the Department of History, and one from outside the department, either at Vanderbilt or at another university.

Students take their qualifying examination either in the spring of the second year or fall of the third year. The examination is administered by the student's Ph.D. committee. *Note:* the examination cannot be scheduled until the student has 30 quality hours, with at least a B average and no Incompletes, and has met the language requirement. When the student has passed the qualifying examination, the Ph.D. committee shall recommend to the Graduate School that the student be admitted to candidacy for the Ph.D.

The Vanderbilt history program does not have predetermined fields of study. In consultation with their adviser and the director of graduate studies, students define a major field and two minor fields that meet their interests and needs. The major field is typically defined as a long time span and either a regional or a national geographic framework (for example, Europe 1600–1789 or modern Germany). A large topical field such as modern medical history, Anglo-American legal history, or the Reformation may also be appropriate. One of the minor fields may be a subfield of the major field, defined by topic and/or geography. An example would be a major field on modern Latin America combined with a minor field on Brazil. The other minor field must be distant from the major field in terms of topic, chronology, and/or geography. Typically, this field will have theoretical, cross-cultural, and/or interdisciplinary components (e.g. comparative slavery, postcolonial theory and history, comparative nationalisms). This field may be primarily based in a department other than history or in an interdisciplinary program that trains students at the graduate level.

In the third year, all students take History 8200, which aids students in preparing the dissertation prospectus and beginning work on the dissertation itself. The dissertation prospectus is approved through an oral examination conducted by members of the student's Ph.D. committee. The spring term schedule includes History 6300 (The Art and Craft of Teaching History), an introduction to teaching methods and teaching practicum designed to familiarize students with techniques for lecturing, leading discussions, designing examinations, and grading undergraduates.

From the fourth year forward, students will normally enroll in History 9999, Dissertation Research, each semester they are in residence.

The dissertation should be completed within four years after admission to candidacy for the Ph.D. The candidate will defend the dissertation at a public examination conducted by the Ph.D. committee.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 118.

History of Art

CHAIR Kevin D. Murphy
 DIRECTOR OF GRADUATE STUDIES Betsey A. Robinson
 DIRECTOR OF UNDERGRADUATE STUDIES Sheri Shaneyfelt
 PROFESSORS EMERITI Robert A. Baldwin, F. Hamilton Hazlehurst,
 Milan Mihal, Robert L. Mode, Ljubica D. Popovich
 PROFESSORS Leonard Folgarait, Vivien Green Fryd, Christopher M. S.
 Johns, Kevin D. Murphy
 ASSOCIATE PROFESSORS Tracy Miller, Elizabeth J. Moodey, Betsey A.
 Robinson
 ASSISTANT PROFESSORS Mireille M. Lee, Rebecca K. VanDiver
 ASSISTANT PROFESSOR OF THE PRACTICE Matthew Worsnick
 MELLON ASSISTANT PROFESSOR Heeryoon Shin
 PRINCIPAL SENIOR LECTURER Sheri Shaneyfelt

DEGREE OFFERED: *Master of Arts*

THE Department of History of Art does not accept external applications for a terminal master's degree. The M.A. is available only to Vanderbilt undergraduates who enroll in the department's 4+1 combined B.A./M.A. program.

The Department of History of Art treats critically the major fields in world art, from ancient to contemporary, and serves to connect the arts to the other humanities. Many students will use the program in history of art as a foundation for careers in which analytical reading and writing skills gained in the major are especially valued: as the basis for advanced training in professional schools (such as architecture, law, medicine, journalism, and business), for postgraduate work in history of art, and for employment in galleries, museums, or design-related fields. A major goal of the department is to help students become readers of visual images and material culture throughout their lives, as well as to encourage visual approaches to learning.

Interdisciplinary research is fundamental to history of art, and graduate students are encouraged to pursue courses in related departments and programs such as Anthropology, African American and Diaspora Studies, American Studies, Asian Studies, Cinema and Media Arts, Classical and Mediterranean Studies, English, European Studies, History, Latin American Studies, Medicine, Health, and Society, Philosophy, Religious Studies, Women's and Gender Studies, and departments of foreign language and literature.

The History of Art 4+1 program allows outstanding students of the history of art and architecture to complete a B.A. and M.A. in five years. It is available to current Vanderbilt undergraduate students majoring or minoring in history of art, as well as students in related fields who have completed significant course work in history of art. Students will be provisionally admitted to the 4+1 program only by approval of the department.

Typically, a 4+1 student will work closely with the undergraduate adviser to ensure that all B.A. requirements will be fulfilled, and then register for 3 to 6 credit hours of graduate course work in the senior year, in consultation with the director of graduate studies (DGS). Accepted students receive registration priority in order to complete the B.A. and begin M.A. requirements.

A minimum of 30 didactic (letter-graded) credit hours is required for the master's degree. This includes enrollment in at least 24 credit hours of course work, plus 3 credit hours in method, theory, historiography, and professional practice [HART 6990: Special Topics], and 3 credit hours preparing a Qualifying Paper [HART 6999]. Of the 24 credit hours of formal course work, 15 must be taken in History of Art. Courses in other departments shall be counted with approval of the director of graduate studies. With the approval of the DGS, up to 3 courses in the M.A. program may be undergraduate courses at the 2000 level and above, with added work for graduate credit. The average load per semester as a graduate student in the fifth year is 9–12 credit hours.

Most 4+1 students engage in research, internships, or travel in the summer between their fourth and fifth years.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 121.

Human Genetics

DIRECTOR David Samuels
 DIRECTOR OF GRADUATE STUDIES Todd Edwards
 ASSOCIATE DIRECTOR OF EDUCATION Douglas Mortlock
 PROFESSORS Thomas Aune, H. Scott Baldwin, Kendal Broadie, Ellen Wright Clayton, Nancy Cox, James Crowe, Joshua Denny, Rizwan Hamid, Carl Johnson, MacRae Linton, James G. Patton, John A. Phillips III, Dan Roden, Antonis Rokas, Laurence J. Zwiebel
 ASSOCIATE PROFESSORS Seth Bordenstein, Milam Brantley, Katherine Friedman, Antonis Hatzopoulos, Ela Knapik, Bingshan Li, Chor Yin (Maggie) Ng, Douglas Ruderfer, David Samuels, Jeffrey Smith, Michelle Southard-Smith, James S. Sutcliffe, Todd Edwards, Digna Velez-Edwards
 ASSISTANT PROFESSORS Melinda Aldrich, Jennifer Below, John Capra, Lea Davis, Emily Hodges, Timothy Hohman, Douglas Mortlock, Shirley Russell, Bryan Venters, Quinn Wells

DEGREE OFFERED: *Doctor of Philosophy*

THE overall goal of the Human Genetics Ph.D. degree program is to provide students with a solid foundation for a career in genetics research and teaching. Training is available in human genetic analysis and in genetic analysis of model systems that contribute to our understanding of human disease. The training combines a prescribed set of basic courses intended to ground students in the fundamentals of genetic analyses, the basics of human genetics, a set of elective courses designed to meet individual needs, and a rigorous research experience that will contribute to the field of genetics. Students completing the requirements of the Ph.D. program in Human Genetics will have demonstrated mastery of knowledge in genetics and contributed substantial and original scientific knowledge to the field.

Ph.D. students in the Human Genetics program are required to complete a minimum of 30 credit hours of formal course work, consisting of 24 hours of required course work and 6 hours of electives. One of the required courses will be a statistics course to be chosen from several currently available on campus and approved by the program faculty. Students will take a minimum of 6 hours of didactic classes per semester during their

first two years of study. It is expected that during the second year at least one semester will exceed this minimum in order to complete the required courses prior to year three of study. The electives come from an approved list of advanced genetics courses and the choice of these courses will be based on the individual student's research interests.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 124.

Interdisciplinary Graduate Program in Biomedical Sciences

ELEVEN programs participate in the Interdisciplinary Graduate Program: Biochemistry, Biological Sciences, Cancer Biology, Cell and Developmental Biology, Molecular Pathology and Immunology, Chemical and Physical Biology, Microbe-Host Interactions, Molecular Physiology and Biophysics, Neuroscience, Pharmacology, and Human Genetics. During their first year, students take a core curriculum and conduct research in four laboratories before selecting the discipline in which they will earn the Ph.D. degree. Additional course work during subsequent years is appropriate to each discipline and the student's interests.

Ph.D. dissertation research may be conducted in any one of over 250–300 laboratories. Research opportunities are available in the following areas: biochemistry, biological sciences, cancer biology, cell biology, developmental biology, genetics, microbiology, immunology, pharmacology, molecular biology, molecular pathology, molecular toxicology, molecular neuroscience, reproductive biology, signal transduction, structural biology, molecular biophysics, and vascular biology.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 125.

Interdisciplinary Materials Science

DIRECTOR D. Greg Walker
 DIRECTOR OF GRADUATE STUDIES D. Greg Walker
 PROFESSORS EMERITI Jimmy L. Davidson, George T. Hahn, Donald L. Kinser, Taylor G. Wang, James E. Wittig
 PROFESSORS Douglas Adams, David E. Cliffler, Peter Cummings, Craig L. Duvall, Daniel M. Fleetwood, Todd D. Giorgio, Scott A. Guelcher, Richard F. Haglund, Timothy P. Hanusa, G. Kane Jennings, Paul Laibinis, Deyu Li, Clare McCabe, Robert Reed, Sandra Rosenthal, Ronald D. Schrimpf, Norman Tolk, Kalman Varga, Sharon Weiss, David W. Wright
 ASSOCIATE PROFESSORS Joshua Caldwell, Bridget R. Rogers, Florence Sanchez, Jason G. Valentine, D. Greg Walker, Yaqiong Xu

RESEARCH ASSOCIATE PROFESSOR Anthony Hmelo
 ASSISTANT PROFESSORS Rizia Bardhan, Leon M. Bellan, Lauren Buchanan, Kelsey Hatzell, Piran Kidambi, Janet Macdonald, Justus Ndukaife, Cary Pint, John T. Wilson

DEGREES OFFERED: *Master of Science, Doctor of Philosophy*

MATERIALS advancements improve the standard and the quality of living of societies everywhere. They are indeed the underpinning of the development of new technologies with the potential for global impact. In today's sophisticated and complicated world, continued advancements in materials demand intimacy among a variety of disciplines. In recognition of this multidisciplinary need, professors at Vanderbilt University from departments of Chemistry, Physics, Biomedical Engineering, Chemical and Biomolecular Engineering, Electrical Engineering, Mechanical Engineering, and Civil Engineering, and School of Medicine have come together in the Interdisciplinary Materials Science program. Therefore, extensive collaboration in both the teaching of and research in materials science is pervasive, where multidisciplinary study is a hallmark of the educational experience.

The M.S. degree in materials science requires a minimum of 24 semester hours (beyond the baccalaureate) of formal course work plus a thesis of at least 6 semester hours. Nine semester hours are a selection of three of the four Materials Science core program courses. The core courses are Thermodynamics, Materials Chemistry, Atomic Arrangements in Solids, and Solid State Physics of Condensed Matter. Six additional hours are taken from an approved list of Interdisciplinary Materials Science program courses. A minor consisting of 6 semester hours is chosen in a separate but related field. The remaining 3 hours are an elective selected from either Interdisciplinary Materials Science program offerings or a related field.

The Ph.D. degree in materials science requires a total of 72 semester hours (beyond the baccalaureate) plus a dissertation. Within the requirement is a minimum of 24 semester hours of course work that includes 12 hours from the materials science core curriculum and 12 hours from an approved list of Interdisciplinary Materials Science program courses. The intent of these courses is to complement the student's technical interests. The remaining semester hours may be in research dissertation hours or in additional course electives.

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Course descriptions begin on page 125.

Japanese

JAPANESE LANGUAGE SENIOR LECTURER Hideko Shimizu
 LECTURERS Nozomi Imai, Asami Nakano

STUDENTS should consult with the director of Asian Studies and their home department advisers about the acceptability of Japanese courses for their program of study. Courses are not designed for advanced native speakers.

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Course descriptions begin on page 126.

Jewish Studies

DIRECTOR Julia Cohen (Interim Director)
 ASSOCIATE DIRECTOR Adam S. Meyer
 PROFESSORS Robert F. Barsky, Lenn Goodman, Amy-Jill Levine,
 David Price, Choon-Leong Seow, David J. Wasserstein
 ASSOCIATE PROFESSORS Phillip Ackerman-Lieberman, Nathalie
 Debrauwere-Miller, Idit Dobbs-Weinstein, Jay Geller, Emily Greble,
 Ari Joskowicz, Shaul Kelner, Adam S. Meyer, Julia Phillips Cohen,
 Allison Schachter
 MELLON ASSISTANT PROFESSOR Rebecca Epstein-Levi
 ASSISTANT PROFESSOR OF THE PRACTICE Mazalit Haim
 LECTURER Judy Klass

JEWISH Studies at Vanderbilt offers an interdisciplinary academic program that seeks to facilitate the critical study of Jewish history, religion, language, philosophy, politics, culture, society, music, art, and literature across continents and eras, and to situate this study in relation to the world in the present. The program accesses the resources of the entire university to explore Judaism, its evolution and expression from biblical times onwards.

Students interested in graduate instruction in Jewish studies have the option of pursuing a master of arts in Jewish studies through the Graduate Department of Religion, or a graduate certificate in Jewish studies through the Program in Jewish Studies.

Master of Arts

See Religion.

Graduate Certificate in Jewish Studies

The certificate in Jewish studies provides graduate and professional students with access to interdisciplinary scholarship in the field of Jewish studies, supplies them with a valuable professional credential, and strengthens their ability to compete for jobs as well as for national fellowship and postdoctoral awards.

Any student enrolled in a graduate or professional program at Vanderbilt University is eligible to apply for the certificate in Jewish studies. Acceptance to the program requires a minimum cumulative GPA of 3.3, and the approval of both the student's primary adviser and the director of the Program in Jewish Studies.

Courses taken at Vanderbilt University prior to admission to the certificate program may be counted toward the certificate requirements with the approval of the director of the Program in Jewish Studies.

Students wishing to enroll must complete an Intent to Enroll form, which must be signed by the student, the director of the Program in Jewish Studies, and the director of the graduate program (DGS) for the degree program in which the student is enrolled. A signed copy of the form must be submitted to the Graduate School (richard.hoover@vanderbilt.edu) and to the Office of the University Registrar (university).

registrar@vanderbilt.edu).

A certificate in Jewish studies is awarded with either the M.A. or Ph.D. degree upon fulfillment of the following requirements:

1. *Foundational Course, 3 credit hours.* JS 5000, Major Themes in Jewish Studies. As this course is not offered every year, students may petition to have this requirement waived. If this requirement is waived, students will be required to take an additional 3 credit hours under requirement 2.

2. *Focus Courses, 15 credit hours.* Students must complete 15 credit hours of interrelated courses in Jewish studies, appropriate to the student's program of study and forming an intellectually cohesive whole (or 18 credit hours, if the requirement to take JS 5000 is waived). Students are required to complete at least one course from three of four subfields, with at least 9 credit hours coming from a single subfield:

- Area 1: Biblical Studies
- Area 2: Antiquity and Medieval World
- Area 3: Modern and Contemporary Experience
- Area 4: Culture, Philosophy, and Literature

Courses listed below are approved for certificate credit. Other courses not on this list must be approved for credit by the director of the Program in Jewish Studies. Any courses at the 2000 or 3000 level also require instructor permission to enroll and arrangements for additional work beyond the undergraduate requirements.

No more than 6 credit hours of specifically named courses required for the primary degree may be applied toward the certificate.

3. A non-credit final project/paper submitted to the Jewish Studies steering committee that demonstrates an application of Jewish studies contents or methodology to research, teaching, or fieldwork. The project/paper may originate as an assignment in a graduate-level course.

Approved List of Courses

LANGUAGE: **Jewish Studies:** 5301, Jewish Language and Paleography. **Classics:** 6300, Akkadian. **Hebrew (Modern Hebrew):** 1101–1102, Elementary Hebrew; 2201–2202, Intermediate Hebrew; 3851–3852; Independent Study in Modern Hebrew; 5111, Hebrew for Graduate Reading; 5301, Advanced Hebrew Grammar; 5302, Advanced Hebrew Composition. **Religion:** 2514, Elementary Modern Hebrew I; 2515, Elementary Modern Hebrew II; 3102, Intermediate Modern Hebrew I; 3103, Intermediate Modern Hebrew II; 5101–5102, Elementary Biblical Hebrew; 5120, Intermediate Biblical Hebrew;

AREA 1. BIBLICAL STUDIES: **Jewish Studies:** 5100, The New Testament in Its Jewish Contexts. **English:** 3370, The Bible in Literature. **Music Literature:** 2310, The Bible and Music. **Religious Studies:** 5225, Sexuality in the Hebrew Bible and the Ancient Near East; 5926, Ancient Goddesses; 5938, Marriage in the Ancient Near East and the Hebrew Bible. **Religion:** 3109, Exilic Prophecy; 3111, The Pentateuch; 3112, Apocalyptic; 3113, The Wisdom Literature of the Ancient Near East; 3117, The Ethics of Ancient Israel; 3124, Esther and Ruth; 3127, Cultures of Ancient Near East; 3128, Jewish Messianism; 3129, Book of Judges; 3130, Book of Jeremiah; 3131, Voices of Women in the Ancient Near East; 3142, The Old Testament in Greek; 6177, Song of Songs; 6500, The Hebrew Bible; 6501, Literary Analysis of the Hebrew Bible; 6502, Leadership in Hebrew Bible; 6503, Seminar in the History of Ancient Israel; 6504, Modern Interpreters of Ancient Israel; 6505, Biblical Law and Ancient Israel; 6506, Politics and the Economy in Ancient Israel; 6510, Empire and Canon; 6511, Book of Genesis; 6513, The Book of Exodus; 6515, The Book of Deuteronomy; 6516, The Book of Numbers; 6517, Book of Joshua; 6518, Book of Job; 6519,

Book of Qoheleth; 6520, Book of Daniel; 6522, Sexuality in the Hebrew Bible and ANE; 6524, Literature of the Ancient Near East; 6525, Ancient Goddesses; 6528, Book of Amos; 6529, Eighth-Century Prophecy; 6575, Old Testament Theology; 6580, West Semitic Inscriptions; 6609, Feminist Interpretations of Scripture; 9200, Reading Course in Hebrew Bible.

AREA 2. ANTIQUITY AND THE MEDIEVAL WORLD: Jewish Studies: 2600, Islam and the Jews; 5150, Issues in Rabbinic Literature; 5210, Reading across Boundaries: Jewish and Non-Jewish Texts; 5620, Jews in Egypt; 5640, Jews and Greeks; 5892, Topics in Ancient and Medieval Jewish History. **Anthropology:** 8230, The Collapse of Civilizations. **Classics:** 5010, The Ancient Origins of Religious Conflict in the Middle East; 5100, History of the Ancient Near East; 5120, Greece and the Near East from Alexander to Theodosius; 5160, History of Roman Empire. **History:** 3210, Muslims, Christians, and Jews in Medieval Spain; 5160, Medicine in Islam; 5170, Islam and the Crusades. **History of Art:** 5260, The Art of Pagans, Christians, and Jews. **Philosophy:** 2101, Hellenistic and Late Ancient Philosophy; 2102, Medieval Philosophy. **Religion:** 3150, Lives of Jesus: Ancient and Modern; 3151, Jesus and the Early Christian Communities; 3156, Jewish and Christian Self-Definition; 3501, Judaism in New Testament Times; 6526, Jewish Life in Persian Egypt; 6527, Hellenistic Jewish Literature; 6608, Jewish/Christian Relation; 6794, Art of Pagans, Christians, and Jews. **Religious Studies:** 4554, The Qur'an and Its Interpreters.

AREA 3. MODERN AND CONTEMPORARY EXPERIENCE: Jewish Studies: 2400, American Jewish Life; 2450, The Jewish Diaspora; 2500, Modern Israel; 3100, The Holocaust; 3830, Contemporary Jewish Issues; 5300, Modern Jewish Thought; 5540, Power and Diplomacy in the Modern Middle East; 5560, Social Movements in Modern Jewish Life; 5894, Topics in Modern Jewish History. **European Studies:** 2208, Conspiracy Theories and Rumors in European and U.S. History. **History:** 3160, Immigration, Race, and Nationality: The American Experience; 5130, Russia: Old Regime to Revolution; 5135, Russia: The U.S.S.R. and Afterward; 5190, Last Empire of Islam; 5300, Twentieth-Century Germany; 2720, World War II; 5885, Cities of Europe and the Middle East. **Political Science:** 2230, Middle East Politics. **Religion:** 3502, Judaism and Modernity; 8817, The Holocaust: Its Meanings and Implications; 8822, The Holocaust: Representation and Reflection. **Religious Studies:** 2210W, Constructions of Jewish Identity in the Modern World; 3229, The Holocaust: Its Meanings and Implications; 4939, Religious Autobiography. **Sociology:** 3702, Racial and Ethnic Minorities in the United States.

AREA 4. CULTURE, PHILOSOPHY, AND LITERATURE: Jewish Studies: 2210W, Hebrew Literature in Translation; 2230W, American Southern Jews in Life and Literature; 2240W, Black-Jewish Relations in Post-War American Literature and Culture; 2280, Jewish Humor; 2280W, Jewish Humor; 2290W, Imagining the Alien: Jewish Science Fiction; 2420W, American Jewish Music; 5250W, Witnesses Who Were Not There: Literature of the Children of Holocaust Survivors; 5260, Coming of Age in Jewish Literature and Film; 5260W, Coming of Age in Jewish Literature and Film; 5270, Jewish Storytelling; 5270W, Jewish Storytelling; 5320, Freud and Jewish Identity; 5330, Is G-d Guilty? The Problem of Evil in Judaism; 5340, Jewish Philosophy after Auschwitz; 5520, Zionism: Politics, Religion, and Ethnicity; 5000, Major Themes in Jewish Studies. **English:** 3664, Jewish American Literature. **French:** 4430, The Struggle of Encounter: The Israeli-Palestinian Conflict in Literature. **German:** 5445, Nazi Cinema: The Manipulation of Mass Culture; 5344, Women at the Margins: German-Jewish Women Writers. **History of Art:** 5765, Art since 1945. **Music Literature:** 2150, Music, Identity, and Diversity. **Philosophy:** 2109, Twentieth-Century Continental Philosophy; 3005, Jewish Philosophy; 3006, Islamic Philosophy; 3011, Critical Theory. **Religion:** 3503, The Jewish Heritage; 3505, Jewish Ethics; 8805, Jewish Theories of Religion; 8825, Jewish Animals. **Religious Studies:** 2220, Jewish Ethics; 2940, Great Books of Literature and Religion; 5270, Jewish Theories of Religion; 5940, The Nature of Evil. **Russian:** 2434, The Russian Cinema; 5231, Jews in Russian Culture: Survival and Identity. **Sociology:** 3204, Tourism, Culture, and Place; 3222, Sociology of Religion

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Course descriptions begin on page 126. See also Religion.

Latin American Studies

DIRECTOR Edward F. Fischer
EXECUTIVE DIRECTOR Avery Dickins de Girón
ASSISTANT DIRECTOR, DIRECTOR OF UNDERGRADUATE STUDIES,
AND DIRECTOR OF GRADUATE STUDIES Nicolette Kostiw
LATIN AMERICAN BIBLIOGRAPHER Paula Covington

Affiliated Faculty

PROFESSORS Robert Barsky (French and Italian), John Brock (Medicine), Maria Magdalena Campos-Pons (Art), Daniel B. Cornfield (Sociology), Arthur A. Demarest (Anthropology), Tom D. Dillehay (Anthropology), Marshall Eakin (History), David J. Ernst (Physics), Edward F. Fischer (Anthropology), Earl E. Fitz (Portuguese), Leonard Folgarait (History of Art), Edward H. Friedman (Spanish), Lesley Gill (Anthropology), Ruth Hill (Spanish), David J. Hess (Sociology), Vera Kutzinski (English), Jane G. Landers (History), Lorraine Lopez (English), William Luis (Spanish), Terry A. Maroney (Law), Peter Martin (Medicine), Philip D. Rasico (Spanish), Fernando Segovia (Divinity), Mitchell A. Seligson (Political Science), Timothy Sterling (Medicine), Randall S. Thomas (Law), Benigno Trigo (Spanish), Bart Victor (Management), Edward Wright-Rios (History), Andrés Zamora (Spanish), Elizabeth J. Zechmeister (Political Science), Mel Ziegler (Art)

ASSOCIATE PROFESSORS Dominique P. Béhague (Medicine, Health, and Society), Victoria A. Burrus (Spanish and Portuguese), Janey Camp (Engineering), José Cárdenas Bunsen (Spanish), Beth A. Conklin (Anthropology), Markus Eberl (Anthropology), Quentin Eichbaum (Medicine), Carol Etherington (Nursing), William R. Fowler Jr. (Anthropology), Carlos Grijalva (Medicine), Guilherme Gualda (Earth and Environmental Sciences), Jana Harper (Art), T. S. Harvey (Anthropology), Jonathan Hiskey (Political Science), Suzana Herculano-Houzel (Psychology), John Janusek (Anthropology), Christina Karageorgou-Bastea (Spanish), Noam Lupu (Political Science), Paul B. Miller (French and Latin American Studies), Troy Moon (Medicine), Douglas Morgan (Medicine), Ifeoma Nwankwo (English), Emanuelle Oliveira-Monte (Portuguese), Cynthia Paschal (Engineering), Tiffany Patterson (African American and Diaspora Studies), Vesna Pavlovic (Art), Efrén O. Pérez (Political Science), Norbert O. Ross (Anthropology), Mariano Sana (Sociology), Mavis Schorn (Nursing), José Sibaja (Music), Jada Benn Torres (Anthropology), Tiffany A. Tung (Anthropology), Steven A. Wernke (Anthropology), Gilman W. Whiting (African American and Diaspora Studies)

ASSISTANT PROFESSORS Candice Amich (English), Molly Barth (Music), Adriana Bialostozky (Medicine), Carwil Bjork-James (Anthropology), Corey E. Brady (Education), Kathryn L. Carlson (Medicine), Ashley Carse (Education), Celso T. Castilho (History), Jessica Castilho (Medicine), Ana Christina da Silva Iddings (Education), Neerav Desai (Medicine), Andrew Dustan (Economics), Jesus Gomez Velez (Engineering), Federico Gutierrez (Economics), Brian L. Heuser (Education), Maria Luisa Jorge (Earth and Environmental Sciences), Natasha McClure (Nursing), Marzia Milazzo (English), Cecilia Hyunjung Mo (Political Science), W. Frank Robinson (History), Pedro Sant'Anna (Economics), Brent Savoie (Medicine), Carlos Silvera Batista (Engineering), Susan G. Stewart (Astronomy), Sarah V. Suiter (Education), Lori Troxel (Engineering), Julie Vernon (Engineering), Thomas E. Verrier (Music), Carol Ziegler (Nursing)

SENIOR LECTURERS Frances Alpren (Spanish), Ana Regina Andrade (Economics), Jose Aznar (Spanish), Joe Bandy (Sociology), Lorraine Catanzaro (Spanish), Rachel Chiguluri (Spanish), Paula Covington (Latin American Studies), Sarah Delassus (Spanish), Avery Dickins de Girón (Latin American Studies), Heraldo Falconí (Spanish), Victoria Gardner (Spanish), Chalene Helmut (Spanish), Clint Hendrix (Spanish), Nicolette Kostiw (Latin American Studies), Benjamin Legg (Portuguese), Alicia Lorenzo (Spanish), Ryan Middagh (Music), Spring Miller (Law), Patrick Murphy (Spanish), Michael Newton (Law), Elena Olazagasti-Segovia (Spanish), Amarilis Ortiz (Spanish), David A. Owens (Management), Carolina Palacios (Spanish), Gina M. Perez (Medicine), Maria Paz Pintane (Spanish), Shelza Rivas (Nursing), Mareike Sattler (Anthropology), Cynthia Wasick (Spanish), Katherine Wesolek (Spanish), Catesby Yant (Anthropology)

DEGREE OFFERED: LATIN AMERICAN STUDIES.*Master of Arts*

DESIGNATED by the U.S. Department of Education as a National Resource Center for Latin America, Vanderbilt's Center for Latin American Studies draws on departmental strengths and faculty expertise from across campus. Integrating teaching, research, and service, the center maintains substantive collaborations with all of Vanderbilt's colleges and schools. The center has special strengths in Maya studies, Brazilian studies, Andean studies, and the Black Atlantic, as well as unique library collections of Colombiana. Programs of instruction provided by the center promote greater understanding of the region's history, culture, political economy, and social organization and cultivate the ability to think strategically about global issues.

Faculty and courses come from the Departments of Anthropology, Economics, History, History of Art, Political Science, Sociology, and Spanish and Portuguese as well as from Vanderbilt's education, engineering, law, management, medical, music, and nursing schools. The center fosters a lively research community on campus by sponsoring colloquia, conferences, films, and a speaker series that brings distinguished scholars, government and business leaders, and social activists to campus.

Students work toward an M.A. in Latin American studies, a master's or doctoral degree in one of the related programs with an emphasis on Latin American studies, or a certificate in Latin American studies.

Candidates for the M.A. in Latin American studies choose a thesis (30 hours and thesis) or non-thesis (33 hours) option. Each option includes Latin American Studies 5901. While students may spend part of their third or fourth semester doing research in Latin America, subject to approval by the program, the dean of the College of Arts and Science, and the Graduate School, the candidate for the master's degree must complete four semesters of graduate study as a full-time student. Master's degree candidates are expected to demonstrate language ability in Spanish, Portuguese, Haitian Creole, or an indigenous Latin American language; this means advanced ability in one language and intermediate ability in another.

Through the Combined B.A./M.A. (4+1) Option, the department offers exceptional students the opportunity to earn both the B.A. and the M.A. in five years. Students will be provisionally admitted to the 4+1 program only by approval of the department. Further information about the program is available from the director of graduate studies.

Students combining a master's degree from a related discipline with a minor in Latin American studies select area courses as their minor and knowledge of Spanish, Portuguese, Haitian Creole, or an indigenous Latin American language. Doctoral candidates with a minor in Latin American studies must have a reading and speaking competence in either Spanish, Portuguese, Haitian Creole, or an indigenous Latin American language, and a technical reading knowledge of another. The doctoral minor consists of not less than 15 credit hours, selected from area courses in two disciplines.

The Center for Latin American Studies Graduate Certificate seeks to equip students with a broad, interdisciplinary view of Latin America. The program allows students enrolled in a post-baccalaureate degree program to document their specialization in Latin America and their language proficiency as well as to extend their studies beyond their disciplinary specialization. Students completing the certificate must fulfill the following requirements:

1. Complete at least 12 credit hours of interrelated graduate course work on Latin America, with at least 6 credit hours coming from outside the student's home discipline. No more than 6 credit hours of specifically named courses required for the primary degree may be applied toward the certificate. Graduate courses successfully completed at Vanderbilt prior to admission to the program may be counted toward the certificate requirements, and an undergraduate course may be substituted for a graduate course, with the approval of the director of the program and the Graduate School. All courses must be approved by the assistant director of the Latin American Studies program and form an intellectually cohesive whole.
2. Demonstrate conversational or reading proficiency in Spanish, Portuguese, Haitian Creole, or an indigenous Latin American language. Proficiency will be demonstrated by an oral examination administered by a Vanderbilt professor or lecturer (not a graduate student) following ACTFL (American Council on the Teaching of Foreign Languages) guidelines and resulting in a rating of at least "intermediate-mid."
3. Participate in a minimum of five extracurricular activities sponsored by CLAS. A short paper reflecting on the insights gained from participating must be submitted to the assistant director of CLAS.

Students wishing to enroll must complete an Intent to Enroll form, which must be signed by the student, the director of the LAS Certificate Program, and the director of the graduate program (DGS) for the degree program in which the student is enrolled. A signed copy of the form must be submitted to the Graduate School (richard.hoover@vanderbilt.edu) and to the Office of the University Registrar (university.registrar@vanderbilt.edu).

Latin American Studies offers three dual degree programs: M.A./MPH, M.A./MBA, and M.A./M.Ed. in IEPM. Applicants must apply independently to and be accepted by both the Graduate School and the appropriate professional school. The LAS component requires 30 credit hours of course work and a thesis.

See departmental listings for courses offered 2019/2020. The following are specialized courses in the participating programs.

ANTHROPOLOGY: 5106, Culture and Power in Latin America; 5108, Indigenous Peoples of Lowland South America; 5220, Human Landscapes; 5231, Ancient Andean Civilizations; 5603, Comparative Writing Systems; 6122, The Anthropology of Globalization; 6130, Andean Culture and Society; 6140, Myth, Ritual, Belief: The Anthropology of Religion; 6141, Anthropology of Healing; 6143, Medical Anthropology; 6154, Environmental Anthropology; 6200, Ancient Cities; 6202, The Collapse of Civilizations; 6240, Ancient Mesoamerican Civilizations; 6241, The Aztecs; 6242, The Archaeology of the Ancient Maya Civilization; 6243, Classic Maya Religion and Politics; 6250, The Inca Empire; 6620, Maya Language and Literature; 6850-6851, Independent Research; 8000, History of Anthropological Theory I; 8001, History of Anthropological Theory II; 8010, Special Topics: Well-Being, Economics and Culture; 8010, Special Topics: Disease and Adaptation; 8100, Political Violence; 8110, Seminar in Maya Ethnography; 8104, Seminar on Political Economy and Anthropology; 8211, Space, Place, and Landscape; 8220, The Historical Archaeology of Latin America; 8230, The Collapse of Civilizations: General Theories and the Maya Collapse; 8232, Seminar in Mesoamerican Archaeology; 8240, Seminar in South American Archaeology and Ethnohistory; 8311, Violence and Its Embodiments in the Past and Present.

ECONOMICS: 7910, Seminar: Research Economic Development; 7920, Seminar: Research Economic Development.

HAITIAN CREOLE: 5101, Elementary Creole I; 5102, Elementary Creole II; 5201, Intermediate Creole I; 5202, Intermediate Creole II.

HISTORY: 5450, Reform, Crisis, and Independence in Latin America, 1700–1820; 5460, Colonial Mexico; 5470, Modern Mexico; 5480, Central America; 5490, Brazilian Civilization; 5510, Reform and Revolution in Latin America; 5530, African Religions in the Americas; 5535, Latin America and the United States; 5540, Race and Nation in Latin America; 5570, Caribbean History, 1492–1983; 6500, Readings in Colonial Latin America; 6510, Readings in Modern Latin American History; 8600, Comparative Slavery in the Colonial Americas; 8610, Atlantic World History, Fifteenth to the Nineteenth Century; 8620, Studies in Latin American History; 8630, Research Seminar in Latin American History.

K'ICHE' MAYAN LANGUAGE: 5101, Elementary K'iche' I; 5102, Elementary K'iche' II; 5201, Intermediate K'iche' I; 5202, Intermediate K'iche' II.

LAW: 7064, Comparative Law: Europe, Latin America and East Asia; 7128, Crossing Borders in Law and Literature; 7266, International Criminal Law; 7291, International Trade Short Course; 8101, International Mergers and Acquisitions Short Course.

MEDICINE, HEALTH, AND SOCIETY: 7313, Introduction to Medical Anthropology; 7316, Case Studies in Tropical Diseases.

NURSING: 5105, Enhancing Community and Population Health I; 5205, Enhancing Community and Population Health II; 5305, Enhancing Community and Public Health III; 6080, Interdisciplinary Topics in Global Health; 8072, Addressing Global Health Disparities: An Interdisciplinary Perspective.

POLITICAL SCIENCE: 5213, Democratization and Political Development; 5219, Politics of Mexico; 6228, International Politics of Latin America; 8315, Research in Latin American Politics; 8317, The Political Economy of Development.

PORTUGUESE: 5203, Intermediate Portuguese; 5301, Portuguese Composition and Conversation; 5302, Brazilian Pop Culture; 5303, Introduction to Luso-Brazilian Literature; 5350, Brazilian Culture through Native Material; 5420, Brazilian Literature through the Nineteenth Century; 5425, Modern Brazilian Literature; 5850, Independent Study; 5892, Special Topics in Portuguese Language, Literature, or Civilization; 7050, Introduction to Latin American Colonial Studies; 7070, Spanish American and Brazilian Literature I; 7071, Spanish American and Brazilian Literature II; 8200, Seminar: Studies in Colonial Literature; 8210, Seminar: Hispanic American Essay; 8400, Seminar: Studies in Inter-American Literature; 9520, Seminar: Studies in Contemporary Literature of the Portuguese-Speaking World; 9670, Special Studies in Brazilian Literature.

PUBLIC HEALTH: 5255, Global Health in Nicaragua; 5541, Foundational Skills in Global Health; 5542, Foundations of Global Health; 5544, Ethics in Global Health; 5549, Case Studies in Tropical Diseases; 5550, Global Health Politics and Policy.

RELIGION: 6645, Political-Liberationist Biblical Criticism.

SOCIOLOGY: 9888–9889, Directed Studies.

SPANISH: 5340, History of the Spanish Language; 5420, Spanish American Literature from the Conquest to 1900; 5425, Spanish American Literature from 1900 to the Present; 5440, Development of the Short Story; 5450, The Contemporary Novel; 5720, Literary Genres and National Identities in Latin America; 5730, Modern Latin American Poetry; 5740, Spanish-American Literature of the Boom Era; 5741, Spanish-American Literature of the Post-Boom Era; 5750, Afro-Hispanic Literature; 5755, Latina and Latin American Women Writers; 5850, Independent Study; 5891, Special Topics in Hispanic Culture; 5893, Special Topics in Hispanic Literature; 7050, Introduction to Latin American Colonial Studies; 7060, Seminar: Modernismo; 7070, Spanish American and Brazilian Literature I; 7071, Spanish American and Brazilian Literature II; 8200, Seminar: Studies in Colonial Literature; 8210, Seminar: Hispanic American Essay; 8220, Seminar: Studies in Spanish American Literature in a Global Context; 8400, Seminar: Studies in Inter-American Literature; 8600, Seminar: Issues in Latin American Cinema; 9240, Ordering and Disrupting Fictions

in Latin America; 9250, Self-Writing in Latin America; 9260, The Spanish American Novel of the Boom Period; 9265, The Melancholy Novel in Latin America; 9270, The Politics of Identity in Latino U.S. Literature; 9520, Special Topics in Spanish American Literature; 9670, Special Studies in Spanish American Literature.

In addition, qualified graduate students in the Latin American Studies program may, with appropriate permission, enroll in Special Topics (5891) courses directly relating to Latin America.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 128.

Latino and Latina Studies

DIRECTOR Gretchen Selcke
ASSOCIATE DIRECTOR Lorraine López

LATINO and Latina Studies focuses on cultural production and political and socioeconomic experiences of people inculcated with the U.S. experience, self-identifying as Latinos and Latinas, and communicating primarily in English and sometimes in Spanish. The LATS graduate certificate will examine this enduring and dynamic population that crosses and re-crosses borders constructed by geography, linguistics, class, race, and gender. This program of study is designed to accommodate a range of voices and multiple manifestations of Latinx identity and cultural expression in historical and contemporary contexts to fill in this vital but often overlooked component of our national identity and discourse.

Students pursuing a LATS graduate certificate are expected to obtain language competence in Spanish before completing the program, though they do not need to meet this requirement when applying for the certificate. Students may satisfy this requirement by completing SPAN 3303, or any other course with a higher number taught in Spanish, or an oral or written exam administered by the program.

Any student enrolled in a graduate program at Vanderbilt is eligible to apply for the certificate in Latino and Latina studies. Acceptance in the program requires the approval of the student's primary adviser and the director of the Program in Latino and Latina Studies, Gretchen Selcke. Graduate courses successfully completed at Vanderbilt University prior to admission to the program may be counted toward the certificate requirements with the approval of the director of the program. An undergraduate course may be substituted for a graduate course required by the program's curriculum with the approval of the director of the program and the Graduate School.

Students wishing to enroll must complete an Intent to Enroll form, which must be signed by the student, the director of the LATS Certificate Program, and the director of the graduate program (DGS) for the degree program in which the student is enrolled. A signed copy of the form should be submitted to the Graduate School (richard.hoover@vanderbilt.edu), to the Office of the University Registrar (URO) (university.registrar@vanderbilt.edu), and to the LATS program administrator.

A certificate in Latino and Latina studies is awarded with either the M.A. or Ph.D. degree upon fulfillment of the following requirements: (1) Completion of at least 12 (M.A.) or 15 (Ph.D.) credit hours of interrelated course work across two or more disciplines. Two courses, LATS 2201/5201 or ENGL 3658 and LATS 5961, are required. Remaining courses must be taken in at least two different disciplines outside of students' home department, with no more than two courses (6 credit hours) coming from any one discipline. We strongly encourage students to take as wide a range of courses as possible appropriate to the student's program of study and forming an intellectually cohesive whole. Up to 6 credit hours of specifically named required courses from a student's primary degree program may count toward the certificate. Courses must be approved for credit by the LATS director. One course (3 credit hours) may be satisfied through an independent study with a faculty member affiliated with the Latino and Latina Studies program, with the approval of the director of Latino and Latina Studies. (2) Completion of two papers or projects demonstrating the application of concepts related to Latino and Latina studies framework or methodology to research, teaching, or fieldwork.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 128.

Law and Economics

DIRECTORS Joni Hersch, W. Kip Viscusi
 DIRECTOR OF GRADUATE STUDIES Kevin M. Stack
 PROFESSORS Kathryn H. Anderson, Joni Hersch, Paige Marta Skiba,
 W. Kip Viscusi
 ASSOCIATE PROFESSOR Jennifer Bennett Shinall

DEGREE OFFERED: *Doctor of Philosophy*

THE Ph.D. Program in Law and Economics combines analytical training in economic theory and methodology with the study of law. This fully funded, fully integrated program is designed to allow students to satisfy the requirements for the Ph.D. and J.D. within six years. For students who matriculate with a J.D., the requirements for the Ph.D. can be completed within four to five years. The Ph.D. degree is designed for students who wish to pursue careers in universities, research institutions, or government. It is not designed for students who wish to pursue careers in corporate finance.

The program is based in Vanderbilt Law School, and courses are taught by faculty in the Law School and the Department of Economics. Students receive a solid grounding in microeconomic theory, econometrics, and law and economics theory.

Students admitted to the Ph.D. program are required to complete 72 hours of course work and research. This includes a minimum of 42 hours of formal course work in core, field, and elective courses and 6 hours of Ph.D. Law and Economics Workshop. The core consists of 33 hours in law and economics theory, economic theory, and empirical analysis.

After completing the first year of graduate study, all students must pass a written comprehensive examination based on the core Ph.D. courses.

In year 3 for joint-degree students and year 2 for Ph.D.-only students, students select two fields of concentration from a pre-approved list of fields and begin taking the associated field courses. Currently, the list of identified fields includes behavioral law and economics, labor and human resources, and risk and environmental regulation. Field requirements include 12 hours of formal course work (6 hours in each field). In some circumstances, and with the consent of the director of graduate studies and program faculty, students are allowed to develop a new field.

Detailed information is available upon request from program staff (email phd.lawecon@vanderbilt.edu) or from the program webpage, law.vanderbilt.edu/phd.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 128.

Leadership and Policy Studies

CHAIR Carolyn Heinrich
 ASSOCIATE CHAIR Catherine G. Loss
 DIRECTOR OF GRADUATE STUDIES Sean Corcoran
 PROFESSORS EMERITI Robert Dale Ballou, John M. Braxton, Robert
 Crowson, James W. Guthrie, Stephen Heyneman
 PROFESSORS Ellen B. Goldring, Carolyn Heinrich, Joseph Murphy,
 Will Doyle
 ASSOCIATE PROFESSORS Mark D. Cannon, Sean Corcoran, Shaun
 Dougherty, Jason Grissom, Christopher Loss, Claire E. Smrekar
 ASSOCIATE PROFESSORS OF THE PRACTICE Xiu Cravens, Susan
 Douglas, Brian L. Heuser, Catherine G. Loss, Christine Quinn Trank
 RESEARCH ASSOCIATE PROFESSOR Marisa Cannata
 ASSISTANT PROFESSORS Christopher Candelaria, Brent Evans,
 Joanne W. Golann, Matthew Shaw, Adela Soliz
 ASSISTANT PROFESSORS OF THE PRACTICE David Laird, Patrick J.
 Schuermann

DEGREE OFFERED: *Doctor of Philosophy*

THE Department of Leadership, Policy, and Organizations takes as its mission "to understand and enhance the social and institutional contexts in which learning occurs." To fulfill this mission, the department engages in multidisciplinary social and behavioral science research, professional development of leaders, and outreach projects.

LPO's doctoral-level program in leadership and policy studies offers concentrations in K-12 Leadership and Policy and Higher Education Leadership and Policy. Students focus on their selected area of inquiry throughout the program, and are expected to conduct research, present papers at national academic conferences, and publish in academic journals.

The Ph.D. program is designed for those who intend to build a career focused on the study of education and policy, as researchers, professors, and policy analysts. It is a full-time, four- to five-year program that equips its graduates with the knowledge and methodological tools to conduct cutting-edge research on the pressing educational issues of the day. Students learn to examine education problems through the lenses of economics, political science, sociology, and history. All students are expected to develop strong statistical and data analysis skills, and a thorough understanding of causal inference, while developing expertise in other tools of social science,

including experimental and quasi-experimental design, survey research methods, and qualitative research methods.

At the heart of the program is the mentor-apprentice model, where students work on research projects alongside a collection of esteemed faculty. As part of their course work and apprenticeship experiences, students learn to present papers at scholarly conferences and submit journal articles for publication.

Transfer Hours: Up to 24 hours of transfer credit may be accepted in consultation with the student's adviser.

Total Required Hours: 72 hours

Educational Leadership and Policy

Areas of study include educator labor markets, accountability, developing teachers and improving instruction, leadership and governance, educational equity, work force impacts, school finance, school choice, evaluation of education policies and programs, career and technical education, and school reform.

Higher Education Leadership and Policy

Areas of study include student access to higher education, student financial aid, higher education finance, student transitions, student persistence and success, and state higher education policy innovations.

Requirements for All Specializations

I. Social Science Core Requirements (12 hours)

Politics of Education
Sociology of Education
Economics of Education
History of Education

II. Ph.D. Specialty Research Seminars (9 hours)

Education Leadership and Policy
Higher Education Leadership and Policy

III. Research Tools (18 hours)

Research Design and Methods for Education Policy
Statistical Inference
Regression Analysis I
Regression Analysis II
Causal Inference
Qualitative Research Methods

IV. Research Practicum (6 hours)

V. Ph.D. Proseminar (3 hours)

VI. Electives or Transfer Hours (24 hours)

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 129.

Learning, Teaching, and Diversity

CHAIR Deborah W. Rowe

ASSOCIATE CHAIR Anita A. Wager

DIRECTOR OF GRADUATE STUDIES Ilana Horn

PROFESSORS David Dickinson, Noel Enyedy, Rogers Hall, Ilana Horn,

Robert Jimenez, Kevin M. Leander, Richard Milner, Deborah W. Rowe

PROFESSORS OF THE PRACTICE Chris Iddings, Lisa Pray, Anita A.

Wager

RESEARCH PROFESSORS Paul A. Cobb, Dale C. Farran, Kathy

Ganske, Richard Lehrer, Leona Schauble

ASSOCIATE PROFESSORS Amanda Goodwin, Melissa S. Gresalfi,

Jeannette Mancilla-Martinez, Ebony O. McGee

ASSOCIATE PROFESSORS OF THE PRACTICE Molly Collins, Shannon

Daniel, Andrew Hostetler, Melanie Hundley, Heather L. Johnson,

Catherine McTamany, Emily Pendergrass, Ann M. Neely

ASSISTANT PROFESSORS Corey Brady, Nicole Joseph, Luis Leyva,

Emily Phillips-Galloway, Jessica Watson

ASSISTANT PROFESSORS OF THE PRACTICE Teresa K. Dunleavy,

Amy Palmeri, Elizabeth Self

SENIOR LECTURERS Andrea Henrie, Kristen Neal

DEGREE OFFERED: *Doctor of Philosophy*

THE graduate program in learning, teaching, and diversity offered by the Department of Teaching and Learning is designed for persons who will conduct research on learning and activity and who will pursue careers as education faculty members at research universities. The program admits a very select number of students with strong academic credentials and relevant experience, who are interested in working closely with the faculty in research and development projects.

Programs of study for the doctor of philosophy include 72 class credits distributed between (a) a core set of courses that develops a knowledge base in the areas of learning, teaching, and diversity; (b) a specialization area, selected from Diversity, Learning, and Development; Language, Literacy, and Culture; Learning and Design; and Mathematics and Science Education; and (d) quantitative and qualitative research methodology courses.

Students admitted to the doctor of philosophy program in learning, teaching, and diversity may obtain a master of science degree with a major in learning, teaching, and diversity upon completion of 30 semester hours and the completion of either a thesis or the major area paper.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 179.

Liberal Arts and Science

DIRECTOR Andrea Hearn

DEGREE OFFERED: *Master of Liberal Arts and Science*

THE Master of Liberal Arts and Science degree program offers part-time, adult students the opportunity to earn an interdisciplinary, nontraditional graduate degree.

Each course generally meets one night per week, and students select one course per semester. While the program is designed primarily for personal enrichment, students often discover important professional career benefits as well. The requirements and curriculum provide flexibility in program design and course selection, and the tuition, scheduling, admission, and registration procedures acknowledge the special circumstances of the part-time adult student. Although MLAS students take classes part time, in exceptional circumstances and with written approval from the program director, students may be enrolled full time. International students wishing to attend the MLAS program on certain visas will be required to enroll full time to maintain their visa status.

Specific titles, topics, and instructors of courses are available for each semester from the director of the Master of Liberal Arts and Science degree program. Requirements for the degree are listed in the chapter on Academic Regulations in the front of this catalog. Prospective students may also consult the website for additional information: vanderbilt.edu/mlas.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 130.

Materials Science and Engineering

See Interdisciplinary Materials Science

Mathematics

INTERIM CHAIR Mark N. Ellingham
 VICE CHAIR Gieri Simonett
 DIRECTOR OF GRADUATE STUDIES Alexander Powell
 ASSOCIATE DIRECTOR OF GRADUATE STUDIES Michael L. Mihalik
 PROFESSORS EMERITI Philip S. Croke, Richard R. Goldberg, Matthew Gould, Robert L. Hemminger, Ettore F. Infante, Gennadi Kasparov, Richard J. Larsen, Michael D. Plummer, Eric Schechter, Daoxing Xia
 PROFESSORS John F. Ahner, Akram Aldroubi, Dietmar Bisch, Emmanuele DiBenedetto, Paul H. Edelman, Mark N. Ellingham, Douglas P. Hardin, C. Bruce Hughes, Vaughan F. R. Jones, Ralph N. McKenzie, Michael L. Mihalik, Mike Neamtu, Alexander Olshanskiy, Denis Osin, Alexander Powell, John G. Ratcliffe, Edward B. Saff, Mark V. Sapir, Larry L. Schumaker, Gieri Simonett, Constantine Tsinakis, Glenn F. Webb, Dechao Zheng
 RESEARCH PROFESSORS Philip S. Croke, Stephen G. Simpson
 ADJOINT PROFESSORS Mary Ann Horn, Xiaoya Zha
 ASSOCIATE PROFESSORS Jesse Peterson, Jared Speck, Ioana Suvaina, Steven T. Tschantz
 RESEARCH ASSOCIATE PROFESSOR Rares Rasdeaconu
 ASSISTANT PROFESSORS Anna Marie Bohmann, Alexander Cameron, Marcelo Disconzi, Spencer Dowdall, Cain Edie-Michell, Matthew Haulmark, Wöden Kusner, Chenyun Luo, Adam Prenosil, Larry Rolan
 POSTDOCTORAL SCHOLARS: Simon André, Angelica Babei, Mitchell Faulk, James Hateley, Jocelyne Ishak, Ivan Medri, Lauren Ruth, Ian Wagner

DEGREES OFFERED: *Master of Arts, Doctor of Philosophy*

A MASTER'S degree may be earned by completing 36 credit hours of course work at the 5000 level or above. By careful selection of courses, a master's candidate may achieve special preparation in applied mathematics or computer science and thus become qualified for a position in industry or government, or as a teacher in high school or junior college.

Through the Combined B.A./M.A. (4+1) Option, the department offers exceptional students the opportunity to earn both the B.A. and the M.A. in five years. Students will be provisionally admitted to the 4+1 program only by approval of the department. Further information about the program is available from the director of graduate studies.

Candidates for the Ph.D. degree take at least 48 credit hours of formal course work, including seven courses from 6100–6101, 6200–6201, 6300–6301, and 7100–7101, and at least eight additional courses at the 6000 level or above. A complete description of Ph.D. requirements in mathematics may be obtained on request from the director of graduate studies. All Ph.D. students with a teaching assistantship participate in teaching activities.

Courses numbered above 5000 may be used for minor credit by students in other disciplines.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 131.

Mechanical Engineering

CHAIR Nilanjan Sarkar
 ASSOCIATE CHAIR Haoxiang Luo
 DIRECTOR OF GRADUATE STUDIES Eric J. Barth
 DIRECTOR OF UNDERGRADUATE STUDIES Kenneth D. Frampton
 DIRECTOR OF GRADUATE RECRUITING Jason G. Valentine
 PROFESSORS EMERITI Thomas A. Cruse, George T. Hahn, Donald L. Kinser, Arthur M. Mellor, Carol A. Rubin, Taylor G. Wang, James J. Wert, John W. Williamson
 PROFESSORS Douglas E. Adams, Michael Goldfarb, S. Duke Herrell, Deyu Li, Sankara Mahadevan, Caglar Oskay, Robert W. Pitz, Nilanjan Sarkar, Nabil Simaan, Alvin M. Strauss, Robert J. Webster III
 PROFESSOR OF THE PRACTICE Amrutur V. Anilkumar
 ADJOINT PROFESSORS Pietro Valdastri, Peiyong Wang
 ASSOCIATE PROFESSORS Eric J. Barth, Joshua D. Caldwell, Haoxiang Luo, Fabien Maldonado, Keith L. Obstein, Jason G. Valentine, Greg Walker
 ASSOCIATE PROFESSORS OF THE PRACTICE Robert J. Barnett, Kenneth D. Frampton, Thomas J. Withrow
 ADJOINT ASSOCIATE PROFESSOR Joseph A. Wehrmeyer
 ASSISTANT PROFESSORS Leon M. Bellan, David Braun, Kelsey Hatzell, Justus C. Ndukaife, Cary Pint, Karl E. Zelik
 RESEARCH ASSISTANT PROFESSORS Neal P. Dillon, Shannon L. Faley, Kevin C. Galloway, Richard J. Hendrick, Zheng Li, Jason Mitchell, Scott J. Webster
 ADJOINT ASSISTANT PROFESSOR Carl A. Hall

DEGREES OFFERED: *Master of Science, Doctor of Philosophy*

THE program in mechanical engineering allows concentration in a variety of areas of mechanical engineering research.

Candidates for the master of science degree must complete 24 hours of course work and 6 hours of acceptable master's thesis. The course work must include at least 12 hours at or above the 5000 level, and a minor of at least 6 hours in courses separate from, but related to, the field of study. The Ph.D. program requires 24 hours of course work beyond the bachelor's degree and an acceptable dissertation. This course work must include a 6 hour minor in an area separate from, but related to, the field of study. At least 12 hours of the 24 must be at or above the 5000 level. A maximum of 6 hours in independent study may be included in the 24 hour requirement. There is also a master of science/doctor of medicine degree program joint between the Department of Mechanical Engineering and the School of Medicine. Details may be obtained from the director of graduate studies in Mechanical Engineering.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 134.

Medical Scientist Training Program (M.D.–Ph.D.)

DIRECTOR Christopher S. Williams
ASSOCIATE DIRECTORS Lourdes Estrada, Danny G. Winder, Ambra Pozzi, Sally J. York
ASSISTANT DIRECTOR Megan A. Williams

DEGREES OFFERED: *Doctor of Medicine, Doctor of Philosophy*

THE central goal of the Medical Scientist Training Program at Vanderbilt University is to identify, mentor, and foster the careers of a diverse workforce of superior future leaders in academic medicine, industry, and government who are dedicated to improving human health through research, clinical activities, and leadership. Based on solid clinical training and rigorous, highly impactful research training, our program fosters the development of independent scientific careers. We provide students with an integrated curriculum comprising a strong core education in medicine and intensive training in scientific inquiry. Successful completion of the program leads to both the M.D. and Ph.D. degrees. MSTP students come from a diverse applicant pool drawn from throughout the nation and abroad.

The MSTP is a dual endeavor between the Vanderbilt University School of Medicine and the Vanderbilt University Graduate School. Trainees are required to fulfill all of the requirements for both the M.D. and Ph.D. degrees. Since some competencies for the M.D. degree are met by the graduate school experience, it is possible for MSTP students matriculating July 2013 or after to complete the M.D. program in a total of three years. The MSTP allows both dual and alternating enrollment in the School of Medicine and the Graduate School. MSTP students will typically complete the FMK and FCC phases, exit for graduate studies, then return for a single year in the Immersion Phase.

The cornerstone of the Vanderbilt MSTP is training in scientific inquiry afforded by a rigorous Ph.D. experience.

After completing the first two years of medical school and at least two laboratory rotations, trainees select a laboratory and department for graduate studies. This selection is typically formalized before the end of the second year of medical school. Requirements for successful completion of the Ph.D. degree are the same for all students at Vanderbilt and the Ph.D. thesis must be successfully defended prior to reentry into medical school. Most MSTP students will begin their final year of medical school in early July with the Clinical Immersion phase of their training.

To facilitate the training of clinical investigators, we developed a distinct track within the Vanderbilt MSTP called the MSTP Clinical Investigation Track. The goal of the MSTP-CIT is to provide comprehensive training in science for physician scientists engaged in translational and patient-oriented research. This program is intended for students who enter the MSTP after the third year of medical school or during residency or fellowship.

For additional information about the Vanderbilt MSTP, including application information, visit the program's website at medschool.vanderbilt.edu/mstp.

Course descriptions begin on page 135.

Medicine, Health, and Society

DIRECTOR Jonathan M. Metzl
ASSISTANT DIRECTOR JuLeigh Petty
DIRECTOR OF GRADUATE STUDIES JuLeigh Petty
PROFESSORS Derek Griffith, Jonathan M. Metzl, Hector Myers
ASSOCIATE PROFESSORS Dominique Béhague, Martha W. Jones, Kenneth MacLeish, Lijun Song, Laura Stark
ASSISTANT PROFESSORS Lauren Gaydosh, Gilbert Gonzales, Aimi Hamraie, Ebony McGee, Tara McKay
SENIOR LECTURERS JuLeigh Petty, Danielle Picard

Affiliated Faculty
PROFESSORS Kathryn Anderson (Economics), Victor Anderson (Christian Ethics), David Aronoff, (Medicine), Gregory Barz (Ethnomusicology), Michael Bess (History), James Blumstein (Health Law and Policy), Frank Boehm (Obstetrics and Gynecology), Peter Buerhaus (Nursing), Christopher Carpenter (Economics), Larry Churchill (Medicine), Ellen Clayton (Pediatrics and Law), Jay Clayton (English), Charles Cobb (Molecular Physiology and Physics), Bruce Compas (Psychology and Human Development), Katherine Crawford (History), Kate Daniels (English), Dennis Dickerson (History), Edward Fisher (Anthropology), Volney Gay (Religious Studies), Lenn Goodman (Philosophy), Douglas Heimbarger (Medicine), Joni Hersch (Law and Economics), David Hess (Sociology), Kathleen Hoover-Dempsey (Psychology and Human Development), Carl Johnson (Biological Sciences), Cindy Kam (Political Science), John Lachs (Philosophy), Jane Landers (History), Jana Lauderdale (Nursing), Leah Marcus (English), Terry Maroney (Law), Richard McCarty (Psychology), Timothy McNamara (Psychology), Melissa McPheeters (Health Policy), Velma McBride Murry (Human and Organizational Development), Linda Norman (Nursing), Scott Pearson (Surgery), Russell Rothman (Medicine), Sharon Shields (Human and Organizational Development), John Tarpley (Surgery), Benigno Trigo (Spanish), Arleen Tuchman (History), Holly Tucker (French), Bart Victor (Organization Studies), Kip Viscusi (Law and Economics), Lynn Walker (Pediatrics and Psychology and Human Development), Kenneth Wallston (Nursing and Psychology), David W. Wright (Chemistry), Laurence Zwiebel (Biological Sciences)

ASSOCIATE PROFESSORS Muktar Aliyu (Health Policy and Medicine), Laura Carpenter (Sociology), André Christie-Mizell (Sociology), Beth Conklin (Anthropology), Julián F. Hillyer (Biological Sciences), Sara Igo (History), Rolanda Johnson (Nursing), Melanie Lutenbacher (Nursing), Ifeoma Nwankwo (English), Evelyn Patterson (Sociology), Ruth Rogaski (History), Louise Rollins-Smith (Nursing), Norbert Ross (Anthropology), David Schlundt (Psychology), Phillis Sheppard (Religion), Tiffany Tung (Anthropology), Timothy J. Vogus (Management and Organization Studies)

ASSISTANT PROFESSORS Carolyn Audet (Preventive Medicine), Ian Campbell (Medicine), Joseph B. Fanning (Medicine), Troy Moon (Pediatric Infectious Disease), Sayeh Nikpay (Health Policy), Kevin T. Seale (Biomedical Engineering)

DEGREE OFFERED: *Master of Arts*

GRADUATE study in medicine, health, and society at Vanderbilt offers an interdisciplinary master of arts and a graduate certificate for students interested in studying health-related beliefs and practices in their social and cultural contexts. It is available to graduate and professional students from the six participating Vanderbilt schools (Arts and Science, Divinity, Law, Medicine, Nursing, and Peabody). External candidates are also considered for admission, as are Vanderbilt undergraduates applying through the 4+1 program in the College of Arts and Science.

MHS draws on a variety of fields in the social sciences and humanities—anthropology, economics, history, literature, psychology, sociology, philosophy/ethics, and religious studies. It should be of particular interest to students preparing for careers in a health-related profession, but also has much to offer any graduate or professional student interested in examining an important part of human experience from multiple perspectives and developing a critical understanding of contemporary society.

Master of Arts

Students may choose a thesis option (24 credit hours of course work plus 6 credit hours of thesis research) or non-thesis option (30 hours). The thesis should draw on at least two disciplines.

Requirements include the 3 credit hour core colloquium (MHS 6100) and an additional 21 or 27 credit hours (depending on the option) of courses approved for the MHS graduate program.

It is expected that students who can devote themselves to the MHS program full time will complete their studies in three terms (i.e., two semesters and one summer or three semesters). However, the length of the program will be flexible to accommodate the needs of different constituencies.

M.D./M.A.

This program is available to current medical students, who may choose between the thesis and non-thesis options described above. The M.A. may be completed in one year, plus either a summer or two research electives.

4+1 M.A. Program

This program is available only to current Vanderbilt undergraduate students. Students may choose between the thesis and non-thesis options described above.

Graduate Certificate

The certificate is available only to current graduate and professional students from the six participating Vanderbilt schools

(Arts and Science, Divinity, Law, Medicine, Nursing, and Peabody). Acceptance to the program requires a minimum cumulative GPA of 3.3 and the approval of both the student's adviser and the director of graduate studies for Medicine, Health, and Society. To apply, students will:

1. Complete the Intent to Enroll form from the Graduate School's website.
2. Contact MHS to arrange a meeting with the director of graduate studies.
3. After fulfilling the program requirements, complete the MHS Graduate Certificate Application Form. Turn in the application form and a copy of the paper to be evaluated by the MHS Graduate Committee to the director of graduate studies.

Requirements include:

1. Completion of MHS 6100 and an additional 12 credit hours of graduate-level course work in Medicine, Health, and Society. The courses must form an intellectually cohesive whole. Courses must be approved by the MHS Graduate Committee for credit and should include at least two courses (at least 6 credit hours) outside the student's home discipline. One course may be satisfied through an independent study with a faculty member affiliated with the MHS with the approval of the director of graduate studies. Graduate courses taken at Vanderbilt University prior to admission to the MHS Graduate Certificate Program may be counted toward the certificate requirements with the approval of the MHS Graduate Committee if the course can satisfy one of the curriculum requirements of the program. No more than two courses (6 credit hours) of specifically named courses required for the primary degree may be applied toward the certificate.
2. Submission of a research paper to the MHS Graduate Committee for evaluation. The paper must demonstrate the application of interdisciplinary methods and knowledge of an area of study related to medicine, health, and society.
3. Participation in a minimum of five extracurricular activities sponsored by MHS. A short paper reflecting on the insights gained from participating must be submitted to the assistant director of MHS.

Other Approved Courses

Additional courses not on this list may be approved at the discretion of the CMHS director. Graduate students enrolled in mezzanine-level courses will complete additional work in order to gain graduate credit.

ANTHROPOLOGY: 4373, Health and Disease in Ancient Populations; 5310, Death and the Body; 6141, Anthropology of Healing; 6142, Medicine, Culture, and the Body; 6143, Medical Anthropology; 6344, Genetic Anthropology Lab Techniques; 6345, Human Evolutionary Genetics; 8010, Special Topics (as appropriate); 8310, The Anthropology of Death: Body, Place, and Memory.

DIVINITY/RELIGION: 5022, Reading Course in Medical Ethics; 7004, Theories of Personality; 7007, Religion and Coping; 7024, Research in Religion and Health; 7041, Pastoral Care for Persons with Addictions and Mental Disorders; 7049, The Religious Self According to Jung; 7051, Freudian Theories and Religion; 7052, Post-Freudian Theories and Religion; 7053, Seminar: Contemporary Psychotherapy and Pastoral Counseling; 7101, Methods in Ethics; 7220, Seminar in Clinical and Research Ethics.

ECONOMICS: 5350, Economics of Health; 9480, Health Economics; 9490, Seminar: Health Economics.

ENGLISH: 8155, Special Topics in English and American Literature (as appropriate). *Note:* topics vary; the CMHS director will approve versions with sufficient MHS content for credit toward this program.

HISTORY: 5800, Modern Medicine; 5810, Women, Health, and Sexuality; 5830, Medicine, Culture, and the Body (same as Anthropology 6142).

MEDICINE, HEALTH, AND SOCIETY: 5030, Community Health Research; 5230, Masculinity and Men's Health; 5250, War and the Body; 5310, Psychiatry, Culture, and Globalization; 5330, Men's Health Research; 5350, Perspectives on Trauma; 5410, HIV/AIDS in the Global Community; 6100, Theories and Methods in Critical Health Studies; 6200, Concepts and Methods in Health Disparities Research; 6300, Social Studies of Science and Medicine; 6400, Quantitative Research Methods; 6500, Special Topics: Social Foundations of Health; 7000, Interdisciplinary Research Methods; 7100, Research Workshop; 7305, Foundations in Global Health; 7306, Essential Skills in Global Health; 7308, Ethics, Law, and Medicine; 7311, Ethics in Global Health; 7312, Informatics for Global Health Professionals; 7313, Introduction to Medical Anthropology; 7314, Global Health Politics and Policy; 7315, Leadership and Development in Global Health; 7316, Case Studies in Tropical Diseases; 7317, Introduction to Quality Improvement; 7319, Lab Technology Low Resource Setting; 7830, Graduate Service Learning; 7831, Service Learning Research; 7832, Service Learning Readings; 7850, Independent Study; 7851, Independent Study; 7880, Internship Training; 7881, Internship Research; 7882, Internship Readings; 7999, Master's Thesis Research.

NURSING: 6040, Introduction to Health Informatics; 6149, Special Topics: Complementary and Alternative Therapies; 6812, The Evolution of Midwifery in America.

PSYCHOLOGY: 6310, Advanced General Psychology, as appropriate [topics vary; the program director will approve versions with sufficient MHS content for credit toward this program]; 8310, Research Methods in Clinical Psychology; 8360, Seminar: Clinical Psychology; 8942, Seminar: Social.

SOCIOLOGY: 9363, Special Topics Seminar on Institutions and Organizations (as appropriate).

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 136.

Microbe-Host Interactions

See Pathology, Microbiology, and Immunology

Molecular Pathology and Immunology

See Pathology, Microbiology, and Immunology

Molecular Physiology and Biophysics

CHAIR Nancy Carrasco

DIRECTOR OF GRADUATE STUDIES Richard M. O'Brien

PROFESSORS EMERITI Albert H. Beth, Jackie Corbin, John H. Exton, Daryl K. Granner, Jane Park, Anthony Weil

PROFESSORS G. Roger Chalkley, Alan D. Cherrington, Roger J. Colbran, Shelia Collins, Eric Delpire, Emmanuele DiBenedetto, Ronald B.

Emeson, Maureen Gannon, John C. Gore, Volker H. Haase, Raymond Harris, David Harrison, Alyssa Hasty, Jacek Hawiger, Carl H. Johnson, Fred Lamb, Matthew Lang, Robert Macdonald, Mark A. Magnuson, James M. May, Hassane Mchaourab, Owen P. McGuinness, Richard M. O'Brien, Sachin Patel, John Penn, Alvin C. Powers, Ambra Pozzi, Jeff Rathmell, Richard Simerly, Roland W. Stein, David H. Wasserman, John P. Wikswo Jr., Danny G. Winder

ADJUNCT PROFESSOR Sharron H. Francis

RESEARCH PROFESSORS Charles E. Cobb, Mary C. Moore

ASSOCIATE PROFESSORS Julio Ayala, Milam Brantley, Wenbiao

Chen, Bruce Damon, David Jacobson, Rachel Kuchtey, Bingshan Li, Terunaga Nakagawa, Kevin Niswender, David Samuels, Linda Sealy, Masakazu Shiota, John Stafford, James S. Sutcliffe, Jeanne Wallace, Jamey Young

RESEARCH ASSOCIATE PROFESSORS Dale S. Edgerton, Eric Hustedt, Robert Matthews

ASSISTANT PROFESSORS Nathan Bingham, Abigail Brown, Jonathan Brown, Erin Calipari, Lea Davis, Jose Gomez, Brad Greuter, Erkan Karakas, Annet Kirabo, Meenakshi Madhur, Gregor Neuert, Bryan Venters, Kasey Vickers

ADJUNCT ASSISTANT PROFESSORS Katie Coate, Arion Kennedy, Douglas P. Mortlock, Jason Winnick

RESEARCH ASSISTANT PROFESSORS Derek Claxton, Masoud Ghamari-

Langroudi, Louise Lantier, Anna Osipovich, Richard L. Printz

RESEARCH INSTRUCTORS Rui Chen, Matthew Dickerson, Guillaume

Kraft, Jose Maladonado, Smriti Mishra, Brinda Selvaraj, Sunita Shankaran, Chiyo Shiota, Dollado Srisai, Hirohide Takahashi

ADJUNCT RESEARCH INVESTIGATOR Isin Cakir

DEGREE OFFERED: *Doctor of Philosophy*

STUDENTS interested in this program generally participate in the Interdisciplinary Graduate Program in the Biomedical Sciences or Quantitative and Chemical Biology program during the first year (see Biomedical Sciences). The second year comprises required and elective courses in Molecular Physiology and Biophysics for a total of at least 24 hours of formal course work toward the Ph.D. degree. Variations are permitted in the number of formal course hours above the minimum of 24 required for the degree. A thesis-based master's degree is awarded only under special circumstances.

The emphasis of the graduate program is on research and research training in the areas of molecular and cell biology, cellular regulation and endocrinology, electrophysiology and biophysics, whole animal physiology and pathophysiology, and genetics. However, the training experience is applicable across a wide range of future career options. Students obtain a general background in physiology, biochemistry, molecular biology, and genetics through course work and laboratory exercises. Students are encouraged to rotate freely among various research laboratories in their first year in order to select a particular research area and thesis adviser for dissertation research.

Research areas available to the student include a broad range of multidisciplinary topics spanning the breadth of modern physiology. Students will apply diverse cutting edge techniques to address major questions in the field. Major

themes in the department include:

1. Hormonal and developmental aspects of gene control at the molecular level, with emphasis on single cell analyses and the roles of DNA–protein interactions.
2. Cellular aspects of hormonal and immunological regulation of biological process involving glucose, fatty acid and ion transport, as well as the mechanism of action of hormonal second messengers such as cAMP, cGMP, and calcium.
3. Hormonal regulation of metabolism in whole animal models.
4. Neuroendocrine and neurobehavioral studies of energy homeostasis and drug addiction.
5. Biophysical and structural analysis of membrane protein function, with a focus on the regulation of synaptic transmission.
6. Examination of the genetic basis of neurological and metabolic disorders.

Departmental research programs have strong relevance to a range of human diseases including diabetes, obesity, cardiovascular disorders, cancer, nutritional deficiencies, developmental abnormalities, and addiction.

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Course descriptions begin on page 139.

Music

DEAN Mark Wait (Blair School of Music)

ASSOCIATE DEAN Melissa K. Rose (Blair School of Music)

ASSOCIATE DEAN Pamela Schneller (Blair School of Music)

SENIOR ARTIST TEACHER Marianne Ploger (Musicianship)

THREE courses are currently available in Musicianship for graduate credit: MUSC 5110, Intensive Musicianship I; MUSC 5120, Intensive Musicianship II; MUSC 5130, Intensive Musicianship III.

Neuroscience

DIRECTOR Lisa Monteggia

DIRECTOR OF GRADUATE STUDIES Bruce D. Carter

PROFESSORS EMERITI Ford F. Ebner, Terry Page, Elaine Sanders-Bush

PROFESSORS Malcolm Avison, Jennifer Blackford, Randolph Blake,

James Bodfish, James Booth, Kendal Broadie, David Calkins, Bruce

D. Carter, Kenneth C. Catania, Roger Colbran, Jeffrey Conn, Nancy J.

Cox, Laurie Cutting, Eric Delpire, Ariel Y. Deutch, Melissa Duff, Laura

L. Dugan, Elisabeth Dykens, Ronald B. Emeson, Isabel Gauthier, Rene

Gifford, John Gore, Heidi E. Hamm, Stephan Heckers, E. Duco Jansen,

Angela Jefferson, Carl Johnson, Owen Jones, Jon H. Kaas, Ege Kavali,

Anne K. Kenworthy, Christine Konradi, Jun Li, Robert L. Macdonald,

Beth Malow, René Marois, Douglas McMahon, David Miller, Lisa

Monteggia, Jeffrey L. Neul, Paul Newhouse, Jeffrey D. Schall, Richard

Simerly, David Sweatt, Frank Tong, Mark Wallace, Danny Winder, David

H. Zald, Laurence J. Zwiebel

ASSOCIATE PROFESSORS Julio Ayala, Carissa Cascio, Blythe Corbett, Kevin Currie, Manus J. Donahue, Kevin Ess, Sabine Fuhrmann, Martin Gallagher, Eugenia Gurevich, Troy Hackett, Fiona Harrison, Suzana Herculano-Houzel, Kari Hoffman, Jing-Qiong Kang, Ela Knapik, Andre Lagrange, Terunaga Nakagawa, Kevin Niswender, Sachin Patel, Wellington Pham, Sean Polyn, Tonia Rex, Renã A.S. Robinson, Rebecca Sappington, Michelle Southard-Smith, G. Christopher Stecker, James S. Sutcliffe, Warren D. Taylor, David Vago, Stephen M. Wilson, Thilo Wormelsdorf, Geoffrey F. Woodman, Neil Woodward, Zhongming Zhao

ASSISTANT PROFESSORS Jennifer Below, Erin Calipari, Ana Carneiro, Robert Carson, Catie Chang, Ryan Darby, John Eley, Dario Englot, Vivian Gama, Reyna Gordon, Bradley Grueter, Kathryn Humphreys, Rebecca Ihrie, Lauren Parker Jackson, Autumn Kujawa, Bennett Landman, Miriam Lense, Alan Lewis, Ethan S. Lippmann, Alex Maier, Gavin Price, Ramnarayan Ramachandran, Mikail Rubinov, Douglas Ruderfer, Tiffany G. Woyrnarowski, Qi Zhang, Chengwen Zhou

DEGREE OFFERED: *Doctor of Philosophy*

THE program of study provides a broad background in neuroscience and related disciplines, preparing a student for a career as a research scientist and teacher. Graduates are recruited for positions into academic institutions where the discipline of neuroscience is growing rapidly, as well as into government, industry, and biotechnology.

The Ph.D. program requires a minimum of 24 hours of formal didactic course work. Students enter the program via one of two paths—either directly or via the IGP (see Biomedical Sciences), and complete an interdisciplinary core of course work in their first year. This course work consists of a two-semester survey course of neuroscience along with a two-semester professional development course. These courses survey the broad areas of neuroscience and are designed to link fundamental principles to contemporary research, as well as focus on building the skills necessary for success. An individualized elective schedule augments the required material in areas that relate directly to the student's area of chosen research. Major research emphases within the program span the breadth of contemporary neuroscience, and are divided into twelve themes: addiction and reward, circadian rhythms and sleep, cognitive neuroscience, computational neuroscience and neuroengineering, developmental neuroscience, educational neuroscience, law and society, learning and memory, mood, anxiety and psychosis, neurodegeneration and neuroinflammation, synaptic function and neuroendocrine signaling, and sensory and motor neuroscience. An original research dissertation is required for the Ph.D. degree.

For additional information, see braininstitute.vanderbilt.edu.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 140.

Nursing Science

DEAN Linda D. Norman

PROFESSORS Thomas L. Christenbery, Mary Jo Gilmer, Ruth Kleinpell, Ann F. Minnick, Linda D. Norman, Mariann R. Piano, Sheila H. Ridner (Program Director), Elizabeth E. Weiner

RESEARCH PROFESSOR Mary S. Dietrich

ASSOCIATE PROFESSORS Terrah L. Akard, Jana L. Lauderdale, Melanie Lutembacher, Shelagh A. Mulvaney

ASSISTANT PROFESSORS Leanne Boehm, Kate Clouse, Alvin Jeffery, Sharon M. Karp, Cathy A. Maxwell, Mulubrhan Mogos, Jeremy Neal, Chorong Park, Julia C. Phillippi, Bethany A. Rhoten, Lori Schirle, Deonni Stollendorf

DEGREE OFFERED: *Doctor of Philosophy*

THIS program prepares scholars for research and academic careers in major universities and for research positions in public or private sectors of health care. Two tracks of study are available: Clinical Research and Health Services Research. These areas of study are reflective of the overall research interests and expertise of School of Nursing faculty members and the resources available in the medical center, the university, and the School of Nursing nurse-managed and interdisciplinary care delivery centers. Examples of faculty research interests include gerontology, health promotion, oncology, pediatric palliative care, chronic conditions, natural childbirth issues, midwifery, health psychology/behavioral medicine, life transitions, and symptom management. Health services research topics include outcomes measurement and interventions, workforce policy, and economic aspects of health care delivery.

Admission to the Ph.D. in Nursing Science Program is through the Graduate School. For additional information, go to nursing.vanderbilt.edu/phd. Application materials are online. Successful applicants to the program are those whose previous academic performance, letters of recommendation, Graduate Record Examination scores, and written goal statement meet admission standards for the School of Nursing and the Graduate School and whose research and career goals best match the school's research foci and faculty expertise.

The program requires 72 credit hours of study, of which 15 may be transferred from master's course work, pending review and approval by the graduate faculty. The core curriculum of the program includes 32 credit hours of required course work for all Ph.D. students, 15 credit hours of required course work specific to the selected track of study, and 10 credit hours of course work that supports the student's focus of research (4 research practica and 6 dissertation research credits).

Course work is delivered using a combination of formats using Internet technology with limited, required on-campus visits. Students work with faculty mentors who guide and oversee their educational program from admission through completion of degree requirements. Students participate in intensive research experiences connected with faculty research projects and are exposed to a variety of research designs and analytic techniques. Requirements for the degree include successful completion of advanced course work, a written qualifying exam, oral qualifying exam, and dissertation (including an oral defense). Full-time and part-time options are available.

Further information about the doctoral program can be obtained by writing the Ph.D. Program Office, Godchaux Hall, 461 21st Avenue South, Nashville, Tennessee 37240, calling

(615) 322-7410 or toll-free 1-855-868-7410, or visiting the website at nursing.vanderbilt.edu/phd.

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Course descriptions begin on page 142.

Pathology, Microbiology, and Immunology

CHAIR Samuel A. Santoro

DIRECTOR OF GRADUATE STUDIES Molecular Pathology and Immunology, W. Gray Jerome; Associate Director, Jeffrey C. Rathmell
DIRECTOR OF GRADUATE STUDIES Microbe-Host Interactions, Christopher R. Aiken

PROFESSORS EMERITI John H. Hash, George C. Hill, Geraldine Miller
PROFESSORS Christopher Aiken, David Michael Aronoff, Thomas N.

Aune, Joey V. Barnett, Mark R. Boothby, Kelli L. Boyd, Timothy Cover, Leslie Crofford, James Crowe, Jeffrey Mark Davidson, Mark R. Denison, Wonder Drake, Agnes B. Fogo, David Gailani, David W. Haas, J. Harold Helderman, Richard L. Hoover, Billy G. Hudson, Sebastian Joyce, D. Borden Lacy, Simon Mallal, Houra Merrikh, William (Bill) Mitchell, Harold L. Moses, Kevin G. Osteen, R. Stokes Peebles, Richard Peek, Elizabeth Phillips, John A. Phillips, Jeffrey C. Rathmell, Donald H. Rubin, Samuel A. Santoro, Ed Sherwood, Eric P. Skaar, Subramaniam Sriram, Larry L. Swift, James Ward Thomas, Luc Van Kaer, Lorraine B. Ware, Alissa M. Weaver, Keith T. Wilson, Mary M. Zutter

ASSOCIATE PROFESSORS Julie Bastarache, Seth Bordenstein, Suman Das, Ivelin Georgiev, W. Gray Jerome, Spyros Kalams, Young Kim, Deborah A. Lannigan, Andrew J. Link, Susan Majka, Amy S. Major, Claudio Mosse, Louise A. Rollins-Smith, Jonathan G. Schoenecker, Adam Seegmiller, Gregory Sephel, Ben Spiller, Jeanne Wallace, Andries Zijlstra

RESEARCH ASSOCIATE PROFESSORS Ingrid A. M. Verhamme, Lan Wu

ASSISTANT PROFESSORS Holly M. Algood, Manuel Ascano Jr., Justin Balko, Mariana Byndloss, James E. Cassat, Jennifer Gaddy, Jeremy Goettel, Maria Hadjifrangiskou, Jonathan Irish, John Karijolic, Oliver G. McDonald, Daniel J. Moore, Dawn Newcomb, Michael Noto, Kristen Ogden, Danyvid Olivares-Villagómez, Mary Philip, Heather Pua, Elisabeth Rendina-Ruedy, Jonathan Schmitz, Henrique Serezani, Scott Alan Smith, Thomas P. Stricker, Vivian Lee Weiss

RESEARCH ASSISTANT PROFESSORS Shanna Arnold, Sung Hoon

Cho, S. Kent Dickeson, Melissa Farrow, Sarika Saraswati

RESEARCH INSTRUCTORS Mathew Bechard, Damian Maseda, Gregory Sowd, Haichun Yang

Molecular Pathology and Immunology Program

DEGREE OFFERED: *Doctor of Philosophy*

STUDENTS interested in the Molecular Pathology and Immunology Program enter the program after they participate in the Interdisciplinary Graduate Program in the Biomedical Sciences (see Biomedical Sciences). Molecular pathology and immunology occupies a unique place among the biomedical sciences in that it bridges the basic science and translational disciplines. It seeks to determine the mechanism and etiology of disease, to study the agents and conditions that cause disease, and to

elucidate the steps in the transformation of a normal tissue or process into an abnormal one, with an emphasis on inflammation and immunology. Pathology and Immunology students are ideally positioned to influence the conceptual and methodologic transfer of advances in the basic biological sciences to the alleviation of disease and the maintenance of health.

The program in molecular pathology and immunology leading to the Ph.D. degree is designed to prepare students for careers in biomedical sciences. The program focuses on research, but students from the program find positions in many biomedical science fields. Students in their first year complete a core of course work through the Interdisciplinary Graduate Program in the Biomedical Sciences (see Biomedical Sciences). The second year of study comprises required and elective courses for a total of at least 24 credit hours of formal course work (including the 16 credit hours in the first year). The curriculum is flexible so that course selection can be tailored to the interests and particular needs of the student. Elective hours are often taken in areas such as cell biology, biochemistry, molecular biology, and molecular physiology and biophysics. Qualifying examinations are administered after the second year of study, and the final two to three years of the program are devoted to research. A thesis-based master's degree is awarded only under special circumstances.

The research interests of the faculty include vascular biology and biochemistry, tumor biology, the immune response, inflammation and repair, the biology of the extracellular matrix in response to disease processes, the pathogenesis of infectious agents, and the regulation of gene expression in disease. The department is fully equipped with modern research training facilities and provides close faculty mentoring through a high faculty-to-student ratio.

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Course descriptions begin on page 138.

Microbe-Host Interactions Program

DEGREE OFFERED: *Doctor of Philosophy*

STUDENTS interested in the Microbe-Host Interactions Program participate in the Interdisciplinary Graduate Program in the Biomedical Sciences during their first year (see Biomedical Sciences). The second year of study comprises required and elective courses in bacteriology, virology, and immunology for a total of at least 24 credit hours of formal course work toward the Ph.D. degree.

The Microbe-Host Interactions Program is designed to provide state-of-the-art training in modern bacteriology, virology, host cell and immune responses to microbes, molecular genetics and pathogenesis, and biotechnology. Research experience in a specific area provides the basis for a dissertation. Students normally enter via the Interdisciplinary Graduate Program in Biomedical Sciences, in which they do rotations in the laboratories of four faculty members prior to choosing a field of study. Dissertation research may be initiated in any of the following areas:

- Bacterial pathogenesis, including mechanisms of toxin action and drug resistance (Cover, Drake, Hadjifrangiskou, Lacy, Merrikkh, Peek, Skaar, Spiller);

- Molecular biology of viruses (Aiken, Crowe, Denison, Karijolic, Ogden);
- Immune responses to bacterial, viral, and fungal infections (Algood, Aronoff, Crowe, Gaddy, Joyce, Kalam, Mallal, Rollins-Smith, Sherwood, Van Kaer, Wilson);
- Molecular genetics (Aiken, Bordenstein, Crowe, Das, Georgiev, Hadjifrangiskou, Merrikkh, Ogden, Karijolic, Skaar);
- Protein structure and proteomics (Lacy, Link, Spiller).

Emphasis is on basic research aimed at understanding molecular mechanisms of microbial infections and the host cell and immune defenses. Students whose interests are primarily in ecological or taxonomic aspects of microbiology are not encouraged to apply.

Doctoral study is emphasized. However, an M.S. degree may be granted under special circumstances and may require a research thesis.

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Pharmacology

ACTING CHAIR Joey V. Barnett

VICE CHAIR Ege Kavalali

DIRECTOR OF GRADUATE STUDIES Christine Konradi

ASSOCIATE DIRECTOR OF GRADUATE STUDIES Sean S. Davies

UNIVERSITY PROFESSORS Craig Lindsley, Lawrence Marnett

PROFESSORS EMERITI Wolf D. Dettbarn, Joel G. Hardman, L. Jackson

Roberts II, Elaine Sanders-Bush, Jack N. Wells

PROFESSORS Malcolm Avison, Brian Bachmann, Jeffrey Balsler, Joey

V. Barnett, Italo Biaggioni, Alan R. Brash, Richard M. Breyer, Kendal

S. Broadie, Nancy J. Brown, David Calkins, Richard Caprioli, Jeffrey

Conn, Ariel Y. Deutch, Ronald B. Emeson, John H. Exton, Stephen

Fesik, David Lee Gorden, Vsevolod Gurevich, David W. Haas,

Heidi E. Hamm, David G. Harrison, Tina M. Iverson, Ege Kavalali, Bjorn

Knollmann, Christine L. Konradi, Ethan Lee, MacRae Linton, Terry

Lybrand, Robert Macdonald, Peter R. Martin, Douglas McMahon, Jens

Meiler, W. David Merryman, Lisa Monteggia, Paul Moore, Katherine T.

Murray, Jeffrey Neul, Paul A. Newhouse, John A. Oates, Sachin Patel,

Elizabeth Phillips, Vito Quaranta, Ann Richmond, Matthias Riess, Dan

M. Roden, Sandra Rosenthal, C. Michael Stein, Gary Sulikowski, J.

David Sweatt, Mark Wallace, Danny Winder, Laurence Zwiebel

RESEARCH PROFESSORS J. Oliver McIntyre, Harold Moses, Colleen

Niswender, Tao Yang

ADJUNCT PROFESSORS Sanika Chirwa, John T. Clark, Sakina Eltom,

Lee E. Limbird, Lynn Matrisian, Sukhbir Mokha, Martin Ogletree,

Margaret Whalen

ASSOCIATE PROFESSORS EMERITI Erwin J. Landon, Peter W. Reed

ASSOCIATE PROFESSORS Sean S. Davies, Jerod Denton, Igor

Feoktistov, Barbara Fingleton, Eugenia Gurevich, Carrie K. Jones,

Jing-Qiong Kang, James M. Luther, Michael J. McLean, Rebecca

Sappington-Calkins, Claus Schneider, Jonathan Schoenecker,

Bih-Hwa Shieh, Ben Spiller, Brian E. Wadzinski, C. David Weaver,

Matthew H. Wilson

RESEARCH ASSOCIATE PROFESSORS Olivier Boutaud, Ginger L.

Milne, Alex Waterson, Fiona Yull

ADJUNCT ASSOCIATE PROFESSORS W. Scott Akers, David L. Black,

Chang Chung, J. Scott Daniels, Richard Gumina, Charles Hong,

Christine Saunders, Byeongwoon Song, Xiaofei Wang

ASSISTANT PROFESSORS Raymond Blind, Erin Calipari, Ana M. Carneiro, Robert Carson, John H. Cleator, Brad Grueter, Jennifer Herington, Timothy Hohman, Hind Lal, Carlos Lopez, Gregor Neuert, Elaine Shelton, Quinn Wells

RESEARCH ASSISTANT PROFESSORS John D. Allison, Anna Blobaum, Thomas Bridges, Michael Bubser, Matthew Duvernay, Darren W. Engers, Andrew Felts, Daniel Foster, Rocco Gogliotti, Garrett Kaas, Ali Kaya, Bruce Melancon, Jerri Rook, Michael Schulte, Anna Vilgelm, Zixiu Xiang

EDUCATION ASSISTANT PROFESSOR Kendra Oliver

ADJUNCT ASSISTANT PROFESSORS Christopher B. Brown, Rachel Crouch, R. Nathan Daniels, Hugh Fentress, Klarissa Hardy, Glenroy Dean Martin, Susan Mercer, Dayanidhi Raman, Saumya Ramanathan, Shaun Stauffer, Venkataswarup Tiriveedhi, Qi Zhang

EDUCATION INSTRUCTOR Alice Rodriguez

RESEARCH INSTRUCTORS Julie Engers, Munir Kutlu, Roman Lazarenko, Paula Luis, Zhenzhong Ma, Bartholomew Roland, Nathalie C. Schnetz-Boutaud, Ok-ho Shin, Aldo Vilcaes, Sergey Vishnivetskiy

ADJUNCT INSTRUCTOR Phyllis Freeman

DEGREE OFFERED: *Doctor of Philosophy*

STUDENTS interested in pharmacology participate in the Interdisciplinary Graduate Program in the Biomedical Sciences (see Biomedical Sciences). The program of study provides a broad background in pharmacology and other biomedical disciplines, preparing the student for a career as a research investigator. Graduates have been highly successful in obtaining positions in medical schools, government research institutes, and the pharmaceutical industry.

Students in their first year complete a core of course work through the Interdisciplinary Graduate Program in the Biomedical Sciences. The second year of study is composed of required and elective courses in Pharmacology for a total of 31 hours of formal course work toward the Ph.D. degree (including the 16 hours in the first year IGP). Requirements vary regarding the amount and distribution of course work that must be taken in related fields, but substantial work is usually taken in such other areas as cell biology, biochemistry, molecular physiology, biophysics, and chemistry. Subsequent years focus upon research and specialized course work as directed by mentors in the Pharmacological Sciences Training Program. Fields of research include molecular and biochemical pharmacology; neuropharmacology; autonomic, cardiovascular, endocrine, and clinical pharmacology; and drug metabolism and toxicology. A research dissertation is required for the Ph.D. degree. A thesis-based interdisciplinary master's degree is awarded only under special circumstances.

For more information, visit medschool.vanderbilt.edu/pharmacology.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 144.

Philosophy

CHAIR Robert Talisse
 ACTING CHAIR Paul Taylor
 DIRECTOR OF GRADUATE STUDIES Kelly Oliver
 PROFESSORS EMERITI Clement Dore, Robert R. Ehman, Marilyn Friedman, Larry May, John F. Post, Charles E. Scott, Donald W. Sherburne, Henry A. Teloh, Jeffrey Tlumak
 PROFESSORS Lenn E. Goodman, Michael P. Hodges, John Lachs, Kelly Oliver, Lucius T. Outlaw Jr., Robert Talisse, Paul Taylor, David Wood
 ASSOCIATE PROFESSORS Idit Dobbs-Weinstein, Julian Wuerth
 ASSISTANT PROFESSORS Scott Aikin, Matthew Congdon, Diana Heney, Karen Ng

DEGREES OFFERED: *Master of Arts, Doctor of Philosophy*

WORK for the Ph.D. degree is offered in all major fields in the discipline. Candidates must complete at least 47 credit hours of formal course work and satisfy additional requirements. When appropriate, course work may include a limited number of seminars in other disciplines. For further details and current information, see the Department of Philosophy webpage: vanderbilt.edu/AnS/philosophy.

Through the Combined B.A./M.A. (4+1) Option, the department offers exceptional students the opportunity to earn both the B.A. and the M.A. in five years. Students will be provisionally admitted to the 4+1 program only by approval of the department. Further information about the program is available from the director of graduate studies.

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Physics and Astronomy

CHAIR M. Shane Hutson
 DIRECTORS OF GRADUATE STUDIES Julia Velkovska (Physics), Andreas Berlind (Astrophysics)
 PROFESSORS EMERITI John Paul Barach, Charles A. Brau, Leonard C. Feldman, Dennis Hall, Arnold M. Heiser, P. Galen Lenhert, Charles F. Maguire, Volker E. Oberacker, Akunuri V. Ramayya, C. E. Roos, Medford S. Webster, Robert A. Weller
 PROFESSORS David J. Ernst, Daniel M. Fleetwood, John C. Gore, Senta V. Greene, Richard F. Haglund Jr., Joseph H. Hamilton, Kelly Holley-Bockelmann, M. Shane Hutson, Will E. Johns, Thomas W. Kephart, Sokrates Pantelides, James A. Patton, Sandra J. Rosenthal, Robert J. Scherrer, Paul D. Sheldon, Keivan G. Stassun, Norman H. Tolk, A. Sait Umar, Kalman Varga, Julia Velkovska, Thomas J. Weiler, David A. Weintraub, Sharon Weiss, John P. Wikswo Jr.
 DISTINGUISHED RESEARCH PROFESSOR C. Robert O'Dell
 RESEARCH PROFESSORS Frank E. Block, C. Richard Chappell, Leonard C. Feldman
 ASSOCIATE PROFESSORS Andreas Berlind, Steven E. Csorna, Daniel F. Gochberg, Todd E. Peterson, Jason Valentine, Yaqiong Xu
 RESEARCH ASSOCIATE PROFESSORS Anthony B. Hmelo, Alan Tackett

ASSISTANT PROFESSORS Alfredo Gurrola, William Holmes, Erin Rericha, Jessie C. Runnoe, Stephen R. Taylor
 RESEARCH ASSISTANT PROFESSORS Lauren Campbell, Donald A. Cox III, William E. Gabella, Halina Krzyzanowska, Klaas Padeken, Dina M. Stroud, Sourav Tarafdar, Enhong Wang

DEGREES OFFERED: *PHYSICS. Master of Arts, Master of Science, Doctor of Philosophy*

PHYSICS and astronomy are driving intellectual forces that expand our understanding of the universe, discover the science that underlies new technologies, and applies these technologies to both curiosity-driven and applied research. In keeping with this role, the Department of Physics and Astronomy has active research groups studying the theoretical and experimental physics of elementary particles; nuclear structure, heavy-ion reactions, and relativistic heavy-ion physics; linear and non-linear interactions of photons, electrons, atoms, and molecules with nanocrystals, surfaces, and interfaces; the electric, magnetic, and active mechanical properties of living systems; the structure and dynamics of biopolymers; the physics and technology of medical imaging; computational physics; low mass and young stars; detection of extrasolar planets; structure and dynamics of galaxies; observational and theoretical cosmology; ultra-high energy cosmic rays; and cosmology.

The master of science degree in physics requires a minimum of 30 credit hours consisting of at least 24 hours of formal didactic course work and normally including 6 credit hours of master thesis research. The didactic course work must include at least 9 credit hours above the 8000 level. The master of science degree requires a written thesis approved by at least two graduate faculty members in the physics and astronomy program.

A non-thesis option (master of arts in physics) is available to students admitted to candidacy for the Ph.D. in physics. Under the non-thesis plan, the student presents an oral report on a research subject in the field of investigation and submits a written account of this subject to the program faculty. This degree also requires a minimum of 30 credit hours. For information regarding the master of science and professional doctorate degrees in medical physics, see the medical physics section in the School of Medicine catalog.

The Ph.D. degree requires 72 credit hours of graduate work, including 15 credit hours of core courses, the 1 hour Physics 8000 seminar, 3 credit hours in one breadth course outside the student's main research area, 9 credit hours of elective physics graduate courses, a minimum of six semesters of Physics 8001 Physics Colloquium, and a minimum of two semesters of Physics 8003 Teaching Practicum. The remaining credit hours may be earned through some combination of non-candidate research, dissertation research, and approved lecture courses.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 83 for Astrophysics and on page 145 for Physics. See also Astrophysics.

Political Science

CHAIR Alan Wiseman
 ASSOCIATE CHAIR Jonathan T. Hiskey
 DIRECTOR OF GRADUATE STUDIES Emily H. Ritter
 PROFESSORS EMERITI M. Donald Hancock, Erwin C. Hargrove, William C. Havard Jr., Bruce I. Oppenheimer, Richard A. Pride, James Lee Ray, Mitchell A. Seligson, Benjamin Walter
 PROFESSORS Brooke A. Ackerly, Larry M. Bartels, W. James Booth, Joshua D. Clinton, John G. Geer, Cindy D. Kam, David E. Lewis, Edward Rubin, John M. Sides, Alan Wiseman, Elizabeth J. Zechmeister
 ASSOCIATE PROFESSORS Brett V. Benson, Jonathan T. Hiskey, Jennifer M. Larson, Noam Lupu, Emily H. Ritter, Tariq Thachil
 ASSISTANT PROFESSORS Allison P. Anoll, Amanda B. Clayton, Andrew J. Coe, Cassy Dorff, Brenton Kenkel, Eunji Kim, Kristin Michelitch, Peter Schram, Bradley C. Smith, Sharece Thrower

DEGREES OFFERED: *Master of Arts, Doctor of Philosophy*

THE graduate program in political science provides graduate students with rigorous training in American politics, comparative politics, international relations, political methodology, and political theory.

The Department of Political Science does not accept external applications for a terminal master's degree. A terminal master's degree in political science may be earned by Ph.D. students electing not to continue with the program. The terminal master's can be earned through (a) a program that requires 24 credit hours of course work (including Political Science 8355 and 8356 and at least 18 hours of 8000-level courses), 6 credit hours of master's thesis work, and a thesis or (b) a non-thesis option requiring 33 credit hours of course work (including Political Science 8355 and 8356 and at least 27 credit hours of 8000-level courses). The student must maintain a GPA of at least 3.0 in the 8000-level courses. A master's degree in passing option is available to students en route to the Ph.D., who have completed all courses required for the Ph.D. degree, passed the preliminary examinations, and defended successfully the dissertation proposal.

At least 48 credit hours of formal course work are required for the Ph.D. degree; 72 credit hours (including dissertation research hours) are required in total to complete the degree. Research Design (8355) and Statistics for Political Research (8356) are required of all prospective candidates.

Candidates for the Ph.D. are expected to demonstrate proficiency in research skills, including statistics, at a level fixed by the program faculty.

Through the combined B.A./M.A. (4+1) program, the Department of Political Science offers exceptional Vanderbilt undergraduates the opportunity to earn both the B.A. and the M.A. in five years. Students will be provisionally admitted to the 4+1 program only by approval of the department. Further information about the program is available from the director of graduate studies.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 147.

Portuguese

See Spanish and Portuguese

Psychological Sciences

CHAIRS René Marois, A&S; Bethany Rittle-Johnson, Peabody
 DIRECTORS OF GRADUATE STUDIES Geoffrey F. Woodman, A&S;
 David A. Cole, Peabody
 DIRECTORS OF CLINICAL TRAINING Bunmi O. Olatunji, A&S;
 Bahr Weiss, Peabody
 PROFESSORS EMERITI Leonard Bickman, Penelope H. Brooks, William
 F. Caul, Keith N. Clayton, David S. Cordray, Ford F. Ebner, Robert Fox,
 Jeffery J. Franks, James H. Hogge, Kathleen V. Hoover-Dempsey,
 Martin Katahn, Joseph S. Lappin, Richard D. Odom, Leslie Phillips,
 John Rieser, Howard M. Sandler, William P. Smith, Warren W. Webb
 PROFESSORS Camilla P. Benbow, Randolph Blake, Amy E. Booth,
 James R. Booth, David A. Cole, Bruce E. Compas, Elisabeth M.
 Dykens, Dale Farran, Judy Garber, Isabel Gauthier, Steven D. Hollon,
 Jon H. Kaas, Daniel T. Levin, Gordon D. Logan, David Lubinski, René
 Marois, Richard McCarty, Timothy P. McNamara, Amy Needham,
 Bunmi O. Olatunji, Thomas J. Palmeri, Sohee Park, Kristopher
 Preacher, Bethany Rittle-Johnson, Joseph L. Rodgers, Jeffrey D.
 Schall, Frank Tong, Tedra Ann Walden, Lynn S. Walker, David Zald
 RESEARCH PROFESSORS Leonard Bickman, David S. Cordray,
 Joseph S. Lappin
 ASSOCIATE PROFESSORS Jo-Anne Bachorowski, Sarah Brown-Schmidt,
 Sun-Joo Cho, Denise Davis, Suzanaerculano-Houzel, Kari Hoffman,
 Laura R. Novick, Sean Polyn, Megan Saylor, David G. Schlundt, Craig
 A. Smith, Sonya Sterba, Andrew J. Tomarken, Georgene L. Troseth,
 Duane Watson, Bahr Weiss, Geoffrey F. Woodman, Thilo Womelsdorf,
 Hao Wu
 RESEARCH ASSOCIATE PROFESSOR Georgine M. Pion
 ASSOCIATE CLINICAL PROFESSORS Denise Davis, F. Joseph McLaughlin,
 Nina Martin
 ASSISTANT PROFESSORS Lisa Fazio, Kathryn Humphreys, Autumn
 Kujawa, Jonathan D. Lane, Alexander Maier, Gavin Price, Jennifer
 Trueblood
 RESEARCH ASSISTANT PROFESSORS Chia-Chi Liao, Rankin McGugin,
 Hui-Xin Qi, Jamie Reed, Adriane Seiffert, Iwona Stepniewska
 ASSISTANT CLINICAL PROFESSOR Vicki S. Harris

DEGREES OFFERED: *Master of Arts, Doctor of Philosophy*

THE doctoral program in psychological sciences is offered jointly by the Department of Psychology in the College of Arts and Science and the Department of Psychology and Human Development in Peabody College. The Psychological Sciences program focuses on psychological theory and the development of original empirical research. Students are admitted to work toward the Ph.D. degree in the following areas:

- Clinical Science
- Cognition and Cognitive Neuroscience
- Cognition in Context
- Developmental Science
- Neuroscience
- Quantitative Methods

A major goal of our doctoral program is the placement of its graduates in academic settings. The faculty aim to tailor graduate training to meet the needs and the interests of each individual student. Students are monitored very closely from the

beginning of their training, and emphasis is on active student participation during every stage of training.

Through the Combined B.A./M.A. (4+1) Option, the department offers exceptional students the opportunity to earn both the B.A. and the M.A. in five years. Students will be provisionally admitted to the 4+1 program only by approval of the department. Further information about the program is available from the director of graduate studies.

The curriculum is designed to: (a) familiarize students with the major areas of psychology; (b) provide specialized training in at least one of the five specific areas of psychology emphasized in the program; and (c) provide students sufficient flexibility to enroll in classes consistent with their interests and long-term developmental trajectory. During the first two to three years, students take several core courses in quantitative methods and in substantive areas. Beyond this, the program consists of seminars, further research participation, and other inquiries expressly designed to fulfill career objectives. Each of the five areas offers a seminar on current research every semester, attended by all faculty and graduate students in that area.

We expect students to be continually involved in research throughout their tenure in our program. We use a one-on-one mentoring model as a primary though not exclusive means for the acquisition of scientific skills by students. As such, students work very closely with their advisers in all phases of the research process. In addition, advisory committees that consist of both the adviser and other faculty members offer guidance throughout the student's graduate school years. There is also potential for considerable interaction among programs and with other disciplines across campus. This interaction produces an exciting intellectual environment that is further enriched by visiting faculty members and speakers. Interested students are encouraged to find out more about our research programs by reading the descriptions of faculty research interests available on our program website (vanderbilt.edu/psychological_sciences).

The Clinical Science program in Psychological Sciences at Vanderbilt subscribes to the clinical scientist model of training, with the primary goal of training clinical scientists. Through the combination of advanced course work, practicum experiences, and research emphases, students concentrate in one or more of the following areas: developmental psychopathology (including children and/or adults), prevention and treatment, clinical health psychology, clinical neuroscience, socioaffective science, developmental disabilities (including children and/or adults), and quantitative methods. Regardless of concentration, the training experience includes a core curriculum, a common set of course requirements and research milestones, and a variety of practicum opportunities.

All of our Ph.D. program areas offer a range of financial support options for graduate students, including research fellowships, research assistantships, teaching assistantships, and graduate fellowships.

Applicants to our program need to submit scores on the Graduate Record Examination General Test. Applicants may also submit scores on the Psychology subject test, but this is not required. In addition to overall potential for a scientific career, the fit between an applicant's research interests and those of a potential faculty mentor significantly influence admissions decisions. Admission is not limited to students with undergraduate backgrounds in psychology.

Specific program requirements are described in the *Graduate Student Handbook*, which is available on the Psychological Sciences website.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions for courses offered through the Department of Psychology in the College of Arts and Science begin on page 151.

Course descriptions for Psychology and Human Development courses begin on page 152.

Quantitative and Chemical Biology

The Quantitative and Chemical Biology program is an interdepartmental umbrella graduate program seeking students who have earned undergraduate degrees in the quantitative and/or physical sciences (e.g., chemistry, computer science, engineering, mathematics, or physics) who wish to pursue a doctoral degree at the interface of the chemical, physical, engineering and biological sciences.

In the first year, students will complete four laboratory rotations of their choice as well as take courses related to their interests. The curriculum is designed to familiarize students from a quantitative sciences background with the concepts and nomenclature of modern biomedical research in an expeditious and efficient fashion. Following the completion of the first year, students may enter any of the following Ph.D. programs: Biochemistry, Biological Sciences, Cancer Biology, Cell and Developmental Biology, Chemical and Physical Biology, Chemistry, Human Genetics, Mathematics, Microbe-Host Interactions, Molecular Pathology and Immunology, Molecular Physiology and Biophysics, Neuroscience, Pharmacology, and Physics. Based on their field of research, students are welcome to pursue doctoral scholarship in the School of Medicine, the College of Arts and Science, and the School of Engineering.

Religion

CHAIR James P. Byrd

ASSOCIATE DEAN FOR GRADUATE EDUCATION AND RESEARCH

James P. Byrd

PROFESSORS EMERITI/A J. Patout Burns, Larry Churchill, Paul R.

Dokecki, Volney P. Gay, Thomas A. Gregor, Frank Gulley Jr., Charles H. Hambrick, Peter C. Hodgson, Joseph C. Hough Jr., Douglas A. Knight, Leah Marcus, Sallie McFague, M. Douglas Meeks, Daniel M. Patte, Jack M. Sasson, Richard M. Zaner

PROFESSORS Victor Anderson, Sandra Barnes, Robert Company, Erik Carter, Paul J. DeHart, Dennis C. Dickerson, William Franke, Jay Geller, Lenn E. Goodman, Jacobus J. Hamman, Joel F. Harrington, William J. Hook, James Hudnut-Beumler, Peter Lake, Amy-Jill Levine, John S. McClure, Thomas McGinn, Keith G. Meador, Bonnie J. Miller-McLemore, Bruce Morrill, David Price, Joerg Rieger, Laurel C. Schneider, Fernando F. Segovia, Choon-Leong Seow, Tony Stewart, Emilie M. Townes, David J. Wasserstein

ASSOCIATE PROFESSORS Ellen T. Armour, Gregory F. Barz, Vanessa Beasley, James P. Byrd, Beth Ann Conklin, Idit Dobbs-Weinstein, Juan Floyd-Thomas, Stacey Floyd-Thomas, Kathy L. Gaca, Leor Halevi, Paul C. H. Lim, Herbert R. Marbury, Thomas McGinn, Richard

McGregor, David A. Michelson, Joseph L. Rife, Betsey A. Robinson, Allison Schachter, Phillis I. Sheppard, Melissa Snarr
ASSISTANT PROFESSORS Stephanie Budwey, Anand V. Taneja, Alexis S. Wells-Oghoghomeh

DEGREES OFFERED: *Master of Arts, Doctor of Philosophy*

STUDENTS may be admitted upon graduation from an accredited college with a baccalaureate degree or from an accredited seminary or graduate school with a post-baccalaureate degree. Ordinarily, students with only the baccalaureate degree are admitted to the M.A. program. Successful completion of the latter provides a foundation for doctoral studies but does not guarantee admission to the Ph.D. program. Students with an M.Div., M.T.S., or M.A. degree may be admitted directly to the Ph.D. program. Applicants with the B.A. degree are advised to consider not only the M.A. program in the Graduate School, but also the two-year M.T.S. program in the Divinity School of Vanderbilt University as preparation for Ph.D. work.

Degree programs are offered in ethics and society; Hebrew Bible; historical studies; critical studies in Asian, Islamic, and Jewish traditions; homiletics and liturgics; Jewish studies (M.A. only at present); New Testament; religion, psychology, and culture; and theological studies. Interdisciplinary studies, both within religion and in other areas of knowledge, are encouraged. The study of religion is pursued both as a critical, humanistic discipline, employing a variety of methodological perspectives, and as a theological discipline, interpreting religions and their historical, theological, and ethical heritage.

Master of Arts

The M.A. program is designed to enable students to explore personal interests or vocational options, to acquire a background for teaching at the secondary level, or to attain a foundation for further studies at the doctoral level. A total of 30 credit hours and a thesis are required for the first two programs described below, while the final two programs have special requirements.

1. *Specialty M.A.* This program involves a concentration in one of the subspecialties of religious study. Students will select a major of at least 12 hours and a minor of at least 6 hours from the following areas: ethics and society; Hebrew Bible; historical studies; critical studies in Asian, Islamic, and Jewish traditions; homiletics and liturgics; Jewish studies; New Testament; religion, psychology, and culture; and theological studies. The remaining hours may be chosen from the above areas or from other departments of the Graduate School.
2. *Cross-Disciplinary M.A.* This program, to which students are admitted under exceptional circumstances, provides an opportunity for students to relate one of the subspecialties of religious studies to an appropriate supportive discipline. Normally, 12 hours are taken in one of the areas listed under the specialty M.A., with the remaining hours taken in another department of the Graduate School. The thesis will attempt to integrate the methods and subject matters of the two disciplines in relation to a chosen problem.
3. *Terminal M.A.* The terminal M.A., offered exclusively for Ph.D. students who elect not to complete the Ph.D. program, may be received by students who have demonstrated reading knowledge in at least one foreign language at the level

required for the M.A. degree; have completed 48 semester hours of formal, graded course work at the graduate level, including at least 24 hours at Vanderbilt; have passed an oral examination conducted by a committee of faculty members from the Graduate Department of Religion; and do not seek candidacy for the Ph.D. degree.

4. *Master's Degree in Passing.* Ph.D. candidates may earn the M.A. degree upon completion of at least 42 hours of graduate study, satisfaction of the language requirements, passing of the Ph.D. qualifying exam, and approval of the dissertation proposal according to the GDR guidelines.

M.A. candidates demonstrate reading competence in foreign languages, ancient or modern, as required in the program or area of concentration. Students should consult area policies for specific requirements. In most cases, however, reading knowledge in one foreign language is required for the M.A. Students will normally satisfy this requirement by performing satisfactorily in the departmentally administered Ph.D. language examination, taking and passing with the grade of B+ or higher a Vanderbilt University course designed specifically to teach graduate students to use the language in research, or by presenting an acceptable record of at least 12 hours (or its equivalent) in a language. Candidates specializing in Hebrew Bible or New Testament are expected to work with the original texts in Hebrew or Greek. Students designating Greek or Hebrew as the foreign language may not count introductory courses in these languages toward the requisite 30 hours for the degree.

Joint J.D.-M.A. Program. Students who have been admitted to both the Law School and the Graduate School may work toward the J.D. and the M.A. in religion concurrently. Six hours of religion credits will be accepted toward the J.D. degree, and 6 hours of law credits will be accepted toward the M.A. in religion. The joint program normally takes four years. For further information, write to the chair of the Graduate Department of Religion.

Doctor of Philosophy

Ph.D. programs are currently available in the following areas of major concentration: ethics and society; Hebrew Bible; historical studies; critical studies in Asian, Islamic, and Jewish traditions; homiletics and liturgics; New Testament; religion, psychology, and culture; and theological studies. Students applying to each of these areas may also apply for a fellowship from The Program in Theology and Practice (vanderbilt.edu/gradschool/religion/te&p).

Candidates for the Ph.D. degree must demonstrate reading knowledge of one modern language of research, a second language as designated and approved by the area and the GDR, and additional languages as specified by the area (see area requirements). Each of the areas of major concentration specifies which languages are acceptable for its students. The requirement for modern languages may be satisfied by taking and passing with the grade of B+ or higher a Vanderbilt University course designed specifically to teach graduate students to use the language in research, or by passing the departmental reading examination. Beyond this department-wide requirement, in biblical studies a knowledge of Hebrew or Greek is required, and in some areas of historical studies a knowledge of Latin or Greek is required. Students should be prepared to learn such other languages, ancient and modern, as may appear requisite for scholarly interests. Students should check with their area directors concerning specific requirements.

Certificate Programs

Students enrolled full time in the M.A. or Ph.D. programs may earn graduate certificates in two areas: (1) Jewish Studies (offered through the interdisciplinary program in Jewish Studies, [vanderbilt.edu/jewishstudies/Cert in JS.htm](http://vanderbilt.edu/jewishstudies/Cert%20in%20JS.htm)) and (2) Religion, Gender, and Sexuality Studies (offered through the Carpenter program in Religion, Gender, and Sexuality Studies, vanderbilt.edu/divinity/carpenter).

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 155.

Second Language Studies

DIRECTORS Elyse Petit and Silke Schade

VANDERBILT University's Departments of French and Italian, Spanish and Portuguese, and German, Russian and East European Studies jointly oversee a Graduate Certificate in Second Language Studies. The courses and co-curricular programming offered through this certificate engage graduate students in critical reflection about current research in second language acquisition and foreign language teaching, thereby enhancing their ability to develop as teachers and succeed in a competitive job market. Any student enrolled in a graduate program at Vanderbilt is eligible to apply for the Graduate Certificate in Second Language Studies. Acceptance to the program requires the approval of the student's primary adviser and the director of the program in SLS. Designated graduate courses successfully completed at Vanderbilt prior to admission to the program may be counted toward the certificate requirements with the approval of the director of the program.

Three graduate courses are available in Second Language Studies:

- SLS 6030. Foreign Language Learning and Teaching. [3]
- SLS 7040. Second Language Acquisition: Theories and Research. [3]
- SLS 8090. Special Topics in Second Language Studies. [3]

Requirements for the Graduate Certificate in Second Language Studies

1. 9 credit hours of course work, which includes:
 - a) one required course (3 credit hours):
SLS 6030 (Foreign Language Learning and Teaching), SLS 7040 (Second Language Acquisition: Current Theories and Research), or SLS 8090 (Special Topics in Second Language Studies)
 - b) a minimum of 3 credit hours from the following list of courses:
 - EDUC 6020 Culturally Responsive Pedagogy
 - EDUC 6310 Classroom Ecology
 - EDUC 6530 Educational Linguistics and Second Language Acquisition
 - EDUC 6570 Teaching Second Language Literacy
 - PSY-GS 8360 Human Cognition

PSY-GS 8480 Educational Neuroscience

Note: Students may seek approval from the director of the SLS certificate program to include other relevant courses offered at Vanderbilt.

2. Completion of at least two professional development workshop series offered through the Center for Second Language Studies. The center typically offers a professional development workshop series each semester.
3. Additional teaching experience, which involves completion of at least one of the following activities:
 - a) Work as a teaching assistant or teaching apprentice in a class designed for undergraduate minors and/or majors. The work should include consulting with the professor on syllabus design, attending classes, and teaching one or two units.
 - b) The Certificate in College Teaching offered by the Center for Teaching. This program is non-credit-bearing and involves general orientation to college teaching, instructor authority, and diversity.
 - c) The Certificate in College Humanities Teaching and Learning offered by the Center for Teaching. This program is non-credit-bearing and involves developing an understanding of larger issues related to teaching in different institutional contexts.
 - d) Presentation of two Second Language Studies–related research projects at conferences.
 - e) Contribution to the Center for Second Language Studies' crowd-sourced database Language Panda
4. Final presentation:
Upon completion of the requirements for the certificate program in SLS, each student will give a thirty-to-forty-minute public presentation in the Center for Second Language Studies reviewing an area of interest or specialization in second language development and/or foreign language pedagogy. This presentation will serve as a formal exercise in describing expertise in second language studies in preparation for a job interview.
5. The conferral of the certificate requires a cumulative GPA of 3.5 and successful completion of all the aforementioned requirements.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 174.

Sociology

CHAIR Larry W. Isaac
 DIRECTOR OF GRADUATE STUDIES Lijun Song
 PROFESSORS EMERITI Karen Campbell, Jack P. Gibbs, Walter R. Gove, Gary F. Jensen, Ronnie Steinberg
 PROFESSORS André Christie-Mizell, Daniel B. Cornfield, David J. Hess, Larry W. Isaac, Holly J. McCammon, Jonathan M. Metzl
 ASSOCIATE PROFESSORS George Becker, Laura M. Carpenter, Shaul Kelner, Richard Lloyd, Evelyn Patterson, Richard Pitt, Mariano Sana, Lijun Song, Zdravka Tzankova

ASSISTANT PROFESSORS Christy Erving, Alexandre Frenette, Patrick Greiner, Bianca Manago, Joshua Murray, LaTonya Trotter

DEGREE OFFERED: *Doctor of Philosophy*

THE sociology program prepares students for research and teaching careers in academic and policy settings. Students are exposed to a wide range of sociological works and research methods. Emphasis is on becoming an independent social researcher and teacher. Students have an opportunity to work closely with faculty members, in part because of a low ratio of graduate students to faculty members.

The master's degree requires 36 hours of course work: 6301, 6302, 6310, 6311, 6312, 7500, and 18 hours of electives. Also, students must write a master's paper that must be finished before their fifth semester to receive a master's degree.

Students must satisfy all of the master's degree requirements in order to receive a Ph.D. In addition, Ph.D. degree course work requirements consist of a teaching workshop (7400) and 33 hours of electives (up to 20 hours of which may be 8999 or 9999). Students must pass two special area exams, defend a dissertation proposal, complete a dissertation, and defend a dissertation to receive a Ph.D. degree.

Students may request the transfer of credit hours of eligible, graduate work performed at another institution, subject to the approval of the director of graduate studies, the department chair, and the Graduate School. However, these requests are not always honored.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 174.

Spanish and Portuguese

CHAIR Andrés Zamora
 ACTING CHAIR Benigno Trigo (2019/2020)
 DIRECTOR OF GRADUATE STUDIES José Cárdenas-Bunsen
 PROFESSORS EMERITI M. Fráncille Bergquist, Susan Berk-Seligson, Victoria A. Burrus, Cathy L. Jrade, C. Enrique Pupo-Walker
 PROFESSORS Earl E. Fitz, Edward H. Friedman, Ruth Hill, William Luis, Philip D. Rasico, Benigno Trigo, Andrés Zamora
 ASSOCIATE PROFESSORS Christina Karageorgou-Bastea, Emanuelle Oliveira-Monte, José Cárdenas Bunsen
 ASSISTANT PROFESSORS Luis F. López González, N. Michelle Murray
 VISITING ASSISTANT PROFESSOR Anna Castillo

DEGREES OFFERED:

SPANISH. Master of Arts, Doctor of Philosophy
SPANISH-PORTUGUESE. Master of Arts, Doctor of Philosophy

THE Department of Spanish and Portuguese does not accept external applications for a terminal master's degree. Only students planning to pursue a Ph.D. in Spanish or in Spanish and Portuguese are accepted into the program. All students will complete the requirements for and earn a Vanderbilt M.A. in Spanish or in Spanish and Portuguese as a step toward the doctoral degree. Subject to the approval of the director of graduate studies, students entering the program with a master's degree or with graduate studies elsewhere may transfer up to 15 hours of

graduate credit. An M.A. in Spanish or in Spanish and Portuguese is awarded after successful completion of 30 credit hours of course work and an M.A. thesis in the form of a publishable paper. For the M.A. in Spanish, knowledge of Portuguese or another foreign language is also required. For the combined M.A. in Spanish and Portuguese, no further language study is required.

All doctoral candidates must pass a take-home comprehensive examination based on a reading list of key works, present and defend a dissertation proposal, and complete and defend a dissertation.

The Ph.D. program in Spanish requires 63 credit hours of course work, which includes the 30 credit hours corresponding to the M.A. and 9 credit hours for a minor, which may be Portuguese, a certificate program in Latin American studies, or another approved program of courses from one or more departments, as well as additional course work in Spanish. There is no additional language requirement beyond that required for the M.A.

The combined Ph.D. in Spanish and Portuguese requires 66 credit hours of course work, which includes the 30 credit hours of the M.A. and additional course work reflecting both areas. No minor is necessary. There is no additional language requirement.

Specific program requirements are described under the Graduate Studies tab on the Department of Spanish and Portuguese website.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 150 for Portuguese and on page 175 for Spanish.

Special Education

CHAIR Joseph H. Wehby
 DIRECTOR OF GRADUATE STUDIES Robert M. Hodapp
 DIRECTOR OF PROFESSIONAL STUDIES Alexandra Da Fonte
 PROFESSORS Marcia Barnes, Erik Carter, Laurie Cutting, Douglas Fuchs, Lynn S. Fuchs, Mary Louise Hemmeter, Robert M. Hodapp, Ann P. Kaiser, Paul J. Yoder
 PROFESSOR OF THE PRACTICE Kimberly Paulsen
 ASSOCIATE PROFESSORS Erin E. Barton, Christopher J. Lemons, Jeanne Wanzek, Joseph H. Wehby
 ASSOCIATE PROFESSORS OF THE PRACTICE Alexandra Da Fonte, Naomi Chowdhuri Tyler
 RESEARCH ASSOCIATE PROFESSOR Tamara Stambaugh
 ASSISTANT PROFESSORS Elizabeth Biggs, Joseph Lambert, Jennifer R. Ledford, Blair P. Lloyd
 ASSISTANT PROFESSOR OF THE PRACTICE Andrea M. Capizzi
 INSTRUCTORS OF THE PRACTICE Nea Houchins-Juarez, Johanna Staubitz

DEGREE OFFERED: *Doctor of Philosophy*

THE program of study is based in the multidisciplinary body of knowledge relevant to the understanding, education, and treatment of persons with disabilities. The Ph.D. degree is composed of three major elements of course work: core studies in special education, including 9 hours of proseminar in special education; at least 12 formal course hours in research methods; and a 15 hour minor or related area of study. The program of study will be planned individually with the major professor and

approved by the student's qualifying committee. In addition, the program requires demonstration of competence in research methods, in college teaching, and in supervision. Students who enter without a master's degree may earn a thesis-based M.S. degree while working on their Ph.D.

NOTE: New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

Course descriptions begin on page 178.

Teaching and Learning

See Learning, Teaching, and Diversity

Women's and Gender Studies

INTERIM DIRECTOR Elizabeth Covington
 INTERIM ASSOCIATE DIRECTOR Stacy Simpican
 DIRECTOR OF UNDERGRADUATE STUDIES Stacy Simpican
 PROFESSOR EMERITA Charlotte Pierce-Baker
 PROFESSORS Brooke Ackerley, Ellen Armour, Christopher Carpenter, Laura Carpenter, Katherine Crawford, Stacey Floyd-Thomas, Laurel Schneider, Kathryn Schwarz
 SENIOR LECTURERS Rory Dicker, Allison Hammer, Kristen Navarro, Stacy Simpican, Cara Tuttle Bell
 LECTURERS Rebecca Epstein-Levy, Danyelle Valentine

VANDERBILT University's Program in Women's and Gender Studies offers interdisciplinary graduate study in gender studies in cooperation with the Departments of Anthropology, English, French and Italian, History, Philosophy, Political Science, Sociology, and Spanish and Portuguese, and the Graduate Department of Religion. Affiliated faculty from other schools, including Vanderbilt Peabody College (Human and Organizational Development), Vanderbilt Law School (Law and Economics), and Vanderbilt Divinity School, also participate in the program. Students work toward a certificate in gender studies.

A certificate in gender studies is awarded with either the M.A. or Ph.D. degree upon fulfillment of the following requirements: (1) Completion of at least 13 credit hours of course work across two or more disciplines. Two courses, WGS 8301 (3 credit hours) and WGS 8302 (variable credit hours), are required. Three additional interrelated graduate-level courses (9 credit hours) on women, gender, and/or sexuality, appropriate to the student's program of study and forming an intellectually cohesive whole, are required. At least one course (3 credit hours) must come from outside the student's home discipline. Up to 6 credit hours of specifically named required courses from a student's primary degree program may count toward the certificate. Courses must be approved for credit by the WGS director. One course (3 credit hours) may be satisfied through an independent study with a faculty member affiliated with the Program in Women's and Gender Studies, with the approval of the director of Women's and Gender Studies. (2) Completion of one paper or substantial project demonstrating the application of a gender studies or sexuality studies framework or methodology to research, teaching, or fieldwork.

Any student enrolled in a graduate program at Vanderbilt is eligible to apply for the certificate in gender studies. Acceptance in the program requires a minimum cumulative GPA of 3.3, satisfactory performance of B+ or better in WGS 8301, and the approval of the student's primary adviser and the director of the Program in Women's and Gender Studies. Courses taken at Vanderbilt prior to admission to the program may be counted toward the certificate requirements with the approval of the director of the Program in Women's and Gender Studies.

Students wishing to enroll must complete an Intent to Enroll form, which must be signed by the student, the director of the WGS Certificate Program, and the director of the graduate program (DGS) for the degree program in which the student is enrolled. A signed copy of the form must be submitted to the Graduate School (richard.hoover@vanderbilt.edu) and to the Office of the University Registrar (university.registrar@vanderbilt.edu).

For more detailed information on the gender certificate, please go to as.vanderbilt.edu/wgs or contact the director.

Requirements for Graduate Certificate in Gender Studies

1. Women's and Gender Studies 8301 (Gender and Sexuality: Feminist Approaches). Interdisciplinary introduction to the major debates, theoretical terms, and research methods in feminist, gender, sexuality, and queer studies.
2. Women's and Gender Studies 8302 (Gender and Pedagogy). Feminist theories of teaching and learning; gender and diversity in the classroom; critical pedagogy.
3. Three additional graduate-level courses (9 credit hours) on women, gender, and/or sexuality, appropriate to the student's program of study and forming an intellectually cohesive whole. At least one course (3 credit hours) must come from outside the student's home discipline. Up to 6 credit hours of specifically named required courses from a student's primary degree program may count toward the certificate. Courses must be approved for credit by the WGS director. One course (3 credit hours) may be satisfied through an independent study with a faculty member affiliated with the Women's and Gender Studies program, with the approval of the director of Women's and Gender Studies.
4. A paper submitted to the Women's and Gender Studies steering committee for evaluation. The paper must demonstrate the application of a gender studies or sexuality studies framework or methodology to research, teaching, or fieldwork.

Course descriptions begin on page 181.

Graduate School Courses

Explanation of Symbols

5000-level courses listed in this catalog may be taken by graduate students for credit unless a specific restriction is indicated in the course description and provided there is no duplication of the student's previous courses.

6000-level courses and above listed in this catalog are graduate courses. They are on a level normally considered too high for undergraduates and are not open to undergraduates without consent of the instructor, the adviser, and the Graduate School.

Length of a course is one semester.

The semester in which a one-semester course is offered is indicated by the word FALL (or SPRING) in the course description.

Hours referred to are semester hours, and figures in brackets always indicate semester hours credit.

Formal course work means all courses taken for credit except thesis and dissertation research courses.

The university reserves the right to change the arrangement or content of courses, to change texts and other materials used, or to cancel any course on the basis of insufficient enrollment or for any other reason.

African American and Diaspora Studies

AADS 5002. Theories of Diaspora. [Formerly AADS 300] Interdisciplinary introduction to materials, methods, debates, and theoretical language of scholarly research in Diaspora Studies. [3]

AADS 5095. Directed Study. [Formerly AADS 395A] [3]

AADS 5228. Black Girlhood: History, Performance and Counter-Narratives. Historical and current social, political, and cultural constructions of black girlhood in the United States. Performances in which black girls engage to deconstruct and interrupt these constructions. Scholarly works, poetry, film, photography, and novels. [3]

AADS 5580. The Black Studies Movement. Black Studies and student movements of the 1960s and early 1970s. Intellectual traditions, precedents, and political ideologies of movements. Issues that sparked the call for Black Studies at different college campuses and public school systems. [3]

AADS 5654. Memoirs and Biographies. (Also listed as AADS 2654) Biographies and autobiographies as lenses for the study of historical trends and events; development of gender, sexual, and racial identities in subjects. No credit for students who have earned credit for 2654. [3]

AADS 5890. Special Topics. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

American Studies

AMER 5883. Independent Study. [Formerly AMER 301A] May be repeated for credit more than once if there is no duplication in topic, but students may earn only up to 3 credits per semester of enrollment. [1-3]

AMER 5884. Independent Study. [Formerly AMER 301B] May be repeated for credit more than once if there is no duplication in topic, but students may earn only up to 3 credits per semester of enrollment. [1-3]

AMER 8000. Graduate Workshop In American Studies. [Formerly AMER 300] Issues, methodologies, traditions, approaches, and problems in the interdisciplinary field of American Studies. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [4]

Anthropology

ANTH 5101. Theories of Culture and Human Nature. (Also listed as ANTH 3900) Survey of the views of anthropological thinkers, from the late nineteenth century to the present, about the basic attributes of humankind and human culture. Comparison of different ideas of how people create culture and in turn are molded by culture. No credit for students who have earned credit for 3900. [3]

ANTH 5102. Problems in Anthropological Theory. (Also listed as ANTH 3901, ANTH 6901) Seminar in anthropological theory: cultural evolution, cultural history, ethnic relations, cultural ecology, archaeological method and theory, social structure, political organizations, and religious institutions. Repeat credit for students who have earned credit for 6901. [3]

ANTH 5106. Culture and Power in Latin America. (Also listed as ANTH 2106) Survey of native cultures and Spanish and Portuguese heritage. Fundamental traditions, including marriage and the family, the relationship between men and women, racial and ethnic identity, social class, and religion. Peasant communities and contemporary urban life. No credit for students who have earned credit for 2106. [3]

ANTH 5108. Indigenous Peoples of Lowland South America. (Also listed as ANTH 2108) Native societies of Amazonia, the Orinoco basin, and other forest, savanna, and coastal regions of South America. Ecology, cosmology, social organization, and political relations in historical and contemporary populations. Government policies, human rights, environmentalism, sustainable development, and indigenous activism and advocacy. [3]

ANTH 5109. Food Politics in America. (Also listed as ANTH 2109) The cultural, social, political, and economic contexts of the contemporary food system. Issues of health and nutrition. Land use, ecological relations, food chains, and links to climate change. Ethics of food production, distribution, and consumption. Agricultural policy, immigration, work conditions, animal welfare, and local economies. Roles of citizens and consumers. Rise of movements seeking sustainable alternatives. No credit for students who have earned credit for 2109. [3]

ANTH 5110. Gender and Cultural Politics. (Also listed as ANTH 2110) Cross-cultural comparison of women's roles and status in western and non-Western societies. Role of myths, symbols, and rituals in the formation of gender identities and the politics of sexual cooperation, conflict, and inequality. Case studies from Africa, the Middle East, Europe, North and South America, Asia, and Melanesia. No credit for students who have earned credit for 2110. [3]

ANTH 5112. Psychological Anthropology. (Also listed as ANTH 2112) How personality and culture affect each other. Socialization and the life cycle, the definition of sex roles, individual psychology and group aggression, religion and group personality, and the nature of mental illness and normalcy in non-Western societies. No credit for students who have earned credit for 2112. [3]

ANTH 5130. Global Infrastructure and Everyday Life. Relations between infrastructure and society around the world, past and present. Analysis of large technical systems as sites of cultural meaning, political struggle, and everyday social interaction. Water, energy, communication, and transportation networks in Africa, Asia, and the Americas, with an emphasis on Latin America. [3]

ANTH 5211. Archaeology. (Also listed as ANTH 2211) An introduction to the methods used by archaeologists to study the nature and development of prehistoric societies. Approaches to survey, excavation, analysis, and interpretation are explored through lectures, case studies, and problem assignments. No credit for students who have earned credit for 2211. [3]

ANTH 5220. Anthropological Approaches to Human Landscapes. (Also listed as ANTH 2220) Anthropological approaches to sociocultural processes and human-environment interactions in the formation of landscapes and settlement systems. Relationship of archaeology and cultural

anthropology in the understanding of social space, sacred landscapes, urban plans, and historical ecology. Cross-cultural comparisons. Methods of interpretation and quantification. No credit for students who have earned credit for 2220/2220W. [3]

ANTH 5221. Old World Archaeology. (Also listed as ANTH 2221) Ancient Cultures of the Old World. Archaeology of the Near East, Africa, Asia, and Oceania. The origins of the great civilizations of Egypt and Mesopotamia. The beginnings of cities, agriculture, trade, and empires in light of recent archaeological discoveries. No credit for students who have earned credit for 2221. [3]

ANTH 5223. Native North Americans. (Also listed as ANTH 2223) Indian societies of North America; their archaeological origins, development, and changing adaptation to white society. No credit for students who have earned credit for 2223. [3]

ANTH 5230. South American Archaeology. (Also listed as ANTH 2230) From 12,000 years ago to the present. Archaeology, ethnohistory, and ethnography. No credit for students who have earned credit for 2230. [3]

ANTH 5231. Ancient Andean Civilizations. (Also listed as ANTH 2231) Introduction to the archaeology and peoples of ancient South America. Early hunters and gatherers, origins of agriculture and urbanism, and the rise and fall of the Huari and Inca empires. No credit for students who have earned credit for 2231. [3]

ANTH 5342. Biology of Inequality. (Also listed as ANTH 2342) Biological and health consequences of racial and social inequalities. Psychosocial stress and measurement of its health impact. Effects on disease and precursors to disease. Measures of molecular biology, such as epigenetics and gene expression. Biomarkers of inflammation, cardiometabolic health, and immune function. No credit for students who have earned credit for 2342. [3]

ANTH 5370. Death and the Body. (Also listed as ANTH 2370) Cross-cultural study of death rituals. Mortuary archaeology and anthropology of death and the body. Biological and social perspectives on the corpse and living body, and their treatment in ritual and everyday life. The body as biological specimen and social artifact. Nature of beauty, body modification, and adornment. No credit for students who have earned credit for 2370. [3]

ANTH 5400. Public Health, Language, Media, and Risk Management. Role of language in the politics and ethics of expert, government, and community stakeholder responses to epidemics, environmental pollution, and natural disasters. Theory and case studies of communication in U.S. and global crises. Uses of science, narrative, and metaphor in formation of health policy and health inequalities based in race, ethnicity, sexuality, and geographic marginalization. [3]

ANTH 5601. Introduction to Linguistics. (Also listed as ANTH 2601) Systematic study and analysis of human language. Formation of language sounds, sound systems, the structure of words, the structure of sentences, meaning, language change. Data from diverse languages of the world. No credit for students who have earned credit for 2601. [3]

ANTH 5602. Anthropological Linguistics. (Also listed as ANTH 2602) An introduction to the study of language in its anthropological context. Language and culture, the structure of symbolic systems, vocabulary as a guide to the ways societies classify their universe. Linguistic analysis as a tool for ethnographic investigation. No credit for students who have earned credit for 2602. [3]

ANTH 5603. Comparative Writing Systems. (Also listed as ANTH 2603) The origins, development, and social uses of writing in the ancient Middle East, Mediterranean, and Mesoamerica. Decipherments of hieroglyphic systems. Literacy, historiography, and cross-cultural translation. No credit for students who have earned credit for 2603. [3]

ANTH 5604. Introduction to Language Contact. (Also listed as ANTH 2604) Structural, social, and cultural issues involved in protracted contact between speakers of different languages. Bilingualism and multilingualism, lexical and structural borrowing, nativization, code switching, and Pidgins and Creoles. Linguistic psychosocial theories regarding common contact patterns. The sociocultural meaning of language contact in different societ-

ies. Case studies. No credit for students who have earned credit for 2604. [3]

ANTH 5612. Introduction to a Maya Language. (Also listed as ANTH 2612) Beginning instruction in Kaqchikel, K'iche', or Q'eqchi'. Basic speaking, reading, and writing skills. No credit for students who have earned credit for 2612. [3]

ANTH 5614. Conversational K'iche' Maya. (Also listed as ANTH 2614) Intermediate level course with advanced grammar. Counterfactual constructions, deixis, verbal derivations of positional roots, sound symbolic verbs, and verbal nominalizations. Vocabulary and idioms. Various literary genres. No credit for students who have earned credit for 2614. [3]

ANTH 5866. Archaeological Excavation. (Also listed as ANTH 3866) Excavation techniques and field recording methods through participation in an archaeological dig. Excavation unit layout, digging techniques, feature and artifact identification. Mapping and field instrumentation. Data registry, statistical analysis, artifact curation, and conservation. Stratigraphy, relative and absolute dating, sampling strategies and techniques, data management. Research design and archaeological ethics. [4]

ANTH 6120. Sociocultural Field Methods. (Also listed as ANTH 3120) Research design and proposal writing, access to data, ethical issues, sampling techniques, interviewing questionnaire design and question writing, data analysis. No credit for students who have earned credit for 3120. [3]

ANTH 6121. Global Wealth and Poverty. (Also listed as ANTH 3121) The production of inequality. How wealth is accumulated, lost, exchanged, and displayed; how poverty is created, endured, and overcome. Explanations in terms of luck, hard work, immorality, occult forces, and public policies. Case studies. No credit for students who have earned credit for 3121. [3]

ANTH 6122. The Anthropology of Globalization. (Also listed as ANTH 3122) Perspectives on globalization based on ethnographic case studies. The impact of new technologies on native cultures; different cultural meanings of global commodities; creation of new diaspora cultures; effects of neoliberal reforms on local economies; ethnic movements and terror networks. No credit for students who have earned credit for 3122. [3]

ANTH 6123. Maya Culture and Ethnography. (Also listed as ANTH 3123) Survey of the different cultural groups of the Maya peoples of Mexico and Guatemala. Comparison of cultural features and social and political history. Relationship of culture and language. Introduction to the Maya language family with a focus on Tzotzil. No credit for students who have earned credit for 3123. [3]

ANTH 6125. Public Scholarship Practicum in Community Research. Theory and methods for publicizing research to policy makers, organizations, and the public. Uses of media. Communicating research in civil rights; environmentalism; and advocacy on gender, sexuality, health, and religion. Translating original scholarship into pieces for newspapers, blogs, websites, video resources, and public presentations. Prior research experience is expected. Consent of instructor is required. [3]

ANTH 6130. Andean Culture and Society. (Also listed as ANTH 3130) Historical and archaeological background, languages, economy, environment, and cultural adaptation of Andean peoples. Spanish and native American heritage. Religion, family structure, political organization, contemporary social issues, and economic background. Urban and rural traditions, social movements, and change. No credit for students who have earned credit for 3130. [3]

ANTH 6132. Social Movements. (Also listed as ANTH 3132) Collective action, past and present. Class- and identity-based movements, transnational activism, and networks. The early U.S. labor movement; 1960s gay, women's and civil rights movements. Global struggles for social justice. No credit for students who have earned credit for 3132. [3]

ANTH 6133. Political Anthropology: States and Their Secrets. Development, workings, and techniques of the ancient and modern state. Bureaucracy, state secrecy, diplomacy, organization of warfare, surveillance. Anthropological theories of power, state formation, nationalism, authority, influence, and coercion. Case studies of atrocities, disclosure of secrets, and whistleblowing. Ethics and responsibility in complex power structures. [3]

ANTH 6135. Development, Social Enterprise, Social Justice. Theories of economic and human development. Multidimensional approaches to poverty and well-being. Roles of inequality, discrimination, and social justice. Practical focus on social entrepreneurship in international context. [3]

ANTH 6140. Myth, Ritual, Belief: The Anthropology of Religion. (Also listed as ANTH 3140) Cross-cultural survey of religious and ritual beliefs in light of theories of religion. Topics include sacrifice, myth, witchcraft, divination, religious change, and millenarian movements. No credit for students who have earned credit for 3140. [3]

ANTH 6141. Anthropology of Healing. (Also listed as ANTH 3141) Ritual, symbols, belief, and emotion in health, illness, and therapeutic processes. Practices and politics of healing in western and non-western societies, including shamanism, faith healing, ecstatic religious experience, alternative medicine, and biomedicine. Mind-body interactions, medical pluralism, relations between patients and healers, and implications for improving medical care. No credit for students who have earned credit for 3141. [3]

ANTH 6142. Medicine, Culture, and the Body. (Also listed as ANTH 3142) Concepts of the human body from historical and cross-cultural perspectives. Exploration of experiences, representations, and medical theories of the body in birth, death, health, and illness in Western and non-Western societies. Comparison of methodologies of anthropology and history. No credit for students who have earned credit for 3142 or HIST 2830 or 5830. [3]

ANTH 6143. Medical Anthropology. (Also listed as ANTH 3143) Bio-cultural aspects of human adaptations to health, disease, and nutrition. Non-Western medical and psychiatric systems. Effects of cultures on the interpretation, diagnosis, and treatment of illness. Case studies from Africa, Oceania, Latin America, and the contemporary United States. No credit for students who have earned credit for 3143. [3]

ANTH 6150. Cognitive Anthropology. (Also listed as ANTH 3150) A survey of methods and approaches in linguistics and the cognitive sciences. Exploration of culture and thought; how culture affects our ways of reasoning. No credit for students who have earned credit for 3150. [3]

ANTH 6152. Activism and Social Change: Theory, Experience, and Practice. (Also listed as ANTH 4152) Introduction to theory and ethics of social activism and advocacy. Roles of academics and scholars. Theories of political organizing and mobilization. Application of anthropological research methods. Case studies in local, national, and global social issues, processes of civic mobilization, and social change. No credit for students who have earned credit for 4152. [3]

ANTH 6153. Economic Anthropology. (Also listed as ANTH 4153) Modern and postmodern cultural organization of Western and non-Western economies. Crosscultural comparison of concepts of self-interest and rationality. Relation of the growth of post-industrial (service and information) economies to economic strategies of ethnic groups. Survey of indigenous alternatives to development. Theoretical issues grounded in case studies from our own and other cultures. No credit for students who have earned credit for 4153. [3]

ANTH 6154. Environmental Anthropology. (Also listed as ANTH 4154) The relationship between human beings and the environments that sustain them. Global diversity of human ecological adaptations. Hunter-gatherers, pastoral nomads, slash-and-burn agriculturalists, and irrigation agriculturalists. Human impact on the environment. Theories of human ecological interaction. No credit for students who have earned credit for 4154. [3]

ANTH 6160. Anthropologies and Archaeologies of Community. (Also listed as ANTH 3160) Creation, maintenance, and transformation of communities through time. Community as a village or settlement, and as an "imagined" or virtual aspect of social identity. Behaviorist, interactionist, discursive, and identity-oriented anthropological approaches to community. Community organization and the built environment. Ancient and modern case studies. No credit for students who have earned credit for 3160. [3]

ANTH 6161. Colonial Encounters in the Americas. (Also listed as ANTH 3161) Theoretical discussion of colonialism as a sociocultural process. Comparative colonialism in pre- and post-Hispanic contexts. Methodological consideration of archaeological and archival analyses and their comple-

mentary epistemological statuses. Pan-American case studies. No credit for students who have earned credit for 3161. [3]

ANTH 6200. Ancient Cities. (Also listed as ANTH 3200) Comparative examination of early cities in the Old World and pre-Columbian America. Analysis of social and economic processes supporting preindustrial urbanism. Role of geography, ideology, trade, and settlement systems in the rise of early urban societies. No credit for students who have earned credit for 3200. [3]

ANTH 6202. The Collapse of Civilizations. (Also listed as ANTH 3202) Causes of the decline or collapse of complex societies. Old World and New World examples. Historical, anthropological, and paleoecological theories and controversies. No credit for students who have earned credit for 3202. [3]

ANTH 6240. Ancient Mesoamerican Civilizations. (Also listed as ANTH 3240) Development of pre-Hispanic civilization in Mesoamerica from the beginnings of village life to the rise of the great states and empires: Olmec, Maya, Toltec, and Aztec civilizations. No credit for students who have earned credit for 6240. [3]

ANTH 6241. The Aztecs. (Also listed as ANTH 3241) Origins of the Aztec peoples of central Mexico and their culture; history and structure of the Aztec empire; pre-Columbian social, political, and economic organization; warfare and religion; the Spanish conquest; colonial society in central Mexico; ethno-graphic study of modern descendants of the Aztecs. No credit for students who have earned credit for 3241. [3]

ANTH 6242. The Archaeology of the Ancient Maya Civilization. Archaeological evidence and social theory on the enigmatic origins, complex nature, and sudden collapse of the ancient Maya civilization. May be repeated for credit more than once if there is no duplication in topic. Open to advanced undergraduates with consent of the instructor. [3]

ANTH 6243. Ancient Maya Gods and Rulers. (Also listed as ANTH 3243) Anthropology of politics and religion in Classic Maya culture, A.D. 100-1000. Interpretation of Classic Maya iconography and epigraphy. No credit for students who have earned credit for 3243. [3]

ANTH 6250. The Inca Empire. (Also listed as ANTH 3250) The rise and fall of the Inca state in the Southern American Andes. Inca society, agriculture, economy, warfare, ancestor worship, mummies, and royal wealth. Imperial expansion, the role of the feasting in Inca politics, and place of ecology in Inca religion. Destruction of the empire during the Spanish conquest; persistence of pre-Columbian culture among Inca descendants in Peru and Bolivia. No credit for students who have earned credit for 3250. [3]

ANTH 6260. Ceramic Analysis in Archaeology. (Also listed as ANTH 3260) Ceramic sherds and vessels from ancient societies. Documentation of form, fabric, and decoration through illustrations. Qualitative and quantitative analysis. Integration with archaeological contexts for ceramic sequences and chronology. Technology, production, exchange, and consumption. Function and style. Emphasis on hands-on experience. No credit for students who have earned credit for 3260. [3]

ANTH 6261. Introduction to Geographic Information Systems and Remote Sensing. (Also listed as ANTH 3261) Computerized graphics and statistical procedures to recognize and analyze spatial patterning. Spatial data-collection, storage and retrieval; spatial analysis and graphic output of map features. Integration of satellite imagery with data from other sources through hands-on experience. Assumes basic knowledge of computer hardware and software. [3]

ANTH 6262. Ethics in Anthropology, Archaeology, and Development. (Also listed as ANTH 3262) Ethical perspectives on contemporary problems of archaeological and anthropological research, interaction, and interpretation of past and present non-Western societies. No credit for students who have earned credit for 3262. [3]

ANTH 6343. Biology and Culture of Race. (Also listed as ANTH 3343) Biological and cultural perspectives on race in the United States and internationally. Patterns of human genetic variation. Biomedical use of racial categories. Social and cultural construction of race. Racism and racial discrimination. Racial disparities in health. No credit for students who have earned credit for 3343. [3]

ANTH 6344. Genetic Anthropology Lab Techniques. (Also listed as ANTH 3344) Applications of molecular anthropology techniques. DNA data analysis. Genetic methods and findings. DNA comparisons between world populations. Studies of ancient DNA. No credit for students who have earned credit for 3344. [3]

ANTH 6345. Human Evolutionary Genetics. (Also listed as ANTH 4345) Core issues in human evolution and population genetics. Molecular evidence for the origin of modern humans, reconstruction of human migrations, race, and detection of admixture between populations. Implications for human disease. Offered on a graded basis only. No credit for students who earned credit for 294 section 1 in fall 2012. Prerequisite or corequisite: BSCI 1100, BSCI 1105, or BSCI 1510. [3]

ANTH 6347. Bioethics in Anthropology. Humans as study subjects in research. Human complexities and experimentation; eugenics; and ethical, legal, and social issues of research. [3]

ANTH 6371. Social and Health Consequences of Pandemics. (Also listed as ANTH 3371) Origins, spread, mortality, and the biological and social consequences. The epidemic of bubonic plague in the 1300s, known as the European Black Death. The devastation of indigenous New World populations by European diseases after 1492. Social and medical responses. Implications for modern societies. No credit for students who have earned credit for 3371. [3]

ANTH 6372. Human Osteology. (Also listed as ANTH 3372) Anatomy of the human skeleton. Determination of age, sex, stature, and biological affinity from bones and dentition. Analysis of archaeological skeletal remains for diagnosis of disease and identification of cultural practices. Use of human remains in criminal investigation. No credit for students who have earned credit for 3372. [3]

ANTH 6373. Hlth/Disease Anc Poptltns. (Also listed as ANTH 4373) Paleopathology of mummies and skeletons. Skeletal evidence for violence and warfare. Gender and social status differences in diet, disease, and activity patterns to reconstruct ancient social organization. Biological relationships among ancient and modern populations. Ethics and federal law in the study of human remains. Laboratory analysis of skeletons. No credit for students who have earned credit for 4373. [3]

ANTH 6614. Advanced K'iche' Maya. (Also listed as ANTH 3614) Vocabulary, listening, and speaking skills. Modern and colonial texts. Cultural context of linguistic practices in K'iche' communities. No credit for students who have earned credit for 3614. [3]

ANTH 6615. Readings in K'iche' Mayan. (Also listed as ANTH 3615) Taught in K'iche'. Advanced vocabulary, grammar, syntax, reading, and writing. Colonial and modern texts. No credit for students who have earned credit for 3615. [3]

ANTH 6620. Maya Language and Literature. (Also listed as ANTH 3620) Introduction to a contemporary Maya language. Linguistic analysis and cultural concepts. By permission of instructor. May be repeated for the study of different Maya languages for a total of 6 credits. No credit for students who have earned credit for 3620. [1-6; maximum of 6 credits total for all semesters of ANTH 6620]

ANTH 6622. Classic Maya Language and Hieroglyphs. (Also listed as ANTH 3622) Linguistic analysis of Classic Maya Hieroglyphs from A.D. 100-1000. Methods of decipherment, reading, and interpreting an ancient script. Role of socio-economic status in literacy. No credit for students who have earned credit for 3622. [3]

ANTH 6850. Independent Research. (Also listed as ANTH 3850) Readings on selected topics (of the student's choice) and the preparation of reports. No credit for students who have earned credit for 3850. [1-3]

ANTH 6851. Independent Research. (Also listed as ANTH 3851) Readings on selected topics (of the student's choice) and the preparation of reports. No credit for students who have earned credit for 3851. [1-3]

ANTH 6865. Field Research. (Also listed as ANTH 3865) Directed field research on topics of the student's choice. May be repeated for credit more than once if there is no duplication in topic, but students may earn only up to 6 credits per semester of enrollment. No credit for students who have earned credit for 3865. [1-6]

ANTH 6880. Internship Readings and Research. (Also listed as ANTH 3880) Readings and research conducted under the supervision of a member of the Anthropology department and a substantial research paper are required. Students from any discipline can gain experience working with a local, national, or international organization in developing a project to broaden their understanding of anthropological issues. Hours for background readings and research will be completed in ANTH 6880 concurrently with and regardless of the numbers of hours taken in internship training in 6881. Normally a 2.90 grade point average, 6 hours of prior work in ANTH, and prior approval of the student's plan by the director of undergraduate studies in Anthropology are required. A research paper and report must be submitted at the end of the semester during which the internship training is completed. No credit for students who have earned credit for 3880. [Variable credit: 1-6]

ANTH 6881. Internship Training. (Also listed as ANTH 3881) Offered on a Pass/Fail basis only and must be taken concurrently with 6880. Hours of 6881 will not count toward the Anthropology major or minor. Students from any discipline can gain experience working with a local, national, or international organization in developing a project to broaden their understanding of anthropological issues. Hours for background readings and research will be completed in ANTH 6880 concurrently with and regardless of the numbers of hours taken in internship training in 6881. Normally a 2.90 grade point average, 6 hours of prior work in ANTH, and prior approval of the student's plan by the director of undergraduate studies in Anthropology are required. A research paper and report must be submitted at the end of the semester during which the internship training is completed. No credit for students who have earned credit for 3881. [Variable credit: 1-9]

ANTH 6890. Special Topics. (Also listed as ANTH 3890) Topics vary. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. No credit for students who have earned credit for 3890. [3]

ANTH 7150. Urban Ecology. Environmental contexts and consequences of human and non-human life processes in cities through history. Transformations of landscapes, food systems, and built environments. Origins of cities, urbanization, industrial archaeology, urban planning, and environmental racism. Long-term perspectives on climate change, political ecology, environmental history, green politics, and prospects for sustainability. [3]

ANTH 7999. Master's Thesis Research. [Formerly ANTH 369] [0-12]

ANTH 8000. History of Anthropological Theory I. [Formerly ANTH 314] An advanced consideration of the history of anthropological theory from its origins to the mid-twentieth century. [3]

ANTH 8001. History of Anthropological Theory II. [Formerly ANTH 315] An advanced consideration of the history of anthropological theory from the mid-twentieth century to the present. [3]

ANTH 8010. Special Topics. [Formerly ANTH 367] Problems, themes, or issues in anthropological theory and methods. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [1-3]

ANTH 8100. Political Violence. [Formerly ANTH 318] Comparative and ethnographic analysis of state violence, guerrilla insurgencies, paramilitarism and vigilantism; consequences of repression, impunity, and social fragmentation on historical memory and democratic processes. [3]

ANTH 8104. Seminar on Political Economy and Anthropology. [Formerly ANTH 323] Anthropological approaches to political economy and globalization. Fundamental works in political economy and economic anthropology. [3]

ANTH 8106. Ethics in Anthropology. [Formerly ANTH 345] Ethical obligations of anthropologists in dealing with human subjects on the interpretation, interaction, and action with non-western societies. Ethics from Socrates to radical postmodernism. Debate of specific issues presented by non-Western practices, cultural property rights, sites versus sacred places, repatriation, cultural relativism, and anthropological activism. [3]

ANTH 8107. Race as a Cultural and Legal Construct. [Formerly ANTH 333] Historical and contemporary roles of race and racism in settler colonialism, slavery, the nation-state, and empire. Theoretical perspectives

from social constructionism, anti-colonial literature, critical race theory, and standpoint theory. [3]

ANTH 8110. Seminar in Maya Ethnography. [Formerly ANTH 303] Ethnographic survey of the Maya of Mexico and Guatemala; historical and current data, methods, theories. [3]

ANTH 8200. Archaeological Method and Theory. [Formerly ANTH 310] Development of archaeology as a discipline; relationships with anthropology and history; intellectual trends. Prerequisite: consent of instructor. [3]

ANTH 8201. Advanced Spatial Analysis. [Formerly ANTH 312] Theoretical and methodological training for advanced GIS applications in social science research. Implementing GIS in research design, field spatial data acquisition methods, data processing, management, visualization, and analysis. [3]

ANTH 8210. Preindustrial Political Systems. [Formerly ANTH 331] History, structure, and change of pre-modern political systems around the world. [3]

ANTH 8211. Space, Place, and Landscape. [Formerly ANTH 335] Cross-disciplinary approaches to the significance of space and landscape for human societies in the past and present. [3]

ANTH 8212. Historical Archaeology. [Formerly ANTH 340] Development, practice, methods, and theoretical perspectives in historical archaeology; relationships between archaeology and history. [3]

ANTH 8220. The Historical Archaeology of Latin America. [Formerly ANTH 349] The study of archaeological, historic, and ethnohistorical materials in examining the conquest, colonization, and process of culture change in Latin America. [3]

ANTH 8230. The Collapse of Civilizations: General Theories and the Maya Collapse. [Formerly ANTH 325] An advanced consideration of the causes and processes involved in the decline of complex societies. General theory is then illustrated by detailed interactive study of the evidence and interpretations of the collapse of the civilization of the Classic Maya, arguably the New World's most advanced society. A seminar allowing each student to develop and define their own perspective on this major problem in archaeology and social theory. [3]

ANTH 8232. Seminar in Mesoamerican Archaeology. [Formerly ANTH 350] Important themes in the prehistory of pre-Columbian civilizations of Mexico and Central America. May be repeated for credit if there is no duplication in topic. [3]

ANTH 8240. Seminar in South American Archaeology and Ethnohistory. [Formerly ANTH 360] The prehistory of pre-Columbian civilizations of the Andean and lowland regions of South America. [3]

ANTH 8300. Human Variation and Osteology. [Formerly ANTH 307] Survey of physical and genetic variation in modern human populations. Laboratory techniques in osteological analysis. [3]

ANTH 8301. Bioarchaeology Theory and Methods. The body as a form of material culture. Traumatic violence, structural violence, and community health profiles. Sex and gender in the bioarchaeological record. Skeletal analysis; paleopathology; stable isotope analysis; ancient DNA; radiocarbon dating. Knowledge of skeletal anatomy is encouraged. No credit for students who have earned credit for 8010 section 02 in fall 2015. [3]

ANTH 8310. The Anthropology of Death: Body, Place, and Memory. [Formerly ANTH 329] Cultural responses to death in Western and non-Western societies. Emphasis on issues of how social relations, emotion, and memory are shaped in relation to ideas and practices focused on the body and the significance of places as sites of identity. Theory and perspectives from anthropology, religion, and philosophy. [3]

ANTH 8311. Violence and Its Embodiments in the Past and Present. [Formerly ANTH 328] Anthropology and bioarchaeology of violence in ancient and modern communities. Bioarchaeological theory and method to identify trauma and violence against the body. Study of war and other forms of violence, including domestic abuse, ritual battles, corporeal punishment. [3]

ANTH 8500. Teaching Anthropology. Preparation for teaching anthropology courses at the university level. Pedagogical practice and theory. Observations of master teachers; teaching practice and evaluation. Design of syllabi, readings, and assignments. Approaches to teaching challenging topics. [3]

ANTH 8999. Non-candidate Research. [Formerly ANTH 379] Research prior to entry into candidacy (completion of Qualifying Examination) and for special non-degree students. [Variable credit: 0-12]

ANTH 9000. Seminar in Research Design. [Formerly ANTH 319] Objectives and strategies of contemporary research problems in anthropology; formulation, writing, and construction of grant proposals; interplay between data, method, and theory; develop skill in critiquing research ideas, techniques, and designs. [3]

ANTH 9001. Research Design in Anthropology. [Formerly ANTH 330] Research design, formulating research questions, and definition of appropriate data and methods. [3]

ANTH 9002. Publishing in Anthropology. Preparation to publish in peer-reviewed journals in anthropology and related fields. Peer-review process and editorial decisions. Issues in publishing patterns by sub-discipline, professional rank, and gender. Review of manuscripts in preparation. Familiarity with research design is expected. [3]

ANTH 9999. Ph.D. Dissertation Research. [Formerly ANTH 399] [0-12]

Arabic

ARA 5101. Elementary Arabic. (Also listed as ARA 1101) Development of reading, listening, speaking, and writing skills. No credit for students who have earned credit for a more advanced Arabic language course. No credit for students who have earned credit for 1101. [5]

ARA 5102. Elementary Arabic. (Also listed as ARA 1102) Continuation of 5101. Development of reading, listening, speaking, and writing skills. No credit for students who have earned credit for a more advanced Arabic language course. No credit for students who have earned credit for 1102. [5]

ARA 5201. Intermediate Arabic. (Also listed as ARA 2201) Practice and development of all language skills at the intermediate-advanced level. Intensive work in spoken Arabic with emphasis on vocabulary acquisition, reading comprehension, and writing skills. Advanced grammar, modern Arabic word formation, verb aspect usage, and structure of complex sentences. Three hours of class work per week with an additional two hours per week of individual work in the language laboratory. No credit for students who have earned credit for a more advanced Arabic language course. No credit for students who have earned credit for 2201. [4]

ARA 5202. Intermediate Arabic. (Also listed as ARA 2202) Continuation of 5201. Practice and development of all language skills at the intermediate-advanced level. Intensive work in spoken Arabic with emphasis on vocabulary acquisition, reading comprehension, and writing skills. Advanced grammar, modern Arabic word formation, verb aspect usage, and structure of complex sentences. Three hours of class work per week with an additional two hours per week of individual work in the language laboratory. No credit for students who have earned credit for a more advanced Arabic language course. No credit for students who have earned credit for 2202. [4]

ARA 5301. Advanced Arabic. (Also listed as ARA 3301) Further development of listening, reading, speaking, and writing skills in the Arabic language. Emphasis on grammar and literary techniques. Offered on a graded basis only. No credit for students who have earned credit for a more advanced Arabic language course. No credit for students who have earned credit for 3301. [3]

ARA 5302. Advanced Arabic. (Also listed as ARA 3102) Continuation of 5301. Further development of listening, reading, speaking, and writing skills in the Arabic language. Emphasis on grammar and literary techniques. Offered on a graded basis only. No credit for students who have earned credit for a more advanced Arabic language course. No credit for students who have completed 3102. [3]

ARA 5401. Media Arabic. (Also listed as ARA 3201) Listening to, discussing, simulating, and analyzing Arabic media materials. Coverage of current and historical events, such as TV broadcasts, headline news, documentaries, and public discussions on political, religious, and cultural issues. Offered on a graded basis only. No credit for students who have earned credit for 3201. [3]

ARA 5501. Arabic of the Qur'an and Other Classical Texts. (Also listed as ARA 3301) Syntactical and morphological features of Classical Arabic. Differences and similarities with Modern Standard Arabic in vocabulary usage, semantic extensions, and context; vocabulary borrowing. Texts drawn from the Qur'an, Hadith, and Sira (biographical) literature. No credit for students who have earned credit for 3301. [3]

Asian Studies

ASIA 5151. The Third World and Literature. (Also listed as ASIA 3151) The history of cultural and political concepts of the Third World from 1955 to the present. Contemporary literary and cultural debates regarding models of transnationalism and processes of globalization. National literatures and cultures foundational to the Third World model. The relationship between the genre of the novel and the formation of national communities. No credit for students who have earned credit for 3151. [3]

ASIA 5210. Hollywood Hanoi. (Also listed as ASIA 2210W) Cultural narratives of the Vietnam War, including novels and films. War and representation. International, minority, and antiwar perspectives on the violence and aftermath. Muhammad Ali, Werner Herzog, Jean Genet, Graham Greene, and Dinh Linh. All texts in English translation. No credit for students who have earned credit for 2210W. [3]

ASIA 5511. Popular Culture in Modern Japan. (Also listed as ASIA 2511) Popular culture in Japan from 1900 to the present. The rise of mass culture and media, song, sports, food, fashion, and popular film genres. No credit for students who have earned credit for 2511. [3]

ASIA 5512. Explorations of Japanese Animation. (Also listed as ASIA 2512) Introduction to the form and content of Japanese animation as globalized popular entertainment and as a speculative artistic medium that explores history and memory, nature and technology, human identity, carnivalesque comedy, and gender relations. No credit for students who have earned credit for 2512. [3]

ASIA 5560. Current Japan-U.S. Relations. (Also listed as ASIA 2560) Similarities and differences in theory and practice in the United States and Japan on public policy issues such as trade, defense, environment, education, medical care, and racial prejudice. No credit for students who have earned credit for 2560. [3]

ASIA 5602. Modern Chinese Fiction. (Also listed as ASIA 2602) Short stories and novels of twentieth-century China, Taiwan, and Hong Kong. Traumatic experience of modernity; nation and narration; new perceptions of time and space; transformed gender relations; contested national and local identities. All texts in English translation. No credit for students who have earned credit for 2602. [3]

ASIA 5604. Memory and Forgetting in Traditional Chinese Culture. (Also listed as ASIA 3604) Cultural meanings and religious uses of memory from the late sixteenth to the early nineteenth centuries. Chinese and Western mnemonics. Architecture and memorial sites; nostalgia and mourning; testimonials, memoirs, and novels. Forgetfulness and knowledge. No credit for students who have completed 1111 section 3. [3]

ASIA 5605. Romancing the Nation in Modern Chinese Literature. [Also listed as 2605] From the fourteenth century to the present. Fiction, drama, and poetry. Family relations and nation-state in romantic writings. Knowledge of Chinese is not required. [3]

ASIA 5606. The Martial Tradition in Chinese Literature. [Also listed as 2606] From eleventh century BCE to modern period. War, banditry, revenge, cannibalism, female knight-errant. All genres of literature, supplemented by visual material, theater, and film. Knowledge of Chinese is not required. [3]

ASIA 5607. Self and Society in Pre-modern Chinese Literature. From the seventeenth-century BCE to the seventeenth-century CE. Poetry, prose, fiction, and drama. Self, society, religion, gender, and print culture. No credit for students who have earned credit for 3891 section 01 offered fall 2015. Knowledge of Chinese is not required. [3]

ASIA 5608. Chinese Drama: 13th-20th Centuries. Traditional and modern Chinese drama. Text, image, and performance. Gender, religious thinking, commerce, and censorship. Knowledge of Chinese is not required. [3]

ASIA 5609. Writing and Gender in Traditional China. Pre-modern China: 1st century CE to 20th century CE. Women writers, women in family and society, gender relations, cross-dressing, and foot-binding. Poetry, prose, drama, fiction, and visual materials. Knowledge of Chinese is not required. [3]

ASIA 5633. Self-Cultivation in Ancient China. (Also listed as ASIA 3633) 300 BCE to 500 CE. Methods, goals, and contexts of self-cultivation in antiquity. Breathing exercises, meditation, visualization, sexual arts, sacrifice, alchemy, and other practices in their religious, cultural, and social contexts. No credit for students who have earned credit for 3633. [3]

ASIA 5680. Inside China. (Also listed as ASIA 1680) First-hand experience of China's dynamic society and expanding economy. Guided exploration of famous historical sites and contemporary institutions such as hospitals, businesses, factories, and art galleries in Beijing and Shanghai. Interviews with individuals from many different walks of life, including physicians, entrepreneurs, migrant workers, and college students. No knowledge of Chinese is required. Offered on a graded basis only. [3]

ASIA 5851. Independent Study. (Also listed as ASIA 3851) Designed primarily for majors who want to study Asian topics not regularly offered in the curriculum. Must have consent of instructor. May be repeated for credit more than once, but students may earn only up to 3 credits per semester of enrollment. No credit for students who have earned credit for 3851. [1-3]

ASIA 5852. Independent Study. (Also listed as ASIA 3852) Designed primarily for majors who want to study Asian topics not regularly offered in the curriculum. Must have consent of instructor. May be repeated for credit more than once, but students may earn only up to 3 credits per semester of enrollment. No credit for students who have earned credit for 3852. [1-3]

ASIA 5891. Special Topics. (Also listed as ASIA 3891) Topics vary. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. No credit for students who have earned credit for 3891. [1-3]

ASIA 5892. Special Topics. (Also listed as ASIA 3892) Topics vary. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. No credit for students who have earned credit for 3892. [1-3]

Astrophysics

ASTR 7999. Master's Thesis Research. [Formerly ASTR 369] [0-13]

ASTR 8001. Order of Magnitude Astrophysics. [Formerly ASTR 355] Order-of-magnitude estimates on astrophysical problems. May be repeated for credit more than once. Students may enroll in more than one section of this course each semester. [1]

ASTR 8002. Teaching Practicum. Discussion of best teaching practices in weekly meeting with instructor. Application of teaching strategies via teaching undergraduate lab or leading homework help-desk sessions. Offered on satisfactory/unsatisfactory basis. [0-1]

ASTR 8003. Astrophysics Seminars. Weekly attendance at Astrophysics program events: colloquium, journal club, and seminars. [0]

ASTR 8010. Radiative Processes. [Formerly ASTR 310] Electromagnetic radiation from astrophysical sources. Radiative transfer; blackbody radiation; atomic and molecular absorption and emission; radiation from moving charges. [3]

ASTR 8020. Special Topics in Astrophysics. [Formerly ASTR 351] Topics vary. May be repeated for credit more than once if there is no duplication

in topic. Students may enroll in more than one section of this course each semester. [1-3]

ASTR 8030. Stellar Astrophysics. [Formerly ASTR 352] Physics of stellar structure and evolution, including nuclear energy generation, equations of state, and heat transfer by radiation, conduction, and convection. Numerical stellar models. Observational aspects of stellar astrophysics. [3]

ASTR 8040. The Structure and Dynamics of Galaxies. [Formerly ASTR 353] The stellar, gaseous, and dark matter content of galaxies; their internal bulk properties, structure, kinematics, and dynamics. Equilibrium and stability of stellar systems. Orbit theory, the gravitational N-body problem, relaxation, dynamical friction, and the Fokker-Planck equation. Galaxy evolution from the standpoint of stellar populations, the initial mass function, chemical evolution, and galaxy interactions. Serves as repeat credit for ASTR 3700. [3]

ASTR 8050. Structure Formation in the Universe. [Formerly ASTR 354] Dark matter and dark energy. Growth of linear and non-linear density fluctuations. Density and velocity fields, perturbation theory, and non-linear collapse models. Cosmological N-body simulations and the formation of dark matter halos. Galaxy clustering measurements and galaxy formation physics. Experimental cosmological probes of dark matter and dark energy. [3]

ASTR 8060. Methods in Observational and Computational Astronomy. [Formerly ASTR 322] Principles and techniques including accurate measurement of astronomical distance, data handling and error analysis, computer programming. Four to six experiments such as determination of Earth's radius, distance to the Moon, refraction by the atmosphere, distance to a star cluster. Scheduled evening sessions at Vanderbilt Dyer Observatory. [3]

ASTR 8900. Independent Study. [Formerly ASTR 390] May be repeated for credit more than once, but students may earn only up to 3 credits per semester of enrollment. [1-3]

ASTR 8999. Non-Candidate Research. [Formerly ASTR 379] Research prior to entry into candidacy (completion of qualifying examination) and for special non-degree students. [Variable credit: 0-13]

ASTR 9995. Half-time Ph.D. Dissertation Research. [Formerly ASTR 2995] For students who have completed 72 hours and devote a half-time effort to dissertation research. [0]

ASTR 9999. Ph.D. Dissertation Research. [Formerly ASTR 399] [0-13]

Biochemistry

BCHM-GS 7999. Master's Thesis Research. [Formerly BCHM-GS 369] [0-12]

BCHM-GS 8300. Introduction to Structural Biology. [Formerly BCHM-GS 300] Introduction to methods to determine the three-dimensional structures of biological macromolecules and macromolecular complexes at or near atomic resolution. Techniques covered include X-ray crystallography, NMR, EPR, and fluorescence spectroscopies, cryo-electron microscopy, and computational modeling. Emphasis is placed on practical aspects of each technique and the range of applications for which each technique is applicable. The course is given during the first third of the semester, just preceding Biochemistry 8303. SPRING. [1] Chazin, Egli, Lacy, Lang, Mchaourab, Ohi, Reiter, Sheehan.

BCHM-GS 8301. Enzyme Mechanisms and Kinetics of Catalysis. [Formerly BCHM-GS 301] This course is focused on the chemical mechanisms by which enzymes catalyze reactions. Chemical principles are applied to biochemical problems. Major topics include principles of catalysis, enzyme kinetics (both steady-state and pre-equilibrium), roles of cofactors and prosthetic groups in catalysis, and interpretation of kinetic results. Prerequisites: Organic chemistry, biochemistry. SPRING [1] Guengerich

BCHM-GS 8302. Advanced Biochemistry, Cell Biology, And Genetics. [Formerly BCHM-GS 302] Advanced concepts in genetics, biochemistry, and cell biology will be reviewed using a combination of lectures and discussion sections based on published manuscripts. Prerequisite: IGP core course or consent of instructor. FALL. [3] Hiebert, Cortez, Reiter, York.

BCHM-GS 8303. Biomolecular X-Ray Crystallography. [Formerly BCHM-GS 303] Introduction to the theory and practice of X-ray crystallography for the determination of the three-dimensional structure of biological macromolecules at atomic resolution. Topics to be covered include X-ray diffraction, symmetry and space groups, crystallization, data collection, phasing, model building, refinement and validation. Prerequisite: Biochemistry 8300, Introduction to Structural Biology. Prerequisite: BCHM-GS 8300, SPRING. [2] Egli, Harp.

BCHM-GS 8323. Special Problems and Experimental Techniques. [Formerly BCHM-GS 323] Opportunity to master advanced laboratory techniques while pursuing special problems under direction of individual members of the faculty in areas of their specialized interests. Admission to course, hours, and credit by arrangement. FALL, SPRING, SUMMER. [Variable credit: 1-6] Cortez and Staff.

BCHM-GS 8325. Special Topics In Biochemistry. [Formerly BCHM-GS 325] Introduction to current research through the biochemical literature. Given on an individual basis by arrangement. May be taken more than once, but not for more than 2 hours credit with a single adviser, nor for more than 4 hours total. May be taken concurrently with 8323 with a different adviser. Prerequisite: consent of instructor. FALL, SPRING, SUMMER. [Variable credit: 1-2] Carter and Staff.

BCHM-GS 8327. Scientific Communication. [Formerly BCHM-GS 327] This course will develop skills required for effective oral and written scientific communication. Students will present research from the current literature and will be required to write an NIH formatted grant proposal to be critiqued by faculty assigned by the course director. Students not working for a degree in biochemistry must have the consent of the instructor to enroll. FALL. [2] Schey, Wagner.

BCHM-GS 8336. Biochemical and Molecular Toxicology. [Formerly BCHM-GS 336] (Also listed as Chemistry 6170) Chemical and biological aspects of toxicology and carcinogenesis, including basic principles and mechanisms, metabolism and enzymology, cellular biology, chemistry of reactive intermediates, tissue-specific toxicity, and a survey of several classes of environmentally important compounds and drugs. Prerequisite: organic chemistry and general biochemistry. Three lectures per week. FALL. [3] Liebler, Guengerich, Marnett, Pietenpol, Porter, Stone.

BCHM-GS 8337. Molecular Aspects of Cancer Research. [Formerly BCHM-GS 337] (Also listed as Cell and Developmental Biology 8337) A focused series of seminars and discussions to explore the molecular basis of cancer. Seminars rely heavily on extramural speakers with recognized expertise in selected research areas. Discussion sections led by a faculty member following each series of three to four seminars. SPRING. [1] Hiebert and Staff.

BCHM-GS 8343. Biomolecular NMR Spectroscopy. [Formerly BCHM-GS 343] Introduction to the theory and practice of nuclear magnetic resonance (NMR) spectroscopy for the study of the structure, dynamics, and biochemistry of biological macromolecules. After introducing the basic concepts of NMR and formalisms for predicting the outcome of experiments, topics to be covered will include multidimensional NMR, scalar and dipolar couplings, chemical exchange, relaxation, resonance assignment strategies, and determination of 3D structures. Prerequisite: Biochemistry 8300. FALL. [3] Chazin, Sanders, Voehler.

BCHM-GS 8349. Graduate Seminar in Molecular Biophysics. [Formerly BCHM-GS 349] (Also listed as CPB 8349) Introduction to research areas of current interest through examination of key publications in the preceding year. The weekly meetings consist of open discussions of assigned readings led by multiple student teams. May be repeated for credit. SPRING. [1] Chazin.

BCHM-GS 8352. Analytical Proteomics. [Formerly BCHM-GS 352] Introduces analytical proteomics methods and approaches through lectures, directed readings, and group and individual data analysis exercises. Topics include (a) mass spectrometry instrumentation, (b) mass spectrometry approaches to protein and peptide analysis, (c) protein and peptide preparation and separation methods, (d) bioinformatics tools for identification of proteins from mass spectrometry data, (e) quantitative proteomics meth-

ods, (f) applications of proteomics in common experimental designs in biochemistry and cell biology, (g) applications to clinical studies. SPRING. [2].

BCHM-GS 8381. Molecular Foundations of Medicine. [Formerly BCHM-GS 381] Molecular Foundations of Medicine is designed to familiarize students with the cellular structures, biomolecules, and processes that constitute life, human health, and disease at the molecular level. The course employs an integrated approach to teach underlying principles of biochemistry, cell and tissue biology, and genetics with an emphasis on human systems and medical conditions. The inclusion of clinical correlation sessions, small groups, and laboratory sessions will further integrate and broaden course material and relate molecular processes to the study of human disease. Prerequisite: MSTP students only. FALL. [Variable credit: 1-6] Osheroff, George, Pettepher.

BCHM-GS 8999. Non-Candidate Research. [Formerly BCHM-GS 379] Research prior to entry into candidacy (completion of qualifying examination) and for special non-degree students. [Variable credit: 0-12]

BCHM-GS 9999. Ph.D. Dissertation Research. [Formerly BCHM-GS 399] [Variable credit: 0-12]

Biological Sciences

BSCI 5226. Immunology. (Also listed as BSCI 3226) The molecular and cellular basis of immunity. Emphasis on molecular structure, the genetic origin of diversity in B-cell and T-cell receptors, antigen presentation, and the cellular interactions leading to the immune response. Tolerance, tumor and transplantation immunity, autoimmune and immunodeficiency diseases, and allergy. Prerequisite: 2201 or 2210. [3]

BSCI 5230. Biological Clocks. (Also listed as BSCI 3230) Study of innate mechanisms for measurement of time in living organisms. Emphasis on the functional significance and physiological basis of biological clocks in animals and humans. Topics include circadian rhythms, time-compensated celestial navigation, photoperiodism, and the role of biological clocks in human behavior. No credit for students who have earned credit for 3230. [3]

BSCI 5233. Conservation Biology. Ecological, evolutionary, social, and economic aspects of biodiversity loss and ecosystem disruption due to human activities. Climate change, habitat fragmentation, species overexploitation, and invasive species. Sustainable development, habitat restoration, and species reintroduction. [3]

BSCI 5234. Microbiology. (Also listed as BSCI 3234) Microorganisms, including bacteria, viruses, and mobile genetic elements. The origins and universality of microbial life, modes of genome evolution, symbioses between microbes and animals, biotechnology, and human microbiome. No credit for students who have earned credit for 3234. [3]

BSCI 5236. Parasitology. (Also listed as BSCI 3236) Biology and epidemiology of eukaryotic parasites of medical and veterinary significance. Diagnosis, treatment, and control of parasitic protists, platyhelminthes, nematodes, and arthropods. Impact on global health. No credit for students who have earned credit for 3236. [3]

BSCI 5238. Ecology. (Also listed as BSCI 2238) Population biology, evolutionary ecology, community structure, with emphasis on species interactions, including competition, predation, and symbiosis. No credit for students who have earned credit for 2238. [3]

BSCI 5238L. Ecology Lab. (Also listed as BSCI 2238L) One three-hour laboratory and discussion period or field trip per week. Prerequisite or corequisite: 5238. No credit for students who have earned credit for 2238L. [1]

BSCI 5239. Evolution of Behavior. (Also listed as BSCI 3239) Theoretical and empirical research on the evolution of behavior. Evolutionary approaches to the study of animal behavior, including the role of behavior in foraging, competition, predator-prey interactions, and sociality. Behavioral adaptations and their roles in sexual selection, mating systems, and animal communication. No credit for students who have earned credit for 3239. [3]

BSCI 5243. Principles of Human Disease. (Also listed as BSCI 3243) Application of genetics, cell biology, and molecular biology to the study

of human diseases. Genomics, gene mapping, and molecular techniques. Animal models of disease. Chromosomal abnormalities, single-gene and multifactorial diseases, and epigenetics. No credit for students who earn credit for 3243. [3]

BSCI 5245. Biology of Cancer. (Also listed as BSCI 3245) Application of cell biology, molecular biology, and genetics to the study of cancer. Tumorigenesis; cellular oncogenes; growth factor signaling; tumor suppressor genes; apoptosis; metastasis and invasion. No credit for students who have earned credit for 3245. [3]

BSCI 5247. Molecular Evolution. (Also listed as BSCI 3247) The theory of evolution at the molecular level. The evolution of DNA and RNA sequences, proteins, and genome structures will be studied using models from population genetics and comparative approaches. Molecular clocks, the evolution of gene regulation and globin genes, molecular phylogeny, and human evolution. No credit for students who have earned credit for 3247. [3]

BSCI 5252. Cellular Neurobiology. (Also listed as BSCI 3252) Structure and function of nerve cells. Emphasis on electrical excitability, synaptic transmission, and sensory transduction. Cellular mechanisms underlying simple behaviors, sensory information processing, and learning and memory. No credit for students who have earned credit for 3252. [3]

BSCI 5254. Neurobiology of Behavior. (Also listed as BSCI 3254) Nerve cell interactions in neuronal networks of the central nervous system of animals and their impact for regulating behavior. Sensory systems, sensory-motor integration, central processing of information, neuronal-hormonal interactions; and brain anatomy and organization in invertebrates and vertebrates. No credit for students who have earned credit for 3254. [3]

BSCI 5256. Molecules of the Brain. (Also listed as BSCI 3256) Molecules of neural wiring, involving cell identity, pathfinding, synaptogenesis. Molecules of nerve cell communication, with relationship to drugs of addiction and abuse. Molecules of nervous system plasticity, and the mechanistic bases of learning and memory. Relation of these mechanisms to causes of human neurological diseases. No credit for students who have earned credit for 3256. [3]

BSCI 5265. Biochemistry II. (Also listed as BSCI 4265) Biochemistry of the expression, transmission, and maintenance of genetic information. DNA transcription, replication, recombination, and repair. Structural mechanisms and biological functions of DNA processing proteins. Offered on a graded basis only. No credit for students who have earned credit for 4265. [3]

BSCI 5266. Advanced Molecular Genetics. (Also listed as BSCI 4266) Principles of classical and molecular genetic analysis: mutation and recombination, mapping, and the application of genetic methodology to the study of complex systems. Special emphasis on modern genomic approaches. No credit for students who have earned credit for 4266. [3]

BSCI 5267. Molecular Virology. (Also listed as BSCI 4267) Application of genetics, biochemistry, molecular and cell biology to the study of viruses. Virus structure and classification, viral strategies of gene expression, genome replication, particle assembly. Host defenses against viruses. Comparisons with other infectious agents. Discussion of real-world outbreaks. No credit for students who have earned credit for 4267. [3]

BSCI 5270. Statistical Methods in Biology. (Also listed as BSCI 3270) An introduction to statistical methods used in the analysis of biological experiments, including the application of computer software packages. Emphasis on testing of hypotheses and experimental design. Topics include descriptive statistics, analysis of variance, regression, correlation, contingency analysis, and the testing of methods for sampling natural populations. No credit for students who have earned credit for 3270. [3]

BSCI 5272. Genome Science. (Also listed as BSCI 3272) Aims and importance of the science. Retrieval of genome data from public databases; experimental and computational methods used in analysis of genome data and their annotation. Functional aspects of genomics, transcriptomics, and proteomics; use of phylogenetics and population genomics to infer evolutionary relationships and mechanisms of genome evolution. No credit for students who have earned credit for 3272. [3]

BSCI 5890. Special Topics in Biological Sciences. (Also listed as BSCI 3890) Topics vary. May be repeated for credit more than once by permis-

sion of the director of undergraduate studies. Students may enroll in more than one section of this course each semester. Prerequisite: 1511. [3]

BSCI 6320. Graduate Seminar in Biological Sciences. [Formerly BSCI 320] May be repeated for credit more than once. Students may enroll in more than one section of this course each semester. [1]

BSCI 6332. Seminar in Biological Rhythms. [Formerly BSCI 332] May be repeated for credit more than once. Students may enroll in more than one section of this course each semester. [1-2]

BSCI 6336. Seminar in Ecology and Evolutionary Biology. [Formerly BSCI 336] May be repeated for credit more than once. Students may enroll in more than one section of this course each semester. [1-2]

BSCI 6341. Focal Topics in Molecular Biology. [Formerly BSCI 341] In-depth analysis of three to four research areas in molecular and cell biology taught by experts in each subdiscipline through lectures and discussions of papers from the current literature. Prerequisite: IGP 8001 or permission of instructor. [3]

BSCI 6384. The Brain and Behavior. [Formerly BSCI 384] Brain and Behavior provides a basic understanding of the human central nervous system and human behavior. The format includes lectures, lab exercises, small-group discussions, and patient case presentations. Brain and Behavior integrates three areas of medical science: (1) neuroanatomy, physiology, and biochemistry; (2) psychopathology and systems neuroscience; and (3) pathology, pharmacology, and radiology. Prerequisites: MSTP students only. [1]

BSCI 6385. Advanced Reading in Biological Sciences. [Formerly BSCI 385] Specialized topics under the guidance of a member of the department's faculty. Open to qualified graduate students only. Admission to course by arrangement. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [1-3]

BSCI 7390. Special Topics and Advanced Techniques in Biological Sciences. [Formerly BSCI 390] Specialized laboratory experiments, open to a limited number of properly qualified students. Admission to course, hours, and credit by arrangement. May be repeated for credit more than once. Students may enroll in more than one section of this course each semester. [2-4]

BSCI 7999. Master's Thesis Research. [Formerly BSCI 369] [0-12]

BSCI 8999. Non-candidate Research. [Formerly BSCI 379] Research prior to entry into candidacy (completion of Qualifying Examination) and for special non-degree students. [Variable credit: 0-12]

BSCI 9999. Ph.D. Dissertation Research. [Formerly BSCI 399] [0-12]

Biomedical Engineering

BME 5100. Lasers in Surgery and Medicine. (Also listed as BME 4100) Fundamentals of lasers, light-tissue interaction, problem-based design of optical instrumentation. Applications in laser surgery, disease detection, and surgical guidance. Includes hands-on experiences. No credit for students who have earned credit for 4100. FALL. [3]

BME 5110. Neuromuscular Mechanics and Physiology. (Also listed as BME 3110) Quantitative characterization of the physiological and mechanical properties of the neuromuscular system. Quantitative models of system components. Applications to fatigue, aging and development, injury and repair, and congenital and acquired diseases. No credit for students who have earned credit for 3110. SPRING. [3]

BME 5130. Systems Physiology. (Also listed as BME 3100) Quantitative physiology from the engineering point of view. Descriptive physiology of several organ systems (nervous, musculoskeletal, cardiovascular, gastrointestinal). Mathematical modeling and computer simulation of organ systems and physiologic control mechanisms. No credit for students who have earned credit for 3100. FALL. [3]

BME 5131. Systems Physiology. (Also listed as BME 3101) Quantitative physiology from the engineering point of view. Descriptive physiology of several organ systems (blood, immune, endocrine, respiratory, renal,

reproductive). Mathematical modeling and computer simulation of organ systems and physiologic control mechanisms. No credit for students who have earned credit for 3101. SPRING. [3]

BME 5200. Principles and Applications of BioMicroElectroMechanical Systems (BioMEMS). (Also listed as BME 4200) The principles, design, fabrication and application of micro- and nano-devices to instrument and control biological molecules, living cells, and small organisms, with a strong emphasis on development of microfabricated systems and micro- and nano-biosensors. Students will lead discussions from the research literature. Graduate students will prepare a research proposal or fabricate a functioning BioMEMS device. No credit for students who have earned credit for 4200. FALL. [3]

BME 5210. Biomaterial Manipulation. (Also listed as BME 2210) Design and characterization of biomaterials. Assessment of tissue engineering scaffolds and nanoparticles. Manipulation of cell growth and expression. Application of mechanics and materials principles to medical and consumer products. Laboratory exercises in tissue culture, microscopy, mechanical testing, biochemical assays, and computer modeling. No credit for students who have earned credit for 3210. Corequisite: BME 2200. SPRING. [3]

BME 5300. Biomedical Instrumentation. (Also listed as BME 3300) Methods to determine physiological functions and variables from the point of view of optimization in the time and frequency domain and the relation to physiological variability. Laboratory exercises stress instrumentation usage and data analysis. Three lectures and one laboratory. No credit for students who have earned credit for 3300. FALL, SPRING. [4]

BME 5400. Foundations of Medical Imaging. (Also listed as BME 4400) Physics and engineering of image formation by different modalities used for medical applications. Concepts common to different imaging modalities and limits of physical phenomena. Mathematical concepts of image formation and analysis; techniques for recording images using ionizing radiation (including CT), ultrasound, magnetic resonance, and nuclear (including SPECT and PET). Methods of evaluating image quality. No credit for students who have earned credit for 4400. SPRING. [3]

BME 5410. Biological Basis of Imaging. (Also listed as BME 4410) Physical and chemical relationships between biological characteristics of tissue and image contrast in major medical imaging modalities. Imaging modalities include x-ray, MRI, PET, and ultrasound. Applications include neurological disorders, neurological function, cardiac function and disease, cancer, and musculoskeletal physiology. No credit for students who have earned credit for 4410. SPRING. [3]

BME 5500. Nanobiotechnology. (Also listed as BME 4500) Synthesis and characterization of nanostructured materials for use in living systems. Clinical applications of nanoscale biosensors. Methods for single molecule detection in biological specimens. Quantitative structure/function assessment of nanostructures in living systems. No credit for students who have earned credit for 4500. SPRING. [3]

BME 5600. Signal Measurement and Analysis. (Also listed as BME 3600) Discrete time analysis of signals with deterministic and random properties and the effect of linear systems on these properties. Brief review of relevant topics in probability and statistics and introduction to random processes. Discrete Fourier transforms, harmonic and correlation analysis, and signal modeling. Implementation of these techniques on a computer is required. No credit for students who have earned credit for 3600. SPRING. [3]

BME 5950. Design of Biomedical Engineering Devices and Systems I. (Also listed as BME 4950) Integration of the engineering and life science backgrounds of senior biomedical engineering students through the presentation of design principles for medical devices and systems. Design principles and case examples for biomedical electronics, mechanical, chemical, and computing systems are presented. A full-semester design project is required. Evaluation is conducted through periodic oral and written presentations, and through a final written and poster report. Corequisite: BME 5300. No credit for students who have earned credit for 4950. [2]

BME 5951. Design of Biomedical Engineering Devices and Systems II. (Also listed as BME 4951) Integration of the engineering and life science backgrounds of senior biomedical engineering students through the presentation of design principles for medical devices and systems. De-

sign principles and case examples for biomedical electronics, mechanical, chemical, and computing systems are presented. A full-semester design project is required. Evaluation is conducted through periodic oral and written presentations, and through a final written and poster report. No credit for students who have earned credit for 4951. [3]

BME 6110. Research and Professional Development in Biomedical Engineering. [Formerly BME 305] Database search strategies, interpreting engineering and scientific literature, communication skills, engineering design, proposal writing, preparation of engineering publications, technology transfer/intellectual property, engineering laboratory documentation, regulatory oversight, ethics, funding. SPRING. [3].

BME 6301. Engineering in Surgery and Intervention: Provocative Questions. Explores engineering and clinical aspects of treating disease or disorders by clinically-driven provocative questions. Surgical/Interventional mechanics, locoregional therapies such as convection-enhanced delivery, neuromodulation, and ablation. Image-guided therapies, and role of discovery and design in context of treatment. SPRING. [3].

BME 6302. Engineering in Surgery and Intervention: Clinical Interactions. Literature review coupled with clinical immersion experience. Literature review centers on clinical translation of engineering research in surgical/interventional applications. Clinical immersion involves observing surgical/interventional procedures and attending clinical conferences. Prerequisite: Permission of Instructor. FALL. [3].

BME 7110. Laser-Tissue Interaction and Therapeutic Use of Lasers. [Formerly BME 320] Optical and thermal aspects and models of the interaction between laser/light and biological tissue as it is used for therapeutic applications in medicine and biology. Issues and objectives in therapeutic and surgical applications of lasers, overview of state-of-the-art topics and current research. FALL. [3]

BME 7120. Optical Diagnosis: Principles and Applications. [Formerly BME 321] Applications of light and tissue optical properties for the diagnosis of tissue pathology. Basic scientific and engineering principles for developing techniques and devices that use light to probe cells and tissues. Recent applications of different optical diagnostic techniques. SPRING. [3]

BME 7310. Advanced Computational Modeling and Analysis in Biomedical Engineering. [Formerly BME 329] Survey of current topics within biomedical modeling: biotransport, biomechanics, tumor and virus growth dynamics, model-based medical imaging techniques, etc. Mathematical development and analysis of biomedical simulations using advanced numerical techniques for the solution of ordinary and partial differential equations. Emphasis will be on graduate research related topics. SPRING. [3]

BME 7410. Quantitative Methods in Biomedical Engineering. [Formerly BME 300] Mathematics, quantitative analysis, and computational methods for biomedical engineering applications. Topics include applied probability and statistics, signal analysis and experiment design, linear systems, Fourier transforms, and numerical modeling and analysis. FALL. [3]

BME 7413. Advanced Biomechanics. [Formerly BME 313] Application of advanced concepts in statics, dynamics, continuum mechanics, and strength of materials to biological systems. Topics include measurement of mechanical properties of biological materials; rheological properties of blood; mechanics of cells, bone, skeletal muscle, and soft tissue; normal and abnormal dynamics of human movement; mechanics of articular joint movement; pulmonary mechanics; cardiac mechanics; arterial mechanics; mechanics of veins and collapsible vessels; and mechanics of flow in the microcirculation. Prerequisite: BME 2100, BME 3000 or equivalent. [3]

BME 7419. Engineering Models of Cellular Phenomena. [Formerly BME 319] Application of engineering methods to model and quantify aspects of cell physiology. Topics include receptor mediated cell processes, cell-cell signaling, cooperative barrier behavior, cell structural components, and cell motility. SPRING. [3] (Offered alternate years)

BME 7420. Magnetic Resonance Imaging Methods. [Formerly BME 378] MR techniques to image tissue for clinical evaluation and research. RF pulses, k-space trajectories, chemical shift, motion, flow, and relaxation. Derivation of signal equations for pulse sequence design and analysis. Course includes hands-on experimental studies. SPRING. [3]

BME 7425. Physical Measurements on Biological Systems. [Formerly BME 325] A survey of the state-of-the-art in quantitative physical measurement techniques applied to cellular or molecular physiology. Topics include the basis for generation, measurement, and control of the transmembrane potential; electrochemical instrumentation; optical spectroscopy and imaging; x-ray diffraction for determination of macromolecular structure; magnetic resonance spectroscopy and imaging. Prerequisite: PHYS 2250. SPRING. [3]

BME 7430. Cancer Imaging. [Formerly BME 330] Applications of noninvasive, in vivo imaging (i.e., MRI, optical, CT, SPECT, PET, and ultrasound) to cancer biology. Emphasis on assessing the response of tumors to treatment using emerging and quantitative imaging techniques. Prerequisites: BME 4400 or PHYS 2805. SPRING. (Offered alternate years) [3]

BME 7440. Neuroimaging. [Formerly BME 331] Applications of noninvasive imaging techniques including MRI, fMRI, optical, EEG, and PET to the study of neural systems. Emphasis on the human brain, with a focus on current scientific literature. Prerequisites: BME 4400 or PHYS 2805. FALL. (Offered alternate years) [3]

BME 7450. Advanced Quantitative and Functional Imaging. Analysis of non-invasive imaging techniques to assess the structure and function of tissues in the body. Applications of computed tomography, positron emission tomography, ultrasound, and magnetic resonance imaging to tissue characterization, including measurement of tissue volume, microstructure, organ perfusion, blood flow, brain function, and receptor density. Prerequisite: working knowledge of MATLAB. FALL. [3]

BME 7473. Design of Medical Products, Processes, and Services. [Formerly BME 373] Medical design projects involving teams of graduate level engineering and management students. Projects are solicited from industry or universities and are undertaken from the initial phase of a design request to the end product, prototype, plan, or feasibility analysis. Prerequisite: BME 4950 or equivalent. SPRING. [3]

BME 7500. Independent Study in Biomedical Engineering. [Formerly BME 390] Study of advanced biomedical engineering topics not regularly offered in the curriculum. Consent of instructor is required. FALL, SPRING. [3]

BME 7899. Master of Engineering Project. [Formerly BME 389]

BME 7999. Master's Thesis Research. [Formerly BME 369]

BME 8900. Special Topics. [Formerly BME 395A] [1-3]

BME 8901. Special Topics. [Formerly BME 395B] [1-3]

BME 8902. Special Topics. [Formerly BME 395C] [1-3]

BME 8903. Special Topics. [Formerly BME 395D] [1-3]

BME 8991. Biomedical Research Seminar. [Formerly BME 391] [1]

BME 8992. Biomedical Research Seminar. [Formerly BME 392] [1]

BME 8993. Biomedical Research Seminar. [Formerly BME 393] [1]

BME 8994. Biomedical Research Seminar. [Formerly BME 394] [1]

BME 8999. Non-Candidate Research. [Formerly BME 379] Research prior to entry into candidacy (completion of qualifying examination) and for special non-degree students. [Variable credit: 0-12]

BME 9999. Ph.D. Dissertation Research. [Formerly BME 399] [0-12]

Biomedical Informatics

BMIF 6300. Foundations of Biomedical Informatics. [Formerly BMIF 300] This introductory course examines the unique characteristics of clinical and life science data and the methods for representation and transformation of health data, information, and knowledge to improve health care. Principles of information security and confidentiality are taught, along with functional components of information systems in clinical settings and the use of databases for outcome management. Through skill modules and weekly programming exercises, the course provides an introduction to methods underlying many biomedical informatics applications, including information retrieval, medical decision making, evaluation of evidence, and

knowledge representation. The historical evaluation of the field of biomedical informatics is taught concurrently, using examples of landmark systems developed by pioneers in the field. FALL. [3] Johnson, Weinberg.

BMIF 6310. Foundations of Bioinformatics. [Formerly BMIF 310] This survey course introduces students to the experimental context and implementation of key algorithms in bioinformatics. The class begins with a review of basic biochemistry and molecular biology. The group will then focus on algorithms for matching and aligning biological sequences, given the context of molecular evolution. The emphasis will move from comparing sequences to the systems developed to enable high-throughput DNA sequencing, genome assembly, and gene annotation. Gene products will be the next focus as students consider the algorithms supporting proteomic mass spectrometry and protein structure inference and prediction. The informatics associated with transcriptional microarrays for genome-wide association studies will follow. Finally, the class will examine biological networks, including genetic regulatory networks, gene ontologies, and data integration. Formal training in software development is helpful but not required. Students will write and present individual projects. Undergraduates need the permission of the instructor to enroll. FALL. [3] Tabb.

BMIF 6315. Methodological Foundations of Biomedical Informatics. [Formerly BMIF 6315] In this course, students will develop foundational concepts of computation and analytical thinking that are instrumental in solving challenging problems in biomedical informatics. The course will use lectures and projects directed by co-instructors and guest lecturers. SPRING. [3] D. Giuse.

BMIF 6321. Scientific Communication. [Formerly BMIF 316A] The course will enhance students' skills in written and oral scientific communication. An introductory segment covers categories of scientific writing, the peer review process, and ethical issues in research communication. Through a two-semester sequence, it provides direct, hands-on experience in writing papers, abstracts, and grant proposals; critiquing and copy editing; and preparing and giving presentations for scientific meetings. FALL, SPRING. [1-1] Aronsky, Miller.

BMIF 6322. Scientific Communication. [Formerly BMIF 316B] The course will enhance students' skills in written and oral scientific communication. An introductory segment covers categories of scientific writing, the peer review process, and ethical issues in research communication. Through a two-semester sequence, it provides direct, hands-on experience in writing papers, abstracts, and grant proposals; critiquing and copy editing; and preparing and giving presentations for scientific meetings. FALL, SPRING. [1-1] Aronsky, Miller.

BMIF 6331. Student Journal Club and Research Colloquium. [Formerly BMIF 317A] The class meets weekly and is a seminar course that involves two revolving formats: journal club presentations and student research in progress presentations. For Biomedical Informatics graduate students only, usually taken in the second year of the program. Fall [1] Denny, Jerome.

BMIF 6332. Student Journal Club and Research Colloquium. [Formerly BMIF 317B] The class meets weekly and is a seminar course that involves two revolving formats: journal club presentations and student research in progress presentations. For Biomedical Informatics graduate students only, usually taken in the second year of the program. Spring [1] Denny, Jerome.

BMIF 6341. Research Rotation in Biomedical Informatics. [Formerly BMIF 318A] Students will perform research under the direction of a faculty adviser. FALL. [1-1] Staff.

BMIF 6342. Research Rotation in Biomedical Informatics. [Formerly BMIF 318B] Students will perform research under the direction of a faculty adviser. SPRING. [1-1] Staff.

BMIF 7311. Systems Biology. [Formerly BMIF 311] This survey course presents the student with the historical, conceptual, and technical foundations of systems biology as it relates to biomedical research using model systems as well as human disease. SPRING. [3] Levy.

BMIF 7320. Healthcare System and Informatics. [Formerly BMIF 320] The purpose of this course is for students to understand the organizational world in which they will spend most of their professional lives. A better

understanding will lead to strategies to build partnerships with physicians, researchers, hospitals, and academic organizations. In turn, better understanding will lead to working more closely as a team in planning future directions and implementing technological programs and changes. This course provides an overview of theoretical concepts as well as the practical tools for the student to understand and work effectively with two major topic areas: (1) understanding the health care environment; and (2) understanding organizational informatics, including the implementation of informatics systems and the concepts of behavioral change management. Prerequisite: BMIF 6300 is a required prerequisite to this course. SPRING. [3] Lorenzi.

BMIF 7330. Machine Learning for Biomedicine. [Formerly BMIF 330] This course builds on the material covered in Methodological Foundations of Biomedical Informatics (BMIF 6315) by introducing several additional machine learning concepts and algorithms with a focus on biomedical decision-making and discovery. Even though biomedical applications and examples will be discussed, the methods have broad applicability in science and engineering. The following topics will be covered in this course (may be expanded or modified based on the background of the class participants): decision support systems, natural language processing and text mining, Bayesian networks, neural networks, decision trees, feature selection, SVM regression and unsupervised SVMs, hidden Markov models, Bayesian network learning, and causal discovery using Bayesian networks. Prerequisite: for Biomedical Informatics students, BMIF 6315; for non-Biomedical Informatics students, a course in data structures or algorithm design and analysis, the ability to program in MATLAB version 6 or later, and basic concepts of machine learning and fundamental mathematical concepts needed in machine learning at the level covered in BMIF 6315. SPRING. [3] Mani.

BMIF 7340. Clinical Information Systems and Databases. [Formerly BMIF 340] This course builds on material covered in Methodological Foundations of Biomedical Informatics (BMIF 6315) by introducing and developing concepts in distributed systems and network computing: OSI stack, protocols, TCP/IP, Sockets, and DNS; clinical database concepts: synchronization, concurrency, deadlock, full-text databases; distributed database services, including high-availability techniques; and architectural considerations in the design of clinical information systems. The VUMC clinical database architecture is used as a case study. Prerequisite: for Biomedical Informatics students, BMIF 6315 or permission of instructor; for non-Biomedical Informatics students, coding ability in some standard procedural or object-oriented computer language, preferably PERL. FALL. [3] D. Giuse.

BMIF 7350. Technology and Society. This course engages students in discovering relationships among individuals, institutions, and technologies, and how those relationships evolved in specific cultural contexts. Students and instructors will explore this topic in four modules: 1) understanding health care actors and technologies; 2) institutions and other infrastructures, including scientific disciplines, government, and information infrastructures; 3) principles of ethics and their application in biomedical informatics research and practice; and 4) integration of the concepts. The course will be conducted as a seminar, in which students and instructors will discuss assigned readings and films. Each student will present a final case to the group. [3]

BMIF 7370. Evaluation Methods in Biomedical Informatics. [Formerly BMIF 370] Students are introduced to health information technology evaluation, with exposure to study design, including sampling, appropriate use of controls; data collection, including human subjects research considerations; analysis, including testing for statistical significance, definitions of sensitivity and specificity, ROC plots; and reporting of results. Quantitative and qualitative methods will be covered, as well as methods and issues specific to health care settings. FALL. [3] Gadd, Peterson, Aronsky.

BMIF 7380. Data Privacy in Biomedicine. [Formerly BMIF 380] This course introduces students to concepts for evaluating and constructing technologies that protect personal privacy in data collected for primary care and biomedical research. Material in this course touches on topics in biomedical knowledge modeling, data mining, policy design, and law. Prerequisite: students are expected to be proficient in writing basic software programs, although no specific programming language is required. SPRING. [3] Malin.

BMIF 7391. Special Topics Seminar in Biomedical Informatics. [Formerly BMIF 391] This course is designed for faculty to offer small groups of students a study course on a topic of mutual interest and concern in the faculty member's area of expertise.

BMIF 7395. Directed Research/Independent Study. [Formerly BMIF 395] Students will work under close supervision of a specific faculty member on an ongoing research problem. Depending on the specific project, students will learn aspects of study design, research methods, data collection and analysis, research manuscript writing, and human factors engineering. SPRING/FALL. [1-3] Staff.

BMIF 7999. Master's Thesis Research. [Formerly BMIF 369]

BMIF 8999. Non-Candidate Research. [Formerly BMIF 379] Research prior to entry into candidacy (completion of qualifying examination) and for special non-degree students. [Variable credit: 0-12]

BMIF 9999. Ph.D. Dissertation Research. [Formerly BMIF 399]

Biomedical Sciences

BMS 7001. Scientific Communication in the Biomedical Sciences. Weekly reading assignments will be accompanied by writing assignments in which students will communicate their own life lessons in the context of assigned readings. A goal will be for each student to define personal motivation to pursue careers in the biomedical sciences. [1]

BMS 7002. Critical Thinking in the Biomedical Sciences. Reading and critical analysis of primary scientific literature. [1-3]

BMS 8002. Narrative-based Healthcare. In this seminar, both classical and contemporary illness narratives are examined as a way to better understand the doctor-patient relationship. Readings are assigned to discuss each week and range from stories by Anton Chekhov to articles from the *New England Journal of Medicine* to illness narratives written by patients and providers. The primary text is *Narrative Medicine* (Oxford University Press) by Rita Charon. To understand multidisciplinary care, we will reach beyond the doctor-patient relationship to a broad range of care providers including nurses, dentists, pharmacists, and therapists, among others. Full realization of narrative medicine crosses the disciplines of medicine and the humanities to include issues of bioethics, cultural competency, spirituality, and social determinants of health. To better understand the doctor-patient relationship, each student writes a journal of someone they have known with illness. Writing is a crucial component of the class as each student writes two papers in addition to their journal. Selected videos will be used to portray the strengths and weaknesses of the doctor-patient relationship. Role play exercises allow the students to experience the perspective of both provider and patient. The format of this course is a seminar. As such, class participation is paramount for each student. [3]

BMS 8003. Service Learning in the Biomedical Sciences. This course structures opportunities for students in the MS Program in the Biomedical Sciences to participate in service/learning experiences in the Nashville area. Students will arrange activities that complement medical school applications. The course will be one credit hour, offered every semester. At the end of each semester, students will need to write a paper describing their experiences and give an oral presentation to the course director. Dr. James G. Patton will serve as instructor/course director. [1]

Biostatistics

BIOS 6301. Introduction to Statistical Computing. [Formerly BIOS 301] This course is designed for students who seek to develop skills in statistical computing. Students will learn how to use R and STATA for data management, database querying, reporting generating, data presentation, and data tabulation and summarization. Topics will include organization and documentation of data, input and export of data sets, methods of cleaning data, tabulation and graphing of data, programming capabilities, and an introduction to simulations and bootstrapping. Students will also be introduced to LaTeX and Sweave for report writing. Students will also be briefly introduced to SAS and SQL programming. FALL. [2] Staff.

BIOS 6306. Introduction to Study Design. This course will introduce principles of study design in medical and health statistics. The designs considered will be case series, ecologic studies, matched and unmatched case-control studies, observational cohort studies, historically controlled clinical trials, screening trials and randomized clinical trials. The goal is to introduce critical design challenges that ultimately impact the ability to make statistical inferences from observed samples to the target populations. Concepts such as internal and external validity, bias identification and control, confounding and effect modification will be discussed and illustrated with examples from the medical literature. The dependence of traditional univariate measures of statistical association (absolute risk, relative risk and odds ratios) on critical design elements will be highlighted. Statistical evaluation of diagnostic tests will also be introduced along with a brief introduction to causal inference. Permission of instructor required. Prerequisite: Access to STATA statistical software. Fall. [3] Dupont

BIOS 6311. Principles of Modern Biostatistics. [Formerly BIOS 311] This is the first in a two-course series designed for students who seek to develop skills in modern biostatistical reasoning and data analysis. Students learn the statistical principles that govern the analysis of data in the health sciences and biomedical research. Traditional probabilistic concepts and modern computational techniques will be integrated with applied examples from biomedical and health sciences. Statistical computing uses software packages STATA and R; prior familiarity with these packages is helpful but not required. Topics include: types of data, tabulation of data, methods of exploring and presenting data, graphing techniques (boxplots, q-q plots, histograms), indirect and direct standardization of rates, axioms of probability, probability distributions and their moments, properties of estimators, the Law of Large numbers, the Central Limit Theorem, theory of confidence intervals and hypothesis testing (one sample and two sample problems), paradigms of statistical inference (Frequentist, Bayesian, Likelihood), introduction to non-parametric techniques, bootstrapping and simulation, sample size calculations and basic study design issues. One hour lab required; Students are required to take 6311L concurrently. Prerequisite: Calculus I. FALL. [3] Staff.

BIOS 6311L. Principles of Modern Biostatistics Lab. [Formerly BIOS 311L] This is a discussion section/lab for Principles of Modern Biostatistics. Students will review relevant theory and work on applications as a group. Computing solutions and extensions will be emphasized. Students are required to take 6311 concurrently. FALL. [1] Staff.

BIOS 6312. Modern Regression Analysis. [Formerly BIOS 312] This is the second in a two-course series designed for students who seek to develop skills in modern biostatistical reasoning and data analysis. Students learn modern regression analysis and modeling building techniques from an applied perspective. Theoretical principles will be demonstrated with real-world examples from biomedical studies. This course requires substantial statistical computing in software packages STATA and R; familiarity with at least one of these packages is required. The course covers regression modeling for continuous outcomes, including simple linear regression, multiple linear regression, and analysis of variance with one-way, two-way, three-way, and analysis of covariance models. This is a brief introduction to models for binary outcomes (logistic models), ordinal outcomes (proportional odds models), count outcomes (poisson/negative binomial models), and time to event outcomes (Kaplan-Meier curves, Cox proportional hazard modeling). Incorporated into the presentation of these models are subtopic topics such as regression diagnostics, nonparametric regression, splines, data reduction techniques, model validation, parametric bootstrapping, and a very brief introduction to methods for handling missing data. One hour lab required. Students are required to take 6312L concurrently. Prerequisite: Biostatistics 6311 or equivalent; familiarity with STATA and R software packages. SPRING. [3] Staff.

BIOS 6312L. Modern Regression Analysis Lab. [Formerly BIOS 312L] This is a discussion section/lab for Modern Regression Analysis. Students will review relevant theory and work on applications as a group. Computing solutions and extensions will be emphasized. Students are required to take 6312 concurrently. SPRING. [1]

BIOS 6321. Clinical Trials and Experimental Design. [Formerly BIOS 321] This course covers the statistical aspects of study designs, monitoring and analysis. Emphasis is on studies of human subjects, i.e. clinical trials.

Topics include: principles of measurement, selection of endpoints, bias, masking, randomization and balance, blocking, study designs, sample size projections, study conduct, interim monitoring of accumulating results, flexible and adaptive designs, sequential analysis, analysis principles, adjustment techniques, compliance, data and safety monitoring boards (DSMB), Institutional Review Boards (IRB), the ethics of animal and human subject experimentation, history of clinical trials, and the Belmont report.

BIOS 6341. Fundamentals of Probability. [Formerly BIOS 341] The first in a two-course series (6341 - 6342), Fundamentals of Probability introduces and explores the probabilistic framework underlying statistical theory. Students learn probability theory -- the formal language of uncertainty -- and its application to everyday statistical concepts and analysis methods. Students will validate analytical solutions and explore limit theorems using R software. This course covers probability axioms, probability and sample space, events and random variables, transformation of random variables, probability inequalities, independence, discrete and continuous distributions, expectations and variances, conditional expectation, moment generating functions, random vectors, convergence concepts (in probability, in law, almost surely), Central Limit Theorem, weak and strong Law of Large Numbers, extreme value distributions, order statistics and exponential family. (Shepherd) Fall [3]

BIOS 6341L. Fundamentals of Probability Lab. [Formerly BIOS 341L] This is a discussion section/lab for Fundamentals of Probability. Students will review relevant theory and work on applications as a group. Computing solutions and extensions will be emphasized. Students are required to take 6341 concurrently. [1]

BIOS 6342. Contemporary Statistical Inference. [Formerly BIOS 342] The second in a two-course series (6341 - 6342), Contemporary Statistical Inference introduces and explores the fundamental inferential framework for parameter estimation, testing hypotheses, and interval estimation. Students learn classical methods of inference (hypothesis testing), and modes of inference (Frequentist, Bayesian and Likelihood approaches) and their surrounding controversies. Topics include: delta method, sufficiency, minimal sufficiency, exponential family, ancillarity, completeness, conditionality principle, Fisher's Information, Cramer-Rao inequality, hypothesis testing (likelihood ratios test, most powerful test, optimality, Neyman-Pearson lemma, inversion of test statistics), Likelihood principle, Law of Likelihood, Bayesian posterior estimation, Interval estimation (confidence intervals, support intervals, credible intervals), basic asymptotic and large sample theory, maximum likelihood estimation, resampling techniques (e.g., bootstrap).

BIOS 6342L. Contemporary Statistical Inference Lab. [Formerly BIOS 342L] This is a discussion section/lab for Contemporary Statistical Inference. Students will review relevant theory and work on applications as a group. Computing solutions and extensions will be emphasized. Students are required to take 6342 concurrently.

BIOS 7323. Applied Survival Analysis. [Formerly BIOS 323] This course provides an applied introduction to methods for time-to-event data with censoring mechanisms. Topics include: life tables, nonparametric approaches (e.g., Kaplan-Meier, log-rank), semi-parametric approaches (e.g., Cox model), parametric approaches (e.g., Weibull, gamma, frailty) competing Risks (introduce Poisson regression as connection to Cox model), and time-dependent covariates. Focus is on fitting the models and the relevance of those models for the biomedical application. [3] Chen

BIOS 7323L. Applied Survival Analysis Lab. [Formerly BIOS 323L] This is a discussion section/lab for Applied Survival Analysis. Students will review relevant theory and work on applications as a group. Computing solutions and extensions will be emphasized. Students are required to take 7323 concurrently. [1] Fall

BIOS 7330. Regression Modeling Strategies. [Formerly BIOS 330] The course presents strategies for, and a survey of current thinking on, building predictive models. Multivariable predictive modeling for a single response variable: using regression splines to relax linearity assumptions, perils of variable selection and over-fitting, where to spend degrees of freedom, shrinkage, imputation of missing data, data reduction, and interaction surfaces. Methods for graphically understanding models (e.g., using nomograms) and using resampling to estimate a model's likely performance on new data. Statistical methods related to binary logistic models and ordinal

logistic and survival models will be covered. Students will develop, validate, and graphically describe multivariable regression models. Prerequisite: BIOS 6311 and 6312 or permission [3] Spring, Harrell.

BIOS 7345. Advanced Regression Analysis I (Linear and General Linear Models). [Formerly BIOS 345] Students are exposed to a theoretical framework for linear and generalized models. First half of the semester covers linear models: multivariate normal theory, least squares estimation, limiting chi-square and F-distributions, sum of squares (partial, sequential) and expected sum of squares, weighted least squares, orthogonality, Analysis of Variance (ANOVA). Second half of the semester focuses on generalized linear models: binomial, Poisson, multinomial errors, introduction to categorical data analysis, conditional likelihoods, quasi-likelihoods, model checking, matched pair designs. BIOS 6341 and 6342 are prerequisites for this course. [3] Saville

BIOS 7345L. Adv Regression Analysis I Lab. [Formerly BIOS 345L] This is a discussion section/lab for Advanced Regression Analysis. Students will review relevant theory and work on applications as a group. Computing solutions and extension will be emphasized. BIOS 6341 and 6342 are prerequisites for this course. Students are required to take 7345 concurrently. Fall. [1]

BIOS 7346. Advanced Regression Analysis II (General Linear & Longitudinal Models). [Formerly BIOS 346] Second in a yearlong series, students are exposed to a theoretical framework for generalized linear and longitudinal models. Covers classic repeated measures models, random effect models, generalized estimating equations (GEEs), Hierarchical models, and transitional models for binary data, marginal vs. mixed effects models, model fitting, model checking, clustering, and implication for study design. Also includes discussion of missing data techniques, Bayesian and Likelihood methods for GLMs, and various fitting algorithms such as maximum likelihood and generalized least squares. Prerequisite: BIOS 7345 [3] Spring, Schildcrout.

BIOS 7346L. Advanced Regression Analysis II Lab. [Formerly BIOS 346L] This is a discussion lab for Advanced Regression Analysis II. Students will review relevant theory and work on applications as a group. Computing solutions and extensions will be emphasized. Students are required to take BIOS 7346 concurrently. [1] Fall. Schildcrout.

BIOS 7351. Statistical Collaboration in Health Sciences I. [Formerly BIOS 351] First course of two on collaboration in statistical science. Students are exposed to a variety of problems that arise in collaborative arrangements. The course's goal is to sharpen students' consulting skills while exposing them to the application of advanced statistical techniques in routine health science applications. The importance of understanding and learning the science underlying collaborations will be emphasized. Students will role-play with real investigators, discuss real consulting projects that have gone awry, and face real-life problems such as opaque scientific direction poor scientific formulation, lack of time, and ill-formulated messy data. Students will engage in several consulting projects that will involve the use of a wide range of biostatistics methods from design to analysis. Course content will also make use of departmental clinics that are run concurrently. [3] Davidson

BIOS 7352. Statistical Collaboration in Health Sciences II. [Formerly BIOS 352] Second course of a yearlong sequence in collaboration in statistical science. Students are exposed to a variety of problems that arise in collaborative arrangements. The course's goal is to sharpen students' consulting skills while exposing them to the application of advanced statistical techniques in routine health science applications. The importance of understanding and learning the science underlying collaborations will be emphasized. Students will role-play with real investigators, discuss real consulting projects that have gone awry, and face real-life problems such as opaque scientific direction, poor scientific formulation, lack of time, and ill-formulated messy data. Students will engage in several consulting projects that will involve the use of a wide range of biostatistics methods from design to analysis. Course content will also make use of departmental clinics that are run concurrently. Prerequisite: BIOS 7351 [3] Fall. Davidson.

BIOS 7361. Advanced Concepts in Probability and Real Analysis for Biostatisticians. [Formerly BIOS 361] To include characteristic functions, modes of convergence, uniform integrability, Brownian motion, classical limit

theorems, L_p spaces, projections, sigma-algebras and RVs, martingales, random walks, Markov chains, probabilistic asymptotics. Emphasis on measure theory is minimal. Concepts are illustrated in biomedical applications whenever possible. [3]

BIOS 7362. Advanced Statistical Inference. [Formerly BIOS 362] This course is an in-depth examination of modern inferential tools. Topics include High-order asymptotics, Edgeworth expansions, nonparametric statistics, quasi-likelihood and estimating equations theory, multivariate classification methods, re-sampling techniques, statistical learning, methods and theory of high-dimensional data, estimation-maximization (EM) algorithms, and Gibbs sampling. Concepts are illustrated in biomedical applications whenever possible. [3]; Spring; Li.

BIOS 7362L. Advanced Statistical Inference Lab. [Formerly BIOS 362L] This is a discussion section/lab for Advanced Statistical Inference. Students will review relevant theory and work on applications as a group. Students are required to take 7362 concurrently. [1] Spring. Shotwell.

BIOS 7393. Independent Study in Biostatistics. [Formerly BIOS 393] Designed to allow the student to explore and/or master advanced or specialized topics in Biostatistics under the guidance of faculty with relevant expertise. May be repeated.

BIOS 7999. Master's Thesis Research. [Formerly BIOS 369] Master's Thesis Research

BIOS 8366. Advanced Statistical Computing. [Formerly BIOS 366] Course covers numerical optimization, Markov Chain Monte Carlo (MCMC) estimation-maximization (EM), algorithms, Gaussian processes, Hamiltonian Monte Carlo, and data augmentation algorithms with applications for model fitting and techniques for dealing with missing data. Prerequisite: BIOS 6341 and BIOS 6342 or permission of instructor. FALL [3] Fonnesbeck.

BIOS 8370. Foundations of Statistical Inference. [Formerly BIOS 370] Examines the foundations of statistical inference as viewed from Frequentist, Bayesian, and Likelihood approaches. Famous papers and controversies are discussed along with statistical theories of evidence and decision theory, and their historic significance. (3) Spring (Blume)

BIOS 8372. Bayesian Methods. This course covers the methodology and rationale for Bayesian methods and their applications. Statistical topics include the historical development of Bayesian method such as hierarchical models, Markov Chain Monte Carlo (MCMC) and related sampling methods, specification of priors, sensitivity analysis, and model checking and comparison. This course features applications of Bayesian methods to biomedical research. Prerequisites: BIOS 6301, BIOS 6312, BIOS 7330, BIOS 6341, BIOS 6342 and BIOS 7345, or equivalent; for non-biostatistics students, permission required. FALL [3] Choi.

BIOS 8375. Causal Inference. This course provides an introduction to causal inference methods for observational data and randomized studies. Topics include the Rubin causal model, directed acyclic graphs, propensity scores, inverse probability weighting, instrumental variables, causal mediation analysis, marginal structural models, g-computation, and sensitivity analyses to examine robustness to untestable assumptions. Students will learn the basic theory behind the methods and will apply them to biomedical data examples. Prerequisites: 6341, 6342, 7323, and 7346 or approval by the instructor. Spring. [3] (Shepherd)

BIOS 8999. Non-Candidate Research. [Formerly BIOS 379]

BIOS 9999. Ph.D. Dissertation Research. [Formerly BIOS 399]

Cancer Biology

CANB 7999. Master's Thesis Research. [Formerly CANB 369] Master's Thesis Research

CANB 8320. Cancer and Development. [Formerly CANB 320] A cross-listed CDB/CB graduate-level course that will examine relationships between cellular responses in normal tissue development and cancer. The goal of the course is to familiarize the students with major cellular pathways and responses that are regulated in normal embryonic and post-natal tissue

development and how abnormal re-activation of these responses gives rise to malignant disease. SPRING. [3] deCaestecker.

CANB 8340. Introduction to Cancer Biology. [Formerly CANB 340] This is a didactic lecture series in which general concepts in cancer biology will be reviewed. Topics range from molecular biology of cancer (oncogene and tumor suppressors) to novel concepts such as cancer stem cells and therapeutic approaches. Prerequisite: IGP core course or consent of instructor. FALL [2] Yull.

CANB 8341. Cell Migration in Normal and Diseased States. [Formerly CANB 341] This course is focused on molecular and cell biological underpinnings of cell migration, with emphasis on cancer motility, invasion and metastasis. It is an in-depth analysis of three to four research areas in molecular and cell biology. It is intended for graduate students with a strong foundation in experimental biology. Students in interdisciplinary fields such as engineering and mathematics are welcome (and encouraged) to take the course if they already have some background biological knowledge, however it is encouraged to discuss enrollment with the instructor first. This course will add options for graduate students interested in cancer metastasis and related biological processes (leukocyte motility, bone and tissue remodeling, embryonic development, etc.) taught by experts in each sub-discipline through lectures and discussions of papers from the current literature.

CANB 8342. Advanced Concepts in Cancer Biology. [Formerly CANB 342] Advanced concepts in cancer biology will be reviewed in depth using a combination of lectures and student-led discussion sessions based on current literature. This course is offered only in tandem with the Introduction to Cancer Biology course to be taken concurrently. Prerequisite: must be a Cancer Biology graduate student or have consent of instructor. FALL. [4] Fingleton.

CANB 8344. Cancer Immunotherapy. (Also listed as a module in IGP). The extraordinary rise of Cancer Immunotherapy is used as a platform to examine the past, current and future implications of this rapidly growing discipline. The team taught course combines didactic lecture with key literature assignments aimed at providing not only an understanding of the current immunotherapy landscape, but also an important sense of perspective. The first half of the course covers basic concepts in adaptive and innate immunology, and cancer, needed to read and understand the literature. The second half is based on recent landmark literature in "Cancer Immunotherapy". Instructor presentations aimed at addressing overarching concepts will be coordinated with student-presentations of key papers. Reynolds, Wilson, Joyce. [2]

CANB 8346. Cancer Imaging. [Formerly CANB 346] Cancer Imaging [3]

CANB 8347. Cancer Systems Biology. [Formerly CANB 347] This course introduces students to the field of Cancer Systems Biology, which aims to frame cancer as a complex biological system through multidisciplinary approaches linking biology, engineering, and computer science. It is designed to teach students how to apply "systems thinking" to the analysis and modeling of fundamental questions in cancer research. The course will provide an overview of basic concepts in systems biology, including complexity, systems dynamics, networks, evolution and game theory. A survey of mathematical, statistical and computational tools will empower students to apply these concepts to concrete cancer biology projects. Examples of class activities include: construction of gene or signaling networks using literature-based knowledge and existing databases; visualization of multidimensional data; and, basic programming workshops. There will be strong emphasis on designing "systems" experiments and interpreting results in a modern cancer research laboratory. [3]

CANB 8351. Teaching Assistantship in Cancer Biology Curriculum. [Formerly CANB 351] Enrollees in the course will act as teaching assistants for one of the Cancer Biology courses (8340 or 8342 in Fall; 8347 or 8384 in spring) with a maximum of 16 hours class contact time. All enrollees will be also required to participate in a monthly journal club for that semester devoted to teaching methods in STEM subjects; and to work with course directors on evaluations. Prerequisites: CANB 8340 and CANB 8342, Ph.D. candidacy. [1] Fingleton.

CANB 8352. Biophysical Models of Cancer. [Formerly CANB 352A] The study of biophysical modeling in cancer biology, including models of DNA damage, avascular tumor growth, tumor cell motion and invasion, angiogenesis, transport within tumors, and therapy response. Prerequisites: MATH 2400 or MATH 2420/2610, one year calculus-based physics, or consent of instructor.

CANB 8381. Molecular Foundations of Medicine. [Formerly CANB 381] Molecular Foundations of Medicine is designed to familiarize students with the cellular structures, biomolecules, and processes that constitute life, human health, and disease at the molecular level. The course employs an integrated approach to teach underlying principles of biochemistry, cell and tissue biology, and genetics with an emphasis on human systems and medical conditions. The inclusion of clinical correlation sessions, small groups, and laboratory sessions will further integrate and broaden course material and relate molecular processes to the study of human disease. Prerequisite: MSTP students only. FALL. [1] Osheroff, George, Pettepher.

CANB 8384. Precision Cancer Medicine. [Formerly CANB 384] Precision medicine is the tailoring of patient therapy based on pharmacogenetic biomarkers that predict the likelihood of drug response or risk of adverse events, and highlights the importance of foundational science translation in improving patient outcomes. Although precision medicine can be applied to a number of diseases, oncology, arguably, sits at the forefront. Over the last decade, there has been an increase in the understanding of cancer molecular drivers and based on this information, gene mutation-specific inhibitors have been successfully used in the clinic that target only sub-populations of patients with particular tumor genotypes. As a result, there is a need for oncologists to have an appreciation of the fundamental molecular biology underlying the patient's tumor to effectively translate tumor genotype to precision patient care. This course will provide a unique experience in oncology where medical and graduate students work together to explore the molecular drivers of cancer and how that information is translated into targeted cancer therapies. Foundational science topics will include anatomy, physiology, histology, biochemistry, cell biology, genetics, molecular biology, immunology, pathology, radiobiology, and toxicology. Students will explore the concepts of oncogene addiction, acquired resistance to targeted therapy, immunotherapy, tumor heterogeneity, drug discovery, genetic screening and counseling, molecular diagnostics, and cancer clinical trials through online modules, seminars, team-based learning, and case-based learning activities. The information learned will be used as a platform to describe how molecular changes are detected in the laboratory and leveraged in the clinic for personalized patient care. Students will examine the multidisciplinary teams necessary in the care of cancer patients and the benefits of and challenges that precision medicine offers to oncologists through participation in individualized clinical experiences and tumor boards. Students will also have the ability to pursue their own interests in oncology through student-led presentations on a topic of their choice. [2]

CANB 8999. Non-Candidate Research. [Formerly CANB 379] Research prior to entry into candidacy (completion of qualifying examination) and for special non-degree students. [Variable credit: 0-12]

CANB 9999. Ph.D. Dissertation Research. [Formerly CANB 399]

Cell and Developmental Biology

CBIO-GS 8310. Effective Scientific Communication. [Formerly CBIO-GS 310] This is a graduate-level course with two major goals pivotal for success as a scientist: (1) To learn effective scientific written and oral communication (2) To learn effective grant writing and reviewing. The class features lectures and workshops with faculty from the Department of Cell and Developmental Biology and other departments. The course is divided into three sections: (1) Instruction on scientific writing, rigor and reproducibility, experimental design, manuscript preparation, and practical statistics (2) Grant Writing and Reviewing. Proposals written by the students on a topic related to their research interests will be discussed by the class in writing workshops and feedback sessions and reviewed by their fellow students at a mock study section (3) Student Presentations. Students will prepare and present lectures related to their research interests. Prerequisite: Bioregulation classes. [2]

CBIO-GS 8311. Contemporary Technologies and Approaches. This is a graduate-level course to provide knowledge of cutting edge techniques and approaches critical for contemporary cellular and molecular biology. Lectures are presented from faculty from multiple departments and cores across the Vanderbilt campus. Topics include proteomics, genomics, microscopy, stem cell biology, single cell technology, drug discovery and model organisms and organoids. Prerequisite: Bioregulation classes. [1]

CBIO-GS 8312. Introduction to Developmental Biology. [Formerly CBIO-GS 312] This combined lecture and laboratory course will present students with the basics in the analysis of standard animal models used in modern developmental biology. Central concepts in development will be presented in lecture while the student will gain "hands on" training in the growth and care of embryos and analysis of embryonic development in model organisms. Standard methods of analysis (e.g. basic microscopy/morphological analysis, immunolabeling, time-lapse imaging, embryo microinjection) will be presented. Prerequisite: IGP Curriculum. Tuesday/Thursday; Summer Session. [3] Bader, Jessen.

CBIO-GS 8313. Introduction to Modern Biological Microscopy. [Formerly CBIO-GS 313] This lecture course will provide students an introduction to modern microscopy and its biological applications. Topics will include diverse methods of light and electron microscopy, the basic principles of each method, details of specific instrumentation, historical background, advantages and restrictions, as well as applicability to various model systems and organisms. Sample preparation, technical hurdles, tricks of live imaging, micro- and nanomanipulation, quantitative image analysis and other issues will be addressed. The course will also include a tour of microscopy facilities available at Vanderbilt. SPRING. [2] Tyska/Kaverina

CBIO-GS 8314. Basic Biological Microscopy. [Formerly CBIO-GS 314] This lecture course will present students with an introduction to microscopy and its applications to biology. Lectures will cover basic principles of light and optics, transmitted light microscopy, fluorescence microscopy, digital image acquisition and the "do's and don'ts" of digital image processing. Fixed sample preparation and basic live cell imaging will also be covered.

CBIO-GS 8320. Cancer and Development. [Formerly CBIO-GS 320] (Also listed as CANB 8320) Graduate-level course that will examine relationships between cellular responses in normal tissue development and cancer. The goal of the course is to familiarize the students with major cellular pathways and responses that are regulated in normal embryonic and post-natal tissue development and how abnormal re-activation of these responses gives rise to malignant disease. Offered every other year. SPRING. [3] deCaestecker.

CBIO-GS 8324. Epithelial Pathobiology. To introduce students to issues of polarized epithelial cell function in the context of normal physiology as well as alterations associated with disease. Two one-and-one-a-half-hour sessions per week, one-semester course; paper presentation and discussion on Wednesday, lecture on Friday by visiting scientists from outside Vanderbilt will present special topics changing each year. Prerequisite: Open to all graduate students. Offered every other year. [3]

CBIO-GS 8325. Histology. [Formerly CBIO-GS 325] (Also listed as Cancer Biology 8325) This course focuses on the organization of cells to form tissues and organs both in terms of structure and function. Our studies begin with a discussion of the basic tissue types that form all multicellular organisms. Lecture and microscopic laboratory formats will introduce students to epithelia, connective tissue, muscle, nerve, and lymphoid tissues. Students will examine histological preparations microscopically in laboratory during this phase of the course. Next, a discussion of the organization of tissues into functioning organs will be pursued. Here, we will focus on basic concepts in organ arrangement rather than memorizing various structures. Students will have significant input on which adult or developing organs are used as models of organ structure and function. Learning laboratory methods in the analysis of tissues and organs will run concurrently with didactic instruction. Students will be asked to choose specific tissues/organs (often directly related to their thesis work) that they will prepare for morphological analysis. Specifically, students will learn methods in fixation, processing, sectioning, and microscopic analysis including morphometrics, immunofluorescence, histochemistry, and electron microscopy. Offered every other year. FALL. [3] Bader.

CBIO-GS 8330. Seminar in Cell and Developmental Biology. [Formerly CBIO-GS 330] The goal of the course is for graduate students to learn about two cutting-edge areas of research in cell and developmental biology. Each area will be presented by four outside speakers (eight dates total). The week before each seminar, the student will read and discuss, facilitated by a faculty member, a paper authored by the next week's speaker and prepare written critiques. The students will attend the seminar followed by a discussion section with the speaker. FALL, SPRING. [1] L. Lee (fall); Gu (spring)

CBIO-GS 8331. Current Topics in Stem Cell and Developmental Biology. [Formerly CBIO-GS 331] This course in both fall and spring semesters meets once per week to hear a graduate student, postdoctoral fellow, or faculty member discuss a research paper from outside his or her own field of research, with substantial audience Q&A and discussion. Students taking the course for credit must attend most of the semester's presentations. After pairing with a faculty mentor, they together choose and prepare a topical paper that the trainee presents towards the end of the semester. Students planning to register must contact and discuss plans with the director (chris.wright@vanderbilt.edu) in the preceding semester. FALL, SPRING. [1] Wright.

CBIO-GS 8333. Classic Papers. The goal of this one-credit course is to expose graduate students to landmark experiments in cell and developmental biology and to show how these studies have shaped contemporary research. At each week, a student, with help of a faculty member from the Department of Cell and Developmental Biology, will lead the discussion of a landmark paper and another outstanding newer paper on related topics. Other students will participate by engaging active discussion and writing a one-page summary to summarize how the original studies had addressed a key gap in a field and how that had altered research trajectories. The course aims at helping students to learn how to identify key gaps in research and how to design experiments to address the gaps. The course also aims to encourage/teach students to use innovative thinking in project designing and planning in their thesis research. [1]

CBIO-GS 8337. Molecular Aspects of Cancer Research. [Formerly CBIO-GS 337] (Also listed as Biochemistry 8337) A focused series of seminars and discussions to explore the molecular basis of cancer. Seminars rely heavily on extramural speakers with recognized expertise in selected research areas. Students meet with the speaker immediately following each seminar. Discussion sections led by a faculty member follow each series of three to four seminars. SPRING. [1] Hiebert (Biochemistry).

CBIO-GS 8338. Special Topics Cell Biology. [Formerly CBIO-GS 338] This course is intended to give first-year IGP students a personal perspective on the careers of exceptional cell and developmental biology researchers. Each session will focus on Nobel Prize or Lasker Award winners in Physiology or Medicine that have impacted cell and developmental biology fields. A faculty member with training or interest ties to the researcher will present and lead a discussion on the research topic and the history of the researcher's career. In preparation for each session, the students will research the information at or linked to the award Web sites. For each session, the students will be given a key paper(s) of the winner (or the winner's acceptance speech, or biographical articles, etc. at the discretion of the faculty member). During the class-time interactions with the faculty member, the students will incorporate their perspectives on what they found interesting about the winner's history. For the last wrap-up session, each student will pick an award winner, who has not been discussed, and prepare a 15-minute presentation about that person, Prerequisite: Must be first-year IGP student. [1]

CBIO-GS 8339. Research Seminar in Cell Biology. [Formerly CBIO-GS 339] Students and postdoctoral fellows present their research projects in an informal atmosphere. Students are critiqued on presentations. [1]

CBIO-GS 8340. Special Problems and Experimental Techniques. [Formerly CBIO-GS 340] Designed to allow the student an opportunity to master advanced techniques in cell biology while pursuing special projects under individual members of the faculty in their areas of expertise. Admission to course, hours, and credit by arrangement. [Variable credit: 1-6] (Not currently offered)

CBIO-GS 8341. Molecular Developmental Biology. [Formerly CBIO-GS 341] This course comprises three cutting-edge areas of developmental biology per year. The aim of this course is to provide the student with a comprehensive and up-to-date understanding of fundamental issues in modern developmental biology. Faculty didactic lectures provide essential background to facilitate critical reading and discussions of the recent scientific literature. This course is modular, with each module (approximately one month) corresponding to a single thematic topic. Students meet with external lecturers. Topics to be selected. Offered every other year. SPRING. [Variable credit: 1-3] Wright.

CBIO-GS 8345. Cellular and Molecular Neuroscience. [Formerly CBIOGS 345] (Also listed as Molecular Physiology and Biophysics 8345, Neuroscience 8345, Pharmacology 8345) This course is a required entry-level course for students in the Cell and Molecular Track of the Neuroscience Graduate Program at Vanderbilt that should be taken in the first graduate school year. It also serves as an elective for medical students and graduate students in a number of other programs. Its goal is to expose students to fundamental concepts and techniques in molecular and cellular neuroscience and provide a theoretical context for experimental analysis of brain function and disease. The course is divided into three modules. Module I: Neural Anatomy and Development provides an overview of the anatomy of the nervous system and neurotransmitters and examines concepts in neural pattern formation, neuronal migration, axon guidance, and synapse formation. Module II. Signaling, Plasticity, and Modulation reviews biophysical and molecular concepts relating to neuronal membrane excitability, secretion, and plasticity. Module III: Neural Diseases and Disease Models focuses on specific brain disorders such as epilepsy, pain disorders, Alzheimer's disease, depression, and schizophrenia and current models used to investigate their origin and/or treatment. This course combines faculty lecture with discussion of original articles, with an emphasis on fundamental concepts and the elucidation of important research paradigms in the discipline. Faculty and assistants guide students through important research paradigms with a critical analysis of the primary literature in the topic area. Prerequisite: Bioregulation I (IGP 8001) or consent of instructor. Course directors may consider undergraduate course work in cell biology or biochemistry to meet this requirement. SPRING. [4] Currie, Carter, and Staff

CBIO-GS 8347. The Visual System. [Formerly CBIO-GS 347] (Also listed as Neuroscience 8347, Psychology 5780) An interdisciplinary approach to how humans see and interpret their visual environment. Topics include the structure of the eye and brain (including optics), the physiology of individual cells and groups of cells, machine vision and models of visual function, visual attention, and mechanisms of complex visual perception. Lectures by faculty from Psychology and Cell and Developmental Biology. Graduate students attend one hour discussion section per week in addition to lecture, and turn in a more extensive paper than undergraduates. SPRING. [3] Roe

CBIO-GS 8349. Genetics of Model Organisms. [Formerly CBIO-GS 349] (Also listed as Human Genetics 8349, Molecular Physiology and Biophysics 8349) Basic genetic principles across a broad range of organisms (yeast, *C. elegans*, *Drosophila melanogaster*, plants, mouse, zebrafish) that are used in genetic analyses to investigate molecular pathways of interest for human disease will be presented. This course will provide students with in-depth terminology and understanding of the advantages, applications, and approaches specific to each organism. Genomic and bioinformatics tools that facilitate genetic analysis in each species will be emphasized. Specific examples of how each model organism has successfully contributed to elucidation of a human disease gene, pathway, or genetic principle will be presented. Course combines faculty lectures with student presentation and discussion of original articles to emphasize the uniqueness of each model system. Prerequisite: one statistics course at the upper undergraduate level or higher and Fundamentals of Genetic Analysis (MPB 8385), or permission of instructor. Offered every other year. SPRING. [3] Southard-Smith and Staff.

CBIO-GS 8381. Molecular Foundations of Medicine. [Formerly CBIO-GS 381] Molecular Foundations of Medicine is designed to familiarize students with the cellular structures, biomolecules, and processes that constitute life, human health, and disease at the molecular level. The course employs an integrated approach to teach underlying principles of biochemistry, cell and tissue biology, and genetics with an emphasis on

human systems and medical conditions. The inclusion of clinical correlation sessions, small groups, and laboratory sessions will further integrate and broaden course material and relate molecular processes to the study of human disease. Prerequisite: THSP students only. FALL. [Variable credit: 1-5] Osheroff, George, Pettepher.

CBIO-GS 8999. Non-Candidate Research. [Formerly CBIO-GS 379] Research prior to entry into candidacy (completion of qualifying examination) and for special non-degree students. [Variable credit: 0-12]

CBIO-GS 9999. Ph.D. Dissertation Research. [Formerly CBIO-GS 399]

Chemical and Biomolecular Engineering

CHBE 5200. Phase Equilibria and Stage-Based Separations. (Also listed as CHBE 3200) Thermodynamic principles and calculations of mixture phase equilibrium. Development of correlations to design chemical separation processes. Applications to separation processes involving gases, liquids, and solids such as distillation, adsorption, and extraction. Simulation of separation processes. No credit for students who have earned credit for 3200. FALL. [3]

CHBE 5250. Chemical Reaction Engineering. (Also listed as CHBE 3250) Thermodynamic basis of chemical equilibrium. Analysis of chemical kinetic data and application to the design of chemical reactors. Batch, semi-batch, and flow reactors are considered in both steady-state and transient operation. Brief treatments of catalysis and physical and chemical adsorption. No credit for students who have earned credit for 3250. SPRING. [3]

CHBE 5300. Fluid Mechanics and Heat Transfer. (Also listed as CHBE 3300) Principles of momentum and energy transport and their application to the analysis and design of chemical and biological engineering systems. No credit for students who have earned credit for 3300. FALL. [3]

CHBE 5350. Mass Transfer and Rate-Based Separations. (Also listed as CHBE 3350) Principles of mass transfer and their application to the analysis of chemical and biological engineering systems. Design of rate-based separation operations. No credit for students who have earned credit for 3350. SPRING. [3]

CHBE 5500. Bioprocess Engineering. (Also listed as CHBE 4500) Application of cellular and molecular biology to process engineering to describe the manufacture of products derived from cell cultures. Design and scale-up of bioreactors and separation equipment. Metabolic and protein engineering utilizing genetically engineered organisms. No credit for students who have earned credit for 4500. [3]

CHBE 5600. Chemical Process Control. (Also listed as CHBE 3600) Design of control systems for chemical processes. Principles of process dynamics and control of single and multivariable systems. Frequency and stability analyses and their effect on controller design. No credit for students who have earned credit for 3600. [3]

CHBE 5800. The Molecular and Cellular Mechanome. (Also listed as CHBE 4800) Applications of molecular and cellular biophysics and mechanics over various lengths, energy and timescales to describe biological phenomena through an 'omics' systems level perspective to molecular motors, cell machinery, mechanotransduction, cell migration, cell division, and nonequilibrium receptor ligand interactions. Physical and engineering based descriptions of molecular and cellular machinery incorporating biophysics and statistical and continuum mechanics perspectives. Modern and historical results, instrumentation, and measurement techniques. No credit for students who have earned credit for 4800. FALL. [3]

CHBE 5810. Metabolic Engineering. (Also listed as CHBE 4810) Analysis and synthesis of metabolic networks using principles of thermodynamics, kinetics, and transport phenomena. Computational approaches for predicting metabolic phenotypes. Experimental techniques to measure and manipulate key metabolic variables including pathway fluxes, protein/gene expression, enzyme regulation, and intracellular metabolite concentrations. No credit for students who have earned credit for 4810. [3]

CHBE 5820. Immunoengineering. (Also listed as CHBE 4820) Approaches and technologies for manipulating and studying the immune system. Topics include fundamentals of immunology, immunology tools and

methods, vaccines and immunotherapies, drug delivery principles, and materials engineering for immunomodulation. No credit for students who have earned credit for 4820. [3]

CHBE 5830. Molecular Simulation. (Also listed as CHBE 4830) Modern tools of statistical mechanics, such as Monte Carlo and molecular dynamics simulation, and variations. Methods, capabilities, and limitations of molecular simulation and applications to simple and complex fluids relevant to the chemical and related processing industries. No credit for students who have earned credit for 4830. [3]

CHBE 5840. Applications of Nanostructures. (Also listed as CHBE 4840) An engineering and materials science perspective on the physical and chemical properties of organic and inorganic nanostructures. Applications in nanomedicine for imaging and therapy, and in power systems for solar energy conversion and energy storage. No credit for students who have earned credit for 4840. SPRING. [3]

CHBE 5850. Semiconductor Materials Processing. (Also listed as CHBE 4850) Materials processing unit operations of silicon device manufacturing. Basic semiconductor physics and device theory, production of substrates, dopant diffusion, ion implantation, thermal oxidation and deposition processes, plasma deposition processes, photolithography, wet chemical and plasma etching, and analytical techniques. Lectures alternate with one two-hour laboratory on a weekly basis. No credit for students who have earned credit for 4850. FALL. [3]

CHBE 5860. Molecular Aspects of Chemical Engineering. (Also listed as CHBE 4860) Integration of molecular chemistry, property-based thermodynamic descriptions, and a focus on intermolecular energetics for process analysis and product design. Case studies involve molecular, macromolecular, supramolecular, and biomolecular systems. No credit for students who have earned credit for 4860. [3]

CHBE 5870. Polymer Science and Engineering. (Also listed as CHBE 4870) Macromolecular systems with emphasis on the interrelationship of chemical, physical, and engineering properties. Further relation of these properties to synthesis. Physicochemical and biological applications. No credit for students who have earned credit for 4870. [3]

CHBE 5880. Corrosion Science and Engineering. (Also listed as CHBE 4880) Aqueous-phase metal and alloy corrosion phenomena. Fundamental chemistry and electrochemistry theories, as applied to corroding systems. Specific forms of corrosion including pitting, crevice corrosion, and galvanic corrosion. Methods for corrosion control based on electrochemical fundamentals. No credit for students who have earned credit for 4880. SPRING [3]

CHBE 5890. Special Topics. (Also listed as CHBE 3890) No credit for students who have earned credit for 3890. [Variable credit: 1-3 each semester]

CHBE 6100. Applied Mathematics in Chemical Engineering. [Formerly CHBE 310] Chemical engineering applications of advanced mathematical methods. Analytical and numerical methods for ordinary and partial differential equations. Emphasis on recognizing the form of a mathematical model and possible solution methods. Applications in heat and mass transfer, chemical kinetics. FALL. [3]

CHBE 6110. Advanced Chemical Engineering Thermodynamics. [Formerly CHBE 311] Application of the thermodynamics method to chemical engineering problems. Development of the first, second, and third laws of thermodynamics; estimation and correlation of thermodynamic properties; chemical and phase equilibria; irreversible thermodynamics. FALL. [3]

CHBE 6120. Applied Chemical Kinetics. [Formerly CHBE 313] Experimental methods in kinetics. Kinetics of industrial reactions and reactor design. Absorption and catalytic systems are considered. FALL. [3]

CHBE 6200. Transport Phenomena. [Formerly CHBE 312] The theory of non-equilibrium processes. Development of the analogy between momentum, energy, and mass transport with applications to common engineering problems. SPRING. [3]

CHBE 6250. Professional Communication Skills for Engineers. [Formerly CHBE 395] Written and oral communication skills for engineers to produce peer-reviewed journal publications, research proposals, and research presentations. SPRING. [1]

CHBE 7899. Master of Engineering Project. [Formerly CHBE 389]. [0-6]

CHBE 7999. Master's Thesis Research. [Formerly CHBE 369] [0-6]

CHBE 8900. Special Topics. [Formerly CHBE 397] [Variable credit: 1-3 each semester]

CHBE 8991. Seminar. [Formerly CHBE 398] [0]

CHBE 8999. Non-Candidate Research. [Formerly CHBE 379] Research prior to entry into candidacy (completion of qualifying examination) and for special non-degree students. [Variable credit: 0-12]

CHBE 9999. Ph.D. Dissertation Research. [Formerly CHBE 399]

Chemical and Physical Biology

CPBP 8306. Introduction to Chemical and Physical Biology. [Formerly CPBP 306] This course is designed to provide a basic overview of modern molecular and cellular biology, with particular emphasis on physical and quantitative approaches that are currently being used to address important questions in these fields. Topics covered include DNA, RNA, protein structure and function, protein machines, membrane structure and function, membrane proteins and signaling, cellular structure and function, metabolism, and cell cycle. This course will be offered at one to four credit hours. [1-4]

CPBP 8307. Ion Channel Structure and Function. [Formerly CPBP 307] Membrane Protein Structure and Function or Structural Biology [1]

CPBP 8308. Protein-Protein Interactions. [Formerly CPBP 308] Essentially all cellular functions depend on appropriately specific and dynamically modulated interactions of multiple proteins. This course is intended to provide students with a cohesive and comprehensive overview of current qualitative and quantitative methodology used in this field, and the application of these techniques to provide novel insights into disparate cellular functions/systems. [1]

CPBP 8309. Membrane Protein Structure and Function. Membrane proteins are key control points in cell communication, movement of molecules across membrane barriers, flow and use of energy, as well as in triggering the initiation of numerous signaling pathways. For instance ion channels set the pace of electrical activity, transporters have critical role in diverse critical functions such as drug clearance and neurotransmitters reuptake and G-protein coupled receptors mediate transduce ligand binding into cascades of cellular signaling. This module will provide an overview of these therapeutically important molecules. In addition, we will explore aspects of their structure, function and involvement in human diseases. [1]

CPBP 8310. Graduate Seminar in Chemical Biology. [Formerly CPBP 310]

CPBP 8311. In Vivo Cellular and Molecular Imaging. [Formerly CPBP 311]

CPBP 8312. Current Topics in Imaging Science. [Formerly CPBP 312]

CPBP 8320. Foundations in Chemical Biology. [Formerly CPBP 320] A series of overviews and in-depth case studies will demonstrate the breadth of chemical biology and the importance of this emerging field in advancing biological sciences.

CPBP 8324. Scientific Communication in Chemical and Physical Biology. [Formerly CPBP 324] Principles of effective oral and written communication in the sciences. Each student will write, present, and defend a short research proposal based on their research area. [1]

CPBP 8325. Fndmtls Molecular Probes. [Formerly CPBP 325] FNDMTLS MOLECULAR PROBES

CPBP 8327. Data Analysis for the Biomedical Sciences. This module will focus on the variety of analytical approaches for determination of quantitative physical and biological parameters from noisy data with an emphasis on programming. [1]

CPBP 8330. Special Topics in Protein Biochemistry. [Formerly CPBP 330] Structural, chemical, biochemical, and biophysical studies of ligand-

protein recognition including the activation of G protein-coupled receptors (GPCRs). May be repeated. [1]. Meiler.

CPBP 8349. Graduate Seminar in Molecular Biophysics. [Formerly CPBP 349] SPRING. [1] Chazin.

CPBP 8350. Independent Study. [Formerly CPBP 350] FALL, SPRING, SUMMER. [1-6] TBA

CPBP 8999. Non-Candidate Research. [Formerly CPBP 379] Research prior to entry into candidacy (completion of qualifying examination) and for special non-degree students. FALL, SPRING, SUMMER. [0-12]

CPBP 9999. Ph.D. Dissertation Research. [Formerly CPBP 399]

Chemistry

CHEM 5010. Inorganic Chemistry. A survey of modern inorganic chemistry including coordination compounds and the compounds of the main-group elements. Representative reactions and current theories are treated. No credit for students who have earned credit for 3010. [3]

CHEM 5020. Introduction to Bioinorganic Chemistry. (Also listed as CHEM 3020) Functions of inorganic elements in living cells. The manner in which coordination can modify the properties of metallic ions in living systems. No credit for students who have earned credit for 3020. [3]

CHEM 5030. Physical Methods in Inorganic Chemistry. [Formerly CHEM 306] Application of spectroscopic methods to inorganic chemistry. Discussion of symmetry and group theory as required for the use of spectroscopic methods is also included. [3]

CHEM 5040. Nanoparticles. [Formerly CHEM 305] Bottom-up synthetic schemes for nanoparticle construction; characterization techniques; consequences of quantum confinement, and surface area enhancement; design for specific applications. No credit for students who earned credit for 304 section 1 in fall 2011 or spring 2013. Prerequisite or corequisite: 3010. [3]

CHEM 5050. Introduction to Organometallic Chemistry. (Also listed as CHEM 4050) A general description of the preparation, reaction chemistry, molecular structure, bonding, and spectroscopic identification of organometallic compounds of the transition metals. No credit for students who have earned credit for 4050. [3]

CHEM 5120. Instrumental Analytical Chemistry. (Also listed as CHEM 3120) Chemical and physical principles of modern analytical chemistry instrumentation. No credit for students who have earned credit for 3120. [3]

CHEM 5130. Advanced Analytical Chemistry. [Formerly CHEM 313] Design and analysis of experimental data, instrumental design, and analytical surface science. [1-3]

CHEM 5140. Analytical Mass Spectrometry. [Formerly CHEM 311] Theory, design, and interpretation of mass spectrometry instrumentation and experiments. [3]

CHEM 5150. Electrochemistry: Theory and Analysis. [Formerly CHEM 312] [3]

CHEM 5160. Separation Methods: A Practical Approach. [Formerly CHEM 315] Theories of separation science; distillation, capillary electrophoresis, membrane separation, and supercritical fluid extraction; emphasis on chromatography. [3]

CHEM 5170. Analytical Optical Methods. [Formerly CHEM 314A] Analytical spectroscopy and biomedical imaging. [3]

CHEM 5209. Organic Chemistry Structure and Mechanism. [Formerly CHEM 320A] The first half of 5210. Theory, models, and description of chemical bonding. Stereochemistry, and conformational analysis. Reaction thermodynamics, kinetics, and mechanism. Not open to students who have earned credit for CHEM 4210 or 5210 without permission. Total credit earned for this course and CHEM 4210 or 5210 will not exceed 4 hours. Credit reduced from most recent course taken (or from test or transfer credit) as appropriate. Prerequisite: One year of organic chemistry. [2]

CHEM 5210. Organic Structure, Mechanism, and Reactions. [Formerly CHEM 320] Theory, models, and description of chemical bonding.

Stereochemistry, and conformational analysis. Reaction thermodynamics, kinetics, and mechanism. Synthetic transformations employed in small molecule synthesis. Serves as repeat credit for CHEM 4210. Not open to students who have earned credit for CHEM 5209 without permission. Total credit earned for this course and CHEM 5209 will not exceed 4 hours. Credit reduced from most recent course taken (or from test or transfer credit) as appropriate. Prerequisite: One year of organic chemistry. [4]

CHEM 5220. Spectroscopic Identification of Organic Compounds. (Also listed as CHEM 3220) Theoretical and practical aspects of spectroscopic methods, with an emphasis on NMR spectroscopy, for structural characterization of organic compounds. No credit for students who have earned credit for 3220. [3]

CHEM 5230. Physical Organic Chemistry. (Also listed as CHEM 4230) Structure and bonding in organic molecules. Reactive intermediates and organic reaction mechanisms. No credit for students who have earned credit for 4230. [3]

CHEM 5240. Advanced Organic Reactions. (Also listed as CHEM 4240) A comprehensive study of organic reactions and their application to the preparation of small molecules. Three lectures per week. No credit for students who have earned credit for 4240. [3]

CHEM 5310. Biophysical Chemistry: Thermodynamics in Chemical and Biological Systems. (Also listed as CHEM 3310) Chemical thermodynamics and equilibrium, their statistical foundation, and applications to chemical and biological phenomena in biomedical research. No credit for students who have earned credit for 3310. [3]

CHEM 5320. Quantum Chemistry. [Formerly CHEM 338] Limits of classical mechanics at the atomic and molecular level; postulates of quantum mechanics applied to problems in one, two, and three dimensions; perturbation and other methods. Prerequisite: 3300 or equivalent. [3]

CHEM 5330. Spectroscopy. [Formerly CHEM 339] Experimental and theoretical aspects of spectroscopy. Energy levels, selection rules, and spectral transitions related to atomic and molecular structure. Design of contemporary magnetic resonance and optical spectroscopy measurements. Prerequisite: 3310. [3]

CHEM 5340. Applications of Group Theory. [Formerly CHEM 340] Molecular symmetry, point groups, and character tables. Application to molecular orbitals, vibrational spectra, organic and inorganic systems. [3]

CHEM 5350. Statistical Thermodynamics. [Formerly CHEM 331] Statistical mechanics and chemical equilibrium; distribution laws, partition functions, and thermodynamic properties of atoms and molecules; applications to gases, liquids, and solids. Prerequisite: 232. [3]

CHEM 5360. Advanced Quantum Chemistry. [Formerly CHEM 330] Advanced topics in the application of quantum mechanics to chemical bonding and spectroscopy. Prerequisite: 5320. [3]

CHEM 5410. Molecular Modeling Methods. [Formerly CHEM 333] Computer simulation studies of molecules with emphasis on applications to biological molecules and complexes. Background theory, implementation details, capabilities and practical limitations. Prerequisite: 3300 and 3310. Includes one three hour laboratory per week. Serves as repeat credit for students who completed 233 prior to fall 2010. [4]

CHEM 5420. Computational Structural Biochemistry. [Formerly CHEM 337] Theoretical and practical aspects of protein sequence alignments, secondary structure prediction, comparative modeling, protein-protein and protein-ligand docking. Structure-based drug design, virtual screening, quantitative structure activity relations, cheminformatics, and pharmacophore mapping in therapeutic development. Prerequisite: 3310. Serves as repeat credit for students who completed 238 prior to fall 2010. [4]

CHEM 5600. Chemical Literature. (Also listed as CHEM 3600) Assigned readings and problems in the nature and use of the chemical literature. No credit for students who have earned credit for 3600. [1]

CHEM 5610. Chemistry of Inorganic Materials. [Formerly CHEM 350A] Chemical synthesis, processing, characterization, and applications of inorganic materials. Molecular precursor routes to inorganic solids. Structure and bonding properties of materials at the atomic, molecular, or extended

molecular level and their relationship to desired properties. Carbon-based materials (graphene, fullerenes, diamond), ceramics and zeolites, semiconductors, electronic, magnetic, and optical materials, and nanomaterials. Prerequisite: General chemistry. Serves as repeat credit for students who completed 350 in fall 2011, fall 2009, or fall 2007. [3]

CHEM 5620. Chemistry of Biological Materials. [Formerly CHEM 350B] The synthesis, directed self-assembly, and hierarchical organization of naturally occurring materials. Engineering of new bioinspired artificial materials for diverse applications. Materials and devices from DNA, genetic reprogramming of the design of new materials. Peptide-, protein-, and carbohydrate-based materials. Biomineralization, biomimetic systems, and complexity in self-assembly. [3]

CHEM 5630. Macromolecular Chemistry: Polymers, Dendrimers, and Surface Modifications. (Also listed as CHEM 3630) Synthesis and characterization of macromolecular materials including linear, branched, dendrimetric, and star polymers. Mechanical and physicochemical properties of polymeric types. Kinetics of living polymerization. Applications to nanostructures, templates, and advanced devices. No credit for students who have earned credit for 3630. [3]

CHEM 5710. Bioorganic Chemistry. (Also listed as CHEM 3710) Essential metabolites including vitamins, steroids, peptides, and nucleotides. Consideration of phosphate esters and the synthesis of oligodeoxynucleotides. Three lectures per week. No credit for students who have earned credit for 5710. [3]

CHEM 5720. Drug Design and Development. (Also listed as CHEM 4720) Concepts of drug design; physical chemistry of drug interactions with receptors, enzymes, and DNA; drug absorption and distribution. Organic chemistry of drug metabolism; mechanism of action for selected therapeutic classes. No credit for students who have earned credit for 4720. [3]

CHEM 6050. Special Topics in Inorganic Chemistry. [Formerly CHEM 304] [3]

CHEM 6150. Special Topics in Analytical Chemistry. [Formerly CHEM 314B] [3]

CHEM 6250. Special Topics in Organic Chemistry. [Formerly CHEM 324] [1-3]

CHEM 6340. Special Topics in Chemical Physics. [Formerly CHEM 332] [3]

CHEM 6900. Professional Development. [Formerly CHEM 301A] Grant writing, from specific aims and development of hypotheses to broader impact statements. The curriculum vitae, the "three-minute thesis" pitch, scientific presentations, and responsible conduct in research. Open only to chemistry graduate students. May be repeated for credit once for a total of two credit hours. [1]

CHEM 6901. Introduction to Research. [Formerly CHEM 380] Introduction to chemical research under the guidance of individual faculty members. Students participate in three rotations among faculty research groups and provide graded work. For chemistry graduate students only. [1-2]

CHEM 6902. Practicum in Chemistry Instruction. [Formerly CHEM 360] Preparation for and the teaching of chemistry to undergraduate students. No credit for chemistry graduate students. [0]

CHEM 6903. Advanced Reading in Chemistry. [Formerly CHEM 385] Specialized topics under the guidance of a departmental faculty member. Open to qualified graduate students only. [3]

CHEM 7999. Master's Thesis Research. [Formerly CHEM 369] [0-12]

CHEM 8999. Non-candidate Research. [Formerly CHEM 379] Research prior to entry into candidacy (completion of Qualifying Examination) and for special non-degree students. [Variable credit: 0-12]

CHEM 9999. Ph.D. Dissertation Research. [Formerly CHEM 399] [0-12]

Chinese

CHIN 5101. Elementary Chinese I. (Also listed as CHIN 1101) Introduction to Modern Chinese pronunciation, grammar, conversation, reading,

and writing. Two hours of lecture and three hours of drill per week. No credit for students who have earned credit for a more advanced Chinese language course. No credit for students who have earned credit for 1101. [5]

CHIN 5102. Elementary Chinese II. (Also listed CHIN 1102) Continuation of 5101. Introduction to Modern Chinese pronunciation, grammar, conversation, reading, and writing. Two hours of lecture and three hours of drill per week. No credit for students who have earned credit for a more advanced Chinese language course. No credit for students who have earned credit for 1102. [5]

CHIN 5110. Calligraphy. (Also listed as CHIN 1110) Basic skills of writing standard script kaishu. Basic aesthetic of Chinese calligraphy. No Chinese language background necessary. No credit for students who have earned credit for 1231. [1]

CHIN 5201. Intermediate Chinese I. (Also listed as CHIN 2201) Oral and written language training. Two hours of lecture and three hours of drill per week. No credit for students who have earned credit for a more advanced Chinese language course. Prerequisite: 1102. [5]

CHIN 5202. Intermediate Chinese II. (Also listed as CHIN 2202) Continuation of 2201. Language training in oral and written Chinese. Two hours of lecture and three hours of drill per week. No credit for students who have earned credit for a more advanced Chinese language course. Prerequisite: 2201. [5]

CHIN 5301. Advanced Chinese I. (Also listed as CHIN 3301) Readings in Chinese culture to enhance proficiency in oral and written Chinese. No credit for students who have earned credit for a more advanced Chinese language course. No credit for students who have earned credit for 3301. [3]

CHIN 5302. Advanced Chinese II. (Also listed as CHIN 3302) Readings in Chinese culture to enhance proficiency in oral and written Chinese. No credit for students who have earned credit for a more advanced Chinese language course. No credit for students who have earned credit for 3302 or 3302W. [3]

CHIN 5401. Business Chinese I. (Also listed as CHIN 4401) Language skills for listening, speaking, reading, and writing in business environments. Modern China from economic and business perspectives. No credit for students who have earned credit for a more advanced Chinese language course. No credit for students who have earned credit for 4401. [3]

CHIN 5402. Business Chinese II. (Also listed as CHIN 4402) Continuation of 5402. Language skills for listening, speaking, reading, and writing in business environments. Modern China from economic and business perspectives. No credit for students who have earned credit for 4402. [3]

CHIN 5403. Readings in Modern Chinese Media. (Also listed as CHIN 4403) Books, newspapers, Internet, and television documents and productions pertaining to political, social, and economic issues in China, including foreign trade-related issues. No credit for students who have earned credit for 4403. [3]

CHIN 5404. Readings in Modern Chinese Media. (Also listed as CHIN 4404) Books, newspapers, and Internet sources pertaining to political, social, and cultural issues. No credit for students who have earned 4404. [3]

CHIN 5405. Classical Chinese Literature and Philosophy. (Also listed as CHIN 4405) Classical writings by Confucius, Sunzi, and Zhuangzi. Poems by Li Bai and Du Fu. Excerpts from *The Dream of the Red Chamber*. Linguistic comparisons between classical and modern Chinese. No credit for students who have earned credit for 4405. [3]

CHIN 5406. Readings in Modern Literary Chinese. (Also listed as CHIN 4406) 1910 to the present. Chinese literature and poetry. Linguistic transformations that produced modern literary Chinese. No credit for students who have earned credit for 4406. [3]

CHIN 5851. Independent Study. (Also listed as CHIN 3851) Designed primarily for majors who want to study Chinese not regularly offered in the curriculum. Must have consent of instructor. May be repeated for a total of 12 credits in 5851 and 5852 combined if there is no duplication in topic, but students may earn only up to 3 credits per semester of enrollment. [1-3;

maximum 12 credits total for all semesters of CHIN 5851 and 5852.] No credit for students who have earned credit for 3851.

CHIN 5852. Independent Study. (Also listed as CHIN 3852) Designed primarily for majors who want to study Chinese not regularly offered in the curriculum. Must have consent of instructor. May be repeated for a total of 12 credits in 5851 and 5852 combined if there is no duplication in topic, but students may earn only up to 3 credits per semester of enrollment. [1-3; maximum 12 credits total for all semesters of CHIN 5851 and 5852.]

Civil Engineering

CE 5100. Geographic Information Systems (GIS). (Also listed as CE 4100) Principles of computerized geographic information systems (GIS) and analytical use of spatial information. Integration with global positioning systems (GPS) and internet delivery. Includes GIS software utilization and individual projects. No credit for students who have earned credit for 4100. SPRING. [3]

CE 5150. Energy Systems Engineering. (Also listed as CE 4150) Physical principles of energy conversion. Energy sources and usage. Sustainability and carrying capacity. Systems tools and economics for energy systems. Energy distribution and storage. Future energy system design. SPRING. [3]

CE 5200. Advanced Structural Steel Design. (Also listed as CE 4200) Advanced topics in column and beam design including local buckling, composite beams, plate girders, and torsion design. Behavior and design of bolted and welded connections. Structural planning and design of structural systems such as multistory buildings including computer applications. No credit for students who have earned credit for 4200. FALL. [3]

CE 5210. Advanced Reinforced Concrete Design. (Also listed as CE 4210) Design and behavior of two-way slab systems. Yield line theory. Shear and torsion analysis and design. Serviceability requirements and control of deflections of reinforced concrete systems. Prestressed concrete. No credit for students who have earned credit for 4210. SPRING. [3]

CE 5240. Infrastructure Systems Engineering. (Also listed as CE 4240) Systems-level approach to the infrastructure of the built environment. Elements of systems engineering. Case studies of infrastructure under duress. Smart infrastructure. Transportation, building, and water and wastewater supply and distribution systems. Infrastructure interdependencies and concepts of smart cities. Applications to infrastructure system design. FALL. [3]

CE 5250. Foundation Analysis and Design. (Also listed as CE 4250) Study of shallow and deep foundation elements and systems for civil engineering structures. Soil exploration and site investigation. No credit for students who have earned credit for 4250. SPRING. [3]

CE 5300. Reliability and Risk Case Studies. (Also listed as CE 4300) Review of historical events involving successes and failures in managing system reliability and risk from a wide range of perspectives, including design, production, operations, organizational culture, human factors and exogenous events. Analysis of risk factors leading to event occurrence, as well as event consequences in terms of impacts to public health, safety, security and environmental protection. Evaluation of risk mitigation strategies based on achievable goals, technical and political feasibility, and economic impact. Cases drawn from natural disasters, industrial accidents, and intentional acts. No credit for students who have earned credit for CE 4300. FALL. [3]

CE 5320. Data Analytics for Engineers. (Also listed as CE 4320) Programming, analysis, and visualization of real data for the purposes of informing decision making in engineering problems. Statistical modeling in a practical and applied perspective; application of data analytics to bridge the gap between data and decisions; fundamentals of design of experiments. No credit for students who have earned credit for CE 4320. FALL. [3]

CE 5340. Risk and Decision Analysis. (Also listed as CE 4340) Risk quantification, risk perception, decision-making under uncertainty, risk communication. Model risk and decisions using analytical and simulation approaches. Focus on theory and methodology, applications in engineering, environmental systems, business, and healthcare. No credit for students who have earned credit for CE 4340. FALL. [3]

CE 5400. Construction Project Management. (Also listed as CE 4400) Theory and application of the fundamentals of construction project management. The construction process and the roles of professionals in the process. Overview of the construction project from conception through completion. Application of management practices including planning, directing, cost minimizing, resource allocation, and control of all aspects of construction operations and resources. No credit for students who have earned credit for 4400. FALL. [3]

CE 5401. Advanced Construction Project Management. (Also listed as CE 4401) Current and critical issues in the construction industry, including best practices developed at the Construction Industry Institute (CII). Guest lecturers include representatives of the CII and visiting industry leaders. No credit for students who have earned credit for 4401. FALL. [3]

CE 5405. Construction Estimating. (Also listed as CE 4405) Estimation of material, labor, and equipment quantities, including costing and pricing of construction projects. Application of estimating practices using real-world examples and project estimating software. Corequisite: CE 5400. No credit for students who have earned credit for 4405. FALL. [3]

CE 5410. Construction Planning and Scheduling. (Also listed as CE 4410) Fundamentals of construction planning and scheduling. Application of management practices including: process planning; directing, costing; resource allocation; and controlling all aspects of construction operations and resources, from pre-construction through operation and maintenance. Use of real-world examples and project scheduling software. No credit for students who have earned credit for 4410. SPRING. [3]

CE 5415. Construction Materials and Methods. (Also listed as CE 4415) Implications of design realities, material specifications, code limitations, and regulations on the construction process. Natural and man-made materials, construction techniques, and other issues that impact quality, constructability, and life-cycle assessment. No credit for students who have earned credit for 4415. SUMMER. [3]

CE 5420. Construction Law and Contracts. (Also listed as CE 4420) Review of case studies involving successes and failures in legal principles and landmark cases relevant to civil engineering and construction. Contracts, torts, agency and professional liability, labor laws, insurance, expert testimony, arbitration, patents and copyrights, sureties, and ethics. No credit for students who have earned credit for 4420. SPRING. [3]

CE 5425. Building Information Modeling. (Also listed as CE 4425) Generation and management of building data during its life cycle. Three-dimensional, real-time, dynamic modeling to increase productivity in building design and construction. Considerations of building geometry, spatial relationships, geographic information, and building components. No credit for students who have completed 4425. FALL. [3]

CE 5430. High Performance and Green Buildings. (Also listed as CE 4430) Design and construction of high performance buildings and related systems in buildings. Leadership in Energy and Environmental Design (LEED) green Building Rating System (TM) building approach to sustainability. No credit for students who have earned credit for 4430. SPRING. [3]

CE 5500. Transportation System Design. (Also listed as CE 4500) Geometric analysis of transportation ways with particular emphasis on horizontal and vertical curve alignment. Design of highways, interchanges, intersections, and facilities for air, rail, and public transportation. No credit for students who have earned credit for 4500. SPRING. [3]

CE 5505. Urban Transportation Planning. (Also listed as CE 4505) Analytical methods and the decision-making process. Transportation studies, travel characteristic analysis, and land-use implications are applied to surface transportation systems. Emphasis is on trip generation, trip distribution, modal split, and traffic assignment. Computerized planning programs are used. No credit for students who have earned credit for 4505. SPRING. [3]

CE 5510. Traffic Engineering. (Also listed as CE 4510) Analysis of the characteristics of traffic, including the driver, vehicle, volumes, speeds, capacities, roadway conditions, and accidents. Traffic regulation, control, signing, signalization, and safety programs are also discussed. No credit for students who have earned credit for 4510. FALL. [3]

CE 5884. Internship. Internship working in a professional setting. Intended for M.Eng. students in the area of construction management. Corequisite: CE 5400. [0]

CE 5999. Special Topics. (Also listed as CE 3890) No credit for students who have earned credit for 3890. [3]

CE 6200. Continuum Mechanics. [Formerly CE 301] Mathematical preliminaries: tensor algebra, tensor calculus, coordinate transformation, principal values and directions. Kinematics of continuum: motion and deformation, infinitesimal and finite strain theory, balance of mass. Stress and integral formulations: traction on planes, stress invariants and failure theories, Piola-Kirchhoff stress tensors, balance of momentum, stress power. Elastic solid: linear isotropic and anisotropic elasticity, engineering material constants, plane elastic waves, non-linear isotropic elasticity. FALL. [3]

CE 6205. Theory of Inelasticity. [Formerly CE 302] Physical mechanisms of deformation and failure. Modern theories of plasticity, viscoplasticity and continuum damage mechanics. Thermodynamics of plasticity and damage processes. Numerical and computational aspects of inelastic deformation mechanisms in solids and structures. SPRING. [3]

CE 6210. Finite Element Analysis. [Formerly CE 307] Discrete modeling of problems of the continua. Mathematical basis of finite element method-weighted residual and variational concepts. Finite element formulations; displacement, force, and mixed methods. 1-D problems of the continua and finite element solution-C0 and C1 elements, eigenvalue and transient problems. Error checks and control. Mapping, shape functions, numerical quadrature, and solution of equations. Formulation of 2-D problems (single and multi-field)-mapping and shape functions, triangular and quad elements with straight or curved boundaries. 3-D elements, singular problems, buckling, and nonlinear problems. Error estimation and quality control. Computer implementation. Commercial packages. Prerequisite: MATH 2410, MATH 3620. FALL. [3]

CE 6212. Advanced Computational Mechanics. [Formerly CE 308] Nonlinear mechanics, geometric and material nonlinearities. Discrete Lagrangian, Eulerian and other formulations. Nonlinear material models. Numerical solution algorithms in space and time. Solution of nonlinear (second-order and higher) problems. Multi-disciplinary problems. Error estimation and adaptive model improvement. Multi-scale modeling and atomistic/continuum coupling. Prerequisite: CE 6210. SPRING. [3]

CE 6215. Structural Dynamics and Control. [Formerly CE 309] Analysis of single- and multi-degree-of-freedom systems. Modal superposition method. Time and frequency domain analyses. Numerical methods and nonlinear dynamic analysis. Application to structures subject to earthquake and impact forces. Elements of feedback control systems. Control of lumped parameter systems. Active, passive, and hybrid mass dampers. Application to simple building and bridge structures. SPRING. [3]

CE 6300. Probabilistic Methods in Engineering Design. [Formerly CE 310] Applications of probabilistic methods in the analysis and synthesis of engineering systems. Review of basic probability concepts, random variables and distributions, modeling and quantification of uncertainty, testing the validity of assumed models, linear regression and correlation analyses, Monte Carlo simulation, reliability analysis and reliability-based design. Prerequisite: MATH 2410. FALL. [3]

CE 6305. Engineering Design Optimization. [Formerly CE 311] Methods for optimal design of engineering systems. Optimization under uncertainty, reliability-based design optimization, robust design, multidisciplinary problems, multi-objective optimization. Discrete and continuous design variables, advanced numerical algorithms, and formulations and strategies for computational efficiency. Practical applications and term projects in the student's area of interest. Prerequisite: MATH 4630, MATH 4620 or CE 6300. [3]

CE 6310. Uncertainty Quantification. [Formerly CE 313] Computational methods for analysis and design of modern engineering systems under uncertainty. Emphasis on epistemic uncertainty due to data and models. Topics include stochastic finite elements; time-dependent reliability; Bayesian methods and networks; surrogate modeling; advanced simulation; global sensitivity analysis; model verification, validation, and calibration; and opti-

mization under uncertainty. Applications to practical engineering systems. Prerequisite: CE 6300. SPRING. [3]

CE 6313. Multiscale Modeling. [Formerly CE 314] State-of-the-art and emerging multiscale computational methods for modeling of mechanics, transport, and materials phenomena. Principles of information transfer between multiple spatial and temporal scales, including atomistic-to-continuum coupling, continuum-to-continuum coupling, and bridging of time scales. Enrichment methods including generalized finite elements, partition of unity, variational multiscale methods. FALL. [3]

CE 6318. Prestressed Concrete. [Formerly CE 318] Behavior and design of statically determinate prestressed concrete structures under bending moment, shear, torsion, and axial load effects. Design of statically determinate prestressed structures such as continuous beams, frames, slabs and shells. Creep and shrinkage effects and deflections of prestressed concrete structures. Application to the design and construction of bridges and buildings. Prerequisite: CE 3205. [3]

CE 6351. Public Transportation Systems. [Formerly CE 351] Comprehensive study of public transportation, with emphasis on planning, management, and operations; paratransit, ridesharing, and rural public transportation systems. Prerequisite: CE 4505. SPRING. [3]

CE 6353. Airport Planning and Design. [Formerly CE 353] Integration and application of the principles of airport master planning from the beginning stages of site selection through actual design of an airport facility. Specific study topics address demand forecasting, aircraft characteristics, capacity analyses, and geometric design of runways, terminals, and support facilities. Prerequisite: CE 3601. [3]

CE 6355. Advanced Transportation Design. [Formerly CE 355] In-depth view of the transportation design process. Complex transportation design problems and solutions, with the use of computer-based analytical design tools. Comprehensive design projects. Prerequisite: CE 4500. SPRING [3]

CE 6356. Advanced Transportation Planning. [Formerly CE 356] A continuation of the concepts from CE 4505, with emphasis on analytical techniques used in forecasting travel. Use of computer-based models, along with transportation and energy contingency planning methods. Prerequisite: CE 4505. SPRING [3]

CE 6357. Theory of Traffic Flow. [Formerly CE 357] A study of traffic flow from the perspective of probability as applied to highway, intersection and weaving capacities. Discrete and continuous flow, vehicle distributions, queuing, and simulation. Prerequisite: CE 4510. [3]

CE 6359. Emerging Information Systems Applications. [Formerly CE 359] Role of emerging information systems technologies in improving productivity and efficiency and in managing engineering operations. Design of integrated approaches to enhance the speed, accuracy, reliability, and quantity of information available for decision support. Emphasis on case studies of innovative applications in transportation and manufacturing, leading to individual and group projects requiring new product development. Prerequisite: Background in transportation or manufacturing operations. FALL. [3]

CE7899. Master of Engineering Project. [Formerly CE 389]

CE 7999. Master's Thesis Research. [Formerly CE 369] [0-6]

CE 8000. Individual Study of Civil Engineering Problems. [Formerly CE 325A] Literature review and analysis of special problems under faculty supervision. FALL, SPRING, SUMMER. [1-4 each semester]

CE 8001. Individual Study of Civil Engineering Problems. [Formerly CE 325B] Literature review and analysis of special problems under faculty supervision. FALL, SPRING, SUMMER. [1-4 each semester]

CE 8002. Individual Study of Civil Engineering Problems. [Formerly CE 325C] Literature review and analysis of special problems under faculty supervision. FALL, SPRING, SUMMER. [1-4 each semester]

CE 8300. Reliability and Risk Engineering Seminar. [Formerly CE 371A] Perspectives on reliability and risk assessment and management of multi-disciplinary engineering systems. Topics on infrastructure and environmental systems, mechanical, automotive, and aerospace systems; network systems (power distribution, water and sewage systems, transpor-

tation etc.); manufacturing and construction; and electronic and software systems. FALL, SPRING. [1]

CE 8301. Reliability and Risk Engineering Seminar. [Formerly CE 371B] Seminars by expert speakers provide a wide range of perspectives on reliability and risk assessment and management of multidisciplinary engineering systems. Topics on infrastructure and environmental systems; mechanical, automotive, and aerospace systems; network systems (power distribution, water and sewage systems, transportation, etc.); manufacturing and construction; and electronic and software systems. FALL, SPRING. [1]

CE 8999. Non-Candidate Research. [Formerly CE 379] Research prior to entry into candidacy (completion of qualifying examination) and for special non-degree students. [Variable credit: 0-12]

CE 9999. Ph.D. Dissertation Research. [Formerly CE 399]

Classics

CLAS 5000. Classical Tradition in America. (Also listed as CLAS 3000) Influences of classical Greece and Rome on the literature, politics, architecture, and values of the United States from the colonial period to the present. No credit for students who have earned credit for 3000. [3]

CLAS 5010. The Ancient Origins of Religious Conflict in the Middle East. (Also listed as CLAS 3010) Religious oppositions in the eastern Mediterranean world from the Maccabean revolt to the Muslim conquests of the seventh century; beginnings of religious militancy; challenges of monotheism to Greco-Roman civilization; conversion, persecution, and concepts of heresy and holy war in Christianity, Judaism, and Islam. No credit for students who have earned credit for 3010. [3]

CLAS 5100. History of the Ancient Near East. (Also listed as CLAS 2100) From the neolithic period to the conquests of Alexander the Great, in the geographical area from Persia to Troy and Egypt. Special attention to the history of Israel. No credit for students who have earned credit for 2100. [3]

CLAS 5110. History of Greece to Alexander the Great. (Also listed as CLAS 2110) The Greek world from the beginning of the Mycenaean Age (1650 B.C.) to the end of the Classical period. Special attention to the relationship between political history and the development of Hellenism. No credit for students who have earned credit for CLAS 2110. [3]

CLAS 5120. The Greek World from Alexander the Great to the Roman Empire. The eastern Mediterranean from the rise of Macedon and Alexander the Great to the High Roman Empire. Social, cultural, political, and religious changes. Issues of imperialism and colonialism, and questions of identity in a geographically expansive Greek world. [3]

CLAS 5150. History of the Roman Republic. (Also listed as CLAS 2150) The growth and evolution of the Roman world, from the foundation of the city in the seventh century B.C. to the reign of Caesar Augustus. The Romans' unification of Italy, conquest of the Mediterranean and western Europe, adoption of Hellenism, and overthrow of the Republic. No credit for students who have earned credit for 2150. [3]

CLAS 5160. History of the Roman Empire. (Also listed as CLAS 2160) The Roman world from Augustus to the collapse of the western empire in the fifth century. Political, military, social, and religious history. Special attention given to problems arising from use of the primary sources as well as to controversies in modern scholarship. No credit for students who have earned credit for 2160. [3]

CLAS 5180. From Late Antiquity to Islam. (Also listed as CLAS 2180) The Eastern Roman Empire from Constantine to the Arab conquests. Political, social, cultural, and religious history, including monasticism, barbarian invasions, and the changing roles of the Emperor and Church. Special attention to developments in urban life and landscape. No credit for students who have earned credit for 2180. [3]

CLAS 5200. Archaic and Classical Greek Art and Architecture, 1000 to 400 B.C.E. (Also listed as CLAS 2200) Sculpture, vase painting, architecture, and the minor arts. Formal and stylistic developments in relation

to changing cultural background. No credit for students who have earned credit for HART 2200 or 2220. [3]

CLAS 5210. Late Classical Greek and Hellenistic Art and Architecture. (Also listed as CLAS 2210) Sculpture, vase painting, architecture, and the minor arts from after the Parthenon to the Roman Empire. Media that developed significantly in this period, such as wall painting and mosaic. No credit for students who have earned credit for HART 2220. No credit for students who have earned credit for 2210. [3]

CLAS 5250. Roman Art and Architecture. (Also listed as CLAS 2250) Sculpture, architecture, and painting from the tenth century B.C.E. to the early fourth century C.E. Daily life of the Romans as seen in excavations of the towns of Pompeii and Herculaneum. No credit for students who have earned credit for 2250. [3]

CLAS 6030. Death, Disease, and Health in the Ancient World. From the Bronze Age to early Christianity and Late Antiquity. Biological history of the Greeks, Romans, and other Mediterranean peoples. Changing concepts of death and afterlife; interpretations of disease; medical thought and practice. Healing, epidemics, natural catastrophe, and dietary variation. Evidence from classical literature, archaeology, bones and teeth. [3]

CLAS 6100. Women, Sexuality, and the Family in Ancient Greece and Rome. (Also listed as CLAS 3100) The status and role of women, law and the regulation of the private sphere, sexuality and gender roles, demography and family structure, marriage, children, religion, domestic architecture and the household economy, ancient critiques of the family, and the impact of Christianity. No credit for students who have earned credit for 3100. [3]

CLAS 6110. Warfare in the Ancient Mediterranean. [Formerly CLAS 226] Continuity and change in ancient Greek and Roman warfare 800 B.C. to A.D. 120. Social, political, and religious aspects of war. Effects of war, imperialism, and militarism on internal and external populations. [3]

CLAS 6120. Humor, Ancient to Modern. (Also listed as CLAS 3120) Ancient comic forms juxtaposed with modern theories of humor. Aristophanic Old Comedy, New Comedy, and Satire. Modern parallels. No credit for students who have earned credit for 3120. [3]

CLAS 6150. Roman Law. (Also listed as CLAS 3150) The relationship between law and society as illustrated by cases drawn from Roman legal and literary sources. The development of legal reasoning and the rise of an autonomous legal profession at Rome. No credit for students who have earned credit for 3150. [3]

CLAS 6160. Roman Law and Social History. (Also listed as CLAS 3160) Relationship of law and society as illustrated by legal, literary, epigraphic, and papyrological evidence. Views and methodologies of leading modern scholars. Focus on methodology. Marriage, family, personal status, the economy, and judicial system. Basic familiarity with Roman history or law is expected. [3]

CLAS 6190. Augustan Rome. (Also listed as CLAS 3190W) Social, administrative, religious, and military reforms. Common themes in art, architecture, and literature; changes in national identity in the transition from Republic to Empire. No credit for students who have earned credit for 3190W. [3]

CLAS 6200. The Greek City. (Also listed as CLAS 3200) The example of ancient Athens. The stoa, the theatre, the house, and fortifications. Institutions such as the courts, the public assembly, and the family. Literary, historical, archaeological, and philosophical sources. No credit for students who have earned credit for HART 263. No credit for students who have earned credit for 3200. [3]

CLAS 6210. The Archaeology of Greek Sanctuaries. (Also listed as CLAS 3210) Study of ancient Greek religious worship through an examination of temples, altars, cult images, votives, priests, and processions. Panhellenic sanctuaries and oracular and mystery cults. No credit for students who have earned credit for 3700 or 3210. [3]

CLAS 6220. The Trojan War in History, Art, and Literature. (Also listed as CLAS 3220) Representations in Classical Greek art, literature, and archaeological evidence. The composition of the Homeric epics; the meaning of the Trojan War to later audiences. No credit for students who have earned credit for 3220. [3]

CLAS 6230. Alexander the Great. (Also listed as CLAS 3230) Alexander's rise to power and conquests in Europe, Asia, and Africa; the legacy of his introduction of Greek culture to the East; his significance to later audiences. Offered on a graded basis only. No credit for students who have earned credit for 3230. [3]

CLAS 6240. The Parthenon, the Akropolis, and Fifth Century Athens. (Also listed as CLAS 3210) Ancient Athens in the fifth century BCE. Art, architecture, literature, history, and historical evidence for religious and political life in the city. No credit for students who earned credit for 295 or 295W prior to fall 2014. [3]

CLAS 6300. Akkadian. (Also listed as CLAS 3300) Introduction to the cuneiform script and to the grammar of Akkadian, the language of ancient Mesopotamia. Selected readings in Old Babylonian (CODEX Hammurabi, Mari letters) and Neo-Assyrian texts (Creation Poem, Gilgamesh Epic). No credit for students who have earned credit for 3300. [3]

CLAS 6301. Akkadian. (Also listed as CLAS 3301) Continuation of 6300. Introduction to the cuneiform script and to the grammar of Akkadian, the language of ancient Mesopotamia. Selected readings in Old Babylonian (CODEX Hammurabi, Mari letters) and Neo-Assyrian texts (Creation Poem, Gilgamesh Epic). No credit for students who have earned credit for 3301. [3]

CLAS 6310. Culture of the Ancient Near East. (Also listed as CLAS 3310) A survey of highly sophisticated Near East cultures of the last three millennia before the common era (B.C.). Discussion of political histories, and the social, religious, and intellectual heritage of Mesopotamia, Egypt, and Anatolia through excavated artifacts and written documents. No credit for students who have earned credit for 3310. [3]

CLAS 6320. The Amarna Age. (Also listed as CLAS 3320) The Amarna period from the sixteenth through the twelfth centuries B.C.E., as illumined by excavations of palaces and temples in Egypt, Anatolia, Canaan, and Mesopotamia as well as the vast historical, legal, and literary documents of the period. Focus on the internationalism and theological speculation of the period as seen through the powerful personalities and accomplishments of leaders such as Thutmoses III, Suppiluliumas, Ramses II, and the spiritually influential Akehnaten. No credit for students who have earned credit for 3320. [3]

CLAS 7000. Seminar in Classics. [Formerly CLAS 355] May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

CLAS 7100. Seminar: Studies in Ancient History. [Formerly CLAS 309] May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

CLAS 7200. Seminar in Classical Art and Architecture. [Formerly CLAS 305] May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

CLAS 7850. Independent Study. [Formerly CLAS 398] An individual reading and study program on an author or area of classical antiquity not treated in the regular curriculum. No formal instruction is given, but the student's work is supervised and evaluated by one or more members of the staff. Open only to students who have completed one year of graduate study in classics. May be repeated for a total of 12 credits, but students may earn only up to 3 credits per semester of enrollment. [1-3; maximum of 12 credits for all semesters of CLAS 7850]

CLAS 7999. Master's Thesis Research. [Formerly CLAS 369] [0-12]

Communication of Science and Technology

CSET 5100. Science Communication Tools and Techniques. (Also listed as CSET 2100) Translating technical research for a general readership. Benefits and limitations of different formats, texts, and media for telling stories about science. No credit for students who earned credit for 150 in fall 2011 or fall 2012. No credit for students who earned credit for CMST 237 before fall 2013. No credit for students who have earned credit for 2100. [3]

CSET 5200. Technical Writing. Introduction to technical and professional composition for careers in science, business, and industry. Prerequisite: major or minor in Communication of Science and Technology. Open to other students with permission of instructor. [3]

CSET 5890. Special Topics. Topics as announced. May be repeated for credit more than once if there is no duplication in topic, but students may earn only 3 credits per semester of enrollment. [3]

CSET 6100. Science Policy Bootcamp, from Concept to Conclusion. Interdisciplinary service learning. Trends that shape science and innovation policy. Active policy-making. Prerequisite: Major or minor in Communication of Science and Technology or Public Policy Studies. Open to other students with permission of instructor. [3]

Comparative Media Analysis and Practice

CMAP 8001. Media and the Senses. Seminal theories of modern media and how different media shape sensory perception. Impact of media technologies such as phonography, photography, cinema, and digital imaging on vision, hearing, touch, smell, taste, and locomotion. How human body and brain have been theorized as media. Team-taught by interdisciplinary group of faculty. [3]

CMAP 8002. History of Media. History of media technologies with special emphasis on historical moments of rupture: invention of the printing press; advent of photography and phonography; transition from silent to sound film; introduction of personal computing; emergence of satellite imaging and MRI technologies. Team-taught by interdisciplinary group of faculty. [3]

CMAP 8003. Media and Society. Political and economic frameworks of media practice. Authorship, copyright, privacy and publicness in times of big data. Media and power, gender, body, disability, knowledge, and identity. Social media and networks. Media literacy and accessibility. Team-taught by interdisciplinary group of faculty. [3]

CMAP 8004. Media Ecology. Interplay between technology, culture, and all aspects of human life. Media as environment. Effects of media technologies on built environments such as urban centers, academic learning spaces, museum and gallery settings, hospitals, transitory spaces, domestic interiors, and natural surroundings. Team-taught by interdisciplinary group of faculty. [3]

CMAP 8005. Project, Research, and Professionalization Colloquium. Discussion and development of various media-based research work, including dissertations. Institutional and professionalization matters and development of various perspectives for careers, academic or alternative-academic. [3]

CMAP 8010. Creative Media Practice. Creative work with moving images and sound. Principles of web design. Text and print in the digital age. Animation and game development strategies. Tools and strategies of digital pedagogy and online education. Fundamentals in programming and coding. 3D modeling. Desktop fabrication. Team-taught by interdisciplinary group of faculty. [3-4]

CMAP 8011. Working with Data. Fundamentals of digitization and digital curation. Working with databases: text and data mining strategies and topic modeling. Medical imaging techniques and technologies. Geographical information and mapping systems. Copyright law in the digital age. Team-taught by interdisciplinary group of faculty. [3-4]

Computer Science

CS 5250. Algorithms. (Also listed as CS 3250) Advanced data structures, systematic study and analysis of important algorithms for searching; sorting; string processing; mathematical, geometrical, and graph algorithms, classes of P and NP, NP-complete and intractable problems. No credit for students who have earned credit for 3250. FALL, SPRING. [3]

CS 5251. Intermediate Software Design. (Also listed as CS 3251) High quality development and reuse of architectural patterns, design patterns, and software components. Theoretical and practical aspects of developing, documenting, testing, and applying reusable class libraries and object-oriented

frameworks using object-oriented and component-based programming languages and tools. No credit for students who have earned credit for 3251. FALL, SPRING [3]

CS 5252. Theory of Automata, Formal Languages, and Computation. (Also listed as CS 3252) Finite-state machines and regular expressions. Context-free grammars and languages. Pushdown automata. Turing machines. Undecidability. The Chomsky hierarchy. Computational complexity. No credit for students who have earned credit for 3252. SPRING. [3]

CS 5258. Computer Graphics. (Also listed as CS 3258) 2D rendering and image-based techniques, 2D and 3D transformations, modeling, 3D rendering, graphics pipeline, ray-tracing, and texture-mapping. No credit for students who have earned credit for 3258. FALL. [3]

CS 5259. Project in Computer Animation Design and Technology. (Also listed as CS 3259) Principles and techniques of computer animation. Storyboarding, camera control, skeletons, inverse kinematics, splines, keyframing, motion capture, dynamic simulation, particle systems, facial animation, and motion perception. Students work in groups on the design, modeling, animation, and rendering of a computer animation project. No credit for students who have earned credit for 3259. FALL. [3]

CS 5260. Artificial Intelligence. (Also listed as CS 4260) Principles and programming techniques of artificial intelligence. Strategies for searching, representation of knowledge and automatic deduction, learning, and adaptive systems. Survey of applications. No credit for students who have earned credit for 4260. FALL. [3]

CS 5262. Foundations of Machine Learning. Theoretical and algorithmic foundations of supervised learning, unsupervised learning, and reinforcement learning. Linear and nonlinear regression, kernel methods, support vector machines, neural networks and deep learning methods, instance-based methods, ensemble classifiers, clustering and dimensionality reduction, value and policy iteration. Explainable AI, ethics, and data privacy. SPRING. [3]

CS 5265. Database Management Systems. (Also listed as CS 3265) Logical and physical organization of databases. Data models and query languages, with emphasis on the relational model and its semantics. Data independence, security, integrity, concurrency. No credit for students who have earned credit for 3265. [3]

CS 5266. Topics in Big Data. Principles and practices of big data processing and analytics. Data storage databases and data modeling techniques, data processing and querying, data analytics and applications of machine learning using these systems. SPRING. [3]

CS 5269. Project in Artificial Intelligence. (Also listed as CS 4269) Students work in small groups on the specification, design, implementation, and testing of a sizeable AI software project. Projects (e.g., an "intelligent" game player) require that students address a variety of AI subject areas, notably heuristic search, uncertain reasoning, planning, knowledge representation, and learning. Class discussion highlights student progress, elaborates topics under investigation, and identifies other relevant topics (e.g., vision) that the project does not explore in depth. No credit for students who have earned credit for 4269. SPRING. [3]

CS 5270. Programming Languages. (Also listed as CS 3270) General criteria for design, implementation, and evaluation of programming languages. Historical perspective. Syntactic and semantic specification, compilations, and interpretation processes. Comparative studies of data types and data control, procedures and parameters, sequence control, nesting, scope and storage management, run-time representations. Problem solving using non-standard languages. No credit for students who have earned credit for 3270. FALL, SPRING. [3]

CS 5274. Modeling and Simulation. (Also listed as CS 3274) General theory of modeling and simulation of a variety of systems: physical processes, computer systems, biological systems, and manufacturing processes. Principles of discrete-event, continuous, and hybrid system modeling, simulation algorithms for the different modeling paradigms, methodologies for constructing models of a number of realistic systems, and analysis of system behavior. Computational issues in modeling and analysis of systems. Stochastic simulations. No credit for students who have earned credit for 3274. [3]

CS 5276. Compiler Construction. (Also listed as CS 3276) Review of programming language structures, translation, loading, execution, and storage allocation. Compilation of simple expressions and statements. Organization of a compiler including compile-time and run-time symbol tables, lexical scan, syntax scan, object code generation, error diagnostics, object code optimization techniques, and overall design. Use of a high-level language to write a complete compiler. No credit for students who have earned credit for 3276. [3]

CS 5278. Principles of Software Engineering. (Also listed as CS 4278) The nature of software. The object-oriented paradigm. Software life-cycle models. Requirements, specification, design, implementation, documentation, and testing of software. Object-oriented analysis and design. Software maintenance. No credit for students who have earned credit for 4278. FALL. [3]

CS 5279. Software Engineering Project. (Also listed as CS 4279) Students work in teams to specify, design, implement, document, and test a nontrivial software project. The use of CASE (Computer Assisted Software Engineering) tools is stressed. No credit for students who have earned credit for 4279. SPRING. [3]

CS 5281. Principles of Operating Systems I. (Also listed as CS 3281) Resource allocation and control functions of operating systems. Scheduling of processes and processors. Concurrent processes and primitives for their synchronization. Use of parallel processes in designing operating system subsystems. Methods of implementing parallel processes on conventional computers. Virtual memory, paging, protection of shared and non-shared information. Structures of data files in secondary storage. Security issues. Case studies. No credit for students who have earned credit for 3281. FALL, SPRING. [3]

CS 5282. Principles of Operating Systems II. (Also listed as CS 3282) Projects involving modification of a current operating system. Lectures on memory management policies, including virtual memory. Protection and sharing of information, including general models for implementation of various degrees of sharing. Resource allocation in general, including deadlock detection and prevention strategies. Operating system performance measurement, for both efficiency and logical correctness. Two hours lecture and one hour laboratory. No credit for students who have earned credit for 3282. [3]

CS 5283. Computer Networks. (Also listed as CS 4283) Computer communications. Network (Internet) architecture. Algorithms and protocol design at each layer of the network stack. Cross-layer interactions and performance analysis. Network simulation tools. Lab and programming assignments. No credit for students who have earned credit for 4283. [3]

CS 5284. Computer Systems Analysis. (Also listed as CS 4284) Techniques for evaluating computer system performance with emphasis upon application. Topics include measurement and instrumentation techniques, benchmarking, simulation techniques, elementary queuing models, data analysis, operation analysis, performance criteria, case studies. Project involving a real computer system. No credit for students who have earned credit for 4284. [3]

CS 5285. Network Security. (Also listed as CS 4285) Principles and practice of network security. Security threats and mechanisms. Cryptography, key management, and message authentication. System security practices and recent research topics. No credit for students who have earned credit for 4285. [3]

CS 5287. Principles of Cloud Computing. (Also listed as CS 4287) Fundamental concepts of cloud computing, different service models, techniques for resource virtualization, programming models, management, mobile cloud computing, recent advances, and hands-on experimentation. No credit for students who have earned credit for 4287. [3]

CS 5288. Web-based System Architecture. (Also listed as CS 4288) Core concepts necessary to architect, build, test, and deploy complex web-based systems; analysis of key domain requirements in security, robustness, performance, and scalability. No credit for students who have earned credit for 4288. FALL. [3]

CS 5891. Special Topics. (Also listed as CS 3891) [Variable credit: 1-3 each semester] No credit for students who have earned credit for 3891.

CS 5892. Special Topics. (Also listed as CS 3892) [Variable credit: 1-3 each semester] No credit for students who have earned credit for 3892.

CS 6310. Design and Analysis of Algorithms. [Formerly CS 310] Set manipulation techniques, divide-and-conquer methods, the greedy method, dynamic programming, algorithms on graphs, backtracking, branch-and-bound, lower bound theory, NP-hard and NP-complete problems, approximation algorithms. Prerequisite: CS 3250. SPRING. [3]

CS 6311. Graph Algorithms. [Formerly CS 311] Algorithms for dealing with special classes of graphs. Particular emphasis is given to subclasses of perfect graphs and graphs that can be stored in a small amount of space. Interval, chordal, permutation, comparability, and circular-arc graphs; graph decomposition. Prerequisite: CS 6310 or Math 4710. [3]

CS 6315. Automated Verification. [Formerly CS 315] Systems verification and validation, industrial case studies, propositional and predicate logic, syntax and semantics of computational tree and linear time logics, binary decision diagrams, timed automata model and real-time verification, hands on experience with model checking using the SMV, SPIN and UPPAAL tools, and state reduction techniques. [3]

CS 6320. Algorithms for Parallel Computing. [Formerly CS 320] Design and analysis of parallel algorithms for sorting, searching, matrix processing, FFT, optimization, and other problems. Existing and proposed parallel architectures, including SIMD machines, MIMD machines, and VLSI systolic arrays. Prerequisite: CS 6310. [3]

CS 6350. Artificial Neural Networks. [Formerly CS 350] Theory and practice of parallel distributed processing methods using networks of neuron-like computational devices. Neurobiological inspirations, attractor networks, correlational and error-correction learning, regularization, unsupervised learning, reinforcement learning, Bayesian and information theoretic approaches, hardware support, and engineering applications. SPRING. [3]

CS 6351. Advanced Animation. [Formerly CS 351] Current research issues and problems in computer animation, with special focus on motion capture, dynamic simulation, and key-framing. Cloth, deformable bodies, natural phenomena, geometric algorithms, procedural techniques, facial animation, hair, autonomous characters, flocking, empirical evaluation, and interfaces for animation. Prerequisite: CS 3259. FALL. [3]

CS 6352. Human-Computer Interaction. [Formerly CS 352] An overview of human computer interaction and problems of current interest. Topics include: Human factors, GOMS, user interface design and evaluation, interaction modalities, distributed cognition, ubiquitous computing. A project involving design and evaluation will be performed. [3]

CS 6358. Computer Vision. [Formerly CS 358] The fundamentals of computer vision and techniques for image understanding and high-level image processing. Includes image segmentation, geometric structures, relational structures, motion, matching, inference, and vision systems. Prerequisite: EECE 6357. SPRING. [3]

CS 6359. Medical Image Registration. [Formerly CS 359] Foundations of medical image registration. Mathematical methods and practical applications. Image-to-image registration, image-to-physical registration, applications to image-guided procedures and the most commonly used imaging modalities with an emphasis on tomographic images. FALL. [3]

CS 6360. Advanced Artificial Intelligence. [Formerly CS 360] Discussion of state-of-the-art and current research issues in heuristic search, knowledge representation, deduction, and reasoning. Related application areas include: planning systems, qualitative reasoning, cognitive models of human memory, user modeling in ICAI, reasoning with uncertainty, knowledge-based system design, and language comprehension. Prerequisite: CS 4260 or equivalent. [3]

CS 6362. Advanced Machine Learning. Theory and algorithms for designing systems that learn from data including modern machine learning methods that take advantage of increased complexity to provide improved performance. Data types, data pre-processing, measures of similarity and dissimilarity. Supervised learning: decision trees, logistic regression, support vector machines, Bayesian methods, and neural networks; unsupervised learning: partitional, hierarchical, density-based, and graph clustering algorithms. Feature selection for classification and clustering. Evaluation

methods. Reinforcement learning: Markov Decision processes, dynamic programming, Monte Carlo methods, TD-learning. Prerequisite: CS 4262 or 5262 or 6360. FALL. [3]

CS 6364. Intelligent Learning Environments. [Formerly CS 364] Theories and concepts from computer science, artificial intelligence, cognitive science, and education that facilitate designing, building, and evaluating computer-based instructional systems. Development and substantiation of the concept, architecture, and implementation of intelligent learning environments. Multimedia and web-based technology in teaching, learning, collaboration, and assessment. Prerequisite: CS 4260, CS 6360, or equivalent. [3]

CS 6366. Distributed Artificial Intelligence. [Formerly CS 366] Principles and practice of multiple agent systems for distributed artificial intelligence. Game theory, distributed negotiation and decision making, distributed problem solving, cooperation, coalition formation and distributed learning. Prerequisite: CS 4260. [3]

CS 6368. Computational Economics. Models and methods in computational economics, such as linear and non-linear optimization, decision theory, game theory, mechanism design, and computational tools. Applications in areas such as auctions, economics of security and privacy, market design, and algorithmic trading. Prerequisite: CS 4260 or 5260. SPRING. [3]

CS 6375. Discrete-Event Systems: Supervisory Control and Diagnosis. [Formerly CS 375] Algebraic structures, automata and formal language theory, process modeling with finite-state automata, supervisory control theory, controllability and supervision, supervisory control under partial observation, modular and hierarchical supervisory control, supervisory control of real-time systems, fault diagnosis of discrete-event systems, and modular diagnosis approaches. SPRING. [3]

CS 6376. Foundations of Hybrid and Embedded Systems. [Formerly CS 376] Modeling, analysis, and design of hybrid and embedded systems. Heterogeneous modeling and design of embedded systems using formal models of computation, modeling and simulation of hybrid systems, properties of hybrid systems, analysis methods based on abstractions, reachability, and verification of hybrid systems. FALL. [3]

CS 6377. Topics in Embedded Software and Systems. [Formerly CS 377] Specification and composition of domain-specific modeling languages. Design methodologies for embedded systems. Platforms for embedded system design and implementation. Analysis of embedded systems. SPRING. [3]

CS 6381. Distributed Systems Principles. [Formerly CS 381] Techniques and mechanisms in distributed system design, such as logical clocks, distributed consensus, distributed mutual exclusion, consistency models, fault tolerance and paradigms of communication. Contemporary distributed system case studies and open challenges. Prerequisite: CS 3281. [3]

CS 6384. Performance Evaluation of Computer Systems. [Formerly CS 384] Techniques for computer systems modeling and analysis. Analytical modeling with emphasis on queuing network models, efficient computational algorithms for exact and approximate solutions, parameter estimation and prediction, validation techniques, workload characterization, performance optimization, communication and distributed system modeling. Prerequisite: CS 3281 or 6381. SPRING. [3]

CS 6385. Advanced Software Engineering. [Formerly CS 385] An intensive study of selected areas of software engineering. Topics may include CASE tools, formal methods, generative techniques, aspect-oriented programming, metrics, modeling, reuse, software architecture, testing, and open-source software. Prerequisite: CS 4278. FALL. [3]

CS 6386. System-Level Fault Diagnosis. [Formerly CS 386] An overview of the basic concepts of the theory of fault diagnosis and problems of current interest. Topics include the classical PMC and BGM models of fault diagnosis, hybrid (permanent and intermittent faults) models, diagnostic measures for one-step, sequential, and inexact diagnosis. Emphasis is on algorithmic techniques for solving the diagnosis and diagnosability problems in various models. Prerequisite: CS 6381. SPRING. [3]

CS 6387. Topics in Software Engineering. [Formerly CS 387] Topics may include empirical software engineering and open-source software engineering. Prerequisite: CS 4278 or consent of instructor. SPRING. [3]

CS 6388. Model-Integrated Computing. [Formerly CS 388] Problems of designing, creating, and evolving information systems by providing rich, domain-specific modeling environments including model analysis and model-based program synthesis tools. Class presentation and project are required. FALL. [3]

CS 7999. Master's Thesis Research. [Formerly CS 369] [0-6]

CS 8390. Individual Studies. CS 8390. Individual Studies. [Formerly CS 390] [1-3]

CS 8395. Special Topics. [Formerly CS 395] [3]

CS 8396. Special Topics. [Formerly CS 396] [3]

CS 8991. Seminar. [Formerly CS 391] [1-3 each semester]

CS 8992. Seminar. [Formerly CS 392] [1-3 each semester]

CS 8999. Non-Candidate Research. CS 8999. Non-Candidate Research. [Formerly CS 379] Research prior to entry into candidacy (completion of qualifying examination) and for special non-degree students. [0-12]

CS 9999. Ph.D. Dissertation Research. [Formerly CS 399]

Creole [Haitian] Language

CREO 5101. Elementary Creole I (Duke). (Also listed as CREO 1101) Essential elements of Haitian Creole or Kreyòl language and Haitian culture. Understanding, speaking, reading, and writing in contexts of health care, Haitian women's rights, and unpaid child servants (restavèk). Vocabulary and idioms. Offered on a graded basis only. [3]

CREO 5102. Elementary Creole II (Duke). Essential elements of Creole language and aspects of Haitian culture. Speaking, listening, reading, and writing. Exposure to Haitian culture through films, storytelling, games, music, and proverbs. Prerequisite: 1101 or a comparable level of previous Creole language experience, such as familial background in Creole. Offered on a graded basis only. [3]

CREO 5201. Intermediate Creole I (Duke). (Also listed as CREO 2201) Understanding, speaking, reading, and writing in cultural context; issues of rural life in Haiti, religion, Frenchified Creole vs popular Creole. Texts, poems, novel excerpts. Focus on contemporary events and debates in Haitian culture. Offered on a graded basis only. Prerequisite: 1102. [3]

CREO 5202. Intermediate Creole II (Duke). Second semester of Intermediate Creole. Offered on a graded basis only. Prerequisite: 2201 or equivalent. [3]

Data Science

DS 5220. Principles of Programming and Simulation. Students learn the foundations of effective software design and programming practice, how to program and evaluate a simulation, and how to apply modern resampling techniques in simulations in both R and Python. Students learn workflow solutions, e.g., Jupyter Notebooks, Latex, Knitr, Markdown reports, and collaboration platforms (e.g., GitHub and version control). Reproducible methods for programming and data processing are emphasized. [3]

DS 5320. Survey of Data Science Applications. This course introduces foundational data science terminology and conventions, and exposes students to a wide range of data science applications, e.g., in genomics, health care, informatics, astronomy/physics, neuroimaging, cyber-physical systems, business, and finance. [3]

DS 5340. Data Science Rights and Responsibility. This course explores the ethos, ethics, and obligations of the modern data scientist. Modern data security and privacy vulnerabilities, as well as solutions, for individual-level data and the institutions from which the data is derived will be discussed. The history, ethics, and standards for human experimentation are reviewed.

The legal landscape concerning data ownership and privacy will be surveyed. [3]

DS 5380. Data Science in Teams I. Students will work in small groups to engage in real world problems, and apply their skills in a supervised environment where active learning is reinforced, and learn to make practical decisions. First students will learn how to process data, generate analysis reports and data summaries. Data will come from many sources, e.g. Kaggle competitions, VU/VUMC labs, and online documented data sets. Students will experience a goal-oriented teamwork environment and learn how to participate and support teams as the primary data curator and data analyst. [3]

DS 5420. Data Management Systems. This course covers database management systems, e.g., relation databases, data architecture, and security. Topics include entity-relationship models and relational theory; storage and access of data; complex SQL queries; and non-relational databases including NoSQL databases. Students are exposed to data base architectures as time allows. [3]

DS 5610. Exploratory Data Analysis. This course will teach students how to explore, summarize, and graph data (big and small). Topics include principles of perception, how to display data, scatterplots, histograms, boxplots, bar charts, dynamite plots, proper data summaries, dimensionality reduction, multidimensional scaling, and unsupervised clustering algorithms, such as principal component analysis, k-means clustering, and nearest neighbor algorithms. [3]

DS 5620. Probability and Statistical Inference. This course covers the fundamentals of probability theory and statistical inference. Topics in probability include random variables, distributions, expectations, moments, Jensen's inequality, law of large numbers, central limit theorem. Topics in inference include maximum likelihood, point estimation (Bayesian, frequentist, and likelihood versions); hypothesis and significance testing; re-sampling techniques. Complex mathematical proofs will be illustrated with computational solutions. [3]

DS 5640. Modeling and Machine Learning I. This is the first course in a sequence exploring statistical modeling and machine learning techniques. Both courses emphasize unifying and advanced concepts, such as prediction and calibration, classification and discrimination, optimism and cross-validation, re-sampling methods for model assessment, the evaluation of modeling assumptions and bias-variance trade-off. This first course focused on regression, generalized linear models, regularized regression, support-vector machines and kernel methods, and simple neural networks. [3]

Earth and Environmental Sciences

EES 5110. Global Climate Change. (Also listed as EES 2110) Science and policy of global climate change: history and causes of climate change in Earth's past, with emphasis on the last 2 million years; evidence of human impacts on climate since 1850; future climate change and its economic, social, and ecological consequences; economic, technological, and public policy responses. No credit for students who have earned credit for 2110. [3]

EES 5220. Life Through Time. (Also listed as EES 3220) Ecology, classification, and evolution of important groups of fossils, emphasizing invertebrates. Change in marine ecosystems through geologic time. Causes and effects of rapid evolution events and mass extinctions. Three hours of lecture and one laboratory period per week. No credit for students who have earned credit for 3220 or 3220W. [4]

EES 5233. Conservation Biology. Ecological, evolutionary, social, and economic aspects of biodiversity loss and ecosystem disruption due to human activities. Climate change, habitat fragmentation, species overexploitation, and invasive species. Sustainable development, habitat restoration, and species reintroduction. [3]

EES 5238. Ecology. Population biology, evolutionary ecology, community structure, with emphasis on species interactions, including competition, predation, and symbiosis. No credit for students who have earned credit for 4238. [3]

EES 5250. Earth Materials. (Also listed as EES 3250) Solid materials that make up the earth; rock, soil, and sediment - with emphasis on the minerals that are their major constituents. Hand specimen, optical, and X-ray methods of description and identification. Physical and chemical processes that form and modify earth materials and the use of these materials in interpreting earth processes of the past and present. Field trips. Three lectures and one laboratory per week. No credit for students who have earned credit for 3250. [4]

EES 5260. Petrology. (Also listed as EES 3260) Nature, distribution, and theories of origin of igneous, metamorphic, and sedimentary rocks. Mineralogy as a function of rock-forming conditions. Laboratory emphasis on description and interpretation of rocks, using hand sample and microscope techniques. Field trips. Three lectures and one laboratory period per week. No credit for students who have earned credit for 3260. [4]

EES 5310. Global Climate Change. Scientific principles and policy applications. Earth's past; evidence of human impact; future climate change; and economic, social, and ecological consequences. Economic, technological, and public policy responses. Repeat credit for 5110. Students who have earned credit for 5110 will earn only one credit hour. [4]

EES 5340. Structural Geology and Rock Mechanics. (Also listed as EES 3340) Principles of rock deformation; mechanics, fractures, folds, foliation, primary structures, applications of principles. Interactions and feedbacks between tectonics, climate, and erosion. Field trips. Two lectures and one laboratory period per week. No credit for students who have earned credit for 3340. [4]

EES 5420. Geomorphology. (Also listed as EES 4420) Analysis of the Earth's landforms, their morphology, history, and the processes that form them. The building of relief and its subsequent transformation by geologic processes on hillslopes, rivers, coasts, wetlands, and glaciers. The natural history and human impacts on land forms. Field trips. Familiarity with basic physics (mechanics) is expected. No credit for students who have earned credit for 4420. [3]

EES 5510. Earth Systems through Time. (Also listed as EES 2510) Effects of feedbacks between the geologic cycles on the lithosphere, hydrosphere, biosphere, and atmosphere at diverse intervals in the Earth's history. Present and future implications. Interpretations of evidence recorded in Earth materials. Three hours of lecture and one laboratory per week. No credit for students who have earned credit for 2510. [4]

EES 5550. Transport Processes in Earth and Environmental Systems. (Also listed as EES 4550) Principles of conservation and constitutive transport laws; classic and emerging styles of modeling natural systems. Prior study of basic calculus (functions, derivatives, integrals) and physics (mechanics) is expected. No credit for students who have earned credit for 4550. [3]

EES 5600. Geochemistry. (Also listed as EES 4600) Application of chemistry to study the distribution and cycling of elements in the crust of the earth. Includes chemical bonding and crystallization, phase rules and phase diagrams, chemical equilibria, theories on the origin of elements, earth, ocean, atmosphere, and crust. No credit for students who have earned credit for 3600. [3]

EES 5650. Physics of the Climate System. Physical processes affecting the climate system. Global energy balance of Earth and planets. Surface temperature and how it is regulated. Electromagnetic radiation and its interaction with atmospheric gases, clouds, and aerosols. Ocean heat storage, cloud and precipitation processes, and the impact of sea and inland ice on temperature. Processes that govern the water and carbon cycle. No credit for students who have earned credit for 290-01 offered spring 2014 or spring 2015. [3]

EES 5680. Paleoclimates. (Also listed as EES 4680) Fluctuations in Earth's climate with an emphasis on the past 700 million years. Forcings and feedback that influence climate and drive change. Techniques used to reconstruct past climate change using marine and terrestrial geologic deposits and geochronologic methods. No credit for students who have earned credit for 4680. [3]

EES 5760. Agent- and Individual-Based Computational Modeling. Applications in natural, social, and behavioral sciences and engineering.

Designing, programming, and documenting models. Using models for experiments. Examples from environmental science, ecology, economics, urban planning, and medicine. Familiarity with basic statistics and proficiency in algebra are expected. [3]

EES 5820. Paleoecological Methods. (Also listed as EES 4820) Tools used to interpret past environments and climates, including plant microfossils, pollen and phytoliths, vertebrate morphology, and dental microwear and mesowear. Geochemical tools such as stable isotopes and rare earth elements. Integrating methods for paleontological and anthropological studies, including the use of databases and meta-analyses. Readings from primary sources. Serves as repeat credit for students who completed 390 section 4 in spring 2010. No credit for students who have earned credit for 4820. [3]

EES 5830. Volcanic Processes. (Also listed as EES 4830) Nature, behavior, and origin of volcanoes. Magmatic processes that lead to eruptions. Eruptive processes and volcano construction. Impacts of volcanism on Earth's surface environment. No credit for students who have earned credit for 4830. [3]

EES 5841. Directed Study. (Also listed as EES 3841) Readings in related fields and/or laboratory research in pursuit of a scholarly project conceived and executed under the supervision of a faculty member. Open to senior majors and graduate students or by consent of the department chair. Does not count toward minimum requirements for the major. May be repeated for credit more than once if there is no duplication in topic, but students may earn only up to 2 credits per semester of enrollment. [1-2]

EES 5842. Directed Study. (Also listed as EES 3842) Readings in related fields and/or laboratory research in pursuit of a scholarly project conceived and executed under the supervision of a faculty member. Open to senior majors and graduate students or by consent of the department chair. Does not count toward minimum requirements for the major. May be repeated for credit more than once if there is no duplication in topic, but students may earn only up to 2 credits per semester of enrollment. [1-2]

EES 5851. Independent Study. (Also listed as EES 3851) Readings with related field and/or laboratory research in pursuit of a scholarly project conceived and executed under the supervision of a faculty member. Open to senior majors and graduate students. Other students must have consent of department chair. Does not count toward minimum requirements for the major. May be repeated for credit more than once if there is no duplication in topic, but students may earn only up to 3 credits per semester of enrollment. No credit for students who have earned credit for 3851. [1-3]

EES 5852. Independent Study. (Also listed as EES 3852) Readings with related field and/or laboratory research in pursuit of a scholarly project conceived and executed under the supervision of a faculty member. Open to senior majors and graduate students. Other students must have consent of department chair. Does not count toward minimum requirements for the major. May be repeated for credit more than once if there is no duplication in topic, but students may earn only up to 3 credits per semester of enrollment. No credit for students who have earned credit for 3852. [1-3]

EES 5891. Special Topics. (Also listed as EES 3891) Topics vary. May be repeated for credit more than once by permission of the director of undergraduate studies. Students may enroll in more than one section of this course each semester. No credit for students who have earned credit for 3891. [3]

EES 5990. Mass Extinctions. Synthesizing causes, consequences, and dynamics of past mass extinction events. Using fossil records to interpret current and future trends in biodiversity loss. No credit for students who have earned credit for 3891-02 offered spring 2017 or spring 2018. [3]

EES 6100. Earth Fluids. [Formerly EES 310] Fluid dynamics in relation to natural Earth systems, including low and high Reynolds number flows. No credit for students who have earned credit for 390 section 1 in spring 2007, section 3 in fall 2009, section 1 in fall 2011, or section 1 in fall 2013. [3]

EES 6891. Special Topics and Advanced Techniques in Geology. [Formerly EES 390] May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [1-4]

EES 7110. Advanced Topics in Earth Materials. [Formerly EES 311] Selected topics in the structure, composition, properties of the materials that constitute the Earth, and the natural processes that control their stability and transformations. May be repeated for credit if there is no duplication in topic. [3]

EES 7300. Isotopes and the Environment. [Formerly EES 330] Isotope systems, research techniques and applications used to trace, date, and understand environmental processes on Earth's surface. Stable, radiogenic, and cosmogenic isotope systems. Radiometric dating of low temperature processes. No credit for students who earned credit for 390 section 1 in fall 2012. [3]

EES 7350. Magmatic Processes and the Construction of Earth's Crust. [Formerly EES 335] Generation of magma and its role in construction of Earth's crust. Connection between magmatism and large-scale tectonics. Introduction to magmatic tracers: isotopes, trace elements, phase equilibria; geochronology; and the history of the crust, Hadean to present. No credit for students who completed 390 section 1 in fall 2008. [3]

EES 7380. Sedimentary Systems: Source-to-Sink. [Formerly EES 338] Generation and distribution of sediment from mountain tops to deep-sea basins. Construction of depositional landscapes and stratigraphy. Sediment dispersal and interactions between source-to-sink components along transport pathways; feedbacks with climate, tectonics, the biosphere, and humans. Earth system interactions, energy budgets, and nutrient and geochemical cycling. No credit for students who earned credit for 390 section 1 in spring 2007, section 3 in spring 2011, or section 2 in spring 2013. [3]

EES 7620. Macroecology and Biogeography. [Formerly EES 362] Integration of evolutionary biology, paleobiology, ecology, and biogeography to understand interactions between organisms and their environments over large spatial and temporal scales, including in ancient ecosystems. The discipline of macroecology; nature of species, niches, and communities; abundance and distribution of species; species diversity; composition and assembly of continental biotas; allometry and body size; evolutionary dynamics; methodological advances. [3]

EES 7640. Topics in Macroevolution. [Formerly EES 364] Evolutionary processes that operate on geological time scales. Evolutionary theory; systematics; speciation and extinction; evolutionary benefits of sexual reproduction; co-evolution; convergence; biogeography; and relevance of evolution to modern ecology and conservation. Effects of abiotic processes on the evolution of terrestrial and marine organisms. [3]

EES 7999. Master's Thesis Research. [Formerly EES 369] [0-12]

EES 8003. Graduate Teaching Practicum. Discussion of best teaching practices in weekly meeting with instructor. Application of teaching strategies via teaching undergraduate lab, discussion, or lecture. [0-1]

EES 8999. Non-Candidate Research. [Formerly EES 379] Research prior to entry into candidacy (completion of qualifying examination) and for special non-degree students. [Variable credit: 0-12]

EES 9999. Ph.D. Dissertation Research. [Variable credit: 0-12]

Economics

ECON 5050. Topics in Econometrics. (Also listed as ECON 4050) Emphasis on applications. May include generalized method of moments, empirical likelihood, resampling methods, and nonparametric techniques. No credit for students who have earned credit for 4050. [3]

ECON 5100. Wages, Employment, and Labor Markets. (Also listed as ECON 3100) Theories of wages and employment, dual labor markets, internal labor markets, and labor's share of national income. Empirical studies of labor mobility, the effects of unions on relative wages and resource allocation, occupational and industrial wage differentials, and selected labor markets. No credit for students who have earned credit for 3100. [3]

ECON 5110. Macroeconomic Models for Policy Analysis. (Also listed as ECON 4110) Mathematical models of overlapping generations, rational expectations, and open economies with price rigidities applied to social security, government debt, exchange rates, monetary policy, and time in-

consistent optimal policy. No credit for students who have earned credit for 4110. [3]

ECON 5230. Urban Economics. (Also listed as ECON 3230) Urban growth, development of suburbs, location of firms, housing markets, transportation, property taxes, and local government services. Offered on a graded basis only. No credit for students who have earned credit for 3230. [3]

ECON 5240. Poverty and Discrimination. Theories and empirical evidence concerning inequality, poverty, and discrimination, and their relationship to economic growth. Evaluation of anti-poverty and anti-discrimination policies. [3]

ECON 5250. Industrial Organization. (Also listed as ECON 3250) The structure of contemporary industry and the forces that have shaped it, including manufacturing, trade, and transportation. The role of the large corporation in modern industrial organization. The relation of industrial structure to economic behavior and performance. No credit for students who have earned credit for 3250. [3]

ECON 5260. Game Theory with Economic Applications. (Also listed as ECON 4260) Rational decision-making in non-cooperative, multi-person games. Single play and repeated games with complete and incomplete information. Economic applications of games, such as auctions, labor-management bargaining, pricing and output decisions in oligopoly, and common property resources. No credit for students who have earned credit for 4260. [3]

ECON 5270. Economics of Information and Communications Technology. The Internet, cloud computing, social networks, e-commerce, and Internet telephony as influencers of commerce and consumer welfare. Streaming content, big data, informatics, and open source software in economic perspective. Property rights, competition, and regulation in cyberspace. No credit for students who have earned credit for 3893-01 offered spring 2016 or 293-01 offered spring 2015. [3]

ECON 5300. Financial Instruments and Markets. (Also listed as ECON 3300) Theoretical and empirical approaches to the analysis of monetary and other financial instruments. Portfolio analysis, interest rate risk, and financial futures and options markets. No credit for students who have earned credit for 3300. [3]

ECON 5350. Economics of Health. (Also listed as ECON 3350) An examination of some of the economic aspects of the production, distribution, and organization of health care services, such as measuring output, structure of markets, demand for services, supply of services, pricing of services, cost of care, financing mechanisms, and their impact on the relevant markets. No credit for students who have earned credit for 3350. [3]

ECON 5510. Seminar in Macroeconomic Policy. Intensive study of three or four current problems in economic policy. Studies in topics such as macroeconomic policy for the year ahead, financial market issues, international economic policy issues. Limited to majors in economics and public policy. [3]

ECON 5610. International Finance. (Also listed as ECON 3610) Economics of international monetary, financial, and macroeconomic relationships. Effects of monetary and fiscal politics in open economies, balance of payments, exchange rate determination, and international monetary institutions. No credit for students who have earned credit for 3610. [3]

ECON 5650. Development Economics. (Also listed as ECON 3650) Determinants of national economic growth for pre-industrial and newly industrial countries. Inequality and poverty. Imperfect credit markets and microfinance. Political constraints and corruption. Policy issues relevant to developing economics. No credit for students who have earned credit for 3650. [3]

ECON 6100. Microeconomic Theory (M.A. Level). [Formerly ECON 301] The price system in consumer demand and as a mechanism for organizing production, allocating resources, and distributing the national income. [3]

ECON 6200. Macroeconomic Theory (M.A. Level). [Formerly ECON 302] National income accounting. Theories of income, employment and price determination. Growth and planning models. Monetary theory. [3]

ECON 6500. Statistical Analysis (M.A. Level). [Formerly ECON 306] Interpretation of statistical materials, the principles of statistical inference, the use of available statistics for problems of economic analysis, and the importance of statistics in economic policy and administration. [3]

ECON 6600. Econometrics (M.A. Level). [Formerly ECON 308] Empirical measurements with applications to basic economic relations. Specification, estimation of microeconomics and macroeconomics models for the purpose of testing hypotheses, forecasting, and evaluating policy. Prerequisite: 6500. [3]

ECON 7100. Project Evaluation. [Formerly ECON 353] Social-benefit cost analysis of investment projects: investment criteria, estimation of benefits and costs, and evaluation of shadow prices and of the social discount rate. The role of national planning. Case studies utilize the experience of developing economies. [3]

ECON 7500. The Chinese Economy. [Formerly ECON 352] Growth, development, and fluctuations in the Chinese economy. Transition from central planning to markets since 1978. Implications for global economy. Primarily designed for students in the Economic Development program. [3]

ECON 7600. International Trade and Economic Development. [Formerly ECON 357] Selected topics concerning the exchange and transfer of goods and resources between less- and more-developed countries. Possible topics include: the international monetary system, the SDR-aid link, dependence and imperialism, the role of trade in economic growth, foreign exchange strategies, and the structure of protection. Primarily designed for students in the Economic Development program. [3]

ECON 7841. Directed Readings. Intensive study in an area of special interest beyond regular course offerings. Prerequisites: consent of the instructor and the director of graduate studies. [1-3]

ECON 7881. Special Topics in Development Policies. [Formerly ECON 358A] Selected topics in the economic analysis of problems in developing countries. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

ECON 7882. Special Topics in Development Policies. [Formerly ECON 358B] Selected topics in the economic analysis of problems in developing countries. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

ECON 7910. Seminar in Research on Economic Development: Microeconomic Applications. [Formerly ECON 355A] How to select and define a microeconomic problem, assemble relevant factual and statistical information, and analyze and interpret it. Students will write a research paper. Open only to students in the Economic Development program. May be repeated for credit. [3]

ECON 7920. Seminar in Research on Economic Development: Macroeconomic Applications. [Formerly ECON 355B] How to select and define a macroeconomic problem, assemble relevant factual and statistical information, and analyze and interpret it. Students will write a research paper. Open only to students in the Economic Development program. May be repeated for credit. [3]

ECON 7930. Field Experience in Economic Development. How to select and define an economic problem, assemble relevant factual and statistical information, and analyze and interpret it. Students will write a research paper. Participation in a policy relevant field experience is required. Open only to students in the Economic Development program. [3]

ECON 7998. Internship in Economic Development. Internship working in professional setting appropriate to the degree program. Repeatable. Consent of faculty advisor required. Credit hours earned do not apply to the degree requirements for the Graduate Program in Economic Development. Offered on a satisfactory/unsatisfactory basis. [0-3]

ECON 7999. Master's Research. [Formerly ECON 369] [0-12]

ECON 8000. Selected Topics in Mathematics for Economists. [Formerly ECON 300] Mathematics used in the analysis of economic models. [3]

ECON 8100. Microeconomic Theory I. [Formerly ECON 304A] Analysis of resource allocation and relative prices. Behavior of individual economic units and markets. Models of technology, cost, and profit and the firm; consumer preferences, constraints, and choice; expected utility theory and risk aversion; partial equilibrium under competition and monopoly; partial equilibrium welfare and surplus. [3]

ECON 8110. Microeconomic Theory II. [Formerly ECON 304B] Non-cooperative game theory, information economics, public goods. Nash equilibrium, sequential rationality, and incomplete information; oligopoly; bargaining; adverse selection, signaling and screening; principal-agent models; externalities and public goods. Prerequisite: 8100 [3]

ECON 8120. Microeconomic Theory III. [Formerly ECON 304C] General equilibrium, welfare economics, social choice, and mechanism design. Prerequisites: 8100 and 8110; or consent of the instructor and the director of graduate studies. [3]

ECON 8200. Macroeconomic Theory I. [Formerly ECON 305A] Dynamic models and solution techniques. Development of models to study growth, business cycles, and government policies. [3]

ECON 8210. Macroeconomic Theory II. [Formerly ECON 305B] Inflation and growth, optimal monetary and fiscal policy, overlapping-generations models and money non-neutrality. Prerequisite: 8200 or consent of the instructor and the director of graduate studies. [3]

ECON 8220. Macroeconomic Theory III. [Formerly ECON 305C] Theories of consumption, investment, demand and supply of money, the labor market, monetary and fiscal policy, and New Keynesian economics. Prerequisite: 8210. [3]

ECON 8300. Statistical Analysis. [Formerly ECON 307] Statistical methods applicable to quantitative research in economics. Distribution theory, statistical inference, and selected multivariate statistical methods. [3]

ECON 8310. Econometrics I. [Formerly ECON 309A] Analysis of specification errors in single-equation estimation of economic relations. Introduction to the estimation and application of simultaneous-equation models. Prerequisite: 8300. [3]

ECON 8320. Econometrics II. [Formerly ECON 309B] Identification and estimation of econometric models with nonlinearity and/or endogeneity/simultaneity. Asymptotic theory and finite-sample properties of M-estimation and inference. Model building and testing of economic theory. Prerequisite: 8310. [3]

ECON 8400. Introduction to Economic History. [Formerly ECON 371] Measurement and theory. Factors associated with modern economic growth and institutional change in various countries and time periods. Prerequisites: 8100 and 8200, or consent of the instructor and the director of graduate studies. [3]

ECON 8981. Reading Course. [Formerly ECON 349A] Intensive study in an area of special interest beyond regular course offerings. Prerequisites: consent of the instructor and the director of graduate studies. [1-3]

ECON 8982. Reading Course. [Formerly ECON 349B] Intensive study in an area of special interest beyond regular course offerings. [1-3]

ECON 8999. Non-candidate Research. [Formerly ECON 379] Prerequisites: consent of the instructor and the Economics Director of Graduate Studies. [0-12]

ECON 9110. Topics in Microeconomics. [Formerly ECON 333] Advanced theory and applications. Variable topics including auctions, networks, contract theory, social choice, political economy, and market design. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. Prerequisite: 8110, or consent of the instructor and the director of graduate studies. [3]

ECON 9210. Topics in Macroeconomics. [Formerly ECON 377] Advanced theory and applications. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. Prerequisite: 8210. [3]

ECON 9250. Theory of Money and Finance I. [Formerly ECON 332A] Advanced topics in monetary and financial economics theory and applications. Recently developed dynamic theories of money and asset pricing. Inflationary dynamics; money, welfare, and growth; money and business cycles; financial development and growth; credit market imperfections and financial crises. Prerequisites: 8210. [3]

ECON 9260. Theory of Money and Finance II. [Formerly ECON 332B] Analyses of microeconomic foundations and general equilibrium models of money and financial markets. Theory of payments structure, capital asset pricing, rational expectations, efficient markets, and contingent claims markets. Prerequisite: 8210. [3]

ECON 9310. Time Series Econometrics. [Formerly ECON 373] Methods for estimating structural vector autoregressive models and dynamic economic models, such as maximum likelihood method, Bayesian method, and generalized method of moments. Prerequisite: 8320, or consent of the instructor and the director of graduate studies. [3]

ECON 9320. Non-parametric and Semi-parametric Econometrics. [Formerly ECON 374] Non-parametric and semi-parametric methods for estimation and inference in econometric models. [3]

ECON 9330. Microeconometrics. [Formerly ECON 375] Econometric models and methods for dealing with micro data. Structural and reduced-form approaches. Statistical inference using the models and their applications in IO, labor, health, and elsewhere in economics and social sciences. Prerequisite: 8320, or consent of the instructor and the director of graduate studies. [3]

ECON 9440. Topics in Economic History: Microeconomic. [Formerly ECON 366A] Examination of various microeconomic aspects of long-term development. Topics include demographic change, labor market outcomes, the development of institutions, industrialization, migration, health, and inequality. Prerequisites: 8310 and 8400. [3]

ECON 9450. Topics in Economic History: Macroeconomic. [Formerly ECON 366B] Macroeconomic aspects of long-term development. Economic growth, the development of financial markets and the role of financial markets in economic development, the history and evolution of monetary and fiscal policy, capital market integration, and business cycles, including the Great Depression. Prerequisites: 8310 and 8400. [3]

ECON 9480. Health Economics. [Formerly ECON 312B] Conceptual and empirical analysis of demand for health, medical services, and insurance. Causes and consequences of various health risk behaviors. Emphasis on tools and designs of research in modern health economics. Prerequisites: 8110 and 8310, or consent of the instructor and the director of graduate studies. [3]

ECON 9490. Health Economics. [Formerly ECON 312A] Conceptual and empirical analysis of the origins of health attributes; joint investments in skill and health capitals; health-related consumption and lifestyles; the value of health, life, and medical innovation; the demand for health insurance; and the supply of health care. Applied econometrics methods, with a particular emphasis on comparisons among alternative methods used in health economics research. Prerequisite: 8110 and 8310. [3]

ECON 9500. Industrial Organization I. [Formerly ECON 320A] Primary models of imperfect competition. Topics include bargaining; monopoly and oligopoly, allowing for differentiated products and incomplete information. Applications include quality provision and product pricing; consumer search for the lowest price; auctions; network externalities; innovation and market structure; liability and market structure; the theory of the firm; and settlement bargaining. Prerequisite: 8110 [3]

ECON 9510. Industrial Organization II. [Formerly ECON 320B] Emphasis on empirical research in the field and application of models. Consumer demand for differentiated products, static games of imperfect competition, dynamic models of individual choice, dynamic games of imperfect competition, and the estimation of production functions. Prerequisites: 8320 and 9500, or consent of the instructor and the director of graduate studies. [3]

ECON 9550. Labor Economics. [Formerly ECON 329A] Static and dynamic models of labor demand and labor supply, and models of human capital development. Applications of the theory to migration, fertility, health,

wage determination, education, unionism and industrial relations, employment policies, implicit contracting and layoffs, and discrimination. Methodological problems related to the analysis of labor markets. Prerequisite: 8110 and 8310. [3]

ECON 9560. Labor Economics. [Formerly ECON 329B] Static and dynamic models of labor demand and labor supply, and models of human capital development. Applications of the theory to topics such as migration, fertility, health, wage determination, education, unionism and industrial relations, employment policies, implicit contracting and layoffs, and discrimination. Methodological problems related to the analysis of labor markets. Prerequisite: 8110 and 8310. [3]

ECON 9600. International Trade Theory. [Formerly ECON 316] Trade and growth. Models and empirical evidence. Commercial policy, tariffs, the terms of trade and income distribution, international factor movements, and trade agreements. Prerequisite: 8110. [3]

ECON 9610. International Macroeconomics. [Formerly ECON 317] Neoclassical and New Keynesian international business cycle models; interaction of asset markets and goods markets. Dynamic models of exchange rates, relative prices, and the trade balance. Monetary and fiscal policy in the open economy. Simulation and estimation of business cycle models. Prerequisite: 8210, or consent of the instructor and the director of graduate studies. [3]

ECON 9710. Public Economics: Expenditure. [Formerly ECON 354A] Analysis of issues. Possible topics include externalities, public goods, local public goods, and aspects of public choice and voting theory. Prerequisite: 8110. [3]

ECON 9720. Public Economics: Taxation. [Formerly ECON 354B] Analysis of issues. Possible topics include: optimal taxation theory, tax reform, tax incidence, behavioral impacts of taxation, dynamic taxation, tax competition, and the political economy of taxation. Prerequisite: 8810 [3]

ECON 9810. Economic Development. [Formerly ECON 388A] Contemporary theories and empirical studies. Topics include missing markets and market imperfection in developing countries; health, education, and labor market performance in low-income countries; credit, savings and insurance in rural economies; property rights, infrastructure and public provision of goods; intra-household bargaining and allocation; technology adoption; inequality and redistributive policy; and macroeconomic policy. Empirical strategies in development economics. Prerequisite: 8110, 8210, and 8310. [3]

ECON 9820. Economic Development. [Formerly ECON 388B] Contemporary theories and empirical studies. Topics include missing markets and market imperfection in developing countries; health, education, and labor market performance in low-income countries; credit, savings and insurance in rural economies; property rights, infrastructure and public provision of goods; intra-household bargaining and allocation; technology adoption; inequality and redistributive policy; and macroeconomic policy. Strategies in development economics. Prerequisite: 8110, 8210, and 8310. [3]

ECON 9890. Workshop on Economics. [Formerly ECON 398] Research seminar to aid advanced students in the selection of thesis topics and presentation of research papers. Topics covered depend on interests of students and faculty. [0-3]

ECON 9999. Ph.D. Dissertation Research. [Formerly ECON 399] [0-12]

Electrical Engineering

EECE 5218. Microcontrollers. (Also listed as EECE 2218) Microprocessor and microcontroller architecture with emphasis on control applications. Usage of assembly language and interfacing with programs written in high-level languages. Interfacing and realtime I/O with 8-bit microprocessors, control algorithms, and networking with microcontrollers. Graduate credit only for non-majors. No credit for students who have earned credit for 2218. Corequisite: EECE 5218L. SPRING. [3]

EECE 5218L. Microcontrollers Laboratory. (Also listed as EECE 2218L) Laboratory for EECE 5218. A small structured project is required. One three-hour laboratory per week. Graduate credit only for non-majors. No

credit for students who have earned credit for 2218L. Corequisite: EECE 5218. SPRING. [1]

EECE 5233. Electromagnetics. (Also listed as EECE 3233) Electromagnetic field theory. Maxwell's equations developed from a historical approach. Electromagnetic waves with regard to various media and boundary conditions. Graduate credit only for non-majors. No credit for students who have earned credit for 3233. FALL. [3]

EECE 5235. Electronics I. (Also listed as EECE 3235) Semiconductor devices and electronic circuits. Diodes, BJT and MOS transistors. Device models, modes of operation, biasing. Small-signal models, low frequency analysis of single- and multi-stage analog amplifiers, simple amplifier design. Large signal models, dc analysis of digital circuits. Graduate credit only for non-majors. Corequisite: EECE 5235L. No credit for students who have earned credit for 3235. FALL. [3]

EECE 5235L. Electronics I Laboratory. (Also listed as EECE 3235L) Laboratory for EECE 3235. One three-hour laboratory per week. Corequisite: EECE 5235. No credit for students who have earned credit for 3235L. FALL. [1]

EECE 5252. Signal Processing and Communications. (Also listed as EECE 4252) AM and FM modulation. Also, advanced topics in signal processing are treated. No credit for students who have earned credit for 4252. SPRING. [3]

EECE 5257. Control Systems I. (Also listed as EECE 4257) Theory and design of feedback control systems, steady-state and transient analysis, stability considerations. Model representation. State-variable models. No credit for students who have earned credit for 4257. FALL. [3]

EECE 5267. Power System Analysis. (Also listed as EECE 4267) Analysis of large transmission and distribution networks. Analysis of power lines, load flow, short circuit studies, economic operation, and stability are introduced. No credit for students who have earned credit for 4267. [3]

EECE 5275. Microelectronic Systems. (Also listed as EECE 4275) Active devices in the context of digital systems, with an emphasis on embedded systems integration. Characteristics and utilization of different digital integrated circuit families, common bus structures and protocols and real world interfaces (comparators, A/D/A conversion). No credit for students who have earned credit for 4275. SPRING. [3]

EECE 5283. Principles and Models of Semiconductor Devices. (Also listed as EECE 4283) Physical principles of operation of the p-n junction, MOS field-effect transistor, and bipolar transistor. Fundamentals of charge transport, charge storage, and generation-recombination; application to the operation of MOSFET and BJT. Device modeling with emphasis on features and constraints of integrated circuit technologies. No credit for students who have earned credit for 4283. [3]

EECE 5284. Integrated Circuit Technology and Fabrication. (Also listed as EECE 4284) Monolithic integrated circuit technology. Basic semiconductor properties and processes that result in modern integrated circuit. Bipolar and MOSFET processes and structures. Fabrication, design, layout, and applications as regards semiconductor microelectronic technologies. No credit for students who have earned credit for 4284. SPRING. [3]

EECE 5286. Audio Engineering. (Also listed as EECE 4286) Engineering aspects of high fidelity sound reproduction, with emphasis on digital audio and loudspeakers. Analog-to-digital and digital-to-analog conversion, data storage, perceptual coding, loudspeaker design. No credit for students who have earned credit for 4286. [3]

EECE 5287. Engineering Reliability. (Also listed as EECE 4287) Topics in engineering reliability with emphasis on electrical devices and systems. Reliability concepts and models. Risk analysis. Lifetime evaluation. System examples. No credit for students who have earned credit for 4287. [3]

EECE 5288. Optoelectronics. (Also listed as EECE 4288) Fundamentals and applications of light generation, propagation, and modulation in passive and active optoelectronic components. Waveguides, lasers, electro-optic modulators, and emerging optoelectronic technology for optical communication, computing, and sensing applications. No credit for students who have earned credit for 4288. SPRING. [3]

EECE 5334. RF and Microwave Design. Modeling of components and transmission structures at RF and microwave frequencies (30 MHz to 30 GHz), with emphasis on the effects of materials and geometry on passive structures for filtering and impedance matching. Modeling and design of active circuits and components such as RF amplifiers with input and output impedance matching structures. Prereq: EECE 3233. SPRING. [3]

EECE 5353. Image Processing. Digital imaging and computational photography. Image formation. Point processing. Color perception and manipulation. Spatial filtering via convolution. 2D Fourier transforms. Frequency-domain filtering. Intensity quantization. High dynamic range imaging. Resampling for image resizing, rotation, and warping. Image compositing. Panorama generation. Noise reduction. Mathematical morphology. Image compression. Three lectures and one three-hour virtual laboratory. No credit for students who have earned credit for 4353. FALL. [4]

EECE 5354. Computer Vision. Computational processes. Python and OpenCV for real-time processing. Feature detection: edges, corners, and oriented histogram methods. Feature matching. Scale space. Projective geometry. Camera models. Stereopsis. Image rectification. Multi-baseline stereo. Motion estimation. 3D reconstruction. Machine learning for computer vision including multilayer neural networks. No credit for students who have earned credit for 4354. SPRING. [3]

EECE 5356. Digital Signal Processing. (Also listed as EECE 4356) Applications of Digital Signal Processing (DSP) chips to sampling, digital filtering, FFTs, etc. Three lectures and one laboratory period. No credit for students who have earned credit for 4356. SPRING. [4]

EECE 5358. Control Systems II. (Also listed as EECE 4358) Modern control design. Discrete-time analysis. Analysis and design of digital control systems. Nonlinear systems and optimum control systems. Fuzzy control systems. Two lectures and one laboratory. No credit for students who have earned credit for 4358. SPRING. [3]

EECE 5371. Mobile and Wireless Networks. (Also listed as EECE 4371) Design, development, and applications of mobile applications and services. Topics include wireless technologies, smart phone programming, cloud computing services. No credit for students who have earned credit for 4271. [3]

EECE 5376. Embedded Systems. (Also listed as EECE 4376) Design and application of embedded microcontroller-based systems. Programming for real-time systems and the Internet of Things. Embedded system modeling, design, analysis, and implementation using real-time and event-driven techniques. A structured project is required. No credit for students who have earned credit for 4376. Corequisite: EECE 5376L. FALL. [3]

EECE 5376L. Embedded Systems Laboratory. (Also listed as EECE 4376L) Laboratory for EECE 5376. A team-oriented structured project is required. One three-hour laboratory per week. Corequisite: EECE 5376. No credit for students who have earned credit for 4376L. FALL. [1]

EECE 5377. FPGA Design. (Also listed as EECE 4377) Design and applications of field-programmable gate arrays, Electronic Design Automation (EDA) tools for design, placement, and routing. Hardware description languages. Implementation of designs on prototype FPGA board. No credit for students who have earned credit for 4377. [3]

EECE 5380. Electronics II. (Also listed as EECE 4380) Integrated circuit analysis and design. High frequency operation of semiconductor devices. Frequency-response and feedback analysis of BJT and MOS analog amplifier circuits, multi-stage frequency-compensated amplifier design. Transient analysis of BJT and MOS digital circuit families. Digital-to-analog and analog-to-digital conversion circuits. No credit for students who have earned credit for 3380. SPRING. [3]

EECE 5385. VLSI Design. (Also listed as EECE 4385) Integrated circuit and fabrication techniques; CAD tools for design, layout, and verification; parasitic elements and their effects on circuit performance; system-level design experience is gained by completing design and layout phases of a project. No credit for students who have earned credit for 4385. FALL. [3]

EECE 5891. Special Topics. (Also listed as EECE 3891) No credit for students who have earned credit for 3891. [1-3 each semester]

EECE 5892. Special Topics. (Also listed as EECE 3892) No credit for students who have earned credit for 3892. [1-3 each semester]

EECE 6301. Solid-State Materials. [Formerly EECE 301] Properties of charged particles under the influence of an electric field, quantum mechanics, particle statistics, fundamental particle transport, and band theory of solids. FALL. [3]

EECE 6302. Electric and Magnetic Properties of Solids. [Formerly EECE 302] Electromagnetic theory of solids using advanced mathematical and computational techniques. Dielectric, magnetic, and optical properties. Fundamental interactions of electromagnetic radiation and charged particles in solids. Prerequisite: EECE 6301. SPRING. [3]

EECE 6304. Radiation Effects and Reliability of Microelectronics. [Formerly EECE 304] The space radiation environment and effects on electronics, including basic mechanisms of radiation effects and testing issues. Total dose, single-event, high-dose-rate, and displacement damage radiation effects. Effects of defects and impurities on MOS long-term reliability. SPRING. [3]

EECE 6305. Topics in Applied Magnetics. [Formerly EECE 305] Selected topics in magnetism, magnetic properties of crystalline and non-crystalline materials; ferrite materials for electronics and microwave applications, resonance phenomena. Prerequisite: EECE 6302. [3]

EECE 6306. Solid-State Effects and Devices I. [Formerly EECE 306] The semiconductor equations are examined and utilized to explain basic principles of operation of various state-of-the-art semiconductor devices including bipolar and MOSFET devices. FALL. [3]

EECE 6307. Solid-State Effects and Devices II. [Formerly EECE 307] The structure of solids, phonons, band theory, scattering phenomena, and theory of insulators. [3]

EECE 6311. Systems Theory. [Formerly EECE 311] Use of linear algebra and matrix analysis for solving systems of linear and ordinary differential equations. State space representations of control systems. Stability, controllability, and observability. Support-vector machines as applied functional analysis. Gradient-based optimization techniques. Dimensionality reduction. SPRING. [3]

EECE 6321. Cyber-Physical Systems. Modeling, design, and analysis of cyber-physical systems that integrate computation and communication with physical systems. Modeling paradigms and models of computation, design techniques and implementation choices, model-based analysis and verification. Project that covers the modeling, design, and analysis of CPS. [3]

EECE 6341. Advanced Analog Electronics. EECE 6341. Advanced Analog Electronics. [Formerly EECE 341] Analysis and design of analog electronics circuits with emphasis on integrated circuits. Topics include operational amplifiers, wideband amplifiers, multipliers, and phase-locked loops. FALL. [3]

EECE 6342. Advanced Digital Electronics. [Formerly EECE 342] Analysis and design of digital electronic circuits with emphasis on integrated circuits. Topics include logic families, semiconductor memories, and the analog-digital interface. [3]

EECE 6343. Digital Systems Architecture. [Formerly EECE 343] Architectural descriptions of various CPU designs, storage systems, IO systems, parallel and von Neumann processors and interconnection networks. [3]

EECE 6354. Advanced Real-Time Systems. [Formerly EECE 354] Fundamental problems in real-time systems, with focus on modeling, analysis, and design. Topics include: scheduling theory and techniques, time synchronization, time- and event-triggered systems, distributed architectures, advanced programming languages for real-time systems. Literature reviews and projects. [3]

EECE 6356. Intelligent Systems and Robotics. Fundamental technologies in autonomous vehicles. Bayesian probability. Probabilistic robotics. Coordinate changes. Representations of rotation. Motion and sensor models. Bayes filters. Simultaneous localization and mapping. Current machine learning approaches. FALL. [3]

EECE 6357. Advanced Image Processing. [Formerly EECE 357] Techniques of image processing. Topics include image formation, digitization, linear shift-invariant processing, feature detection, and motion. Prerequisite: MATH 2300; programming experience. FALL. [3]

EECE 6358. Quantitative Medical Image Analysis. Image processing and statistical methods for quantitative analysis and interpretation of medical imaging data. Neuroimaging approaches related to brain structure, function, and connectivity. Massively univariate analysis (parametric mapping), multiple comparison issues, random fields, independent components, non-parametric approaches, and Monte Carlo methods. Students should have knowledge of undergraduate probability and computer programming. [3]

EECE 6361. Random Processes. [Formerly EECE 361] Concepts of random variables, functions of random variables, and random processes. Spectral properties of random processes and of the response of linear systems to random inputs. Linear mean square estimation. Emphasis on engineering applications. FALL. [3]

EECE 6362. Detection and Estimation Theory. [Formerly EECE 362] Fundamental aspects of signal detection and estimation. Formulation of maximum likelihood, maximum a posteriori, and other criteria. Multidimensional probability theory, signal and noise problems, and Kalman filter structure are studied. SPRING. [3]

EECE 7899. Master of Engineering Project. [Formerly EECE 389]

EECE 7999. Master's Thesis Research. [Formerly EECE 369] [0-6]

EECE 8395. Special Topics. [Formerly EECE 395] Based on research and current developments in electrical engineering of special interest to staff and students. [3]

EECE 8396. Special Topics. [Formerly EECE 396] Based on research and current developments in electrical engineering of special interest to staff and students. [3]

EECE 8850. Independent Study. [Formerly EECE 397] Readings and/or projects on advanced topics in electrical engineering under the supervision of the staff. Consent of instructor required. [Variable credit: 1-3 each semester]

EECE 8991. Seminar. [Formerly EECE 392] [1]

EECE 8992. Advanced Seminar for Ph.D. Candidates. [Formerly EECE 393] [1]

EECE 8999. Non-Candidate Research. [Formerly EECE 379] Research prior to entry into candidacy (completion of qualifying examination) and for special non-degree students. [Variable credit 0-12]

EECE 9999. Ph.D. Dissertation Research. [Formerly EECE 399]

Engineering Management

ENGM 5000. Enterprise System Design. (Also listed as ENGM 3000) Design of complex enterprise systems and processes including enterprise requirements analysis, process-mapping, modeling, performance measurement, benchmarking, solution development, and change management. No credit for students who have earned credit for 3000. FALL, SPRING. [3]

ENGM 5010. Systems Engineering. (Also listed as ENGM 3010) Fundamental considerations associated with the engineering of large-scale systems. Models and methods for systems engineering and problem solving using a systems engineering approach. No credit for students who have earned credit for 3010. FALL, SPRING. [3]

ENGM 5100. Finance and Accounting for Engineers. (Also listed as ENGM 3100) Time value of money, capital budgeting and formation, financial accounting and reporting, double entry bookkeeping, taxation, performance ratio measurements, and working capital management. Probabilistic models for expected net present value and rate of return, dividend pricing models for alternative growth scenarios, cost and market based models for average cost of capital, taxation algorithms, and regression analysis for individual firm betas. No credit for students who have earned credit for 3100. FALL, SPRING, SUMMER. [3]

ENGM 5200. Technology Marketing. (Also listed as ENGM 3200) Strategies for marketing technology-based products and services. Demand analysis, segmentation, distribution, and personal selling. Economic analysis from inception to end use. No credit for students who have earned credit for 3200. FALL. [3]

ENGM 5300. Technology Assessment and Forecasting. (Also listed as ENGM 3300) Methods of forecasting technological advancements and assessing their potential intended and unintended consequences. Delphi method, trend exploration, environmental monitoring, and scenario development. No credit for students who have earned credit for 3300. SPRING. [3]

ENGM 5600. Technology-Based Entrepreneurship. (Also listed as ENGM 3600) Identification and evaluation of opportunities: risks faced by entrepreneurs, market assessment, capital requirements, venture capital acquisition, legal structures, tax implications for sharing technology-based businesses. No credit for students who have earned credit for 3600. FALL. [3]

ENGM 5650. Operations and Supply Chain Management. (Also listed as ENGM 3650) Manufacturing strategy, process analysis, product and process design, total quality management, capacity planning, inventory control, supply chain design, and advanced operations topics. Modeling and analysis using cases and spreadsheets. No credit for students who have earned credit for 3650. FALL. [3]

ENGM 5700. Program and Project Management. (Also listed as ENGM 3700) Scheduling, cost estimation/predictions, network analysis, optimization, resource/load leveling, risk/mitigation, quality/testing, international projects. Term project required. Provides validated preparation for the Project Management Institute CAPM certification for undergraduates or the PMP for graduate students. Credit given for only one of ENGM 3700 or 5700, CE 4400 or 5400, or EECE 4950. FALL, SPRING, SUMMER. [3]

ENGM 5890. Special Topics. Variable credit each semester. [1-3]

ENGM 6500. Engineering Leadership and Program Management. Application of core principles of leadership and program management for engineering professionals. Strategic planning, people management, staffing, compensation, business process improvement theory, business interruption, leadership styles, emotional intelligence, negotiation, ethical business practices. [3]

English

ENGL 5290. Special Topics in Creative Writing. (Also listed as ENGL 3891) Advanced instruction in creative writing in emerging modes and hybrid genres. [3]

ENGL 7430. Graduate Fiction Workshop. [Formerly ENGL 303] May be repeated for credit. [4]

ENGL 7440. Graduate Poetry Workshop. [Formerly ENGL 304] [May be repeated for credit with the program director's approval] [4]

ENGL 7450. Graduate Nonfiction Workshop. [Formerly ENGL 305] [May be repeated for credit with the program director's approval] [4]

ENGL 7460. Literature and the Craft of Writing. [Formerly ENGL 307] [May be repeated for credit with the program director's approval] [4]

ENGL 7998. Master of Fine Arts Pedagogy Tutorial. [Formerly ENGL 370] Instruction with faculty adviser for MFA students teaching undergraduate courses. [2]

ENGL 7999. MFA Thesis Research. [Formerly ENGL 369] [0-12]

ENGL 8110. Proseminar. [4]

ENGL 8120. Pedagogy Seminar. [4]

ENGL 8137. Introduction to Literary Theory. [Formerly ENGL 337A] [4]

ENGL 8138. Seminar in Critical Theory and Methodology. [Formerly ENGL 337B] Topics include gender and sexuality studies, critical race studies, visibility and/or spectrality, postcolonial studies, disability studies, archival research and editorial practices, digital and public humanities, and

environmental humanities. May be repeated for credit more than once if there is no duplication in topic. [4]

ENGL 8150. Independent Study Problems in English and American Literature. [Formerly ENGL 350] May be repeated for credit more than once if there is no duplication in topic, but students may earn only up to 4 credits per semester of enrollment. [1-4]

ENGL 8155. Special Topics in English and American Literature. [Formerly ENGL 355] May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [4]

ENGL 8303. Queer Theory. [Formerly WGS 303] History and development of queer theory. Key intellectual antecedents, significant theorists, and current trends. How sexuality intersects with gender, race, class, nationality, ability, and religion. [3]

ENGL 8331. Studies in Medieval and Early-Modern British Literature. Early-modern through 17th century. May be repeated for credit more than once if there is no duplication in topic. [4]

ENGL 8340. Seminar in Shakespeare. [Formerly ENGL 310] [4]

ENGL 8351. Studies in 20th and 21st Century American Literatures. Topics include modernisms, African American, Asian American, Latino/a, and Caribbean American literatures. May be repeated for credit more than once if there is no duplication in topic. [4]

ENGL 8370. Studies in 18th Century British Literature. [Formerly ENGL 330] May be repeated for credit more than once if there is no duplication in topic. [4]

ENGL 8410. Studies in Romantic and Victorian Literatures. [Formerly ENGL 316] May be repeated for credit more than once if there is no duplication in topic. [4]

ENGL 8430. Studies in Modern and Contemporary British and Irish Literatures. [Formerly ENGL 325] Topics include British and Anglo-Irish modernisms, black British writers. May be repeated for credit more than once if there is no duplication in topic. [4]

ENGL 8440. Studies in Comparative Literatures. [Formerly ENGL 326] Topics include classical or ancient legacies; hemispheric American literatures, Caribbean literatures in different languages; translation studies; studies of literary genres and forms; global modernisms; transatlantic and transpacific studies. May be repeated for credit more than once if there is no duplication in topic. [4]

ENGL 8441. Studies in Anglophone World Literatures. Topics in global colonial and global postcolonial Anglophone literatures, including Asian, African, and Caribbean writers; global modernisms. May be repeated for credit more than once if there is no duplication in topic. [4]

ENGL 8442. Media Studies. Topics include new models of science and the humanities; modes of reality and representation in the age of cyberculture; American literature and the cinema; early cinema (1893-1920). May be repeated for credit more than once if there is no duplication in topic. [4]

ENGL 8450. Studies in Early and 19th-Century American Literatures. [Formerly ENGL 320] May be repeated for credit more than once if there is no duplication in topic. [4]

ENGL 8998. Non-Candidate Research. [Formerly ENGL 398] [0]

ENGL 8999. Non-candidate Research. [Formerly ENGL 379] Research prior to entry into candidacy (completion of Qualifying Examination) and for special non-degree students. [Variable credit: 0-12]

ENGL 9995. Half-time Ph.D. Dissertation Research. [Formerly ENGL 3995] For students who have completed 72 hours and devote a half-time effort to dissertation research. [0]

ENGL 9999. Ph.D. Dissertation Research. [Formerly ENGL 399] [0-12]

Environmental Engineering

ENVE 5305. Enterprise Risk Management. (Also listed as ENVE 4305) Development of an organization-wide risk management program for pro-

tecting human health, the environment and business continuity. Focus on defining an all-hazards risk management process and program implementation, performing risk assessments, determining and selecting appropriate risk reduction strategies, and influencing risk management decisions internally and externally. Applications drawn from natural disasters, man-made accidents and intentional acts. No credit for students who have earned credit for ENVE 4305. SPRING. [3]

ENVE 5600. Environmental Chemistry. (Also listed as ENVE 4600) Theoretical aspects of physical, organic, and inorganic chemistry applied to environmental engineering. Estimation of chemical parameters based on thermodynamic and structural activity relationships, kinetics of chemical reactions, equilibrium processes in the environment, including the carbonate system, metal complexation and precipitation. No credit for students who have earned credit for 4600. FALL. [3]

ENVE 5605. Environmental Thermodynamics, Kinetics, and Mass Transfer. (Also listed as ENVE 4605) Examination of fundamental environmental processes and phenomena that provide the analytical tools necessary to solve a broad range of environmental problems. These tools include equilibrium phenomena, process rate and mass transport phenomena. No credit for students who have earned credit for 4605. SPRING. [3]

ENVE 5610. Biological Processes in Environmental Systems. (Also listed as ENVE 4610) Principles of biology and their application to wastewater treatment processes with emphasis on microbial ecology, bioenergetics, and the role of chemical structure in biodegradability. Utilization kinetics of inhibitory and non-inhibitory organic compounds. Biological process analysis and design (aerobic and anaerobic) for municipal and industrial wastewaters, using a mass balance approach. No credit for students who have earned credit for ENVE 4610. SPRING. [3]

ENVE 5615. Environmental Assessments. (Also listed as ENVE 4615) Design and conduct of environmental assessments to evaluate risks posed by infrastructure systems or environmental contamination. Impact analyses for sources, infrastructure modifications, due diligence environmental audits, and contaminated site remedial investigations. No credit for students who have earned credit for 4615. FALL. [3]

ENVE 5620. Environmental Characterization and Analysis. (Also listed as ENVE 4620) Acquisition and interpretation of environmental data. Principles of chemical measurement, sample collection and sample program design; laboratory safety and good laboratory practices; analytical instrumentation and methods; quality assurance and quality control; and statistical interpretation of data. Hands-on experience through demonstrations featuring state-of-the-art analytical instrumentation. No credit for students who have earned credit for 4620. SPRING. [3]

ENVE 5625. Environmental Separations Processes. (Also listed as ENVE 4625) Fundamentals and applications of separations processes relevant to water and wastewater treatment and other environmental systems. Topics include coagulation/flocculation, sedimentation, granular filtration; advanced separation processes such as various membrane processes, absorption, ion exchange, thermally driven separations, and electrically driven separations including electro dialysis and capacitive deionization. No credit for students who have earned credit for ENVE 4625. SPRING. [3]

ENVE 5700. Energy and Water Resources. (Also listed as ENVE 4700) Scientific, technological, philosophical, and social issues surrounding approaches to carbon-based energy and alternative energy resources, management of carbon through sequestration, supplying and treating water for agriculture, communities, and industry, and changing climate impacts on regional distribution of water resources. No credit for students who have earned credit for 4700. SPRING. [3]

ENVE 5705. Physical Hydrology. (Also listed as ENVE 4705) Development of fundamental bases of hydrological processes. Land atmosphere flows, surface water flows, soil moisture dynamics, and groundwater flows. Exposition of physical principles, their embodiment in mathematical models, and their use in interpreting observations in the field and laboratory. No credit for students who have earned credit for 4705. FALL. [3]

ENVE 5710. Hydrology. (Also listed as ENVE 4710) The hydrologic cycle, study of precipitation, evapotranspiration, hydrometeorology, stream flow, flood flow, flood routing, storm sewer design, detention basin design,

and water quality. No credit for students who have earned credit for 4710. FALL. [3]

ENVE 5715. Groundwater Hydrology. (Also listed as ENVE 4715) The occurrence and flow of ground water. Basic concepts of the effects of varying permeability and capillarity on seepage flow. Flow toward wells, through dikes, and beneath dams. No credit for students who have earned credit for 4715. SPRING. [3]

ENVE 5720. Surface Water Quality Modeling. (Also listed as ENVE 4720) Analysis of physical, chemical, biological, and physiological contaminants in streams, lakes, and estuaries, and surface water/groundwater interfaces. Analytical and numerical modeling techniques. One- and two-dimension computer simulation of surface water quality. No credit for students who have earned credit for 4720. SPRING. [3]

ENVE 5800. Nuclear Environmental Engineering. (Also listed as ENVE 4800) The nuclear fuel cycle and environmental and societal impacts associated with its traditional implementation. Technical and programmatic challenges associated with fuel production, and waste management including processing, storage, transportation, decontamination, decommissioning, and environmental restoration. Technologies and approaches for reducing impacts of the nuclear fuel cycle. No credit for students who have earned credit for 4800. SPRING. [3]

ENVE 6800. Nuclear Facilities Life Cycle Engineering. [Formerly ENVE 330] The life cycle (including siting, licensing, construction, operations and decommissioning) of the nuclear facilities that comprise the nuclear fuel cycle--from mining uranium ore through the potential recycling of used nuclear fuel. SPRING. [3]

ENVE 6805. Storage, Treatment and Disposal of Radioactive Waste. [Formerly ENVE 332] Evolution of current domestic and international approaches, including waste forms, classification, storage and disposal locations, and environmental and safety assessments. FALL. [3]

ENVE 7531. Nuclear Chemistry and Processes. [Formerly ENVE 331] Chemistry and chemical processing of the actinides and important fission products and byproducts. Development of nuclear chemical engineering processes for these materials. SPRING. [3]

ENVE 7533. Nuclear Process Safety. [Formerly ENVE 333] Approaches for evaluating the safety of nuclear radiochemical processing systems. Safety analysis practices from the chemical industry, the nuclear power community, and the United States nuclear weapons complex, and other quantitative and qualitative risk assessment methods. FALL. [3]

ENVE 7534. Nuclear Environmental Regulation, Law and Practice. [Formerly ENVE 334] Environmental laws and regulations governing radionuclides and radioactive waste, including those concerning hazardous chemicals and wastes and those impacting commercial nuclear fuel cycle facilities and former nuclear weapons and materials sites. Interplay between regulatory agencies such as the US Nuclear Regulatory Commission, the US Environmental Protection Agency, and the states. Self-regulation of activities by the U.S. Department of Energy. SUMMER. [3]

ENVE 7899. Master of Engineering Project. [Formerly ENVE 389]

ENVE 7999. Master's Thesis Research. [Formerly ENVE 369] [0-6]

ENVE 8000. Individual Study. [Formerly ENVE 325A] Literature review and analysis, or laboratory investigation of special problems under faculty supervision. FALL, SPRING, SUMMER. [Variable credit: 1-4 each semester]

ENVE 8001. Individual Study. [Formerly ENVE 325B] Literature review and analysis, or laboratory investigation of special problems under faculty supervision. FALL, SPRING, SUMMER. [Variable credit: 1-4 each semester]

ENVE 8002. Individual Study. [Formerly ENVE 325C] Literature review and analysis, or laboratory investigation of special problems under faculty supervision. FALL, SPRING, SUMMER. [Variable credit: 1-4 each semester]

ENVE 8300. Research Methods Seminar. Coverage of graduate-level skills required to conduct critical review of a topic and produce research proposals, research presentations, and peer-reviewed journal publications. Includes discussion of responsible conduct in research and ethics. FALL. [0]

ENVE 8999. Non-Candidate Research. [Formerly ENVE 379] Research prior to entry into candidacy (completion of qualifying examination) and for special non-degree students. [Variable credit: 0-12]

ENVE 9999. Ph.D. Dissertation Research. [Formerly ENVE 399]

Epidemiology

EPID 8301. Introduction to Statistical Computing and Programming Workshop. [Formerly EPID 301] This course is designed for students who seek to develop skills in statistical computing. Students will learn how to use R and STATA for data management, database querying, reporting generating, data presentation, and data tabulation and summarization. Topics include: organization and documentation of data, input and export of data sets; methods of cleaning data; tabulation and graphing of data; programming capabilities; and an introduction to simulations and bootstrapping. Students will also be introduced to LATEX and SWEAVE for report writing. Students will also be briefly introduced to SAS. [2]

EPID 8310. Causal Inference. [Formerly EPID 310] This course will concentrate on conceptually grasping tools of logic and critical thinking as they apply to epidemiologic research. Our emphasis will be on rigorous definition of a causal effect and the minimal conditions necessary to consistently estimate such effects. In a small group format, we will examine case studies and anchor our discussions in readings from philosophy of science, logic, and probability. We will cover examples of valid and fallacious arguments, probability calculus, probabilistic fallacies, applications of Bayes theorem, the frequentist and Bayesian perspective, counterfactual logic, introduction of directed acyclic graphs (DAG), and interpretation of p-values and confidence intervals in epidemiologic research. [3]

EPID 8311. Epidemiologic Theory and Methods I. [Formerly EPID 311] This is the first of a two-course series on advanced epidemiologic concepts and methods that includes measures of disease frequency, measures of effect, descriptive epidemiology, study designs, bias, misclassification and effect measure modification, and ethics in epidemiologic research. A case-based approach will engage students in demonstrating concepts using actual research data and in critical appraisal of case studies and publications that feature strong and weak examples. [4]

EPID 8312. Epidemiologic Theory and Methods II. [Formerly EPID 312] This second in a two-course series provides an in-depth treatment of concepts and skills in epidemiologic research, including problem conceptualization, study design, data analysis and interpretation. Includes emphasis on how to design studies to best measure etiologic effects and includes advanced discussion of confounding, interaction, and missing data. A continued case-based approach will engage students in demonstrating concepts and methods using the students' own data. Prerequisite: 8311: Epidemiologic Theory and Methods I. [4]

EPID 8315. Scientific Writing I. [Formerly EPID 315] Scientific Writing I. Participatory course in which students develop skills in presenting research results in manuscripts, abstracts, and posters. Students work in small groups to write and critique published and unpublished manuscripts, with a focus on understanding the essential components of a scientific manuscript or presentation, as well as the process of publishing in the peer-reviewed literature and managing reviewer and editor comments and requests. [2]

EPID 8321. Applied Epidemiologic Methods in Regression I: Binary Data. [Formerly EPID 321] Applied Epidemiologic Methods in Regression I: Binary Data. Concepts and applications, including logistic regression, binomial regression, ordinal regression, multinomial regression, quantile regression, model building strategy, additive and multiplicative interaction, clustered and longitudinal data, and graphical exploration. Includes computer-based experience with real data, and an emphasis on logistic regression.

EPID 8323. Epidemiologic Methods: Design and Analysis with Time-to-Event Data. [Formerly EPID 323] Concepts and applications in survival analysis and analysis of incidence rates, including truncation and censoring, life tables, nonparametric approaches (e.g. Kaplan-Meier, log-rank), semi-parametric approaches (e.g. Cox models, proportional hazards regression), parametric approaches (e.g. Weibull, gamma regression) accommodating

time-dependent exposures, Poisson regression, sensitivity analysis, bootstrapping, and multiple imputation. [4]

EPID 8325. Scientific Writing II – Proposal Development in Epidemiology. [Formerly EPID 325] Scientific Writing II – Proposal Development in Epidemiology. Participatory course in which each student develops a high quality, detailed research proposal suitable for submission to NIH or AHRQ that includes both a technical proposal and a draft budget justification. Includes lecture, in-class exercises and group processes. SPRING

EPID 8330. Training in Molecular and Genetic Epidemiology of Cancer (MAGEC). [Formerly EPID 330] To provide advanced training in concepts and issues central to cancer epidemiology. Topics will include methodology for conducting a cancer epidemiology study, state-of-the-art technologies for such studies, key cancer exposures, biology and major risk factors for common cancers. [1]

EPID 8331. Seminar in Quantitative Methods and Measurement. [Formerly EPID 331] Concepts and application of cross-cutting tools used for unique and/or specialized types of measurement and instrument development for areas such as physical activity, clinical laboratory tests, and imaging studies. May be repeated. [2]

EPID 8332. Advanced Methods for Epidemiology. [Formerly EPID 332] These methods electives will be taught in modular format, most often with three modules on related methods topics, which will vary annually. Students will explore methodological issues in epidemiology like measurement error, missing data, intermediate variables, complex study designs, meta-analysis, splines, propensity scores, simulation. Exercises with provided datasets and the student's own data will be included. May be repeated. [1-3]

EPID 8333. Analytic Techniques for Genetic Epidemiology. [Formerly EPID 333] This course will take an example-based approach to provide students with the skills necessary to conduct statistical association analysis of genetic data from human populations for genetic epidemiology studies. Topics will include quality control, statistical methods for association testing, common study design issues, future directions of genetic epidemiology and advanced topics. HGEN 8330, HGEN 8340, MP&B 8341 recommended. [4]

EPID 8334. Critical Perspectives on Sex, Gender, and Medical Research. This course is designed to provide students with the foundation necessary to critically assess research protocols and published literature on the inclusion and omission of sex and/or gender. This course will also provide understanding of the biological mechanisms involved in sex as a biological variable and will investigate the differences and relationship between sex and gender. Topics discussed include: basic definitions and measurements of sex and gender, biological and sociological contributions to sex and gender, review of sex chromosomes, health disparities and ethical implications, and study designs and statistical assessment of sex and/or gender in research. Examples are stressed with reference to assumptions and limitations. Students should have a basic knowledge of introductory biology (what one would learn in an introductory biology course) and they should have taken, or be taking concurrently, an introductory course in epidemiology, genetics, public health, statistics or biostatistics. If unsure about prerequisites contact course instructors and exceptions will be considered. [2]

EPID 8340. Content Area Intensives. [Formerly EPID 340] These intensives are offered on a rotating basis and taught by faculty with research expertise in the content area of focus. Areas of epidemiology may include cancer, cardiovascular disease, child health, chronic disease/diabetes, genetics, global health, health care, infectious disease, nutrition, pharmaco-epidemiology, reproductive, and social. May be repeated. [1-3]

EPID 8370. Current Topics In Research. [Formerly EPID 370] Students attend weekly presentations selecting from the Vanderbilt Epidemiology Center Seminar Series, Biostatistics Clinic, clinical grand rounds on topics related to content area interests, and other relevant seminars. Students will convene with faculty to reflect on and critique components of research presentations relevant to the students' interests and to the contemporaneous topics being covered in the core epidemiology curriculum. Course assignments will focus on critical appraisal of a methodologic challenge identified in a seminar setting that has immediate relevance to the student's own research. May be repeated. [1]

EPID 8371. Special Topics Seminar In Epidemiology. [Formerly EPID 371] Faculty offer small groups of students a study course on a topic of mutual interest and concern in the faculty member's area of expertise. May be repeated with topic change. [1-3]

EPID 8372. Advanced Readings In Epidemiology. [Formerly EPID 372] Additional readings in specialized epidemiologic topics will be explored in depth under the guidance of a faculty member. May be repeated. [1-3]

EPID 8373. Independent Study In Epidemiology. [Formerly EPID 373] Designed to allow the student an opportunity to master advanced skills in epidemiology while pursuing special projects under individual members of the faculty in their areas of expertise. May be repeated. [1-3]

EPID 8374. Advanced Readings in Epidemiologic Context, Thought, and History. [Formerly EPID 374] Reading and discussion of seminal literature in the history of epidemiology as well as contemporary literature that provides social and cultural context for the development of the field, challenges to the application of epidemiologic findings, consideration of roles and history of public health advocacy, and exploration of topics like social justice and research ethics through the lens of fiction, nonfiction, and scientific literature. A core reading will be selected to launch each semester and students will work as a group to select the balance of the readings for the semester from a recommended source list. Discussions will be facilitated by faculty and students including guest lecturers. Minimum of masters training in quantitative discipline and research experience in epidemiology or related field is required; other graduate students with permission of the instructor.

EPID 8999. Non-Candidate Research. [Formerly EPID 379] Research prior to entry into candidacy (completion of qualifying examination) and for special non-degree students. [Variable credit: 0-12]

EPID 9999. Ph.D. Dissertation Research. [Formerly EPID 399]

European Studies

EUS 5220. Religion and Politics in Modern Europe, 1648-Present. (Also listed as EUS 2220) Toleration in the Enlightenment; the French Revolution; antisemitism; genocide; secularism and political Islam. No credit for students who have earned credit for 2220. [3]

Financial Economics

FNEC 5700. Investment Analysis. (Also listed as FNEC 3700) Investment principles and practices. Security analysis and valuation. Portfolio theory. Current issues in the financial sector. Stock market simulation. No credit for students who have earned credit for 3700. [3]

FNEC 5705. Financial Management. (Also listed as FNEC 3705) Analysis of cases representing capital budgeting, forecasting cash flow, risk assessment, capital structure, mergers and acquisitions. Seminar. No credit for students who have earned credit for 3705. [3]

French

FREN 5111. French for Graduate Reading. [Formerly FREN 101G] Survey of grammar and vocabulary, with extensive reading. Available to graduate students for "no credit" only. [0]

FREN 5850. Independent Study. (Also listed as FREN 3850) Content varies according to the needs of the individual student. Primarily designed to cover pertinent material not otherwise available in the regular curriculum. May be repeated for a total of 12 credits over a four-semester period, but students may earn only up to 3 credits per semester of enrollment. [1-3; maximum of 12 credits total for four semesters of FREN 5850] No credit for students who have earned credit for 3850.

FREN 6030. Foreign Language Learning and Teaching. [Formerly FREN 310] (Also listed as German 5310, Portuguese 6030, and Spanish 6030) Principles and practices of teaching a second language, with concentration on recent interactive and communicative models of foreign language instruction. Goals of the course are 1) to introduce principles of Second Language Acquisition and learning, 2) to critically read relevant lit-

erature in the area(s), and 3) to develop FL instructor's awareness through reflective and critical thinking. Classroom observations, journal writing, development of materials, and a small action-research project are expected. Required of all entering teaching assistants. [3]

FREN 7010. Introduction to Research. [Formerly FREN 300] Materials and methods of scholarly research, with attention to their relation to theories of literature. [3]

FREN 7020. History of the French Language: Medieval Period. [Formerly FREN 302] Syntax, morphology, phonology, emphasis on textual explanation. Prerequisite: elementary knowledge of Latin. [3]

FREN 7040. Second Language Acquisition Theories and Research. [Formerly FREN 312] A review of current sociocultural and cognitive theories and research in SLA. [3]

FREN 7050. Applied French Linguistics. [Formerly FREN 318] Phonetics, morphology, syntax, and semantics, with application to teaching; theories of second language acquisition. [3]

FREN 7060. French Literary Theory. [Formerly FREN 380] Literary theory as it has been shaped by and shapes the French tradition. [3]

FREN 8000. Apprenticeship in Undergraduate Teaching. [Formerly FREN 397] Supervised experience and instruction of pedagogical practices in foreign language and literature courses. Consent of supervisor and Director of Graduate Studies required. [3]

FREN 8010. Seminar in Medieval French Literature. [Formerly FREN 332] May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

FREN 8020. French Feminism from de Beauvoir to the Present. [Formerly FREN 338] Ideological, political, and cultural contexts. French feminist theory explored through essays, novels, drama, and poetry. Principal theoretical feminists (Beauvoir, Delphy, Guillaumin, Leclerc, Cixous, Irigaray, Kristeva), as well as lesser-known figures (Halimi, Badinter, Agacinsky, Roudinesco, Amara) and literary figures (Duras, Abécassis, Schwarz-Bart, Ednan and Bâ. [3]

FREN 8030. Seminar in Seventeenth-Century French Literature. [Formerly FREN 342] May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

FREN 8040. Seminar in Eighteenth-Century French Literature. [Formerly FREN 353] May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

FREN 8050. Seminar in Nineteenth-Century French Literature. [Formerly FREN 362] May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

FREN 8060. Seminar in Twentieth-Century French Literature. [Formerly FREN 372] May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

FREN 8070. Seminar in Francophone Literature. [Formerly FREN 388] Literature of the French-speaking world ("La Francophonie"). May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

FREN 8075. Seminar in Francophone Caribbean Literature. [Formerly FREN 387] Major literary figures and intellectual traditions. No credit for students who earned credit for 388 section 1 in fall 2012. [3]

FREN 8080. Seminar in French Film. [Formerly FREN 375] Theory and practice of French-language film, often in comparative context, for example in a side-by-side study of French and Italian New Wave. No credit for students who completed 390 section 1 in fall 2009. [3]

FREN 8090. Special Topics in French Studies. [Formerly FREN 394] Problems, themes, or issues in literature, language, or culture approached in ways that transcend traditional chronological distinctions. [3]

FREN 8999. Non-candidate Research. [Formerly FREN 379] Research prior to entry into candidacy (completion of Qualifying Examination) and for special non-degree students. [Variable credit: 0-12]

FREN 9995. Half-time Ph.D. Dissertation Research. [Formerly FREN 3995] For students who have completed 72 hours and devote a half-time effort to dissertation research. [0]

FREN 9999. Ph.D. Dissertation Research. [Formerly FREN 399] [0-12]

German

GER 4999. Honors Research. Senior Honors Thesis. Open only to honors candidates. [1-3]

GER 5111. German for Graduate Reading. [Formerly GER 101G] Survey of grammar and vocabulary, with extensive reading. Available only to graduate students for "No Credit". [0]

GER 5310. Foreign Language Learning and Teaching. [Formerly GER 310] (Also listed as French 6030, Portuguese 6030, and Spanish 6030) Principles and practices of teaching a second language, with concentration on recent interactive and communicative models of foreign language instruction. Goals of the course are 1) to introduce principles of Second Language Acquisition and learning, 2) to critically read relevant literature in the area(s), and 3) to develop FL instructor's awareness through reflective and critical thinking. Classroom observations, journal writing, development of materials, and a small action-research project are expected. Required of all entering teaching assistants. [3]

GER 5343. The Aesthetics of Violence: Terror, Crime, and Dread in German Literature. (Also listed as GER 3343) The "dark" side of imagination in twentieth-century German literature including history and theory of modern art, emphasis on literary representation, mutual influences between aesthetic reflection and political action. No knowledge of German required. No credit for students who have earned credit for 3343. [3]

GER 5344. Women at the Margins: German-Jewish Women Writers. (Also listed as GER 3344) Examination of themes, forms, and sociocultural issues shaping the work of German-Jewish women writers from the Enlightenment to the present. Readings and discussions in English. No credit for students who have earned credit for 3344. [3]

GER 5345. Love and Friendship. (Also listed as GER 3345) Concepts of life and friendship. Greek antiquity to Romanticism, modern and postmodern times. Philosophical and literary texts, letters, and essays. Taught in English. No credit for students who have earned credit for 3345. [3]

GER 5375. Art and Rebellion: Literary Experiment in the 1960s and 1970s. (Also listed as GER 3375) German literature under the conditions of protest and rebellion. Experiments in poetry, prose, and theatre; new directions in art and media theory; historical influences. Taught in English. No credit for students who have earned credit for 3375. [3]

GER 5378. Dreams in Literature. (Also listed as GER 3378) The difference between sleeping and being awake. Literary and philosophical texts. Novels, short stories, diaries, poems, and drama written within the last two hundred years. Taught in English. No credit for students who have earned credit for 3378. [3]

GER 5443. German Cinema: Vampires, Victims, and Vamps. (Also listed as GER 2443) An analysis of representative German film with special emphasis on its sociocultural and historical context. Discussion will include pertinent theories of cinematography and cinematic narration. Taught in English. No credit for students who have earned credit for 2443. [3]

GER 5445. Nazi Cinema: The Manipulation of Mass Culture. (Also listed as GER 2445) Nazi manipulation of mass culture through film (propaganda, musicals, westerns). Some comparison with American film of the era, additional examination of "fascist" aesthetic legacy in American culture today. No knowledge of German required. No credit for students who have earned credit for 2445. [3]

GER 5535. German Romanticism. (Also listed as GER 4535) The contributions of Schlegel, Tieck, Novalis, Eichendorff, and others to literature,

philosophy, and theory. Intellectual, social, and political currents. No credit for students who have earned credit for 4535. [3]

GER 5537. Women and Modernity. (Also listed as GER 4537) Women in German literature from the eighteenth century to the present, focusing on questions of sexuality, political emancipation, artistic identity. No knowledge of German required. No credit for students who have earned credit for 4537. [3]

GER 5548. German Lyric Poetry-Form and Function. (Also listed as GER 4548) Lyric forms as a reaction to personal trauma, collective desire, scientific and technological advances, and social change since the Thirty Years' War. Love, loss, liberation. Students compose poems in imitation of classic examples of the folk song, ballad, sonnet. No credit for students who have earned credit for 4548. [3]

GER 5563. The Age of Goethe-Weimar 1775 to 1805. (Also listed as GER 4563) Rational pragmatism, aesthetic innovation in response to Kant and French Revolution. Readings drawn from Goethe's *Iphigenia*, *Hermann und Dorothea*, Schiller's *Maria Stuart* and *Wallenstein*, and Wieland's *Oberon*. No credit for students who have earned credit for 4563. [3]

GER 5564. Pleasures and Perils in Nineteenth-Century Theatre. (Also listed as GER 4564) The German drama and dramatic theory from Romanticism up to Naturalism with emphasis on selected works by Kleist, Büchner, Grillparzer, and Hebbel. No credit for students who have earned credit for 4564. [3]

GER 5565. Revolutionizing Twentieth-Century Theatre. (Also listed as GER 4565) German drama and dramatic theory from Naturalism to the present. Emphasis on Brecht and post-Brechtian drama. No credit for students who have earned credit for 4565. [3]

GER 5566. Nineteenth-Century Prose. (Also listed as GER 4566) A study of representative works of the main literary trends from Romanticism to Naturalism. No credit for students who have earned credit for 4566. [3]

GER 5567. The German Novel from Kafka to Grass. (Also listed as GER 4567) A study and interpretation of the main literary trends and major figures in twentieth-century narrative. No credit for students who have earned credit for 4567. [3]

GER 5569. Writing under Censorship. (Also listed as GER 4569) An introduction to the main literary trends and authors of the former East Germany (1949-1989). No credit for students who have earned credit for 4569. [3]

GER 5574. Who Am I? German Autobiographies. (Also listed as GER 4574) Canonical and non-canonical texts from the nineteenth and twentieth centuries constructing cultural, religious, and gender identities. Taught in English. No credit for students who have earned credit for 4574. [3]

GER 5852. Independent Readings. (Also listed as GER 3852) Designed for majors and qualified undergraduates. Projects are carried out under the supervision of a member of the department. All projects must be approved by the department. May be repeated for a total of 6 credits over a four-semester period in 289a and 289b combined if there is no duplication in topic, but students may earn only up to 3 credits per semester of enrollment. [1-3; maximum of 6 credits total for four semesters of GER 289a and 289b]

GER 5884. Teaching Program Option: Internship in Advanced Language and Literature Courses. [Formerly GER 329A] Graduate interns participate in the teaching of advanced language or literature courses and receive training in the writing of syllabi, text selection, testing, the development of supplementary materials, the selection of visual aids. May be repeated for a total of 6 credits, but students may earn only up to 2 credits per semester of enrollment. [1-2; maximum of 6 credits for all semesters of GER 5884]

GER 5890. Selected Topics. (Also listed as GER 3890) May be repeated for a total of 12 credits in 3890 and 3891 combined if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3; maximum of 12 credits total for all semesters of GER 3890 and 3891]. No credit for students who have earned credit for 3890.

GER 5891. Selected Topics. (Also listed as GER 3891) May be repeated for a total of 12 credits in 3890 and 3891 combined if there is no duplication in topic. Students may enroll in more than one section of this course per

semester. [3; maximum of 12 credits total for all semesters of GER 3890 and 3891]. No credit for students who have earned credit for 3891.

GER 7101. Foundations I: Transition Points of Modern German Culture. Analysis and practice of scholarly genres and related academic texts. Different forms of presentation. Efficient time and project management. [3]

GER 7102. Foundations II: Theories of Literary and Cultural Analysis. Key texts on modern thought, media, and the human condition. Twentieth and twenty-first century. From Hermeneutics to Neuraesthetics. [3]

GER 7103. Foundations III: Modes of Scholarly Work and Writing. Analysis and practice of scholarly genres and related academic texts. Different forms of presentation. Efficient time and project management. [3]

GER 7104. Pre-Exam Colloquium. Preliminary Exam preparation. Exam topics. Major works, writers, and genres. [3]

GER 7105. Graduate Tutorials. [Formerly GER 350] Graduate Tutorials. Supervised reading in special areas of German language and literature according to a fixed syllabus. Number, content, and schedule of meetings with the instructor are predetermined, as are reading assignments, tests, term papers, and grading procedure. Units are related to the content and method of period seminars and other graduate courses and allow students to deepen their knowledge of subjects not covered in depth in formal courses offered by the department. Students may not take more than one unit per semester. [3]

GER 7999. Master's Thesis Research. [Formerly GER 369] [0-12]

GER 8102. Problems in Germanic Languages and Literatures. [Formerly GER 385A] [3]

GER 8103. Seminar: Studies in Medieval Literature. [Formerly GER 387] [3]

GER 8104. Seminar: Studies in Literature 1400-1680. [Formerly GER 388] [3]

GER 8201. Seminar: Eighteenth-Century German Literature. [Formerly GER 389] [3]

GER 8202. Seminar: Nineteenth-Century German Literature. [Formerly GER 390] [3]

GER 8203. Seminar: Twentieth-Century German Literature. [Formerly GER 391] [3]

GER 8204. Seminar: Problems of Theory in German Studies. [Formerly GER 392] Author, Archive, Work. [3]

GER 8205. Seminar: Intellectual Constellations. [Formerly GER 393] [3]

GER 8206. Seminar: Society and Ethics. [Formerly GER 394] [3]

GER 8207. Nature: History of an Illusion. Concepts such as genuineness, authenticity, and purity, 1750 to the present. Focus on Enlightenment, Romanticism, Realism, and post-war literature and media in Germany and Austria. [3]

GER 8208. Romanticism: An Aesthetic Idea and Its Transformation.. German culture, art, and politics, 1790-1830. From artistic avant-garde movement to political conservatism. Introduction of genres such as fragment and fairy tale. Origins of literary criticism and hermeneutics. [3]

GER 8301. Pre-Dissertation Colloquium. Qualifying Exam Colloquium. Dissertation topics. Major thinkers, works, genres, and eras. [3]

GER 8999. Non-candidate Research. [Formerly GER 379] Research prior to entry into candidacy (completion of Qualifying Examination) and for special non-degree students. [Variable credit: 0-12]

GER 9995. Half-time Ph.D. Dissertation Research. [Formerly GER 3995] For students who have completed 72 hours and devote a half-time effort to dissertation research. [0]

GER 9999. Ph.D. Dissertation Research. [Formerly GER 399] [0-12]

Greek

GRK 5101. Beginning Greek I. (Also listed as GRK 1101) Elements of classical Greek. Reading of simplified texts from authors of the fifth and fourth centuries B.C. No credit for students who have earned credit for a more advanced Greek language course. No credit for students who have earned credit for GRK 1101. [3]

GRK 5102. Beginning Greek II. (Also listed as GRK 1102) Continuation of 5101. Completion of the elements of classical Greek through readings from classical authors. Introduction to Homeric and Hellenistic Greek. No credit for students who have earned credit for a more advanced Greek language course. No credit for students who have earned credit for 1102. [3]

GRK 5201. Intermediate Greek I: Classical and Koiné Greek. (Also listed as GRK 2201) Review of Greek grammar, and reading from classical and biblical texts. No credit for students who have earned credit for a more advanced Greek language course. No credit for students who have earned credit for 2201. [3]

GRK 5202. Intermediate Greek II: Homer's Iliad. (Also listed as GRK 2202) Selected reading and interpretation; history and literary characteristics of the Homeric epic; practice in reading of meter. No credit for students who have earned credit for a more advanced Greek language course. No credit for students who have earned credit for 2202. [3]

GRK 6010. The Greek Orators. (Also listed as GRK 3010) Classical Athenian orators, with a focus on Lysias and Demosthenes. Historical context, rhetorical technique, and prose style. No credit for students who have earned credit for 3010. [3]

GRK 6020. The Greek Historians. (Also listed as GRK 3020) Selections from the major Greek historians, especially Herodotus and Thucydides, and study of their philosophy of history; investigation of the development of historical prose writing. No credit for students who have earned credit for 3020. [3]

GRK 6040. Readings in Plato and Aristotle. (Also listed as GRK 3040) Selected readings from the dialogues of Plato and from the ethical writings of Aristotle. Corollary readings and discussions of the pre-Socratic philosophers and the post-Aristotelian schools. No credit for students who have earned credit for 3040. [3]

GRK 6100. The Greek Tragedians. (Also listed as GRK 3100) Selections from the plays of Aeschylus, Sophocles, and Euripides. Survey of the development of tragedy. May be repeated for credit with change of subject matter. No credit for students who have earned credit for 3100. [3]

GRK 6110. Greek Lyric Poetry. (Also listed as GRK 3110) The Greek melic, elegiac, and iambic traditions, with an introduction to the Greek dialects and special emphasis on Archilochus, Tyrtaeus, Alcaeus, and Sappho. No credit for students who have earned credit for 3110. [3]

GRK 6200. Early Christian Writers. (Also listed as GRK 3200) Writings of Greek Christians, from the New Testament to critical works and letters by the Cappadocian fathers. Historical and intellectual context. Rhetoric and style. The Roman East. No credit for students who have earned credit for 3200. [3]

GRK 6890. Special Topics in Greek Literature. (Also listed as GRK 3890) May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. No credit for students who have earned credit for 3890. [3]

GRK 7000. Seminar in Classical Greek Prose. [Formerly GRK 313] May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

GRK 7010. Seminar in Classical Greek Poetry. [Formerly GRK 314] May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

GRK 7850. Independent Study. (Also listed as GRK 3850) Designed for majors wanting to familiarize themselves with works and authors not covered in the regular curriculum. May be repeated for a total of 6 credits if there is no duplication in topic, but students may earn only up to 3 credits

per semester of enrollment. No credit for students who have earned credit for 3850. [1-3; maximum of 6 credits total for all semesters of GRK 7850]

Hearing and Speech Sciences

HRSP 8000. Introduction to Doctoral Studies and Research. This course covers professional issues and interdisciplinary research in communicative disorders and related fields, use of common research tools and methods, human and animal research issues, philosophy of science, and provides opportunities to learn key disciplinary skills needed for career success. FALL. [0-3] Melissa Duff.

HRSP 8001. Language and Memory. This course focuses on the relationship between language and memory, two quintessential human abilities. Taking a multiple memory systems perspective, we will discuss theoretical accounts and empirical data on the interaction of language and memory in language acquisition, language use and processing in healthy and disordered populations (e.g., specific language impairment, Alzheimer's disease and other dementias, aphasia, healthy aging) and the implications for rehabilitation of disorders of language and memory. SPRING, Melissa Duff. [3]

HRSP 8341. Seminar: Research in Audiology. [Formerly HRSP 382A] An advanced study of research for the second-year doctoral student. Directed individual research culminating in oral presentation and a manuscript. Prerequisite: consent of instructor. [2-2] (Offered on demand)

HRSP 8342. Seminar in the Neurobiology of Hearing and Multisensory Processes. [Formerly HRSP 342] (Also listed as Neuroscience 8342) Study at the doctoral level of the neural processes underlying auditory and multisensory perception. The course will focus on critical readings of recently published findings that emphasize the connection between plasticity, neural systems, and behavior. May be repeated for credit. Prerequisite: consent of instructor. FALL, SPRING. [Variable credit: 1-2] Polley, Wallace.

HRSP 8344. Grant Writing in Communication Sciences and Disorders. [Formerly HRSP 344] A discussion of the grant writing and grant review processes in communication disorders. Emphasis is on fellowship (F31 and F32) proposals, with additional information on K series training and R series research grants to the National Institutes of Health with a focus on the National Institute on Deafness and Other Communication Disorders. Content includes writing research and training plans and on how proposal are peer reviewed. Spring. [2-3] Camarata

HRSP 8351. Special Problems in Speech Pathology. [Formerly HRSP 351] Areas and problems not included in other courses in speech pathology, chosen to fit the students' interests and the needs of their programs. May be repeated to a total of 12 hours. FALL, SPRING, SUMMER. [Variable credit: 1-6]

HRSP 8352. Special Problems in Audiology. [Formerly HRSP 352] Areas and problems not included in other courses in audiology, chosen to fit the students' interests and the needs of their programs. May be repeated to a total of 12 hours. FALL, SPRING, SUMMER. [Variable credit: 1-4]

HRSP 8366. Practical Electrophysiology. This course will provide a hands-on introduction to human electrophysiology research methods. The theoretical and practical issues related to experimental design, data acquisition, and analytic procedures will be discussed. Students will collect sample EEG/ERP data. Summer of odd numbered years. Instructor: Key. [3]

HRSP 8371. Research Design and Statistical Analysis. [Formerly HRSP 371A] Covers topics in research design and statistics for students preparing for research careers in hearing science, speech science, and communication disorders. Reviews mathematical bases for probability theory and statistical inference. Covers fundamental parametric and non-parametric statistical tests, with extensive discussion of research design in the context of analysis of variance. Presents statistical properties of psychophysical methods and signal detection theory. FALL, SPRING. [3-3] Ashmead. (Also listed as AUD 5371)

HRSP 8372. Research Design and Statistical Analysis. [Formerly HRSP 371B] Covers topics in research design and statistics for students preparing for research careers in hearing science, speech science, and communication disorders. Reviews mathematical bases for probability

theory and statistical inference. Covers fundamental parametric and non-parametric statistical tests, with extensive discussion of research design in the context of analysis of variance. Presents statistical properties of psychophysical methods and signal detection theory. FALL, SPRING. [3-3] Ashmead.

HRSP 8373. Signals And Systems For Hearing and Speech Sciences. [Formerly HRSP 373] A hands-on laboratory course that concentrates on applications for communications science. The course covers: (1) the fundamentals of analog signals, including the Fourier transform and representation of signals in the time and frequency domains; (2) the fundamentals of analog systems (filters), including representation in the time and frequency domains and the analysis of signals that pass through systems; (3) an introduction to digital signals and digital systems, including digital filter design; and (4) an introduction to MATLAB, a powerful tool for understanding and implementing signals and systems. SUMMER of odd-numbered years. [3] Grantham.

HRSP 8376. Language Research Methods. [Formerly HRSP 376] This doctoral-level seminar provides an in-depth analysis of research methods to study language development in children of all ages. Methods used within various fields (e.g. linguistics, communication sciences and disorders, developmental psychology) are reviewed. Critical analysis of research articles with typical and atypical language learners. Spring of even-numbered years. [3] Schuele/Camarata.

HRSP 8377. Seminar in Speech Perception. [Formerly HRSP 377] The study of the processes and models underlying the perception of speech features. Relevant acoustic correlates for speech perception will be evaluated, and these properties will be emphasized through the generation of synthetic speech. The course will cover the contributions of speech perception research to our understanding of speech development, and language and hearing disorders. SPRING. [3] Ohde.

HRSP 8379. Cognitive Neuroscience of Language. The neural and cognitive underpinnings of language are examined from the perspective of cognitive neuroscience, integrating findings from experimental methods including functional neuroimaging, lesion symptom mapping, direct and transcranial cortical stimulation, and electrocorticography. This course is geared toward graduate students in Hearing and Speech Sciences, Psychology, Neuroscience, and related fields. FALL. [3] Wilson.

HRSP 8380. Advanced Seminar in Speech Language Pathology. [Formerly HRSP 380] A doctoral-level course focusing on special topics of interest to faculty and students and based on recent research developments in speech pathology. May be repeated for credit. Prerequisite: consent of instructor. FALL, SPRING, SUMMER. [3]

HRSP 8381. Advanced Seminar in Language. [Formerly HRSP 381] A doctoral-level course focusing on special topics of interest to faculty and students and based on recent research developments in language. May be repeated for credit. Prerequisite: consent of instructor. FALL, SPRING, SUMMER. [3]

HRSP 8382. Seminar: Research in Audiology. [Formerly HRSP 382B] An advanced study of research for the second-year doctoral student. Directed individual research culminating in oral presentation and a manuscript. Prerequisite: consent of instructor. [2-2] (Offered on demand)

HRSP 8383. Seminar in Auditory and Vestibular Neuroscience. [Formerly HRSP 383] The course is a full semester course that combines a small amount of didactic teaching with seminar discussions to introduce students to the neuroscience of the auditory and vestibular systems. For each topic, the short didactic component introduces/refamiliarizes the students with the basic knowledge requisite for that particular topic; the seminar component following the didactic material involves a presentation of both classic papers as well as recent papers that represent the state of art in the field. The seminar component will train students to critically read primary literature, to present scientific information in clear and concise fashion, and provide a theoretical foundation for understanding sensory coding and its relationship with perception using the auditory brain as a model system. The group discussion will also explore the impact of the findings in the papers on various aspects of the field. NOTE: For Ph.D. students, completion

of an introductory neuroscience course, or advisor approval required. For other students, permission of instructor required. FALL [3]

HRSP 8384. Advanced Seminar in Audiology. [Formerly HRSP 384] A doctoral-level course focusing on special topics of interest to faculty and students based on recent research developments in audiology. May be repeated for credit. Prerequisite: consent of instructor. FALL, SPRING, SUMMER. [3] Staff.

HRSP 8385. Instrumentation for Hearing and Speech Sciences: Stimulus Generation, Measurement, And Calibration. [Formerly HRSP 385] A hands-on introduction to the principles and techniques of setting up equipment for hearing and speech perception experiments. Students are exposed to analog generators (noise generators, function generators, oscillators, computer-controlled digital-to-analog converters) processing devices (attenuators, filters, mixers, amplifiers), terminating devices (earphones, loudspeakers, analog-to-digital converters), and measurement devices (oscilloscope, voltmeter, spectrum analyzer). Students will learn to design and implement circuits involving these various devices, and to measure and calibrate various kinds of acoustic stimuli. FALL of odd-numbered years. [3] Grantham.

HRSP 8386. Instrumentation for Hearing and Speech Sciences: Matlab Programming With Real-Time Applications. [Formerly HRSP 386] An introduction to the standard MATLAB computing language in a Windows environment. Basic programming concepts including data types and storage, data input and output, conditional execution, iterative programming, and the use of functions. The goal is for the student to become sufficiently comfortable with MATLAB (and with the concept of programming languages in general) to develop programs to solve specific computational problems too tedious to solve by calculator. The last third of the course will be devoted to the application of MATLAB programming to real-time laboratory problems. Prerequisite: 8385. SPRING of even-numbered years. [3] Grantham.

HRSP 8387. Spatial Hearing. [Formerly HRSP 387] An advanced treatment of the perception by humans of auditory objects in space, including laboratory demonstrations. Topics include (1) binaural processing (lateralization, binaural detection); (2) localization and spatial resolution in the free-field; (3) auditory distance perception; (4) the precedence effect: localization in reverberant spaces; and (5) the central auditory nervous system: binaural pathways. FALL of even-numbered years. [3] Grantham.

HRSP 8388. Independent Study and Readings in Speech Pathology. [Formerly HRSP 388] FALL, SPRING, SUMMER. [1-3]

HRSP 8389. Independent Study and Readings in Audiology. [Formerly HRSP 389] FALL, SPRING, SUMMER. [1-3]

HRSP 8999. Non-Candidate Research. [Formerly HRSP 379] Research prior to entry into candidacy (completion of qualifying examination) and for special non-degree students. [Variable credit: 0-12]

HRSP 9995. Half-Time Ph.D. Dissertation Research. [Formerly HRSP 3995] For students who have completed 72 hours and devote a half-time effort to dissertation research. [0]

HRSP 9999. Ph.D. Dissertation Research. [Formerly HRSP 3999]

Hebrew

HEBR 5111. Hebrew for Graduate Reading. [Formerly HEBR 101G] Survey of grammar and vocabulary, with extensive reading. Available only to graduate students for "No Credit". [0]

HEBR 5301. Advanced Hebrew Grammar. (Also listed as HEBR 2301) Emphasis on syntax and grammar supplemented by listening, speaking, and reading. No credit for students who have earned credit for a more advanced Hebrew language course. No credit for students who have earned credit for 2301. [3]

HEBR 5302. Advanced Hebrew Composition. (Also listed as HEBR 2302W) Development of writing skills through the study of short stories, poems, articles, television, and web materials. No credit for students who have earned credit for 2302W. [3]

History

HIST 5115. Play and Pleasure in Early Modern Japan. (Also listed as HIST 2115) Cultural history of Tokugawa Japan (1603-1868), with emphasis on daily life and popular entertainment in the capital of the warrior government, Edo (present-day Tokyo). Woodblock prints, pleasure quarters, kabuki theatre, commoner carnivals, and popular literature. No credit for students who have earned credit for 2115. [3]

HIST 5120. Japan's War and Postwar, 1931-1989. [Formerly HIST 206] (Also listed as HIST 2120) Japan's war in Asia and the Pacific in the mid-twentieth century and its legacies. The effect of defeat on the nation; reconstruction efforts and economic success. Hirohito's death. [3]

HIST 5130. Russia: Old Regime to Revolution. (Also listed as HIST 2130) Russian history from the early nineteenth-century old regime through the Russian Revolution of 1917. Culture, society, and serfdom; the Great Reforms, ideology, and radicalism; industrialization; modernity in an agrarian society; twentieth-century revolutions. No credit for students who have earned credit for 2130. [3]

HIST 5135. Russia: The U.S.S.R. and Afterward. (Also listed as HIST 2135) Russian history since the 1917 Revolution. Overview of the old regime; revolution and civil war; the Soviet "Roaring '20s"; Stalinism and the totalitarianized society; World War II. Postwar Soviet society and culture; de-Stalinization and the sixties generation; Gorbachev, perestroika, and disintegration; contemporary history. No credit for students who have earned credit for 2135. [3]

HIST 5138. Blood Diamonds, Blood Oil, Commodities, and Conflicts in Africa. (Also listed as HIST 2138) 1870s to the present. Role of diamonds, gold, rubber, and oil in the resulting conflicts in modern Africa. Multinationals, mineral extraction, and politics. Poverty, war, child labor, and corruption. Local and international mining and mineral syndicates. Implications for Africans and their livelihoods. [3]

HIST 5140. The Mughal World. (Also listed as HIST 2140) Mughal history from 1500-1750. The early modern world and Islamic empires. Akbar and Hindu-Muslim interactions in South Asia. Oriental despotism and the idea of the monarch. Gender and authority. English, Dutch, and Portuguese views. Trade and the decline of Mughal authority. Globalization, the rise of Indian entrepreneurs, and the East India company. No credit for students who have earned credit for 2140. [3]

HIST 5150. India and the Indian Ocean. (Also listed as HIST 2150) Cultures along the Indian Ocean coastline from Roman times to 1800, especially South Asia. Coastal societies and politics, Islam, pilgrimage and trade, economic zones, and cultural ties. Pirates, seafarers and merchants; diasporas and genealogies. The entry of European trading companies and debates on trade and empire. No credit for students who have earned credit for 2150. [3]

HIST 5155. Muhammad and Early Islam. (Also listed as HIST 2155) Early Arabian society, Judaism and Christianity in Arabia; Muhammad and the birth of Islam, the conquests, Islamization, Arabization; Jewish influences in early Islam, the medieval Islamic world. No credit for students who have earned credit for 2155. [3]

HIST 5160. Medicine in Islam. (Also listed as HIST 2160) Emergence of medicine in the Islamic world. Links with other traditions. Doctors and society; conventional medical practice in hospitals; prophetic medicine; Jewish and Christian doctors in Islam; pharmacology; developments in the nineteenth-century. No credit for students who have earned credit for 1111 section 21. No credit for students who have earned credit for 2160. [3]

HIST 5170. Islam and the Crusades. (Also listed as HIST 2170) Ideology; successes and failures; history and character of Crusader enterprises in the Holy Land and elsewhere. Muslim religious, political, ideological, and social reactions. Islamic culture and the West; relations among Crusaders, Muslims, and Jews. No credit for students who have earned credit for 2170. [3]

HIST 5190. Last Empire of Islam. (Also listed as HIST 2190) The Ottoman "long nineteenth century," 1789 to 1923. The Reforms (Tanzimat), state patriotism, intercommunal relations, national "awakenings," and the emergence of a public sphere. Historiographical issues, such as percep-

tions of the empire as the "Sick Man of Europe" and debates over its decline. No credit for students who have earned credit for 2190. [3]

HIST 5220. Medieval and Renaissance Italy, 1000-1700. (Also listed as HIST 2220) Transformation of Italy from "medieval" society to the "Renaissance." Cultural, economic, and social developments, especially connections among wealth, status, and patronage. Meaning and applicability of the term "Renaissance." No credit for students who have earned credit for 2220. [3]

HIST 5230. Medieval Europe, 1000-1350. (Also listed as HIST 2230) Economic expansion and the formation of national states; the medieval Church and the revival of learning in the twelfth and thirteenth centuries. No credit for students who have earned credit for 2230. [3]

HIST 5238. Crime and Criminal Law in Western Antiquity. Ancient Athens and Rome. Social values and the quest for justice through the legal system. Definition of offenses, procedures, and penalties. Impact of social, economic, and legal status as well as gender. No credit for students who have earned credit for CLAS 5160. [3]

HIST 5250. Reformation Europe. (Also listed as HIST 2250) The political, intellectual, and social conditions underlying the Protestant revolt. The Reformation of Luther, Calvin, Zwingli, Loyola, and other religious reformers considered within the context of the general developments of sixteenth-century history. No credit for students who have earned credit for 2250. [3]

HIST 5260. Revolutionary Europe, 1789-1815. (Also listed as HIST 2260) Political, cultural, and economic upheavals in the late eighteenth and early nineteenth centuries; the French Revolution and Napoleon, romanticism, and early industrialization. Emphasis on Britain, France, and Germany. No credit for students who have earned credit for 2260. [3]

HIST 5270. Nineteenth-Century Europe. (Also listed as HIST 2270) Major political, social, economic, and cultural developments from 1815 to 1914. No credit for students who have earned credit for 2270. [3]

HIST 5280. Europe, 1900-1945. (Also listed as HIST 2280) Political, socioeconomic, cultural, and colonial history of Europe from 1914 to the fall of Hitler. No credit for students who have earned credit for 2280. [3]

HIST 5290. Europe since 1945. (Also listed as HIST 2290) Origins of the Cold War; political and social transformations, East and West; the breakup of colonial empires; ideological and military tensions; intellectual and cultural trends. No credit for students who have earned credit for 2290. [3]

HIST 5300. Twentieth-Century Germany. (Also listed as HIST 2300) The turbulent history of Germany, as it went from authoritarian state to volatile democracy, to National Socialist dictatorship, to divided country, and to reunification. Special emphasis placed on the Nazi dictatorship, its origins and legacy. No credit for students who have earned credit for 2300. [3]

HIST 5310. France: Renaissance to Revolution. (Also listed as HIST 2310) Social and cultural history from 1515 to 1815. Conditions of life, ambitions, ideas, and tastes of the various social groups. Development of arts, music, and literature in a sociopolitical context. Causes and consequences of the French Revolution of 1789. No credit for students who have earned credit for 2310. [3]

HIST 5340. Modern France. (Also listed as HIST 2340) The fall of Napoleon in 1815 to the present. Emphasis on politics. Major economic, social, cultural, and intellectual developments. No credit for students who have earned credit for 2340. [3]

HIST 5380. Shakespeare's Histories and History. (Also listed as HIST 2380) Readings from a variety of plays by Shakespeare and his contemporaries. Significant political and cultural issues from the 1590s in early English history. No credit for students who earned credit for 294 section 2 in fall 2008. No credit for students who have earned credit for 2380. [3]

HIST 5385. The Real Tudors. (Also listed as HIST 2385) Marital, dynastic history of the Tudors in relation to religious and political change through and after the English Reformation. Court politics, ideological conflict, and the rise of an increasingly confessionalized international politics. Offered on a graded basis only. No credit for students who have earned credit for 2385. [3]

HIST 5410. Victorian England. (Also listed as HIST 2410) Cultural values, liberal reform; urbanization; women and gender; imperialism. No credit for students who have earned credit for 2410. [3]

HIST 5450. Reform, Crisis, and Independence in Latin America, 1700-1820. (Also listed as HIST 2450) Reorganization of the Spanish and Portuguese empires; maturation of transatlantic societies; and revolutions for independence. No credit for students who have earned credit for 2450. [3]

HIST 5470. Revolutionary Mexico. (Also listed as HIST 2470) Revolutionary politics and radical expression in 20th century Mexico. Causes of popular unrest; violent political change; post-conflict state-building; government attempts to alter popular culture; radical muralism and graphic art; revolutionary expression and gender; literature and disenchantment. [3]

HIST 5480. Central America. (Also listed as HIST 2480) Iberian and Amerindian background, colonial society; independence; growth of the plantation economy; the U.S. presence; political and social revolutions in the twentieth century. No credit for students who have earned credit for 2480. [3]

HIST 5490. Brazilian Civilization. (Also listed as HIST 2490) From pre-Columbian times to the present. Clash and fusion of Portuguese, Amerindian, and African cultures; sugar and slavery; coffee and industrialization; race relations; dictatorship and democracy in the twentieth century. No credit for students who have earned credit for 2490. [3]

HIST 5510. Reform and Revolution in Latin America. (Also listed as HIST 2510) Comparative analysis of revolutions and reform movements in twentieth-century Latin America focusing on land tenure, social classes, political culture, economic structures, and foreign influences. No credit for students who have earned credit for 2510. [3]

HIST 5530. African Religions in the Americas. (Also listed as HIST 2530) An interdisciplinary study of Islam, Christianity, and Animist religions in pre-colonial Africa; their transformation and practice in the Americas. Case studies of Brazil, Cuba, and the American South. Material culture studies and visits to local museum exhibits. No credit for students who have earned credit for 2530. [3]

HIST 5535. Latin America and the United States. (Also listed as HIST 2535) The complicated relationship between Latin America and the United States from the early nineteenth century to the present. Role of ideology, national security, economic interests, and cultural factors in shaping inter-American affairs. No credit for students who have earned credit for 2535. [3]

HIST 5540. Race and Nation in Latin America. (Also listed as HIST 2540) Late nineteenth century to the present. Social, political, and cultural constructions of belonging. Citizenship and state building. Immigration, education, urbanization, civil and international wars, and gender and sexuality. Case studies draw from the Andes, Spanish Caribbean, Southern cone, and Brazil. No credit for students who have earned credit for 2540. [3]

HIST 5542. Cuba and the United States. History of Cuba. European conquest, the colonial period, independence, U.S. intervention, the Cuban Revolution, Cold War to present. Special consideration given to the global impact of the Cuban Revolution. [3]

HIST 5570. Caribbean History, 1492-1983. (Also listed as HIST 2570) Amerindian society; age of encounter; imperial contest; slavery and abolition. U.S. influence; independence movements; cultural movements; invasion of Grenada. No credit for students who have earned credit for 2570. [3]

HIST 5580. American Indian History before 1850. (Also listed as HIST 2580) Indian nations' interaction with each other and with European colonies. Resistance and adaptation to colonialism. Early development of United States Indian policy. No credit for students who have earned credit for 2580. [3]

HIST 5590. American Indian History since 1850. (Also listed as HIST 2590) American Indians in the United States and Canada. Their responses to government policies and other forces. Cultural, socioeconomic, and political change among Indian communities. No credit for students who have earned credit for 2590. [3]

HIST 5595. The English Atlantic World, 1500-1688. (Also listed as HIST 2595W) English overseas expansion, including conquest of Ireland, exploration and conquest of the New World. Formation of imperial and American cultures and of racism, the slave trade, Indian relations, and migration from the British Isles. No credit for students who have earned credit for 2595W. [3]

HIST 5610. The Founding Generation. (Also listed as HIST 2610) American history from the 1760s to the 1820s. The Revolutionary War, the Constitution, formation of national government. Political conflict, national culture, commerce, diplomacy, and race and gender in an age of revolution. No credit for students who have earned credit for 2610. [3]

HIST 5620. The Old South. (Also listed as HIST 2620) The South's origins in European expansion; the rise of the plantation economy and society, and its identification with slavery; the differing experiences of whites and blacks, planters and nonplanters; the relationship of the region to the larger United States; the Confederate attempt at independence and the collapse of the slave regime. No credit for students who have earned credit for 2620. [3]

HIST 5630. The New South. (Also listed as HIST 2630) The aftermath of war and emancipation and the era of Reconstruction; social change and dislocation in the late nineteenth century; the Populist Revolt; the origins of segregation and one-party politics. Twentieth-century efforts to modernize the region; the economic, political, and Civil Rights revolutions of the mid-twentieth century; the South in modern American society and politics. No credit for students who have earned credit for 2630. [3]

HIST 5640. Appalachia. (Also listed as HIST 2640) The region from first European intrusions to the present. Frontier-era white-indigenous contact, antebellum society and economy, relations with the slave South, the Civil War and postwar politics, increasing social strainings, industrialization and labor conflict, poverty and outmigration. Examination of mountain culture, tourism, and the construction of the "hillbilly" image. No credit for students who have earned credit for 2640. [3]

HIST 5690. The Civil Rights Movement. (Also listed as HIST 2690) Following two decades of progress from Brown v. Board of Education in 1954 toward racial justice and equality in the United States. Leaders, organizations, and milestones. No credit for students who have earned credit for 2690. [3]

HIST 5692. Biographies of Struggle. Struggles for social justice. Identity, politics, and protest. Exploration of issues, traditions, and targets. Biography, personal testimonies, and oral life narratives of people engaged in efforts to challenge oppression. [3]

HIST 5700. The U.S. and the World. (Also listed as HIST 2700) From the winning of independence to the Great Depression. Relationships among foreign policy, ideology, domestic politics, and social and economic change. No credit for students who have earned credit for 2700. [3]

HIST 5710. The U.S. as a World Power. (Also listed as HIST 2710) From the origins of World War II, through the Cold War, to the present day. Relationships among foreign policy ideology, domestic politics, and social economic change. No credit for students who have earned credit for 2710. [3]

HIST 5800. Modern Medicine. (Also listed as HIST 2800) Scientific, social, and cultural factors influencing the rise of modern medicine. Europe and the U.S., 1750 to the present. No credit for students who have earned credit for 2800. [3]

HIST 5810. Women, Health, and Sexuality. (Also listed as HIST 2810) Women as patients and healers in the U.S. from 1750 to the present. Topics include women's diseases and treatments; medical constructions of gender, sexuality; childbirth, birth control, abortion; midwives, nurses, and doctors. No credit for students who have earned credit for 2810. [3]

HIST 5830. Medicine, Culture, and the Body. (Also listed as HIST 2830) Concepts of the human body from historical and cross-cultural perspectives. Exploration of experiences, representations, and medical theories of the body in birth, death, health, and illness in Western and non-Western societies. Comparison of methodologies of anthropology and history. No credit for students who have earned credit for 2830 or ANTH 3142 or 6142. [3]

HIST 5880. Weimar Germany: Modernism and Modernity, 1918-1933. (Also listed as HIST 3120) Culture and politics. Mass politics, mass media, economic crisis, and social tensions. Architecture, film, theater, painting, and philosophy. No credit for students who have earned credit for 3120. [3]

HIST 5885. Cities of Europe and the Middle East. (Also listed as HIST 3150) Cities of "East" and "West" in the modern period; distinguishing characteristics and shared patterns of urban modernity across different geographies. Conceptions of the European, Middle Eastern, and Islamic metropolis. No credit for students who have earned credit for 3150. [3]

HIST 5890. Religion and the Occult in Early Modern Europe. (Also listed as HIST 3270) Popular and learned ideas about religion and the supernatural within the context of the religious reforms of the sixteenth century. Alchemical and astrological practices to ghosts, werewolves, fairies, and other supernatural beings. The witch craze phenomenon of 1560-1650. Offered on a graded basis only. No credit for students who earned credit for 295 section 1 in fall 2011. No credit for students who have earned credit for 3270. [3]

HIST 6100. Introduction to Historical Methods and Research. [Formerly HIST 300A] [4]

HIST 6110. Introduction to Historical Methods and Research. [Formerly HIST 300B] [4]

HIST 6299. Teaching Workshop. Workshop for new teaching assistants in the Department of History. [0]

HIST 6300. The Art and Craft of Teaching History. [Formerly HIST 301] Readings on pedagogical theory and current research on college-level teaching and learning. Hands-on exercises in course design, preparing and grading tests and assignments, lecturing, leading discussion, cooperative and service learning, and use of technology to enhance teaching. Normally limited to graduate students in History. [4]

HIST 6400. Readings in American History. [Formerly HIST 302A] To the Civil War. [4]

HIST 6410. Readings in American History. [Formerly HIST 302B] Civil War to the present. [4]

HIST 6500. Readings in Colonial Latin American History. [Formerly HIST 303A] [4]

HIST 6510. Readings in Modern Latin American History. [Formerly HIST 303B] [4]

HIST 7999. Master's Thesis Research. [Formerly HIST 369] [0-12]

HIST 8000. Independent Study. [Formerly HIST 390A] May be repeated for credit more than once if there is no duplication in topic, but students may earn only up to 3 credits per semester of enrollment. [1-3]

HIST 8010. Independent Study. [Formerly HIST 390B] May be repeated for credit more than once if there is no duplication in topic, but students may earn only up to 3 credits per semester of enrollment. [1-3]

HIST 8050. Studies in Comparative History. [Formerly HIST 305] May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [4]

HIST 8055. Methods in Legal History. Theoretical, methodological, and analytical tools for studying law and society. Comparative, interdisciplinary overview of leading approaches to and themes in legal history. [4]

HIST 8060. Visual Culture. Methods and interdisciplinary debates. Histories of traditional art objects. Aesthetics, built environments, iconoclasm, war, urbanism, consumerism, gender/sexual identities, race and ethnicity, cross-cultural exchange, and politics. [4]

HIST 8077. Gender, Sex, and Society. Historiography of gender and sexuality since the 1970s; reform movements; history of the body; urban geography; feminist and queer theory in historical practice. [4]

HIST 8100. Studies in the History of Medicine, Science, and Technology. [Formerly HIST 307] May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [4]

HIST 8110. Studies in the History of the Human Sciences. [Formerly HIST 308] May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [4]

HIST 8150. Studies in Environmental History. [Formerly HIST 309] Approaches to writing about human interactions with the natural world and the role of the environment in human history. Methods and preoccupations characteristic of work in environmental history. Comparisons to works in intellectual and cultural history, social history, history of science, and animal studies. [4]

HIST 8200. Third-Year Seminar. [Formerly HIST 397A] For third-year students preparing a dissertation prospectus and starting work on a dissertation. [4]

HIST 8220. Topics in the History of Islam. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [4]

HIST 8250. Studies in Early Modern History. Interdisciplinary study of early modern societies, including, but not limited to, non-European contexts. Themes may include land and seaborne empires, political, diplomatic, social, and religious history, material culture, environmental history, and globalization. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [4]

HIST 8300. Studies in Early Modern European History. [Formerly HIST 315] May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [4]

HIST 8310. Studies in European History, 1815-1914. [Formerly HIST 320] May be repeated for credit once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [4]

HIST 8320. Studies in European History. [Formerly HIST 321] May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [4]

HIST 8330. Studies in Recent European History. [Formerly HIST 324] May be repeated for credit once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [4]

HIST 8340. Studies in German History. [Formerly HIST 330] May be repeated for credit once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [4]

HIST 8350. Studies in Early Modern English History. [Formerly HIST 343] May be repeated for credit once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [4]

HIST 8400. Studies in Modern England. [Formerly HIST 344a] May be repeated for credit once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [4]

HIST 8475. United States in the World. Recent trends in internationalizing the historiography of the modern United States, both to deepen the study of the past and to identify alternative, non-national frames of historical analysis. Immigration and nativism, transnational social movements, cultural borrowings, colonialism, war, missionary projects, and international dimensions of civil rights politics. Repeat credit for students who completed 381 in spring 2011, spring 2013, or fall 2014. [4]

HIST 8500. Studies in East Asian History. [Formerly HIST 350] [4]

HIST 8600. Comparative Slavery in the Colonial Americas. [Formerly HIST 358] Interdisciplinary and cross-cultural study of slavery and resistance in Spanish, British, French, Dutch, and Portuguese America. Does not cover antebellum slavery in the United States. [4]

HIST 8610. Atlantic World History, Fifteenth to the Nineteenth Century. [Formerly HIST 359] Interdisciplinary readings examining disparate colonizations and the creation of an Atlantic world system. Major themes include the consequences of Atlantic expansion on indigenous societies, the African slave trade, and the rise of Atlantic economics, the circulation of peoples, ideas, and material culture throughout the Atlantic and how impe-

rial competition, political ideologies, and subaltern resistance shaped the Atlantic revolutions. Optional instruction in early modern paleography. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [4]

HIST 8615. Readings in African History. Themes, sources, debates, and methods in the historiography of pre-modern and modern Africa. [3]

HIST 8620. Studies in Latin American History. [Formerly HIST 361] May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [4]

HIST 8625. Readings in African American History. Chronological and thematic exploration of major themes, debates, and subjects of inquiry. Classic works; historiography; recent trends in the field. [4]

HIST 8630. Research Seminar in Latin American History. [Formerly HIST 365] May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [4]

HIST 8640. Readings in Global History. Methods and critiques. Topics include long-distance trade, labor and migration, empires and states, human rights and citizenship, international law and politics, capitalism, cross-cultural exchange, environmental issues, and transnational movements. [4]

HIST 8700. Studies in Early American History to 1783. [Formerly HIST 371] May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [4]

HIST 8710. Studies in the Middle Period of American History, 1783-1861. [Formerly HIST 372] May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [4]

HIST 8720. Studies in U.S. History, 1861-1900. [Formerly HIST 373] May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [4]

HIST 8730. Studies in Recent American History. [Formerly HIST 374] May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [4]

HIST 8732. Religion and Civil Rights. Influence of religion in the shaping of the civil rights movement. Impact of Gandhi, white and black religious leaders; nonviolence. [4]

HIST 8733. African American Methodism. African American Methodists' interpretation and implementation of Wesleyan theology. Blending of African American religious sensibilities with Methodism. [4]

HIST 8740. Research Seminar in Recent American History. [Formerly HIST 375] May be repeated for credit once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [4]

HIST 8750. Studies in American History. [Formerly HIST 381] May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [4]

HIST 8760. Studies in U.S. International History. [Formerly HIST 383] May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [4]

HIST 8770. Research Seminar in U.S. International History. [Formerly HIST 384] May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [4]

HIST 8800. Dissertation Seminar. [Formerly HIST 398] May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. Offered on a pass/fail basis only. [0-4]

HIST 8999. Non-candidate Research. [Formerly HIST 379] Research prior to entry into candidacy (completion of Qualifying Examination) and for special non-degree students. [Variable credit: 0-12]

HIST 9995. Half-time Ph.D. Dissertation Research. [Formerly HIST 3995] For students who have completed 72 hours and devote a half-time effort to dissertation research. [0]

HIST 9999. Ph.D. Dissertation Research. [Formerly HIST 399] [0-12]

History of Art

HART 5100. Architecture and the Mapping of Empire in Asia. Use of architecture to express and delimit empire in Asia from the 3rd century BCE through the 20th century CE. Cosmology in the construction of cities, temples, and tombs. Physical manifestations of divine kingship and royal divinities. Appropriation of ancient models to enhance legitimacy. Architecture as an expression of ethnic/state identities. [3]

HART 5112. The Arts of China during the Liao-Song Period. (Also listed as HART 3112) Art and architecture of China during the Liao-Song period from C.E. 907 to C.E. 1279. Political, religious, and aesthetic contexts. Influence of coastal trade and pilgrimage in transformations of painting, sculpture, ceramics, and architecture. No credit for students who have earned credit for 3112. [3]

HART 5120. Arts of Korea. History of Korean art and visual culture from ancient times to the present. Intersections of art, literature, religion, and politics, and cultural interactions with China and Japan. [3]

HART 5134. Art of the Samurai: Myth, Politics, and Visual Culture. (Also listed as HART 2134) From twelfth century to present. Dispelling myths through analysis of origins and history in premodern Japan. Autobiographical writings, art and architectural commissions, artistic depictions, exhibitions, and films of samurai. No credit for students who have earned credit for 2134. [3]

HART 5140. Healing and Art in East Asia. Influence of early healing practices on the development of the arts of East Asia. Magical healing texts, talismans, and tattoos; diagramming the body and the landscape; and the art of the Buddha of Medicine. Gardens and growing transformative herbs. Tea as medicine and art. [3]

HART 5150. East Asian Architecture and Gardens. East Asian religious, vernacular, and garden architecture from the second century CE to the present. Influence of Buddhism on East Asian architecture, fengshui and site selection, garden as religious landscape, Asia in modern architecture. [3]

HART 5164. Art of Buddhist Relic and Reliquary. (Also listed as HART 3164W) From second century BCE to present. Relic veneration and construction of reliquaries from a visual perspective. Beautification, ritualization, use and abuse, and bodily issues spanning India, China, Korea, Japan, and Southeast Asia. No credit for students who have earned credit for 3164W. [3]

HART 5172. Himalayan Art: Art of the Divine Abode. (Also listed as HART 3172) Art of Nepal and Tibet from its inception to the present. Religious and cultural contexts. Initial western responses; Hindu and Buddhist art and architecture in Nepal; Tibetan Buddhist Art; artistic productions in the Tibetan diaspora; and souvenir art in Nepal. No credit for students who have earned credit for 3172. [3]

HART 5173. Art and Empire in India. Art of India between the Mughal and British empires. Rise of colonialism and nationalism; cross-cultural encounters; and emergence of new institutions and technology. [3]

HART 5174. The South Asian Temple. (Also listed as HART 3174) From its inception to the present. Morphological and stylistic analysis. Anthropological and ethnographical approach to temples as living communal entities. No credit for students who have earned credit for 3174. [3]

HART 5210. Art and Architecture of Ancient Egypt. (Also listed as HART 2210) Art, architecture, and culture of Egypt from the fourth millennium through the Old, Middle, and New Kingdoms. Sculpture, wall painting,

architecture, and material culture. No credit for students who have earned credit for 2210. [3]

HART 5224. Greek Sculpture. (Also listed as HART 3224) Style, materials, and techniques ca. 900-31 B.C. Sculptors' craft and their reasons for the creation of both free-standing and architectural sculpture. No credit for students who have earned credit for 3224. [3]

HART 5226. Greek Vases and Society. (Also listed as HART 3226) Ancient Greek vases as social documents. Interdisciplinary approaches, including historiographic, stylistic, semiotic, contextual, and scientific. Production, trade, and the functions of vases in funerary and ritual contexts, particularly the symposium. The development of black- and red-figure vase painting and iconography. No credit for students who have earned credit for 3226. [3]

HART 5228. Gender and Sexuality in Greek Art. (Also listed as HART 3228W) Iconography of vase-painting and sculpture, from the Archaic through the Hellenistic periods. Visual constructions of bodies, poses, gestures, and dress, reflecting cultural attitudes towards courtship, marriage, rape, prostitution, and homosexuality. Emphasis on methodological approaches and comparisons with modern societies. Offered on a graded basis only. No credit for students who have earned credit for 3228W. [3]

HART 5240. Ancient Landscapes. (Also listed as HART 3240W) Greco-Roman attitudes toward nature. Exploitation and stewardship of resources. Country-house and garden design. Representations of mythological and sacred landscapes in painting and poetry. No credit for students who have earned credit for 3240W. [3]

HART 5252. Cities of the Roman East. (Also listed as HART 3252) Provincial centers, sanctuaries, and monuments from Greece to Arabia. Major centers and case studies of public and private commissions. Architectural reflections of Romanization and resistance; local and imperial patronage, patrimony and memory; borderland architecture. No credit for students who have earned credit for 3252. [3]

HART 5260. The Art of Pagans, Christians, and Jews. (Also listed as HART 2260) Religious art of the Roman Empire in late antiquity. Visual art reflecting religious beliefs and practices. Greco-Roman cults, early Christianity, and Rabbinical Judaism. No credit for students who have earned credit for 2260. [3]

HART 5270. Early Christian and Byzantine Art. (Also listed as HART 2270) The development of architecture, sculpture, painting, and the minor arts from the third through eleventh centuries. [3]

HART 5274. Art and Empire from Constantine to Justinian. (Also listed as HART 3274) An interdisciplinary study of Roman social, political, religious, and art historical developments in the fourth through sixth centuries CE. No credit for students who have earned credit for 3274. [3]

HART 5285. Medieval Art. Development of architecture, sculpture, painting, and the minor arts in Europe from the eleventh through the fifteenth centuries. [3]

HART 5288. Art of the Book. Material and visual composition of medieval manuscripts; working with medieval and contemporary artists' books in Vanderbilt's Special Collections. Audience, changing popularity of texts and illustrations, and concerns of patrons and artists. Exemplary works include the *Book of Kells*, *Luttrell Psalter*, and *Très Riches Heures*. [3]

HART 5290. Gothic Paris. From the twelfth to the fifteenth century. Architecture, sculpture, painting, and the luxury arts. No credit for students who have earned credit for 5285. [3]

HART 5310. Italian Art to 1500. (Also listed as HART 2310) Early development of art and architecture primarily in central Italy from the late thirteenth through the fifteenth centuries. The works of Giotto, Duccio, Donatello, Masaccio, and Botticelli. The age of the Medici in Florence. No credit for students who have earned credit for 3320 or 3320W. No credit for students who have earned credit for 2310. [3]

HART 5334. Michelangelo's Life and Works. (Also listed as HART 3334) Sculpture, painting, architecture, and graphic works. Poetry and letters. Cultural, historical, religious, and political climate of his day. Influence upon

artists. Critical reception. No credit for students who have completed 3334 or 3334W. [3]

HART 5362. Fifteenth-Century Northern European Art. (Also listed as HART 2362) Painting, sculpture, prints, and court art in the Low Countries, France, and Germany. Historical, social, economic, religious, and technical analysis. Jan van Eyck, Rogier van der Weyden, and Hieronymus Bosch. No credit for students who have earned credit for 2360 or 2362. [3]

HART 5364. The Court of Burgundy. The visual arts of the Dukes of Burgundy (1363-1477) in cultural context. Portraiture, chivalry, costume, storytelling, and ceremony. Artists include Claus Sluter, Jan van Eyck, and Rogier van der Weyden. [3]

HART 5366. Sixteenth-Century Northern European Art. (Also listed as HART 3366) Painting, sculpture, prints, and court art in the Low Countries, France, England, and Germany. Historical, social, economic, religious, and technical analysis. Albrecht Dürer, Matthias Grünewald, Hans Holbein, and Peter Bruegel. No credit for students who have earned credit for 212 or 3366. [3]

HART 5650. Nineteenth-Century Architecture: Theory and Practice. (Also listed as HART 2650) European and North American architecture from the French Revolution to the First World War. The relationships among architecture and technology, political regimes, social formations, and conceptions of history. Neoclassicism, Gothic Revival, Second Empire, the Arts-and-Crafts Movement, and Commercial Architecture. No credit for students who have earned credit for 2650. [3]

HART 5680. British Art: Tudor to Victorian. (Also listed as HART 2680) Art and visual culture in the British Isles from the reign of Henry VIII in the sixteenth century to Queen Victoria and the rise of the pre-Raphaelites in the nineteenth century. Portraiture and landscape painting, relationship between art and empire, rise of the Royal Academy, and patterns of patronage. Holbein, Hogarth, Gainsborough, Reynolds, Lawrence, and Turner. No credit for students who have earned credit for 2680. [3]

HART 5740. History of Sound Art. (Also listed as HART 3740) From twentieth century to present. Use of sound as artistic medium. Experimental practices; the relationship of art and technology; sound art's position between music, performance and installation art. Cage, Cardiff, Paik, Rosenfeld, and Trimpin. No credit for students who have earned credit for 3740. [3]

HART 5750. African American Art. (Also listed as HART 2750) Colonial Era to the present. Artwork and artists in their political, cultural, social, historical, and aesthetic contexts. Relationship between race and representation. No credit for students who have earned credit for 2750. [3]

HART 5757. Women in Architecture. Women's contributions to the built environment as architects, patrons, critics, and social reformers, primarily in the 19th and 20th centuries. Perspectives of feminism, gender, race, and sexuality studies. Julia Morgan, Eileen Gray, Charlotte Perriand, Denise Scott Brown, and Zaha Hadid. [3]

HART 5760. Early American Modernism, 1865-1945. (Also listed as HART 2760) Painting and sculpture of the United States between the Civil War and the Second World War with emphasis on iconography, social history, class, and gender. No credit for students who have earned credit for 2760. [3]

HART 5765. Art since 1945. (Also listed as HART 2765) A survey of art produced in the United States and Europe since 1945 with an emphasis upon theory and the social and intellectual factors. No credit for students who have earned credit for 2765. [3]

HART 5775. History of Prints. Woodcut, engraving, etching, and lithography from the fifteenth to the twentieth century. Scientific, devotional, ornamental, and documentary functions. Dürer, Piranesi, Hogarth, Daumier, and Kollwitz. Advances in technique and marketing, relationship to fine art, and place in popular culture. [3]

HART 5780. History of Western Urbanism. (Also listed as HART 2780) Urban form and planning from antiquity to the present. The integration of architecture and landscape. Diachronic surveys. Case studies, including Nashville. No credit for students who have earned credit for 2780. [3]

HART 5782. Storied Places: History of Landscape Design. (Also listed as HART 2782) Landscape architecture as art form in Europe, Western Asia, and North America, from antiquity to the present. Stewardship and manipulation of land and water. Design of gardens and green spaces. Social and political meanings and messages. No credit for students who have earned credit for 2782. [3]

HART 5810. Exhibiting Historical Art. (Also listed as HART 3810W) Research and exhibition of art in the permanent collection of the Vanderbilt University Fine Arts Gallery. Research methods and principles of object organization and display, illustrated via selected objects that vary annually. No credit for students who have earned credit for 3810W. May be repeated for credit once if there is no duplication in topic and not twice from the same instructor. Offered on a graded basis only. (Maximum of 6 credits total for all semesters of 5810). [3]

HART 5815. Digital Heritage: Methods and Practice. Case-based introduction to digital applications in history of art and archaeology. Theory, research design, current methods of photogrammetry, 2D and 3D modeling, and immersive environments. Mapping and spatial analysis. Data management and digital publishing. May be repeated for credit with permission of the faculty. [3]

HART 6010. The Methods of Art History. [Formerly HART 301] Comparative analysis of art historical methods including social history, post-structuralism, feminism, gender studies, stylistic analysis, and iconography. Assessment of methods in action through critiques and exercised in independent application. [3]

HART 6285. Seminar: Problems in Medieval Architecture. [Formerly HART 312] [3]

HART 6390. Seminar: Problems in Baroque Art. [Formerly HART 319] [3]

HART 6600. Seminar: Problems in Eighteenth Century Art. [Formerly HART 321] [3]

HART 6680. Seminar in British Art and Culture. [Formerly HART 320] [3]

HART 6700. Seminar: Studies in Twentieth-Century Art. [Formerly HART 324] [3]

HART 6740. Modern Design. From 1850 to present. How thinkers shaped practice. Relationships among modernity, modernism, and design. Historical debates over utopia, gender, social reform, inequality, and aura. Role in world's fairs, empire, fashion, international politics, domesticity. Close study of design exhibitions. [3]

HART 6760. Seminar: Studies in American Art. [Formerly HART 325] [3]

HART 6840. Directed Study. May be repeated for credit, but students may earn only up to 3 credit hours per semester of enrollment. [1-3]

HART 6850. Independent Research. Supervised work in extension of regular offerings in the curriculum. Registration only with agreement of instructor involved and with written approval of the director of graduate studies. May be repeated for credit if there is no duplication in topic, but students may earn only up to 3 credits per semester of enrollment. [1-3]

HART 6990. Special Topics. Topics vary. May be repeated for credit if there is no duplication in topic, but students may earn no more than 3 credits per semester of enrollment. [3]

HART 6999. Qualifying Paper. Research and writing of scholarly paper conceived and executed under supervision of a faculty member. [3]

HART 7999. Master's Thesis Research. [Formerly HART 369] [0-12]

Human and Organizational Development

HOD 7999. Master's Thesis Research. [Formerly HOD 3690] Open to Graduate School students only. [3]

HOD 8000. Community Research in Action Proseminar. [Formerly HOD 3700] The Pro-seminar course provides professional development and practical skills to help new Community Research in Action (CRA) stu-

dents maximize the graduate school experience. Students are given foundational information, instruction, and skill-building exercises on subjects related to teaching, grant-writing, epistemology, research, and service. [2-3]

HOD 8100. Theories of Inequality, Diversity, and Social Justice. [Formerly HOD 3650] This course is designed to acquaint incoming Community Research in Action (CRA) students with the core theories and theoretical perspectives germane to the study of inequality broadly defined. The course includes readings that critically address structural, community, and individual levels of analysis. [3]

HOD 8120. Community Organizing. [Formerly HOD 3670] This course provides graduate students an introduction to theories, processes and models for community organizing. Focus of the course is on post-Alinsky models, particularly congregation-based models in the US. Methods of civic engagement, leadership development, organizational processes and community change are addressed through readings and cases studies. Exposure to and analysis of local organizing efforts are part of this course. [3]

HOD 8130. Public Policy and Advocacy. This course will provide students with a hands on-opportunity to learn about the social policy development process with a focus on community health, youth development, and urbanization and the environment. Students will gain an understanding of the different ways in which policies are made through the legislative, executive, and judicial branches of government at the federal and local levels, as well as the role of the media and advocates/stakeholder groups in shaping social policy. Students will also gain practical experience designing and implementing a campaign aimed at changing social policy. Specifically, students will be asked to select a problem that has policy implications, and then develop a policy analysis and advocacy strategy around their chosen topic. [3]

HOD 8200. Community Development and Urban Policy. [Formerly HOD 3600] Provides the beginning graduate student with an introduction to theory, practice and research in community development (CD) and in urban social policy. It has a laboratory portion in which the student works on a CD project in the local community and uses that to propose to the relevant authorities, a new social policy to implement the findings of the CD project. [3]

HOD 8400. Theory and Application in Action Research. [Formerly HOD 3621] This course is designed to provide students with both intellectual and practical exposure to action research and applied research methods-particularly in relation to working for social change. The course will focus on the issue of knowledge generation and the role of knowledge production in social power. Practical experience will be gained by conducting research on community projects and applying the concepts gained in course work. Prerequisite: one graduate statistics course. [3]

HOD 8810. Doctoral Community Inquiry. [Formerly HOD 3100] Overview of issues and methods in community research. Epistemology, theory, research design, critical analysis, levels of inquiry, and the range of data collection and analysis methods available for community research. Doctoral students only. [3]

HOD 8820. Ethnographic Research Methods in Communities. [Formerly HOD 3450] Through empirical data collection on human behavior in communities, ethnography and other qualitative research methods build hypotheses and theory grounded in the values, beliefs, and aspirations of different societies and cultures. This course introduces and explores the tools and techniques of ethnography and their uses in (1) research problem conceptualization, delineation of assumptions, and generation of culturally competent hypotheses and (2) identification and construction of data sets, field research to collect data, and theory building and practical application derived from data analysis. The course is explicitly interdisciplinary. [3]

HOD 8830. Evaluation Research. [Formerly HOD 3800] This course is a doctoral-level introduction to evaluation research. It is designed for people who expect to work as university faculty members or principal investigators in research organizations with a commitment to using research to understand the contribution of social programs and social change efforts to ending social problems. The first half of the course will be devoted to understanding multiple approaches and types of evaluations and how they are embedded in social and political contexts. The second half will intro-

duce design and analytic techniques particularly useful in large scale social experiments, and some of their limitations. [3]

HOD 8850. Practical Meta-Analysis. [Formerly HOD 3810] The topics covered in this seminar will include the major steps involved in conducting a meta-analysis, with particular emphasis on the technical issues and statistical analyses distinctive to this form of research. Specifically, the course will focus on providing students with the skills needed to be intelligent consumers of systematic reviews and meta-analyses; conduct a systematic, replicable search of the literature used to identify studies eligible for a meta-analysis; create and analyze meta-analytic databases using appropriate statistical techniques; and prepare written reports of meta-analytic findings. [3]

HOD 8999. Non-Candidate Research. [Formerly HOD 3790] Research prior to entry into candidacy (completion of qualifying examination) and for special non-degree students. [Variable credit: 0-12]

HOD 9995. Half-time Ph.D. Dissertation Research. [Formerly HOD 3995] For students who have completed 72 hours and devote a half-time effort to dissertation research. [0]

HOD 9999. Ph.D. Dissertation Research. [Formerly HOD 3990] Variable credit [0-12]

Human Genetics

HGEN 8320. Human Genetics. [Formerly HGEN 320] Research/techniques in human genetics. Human Genetics students only, by arrangement. [Variable credit]

HGEN 8330. Special Topics In Human Genetics. [Formerly HGEN 330] This course will provide students with an introduction to special topics in human genetics research, with emphasis on unanswered questions in the field. An introductory module will give students a basic understanding of human genetic principles. This will be followed by discussion of current special topics. Potential topics include: What do we know about the human genome and what do we have to learn? Is there a gene for everything? Is personalized medicine feasible? SPRING. [3].

HGEN 8335. Genetics Interest Group Seminar Part 1. [Formerly HGEN 335A] The class meets weekly and is a seminar course that involves four revolving formats: journal club presentations, clinical and ethics talks, directed discussion on current topics of interest in human genetics, and student research in progress presentations. For Human Genetics graduate students only. FALL and SPRING. [0]

HGEN 8336. Genetics Interest Group Seminar Part 2. [Formerly HGEN 335B] The class meets weekly and is a seminar course that involves four revolving formats: journal club presentations, clinical and ethics talks, directed discussion on current topics of interest in human genetics, and student research in progress presentations. For Human Genetics graduate students only. FALL and SPRING. [1]

HGEN 8340. Human Genetics I. [Formerly HGEN 340] (Also listed as Molecular Physiology and Biophysics 8340) Designed to cover background and latest advances in human molecular genetics. Topics will include the content of the human genome; human gene structure, function, and expression; cytogenetics and chromosomal abnormalities; the landscape of human genetic variation; genotyping and sequencing methods; the basis of human genetic disease; approaches to treating genetic disease, such as gene therapy; genetic counseling; ethical considerations of genetic testing and human gene editing. Topics will be discussed with reference to specific genetic diseases. FALL. [3] Mortlock

HGEN 8341. Human Genetics II. [Formerly HGEN 341] (Also listed as Molecular Physiology and Biophysics 8341) This course will cover the statistical, population, and analytical aspects of modern human genetics research. Topics to be covered include human population genetics, quantitative genetics, disease gene discovery (emphasizing design, statistical and molecular techniques), linkage and association analyses, computational genetics, and evolutionary genetics. Clinical examples, subject ascertainment, and study design will also be emphasized. Students must have a strong

understanding of Mendelian genetics and basic biostatistics. Prerequisite: consent of instructor. SPRING. [3]

HGEN 8349. Genetics of Model Organisms. [Formerly HGEN 349] (Also listed as Cell and Developmental Biology 8349, Molecular Physiology and Biophysics 8349) Basic genetic principles across a broad range of organisms (yeast, *C. elegans*, *Drosophila melanogaster*, plants, mouse, zebrafish) that are used in genetic analyses to investigate molecular pathways of interest for human disease will be presented. This course will provide students with in-depth terminology and understanding of the advantages, applications, and approaches specific to each organism. Genomic and bioinformatics tools that facilitate genetic analysis in each species will be emphasized. Specific examples of how each model organism has successfully contributed to elucidation of a human disease gene, pathway, or genetic principle will be presented. Course combines faculty lectures with student presentation and discussion of original articles to emphasize the uniqueness of each model system. Prerequisite: one statistics course at the upper undergraduate level or higher and Fundamentals of Genetic Analysis (MPB 8385), or permission of instructor. Offered every other year. SPRING. [3]

HGEN 8350. Directed Study in Human Genetics. [Formerly HGEN 350] Introduction to current research through readings of the genetics literature. Given on an individual basis by arrangement. May be taken more than once, but not for more than 4 hours credit with a single adviser, nor for more than 5 hours total. Prerequisite: consent of instructor and DGS. FALL, SPRING, SUMMER. [Variable credit: 1-4]

HGEN 8370. Tutorials in Human Genetics. [Formerly HGEN 370] A weekly seminar critically evaluating current and past scientific literature from many areas of genetic research. The focus will be on study methods and analysis. FALL. [1]

HGEN 8371. Tutorial in Statistical and Population Genetics. [Formerly HGEN 371] The class meets once weekly. Graduate students critically evaluate research publications in areas statistical methods in human genetic analysis and in the area of human population genetics. Also, there are faculty presentations on ancillary science skills, such as oral and poster presentations, and grant and proposal writing. SPRING. [1]

HGEN 8381. Molecular Foundations of Medicine. [Formerly HGEN 381] Molecular Foundations of Medicine is designed to familiarize students with the cellular structures, biomolecules, and processes that constitute life, human health, and disease at the molecular level. The course employs an integrated approach to teach underlying principles of biochemistry, cell and tissue biology, and genetics with an emphasis on human systems and medical conditions. The inclusion of clinical correlation sessions, small groups, and laboratory sessions will further integrate and broaden course material and relate molecular processes to the study of human disease. Prerequisite: THSP students only. FALL. [Variable credit: 1-6]

HGEN 8384. The Brain and Behavior. [Formerly HGEN 384] Brain and Behavior provides a basic understanding of the human central nervous system and human behavior. The format includes lectures, lab exercises, small group discussions, and patient and case presentations. Brain and Behavior integrates three areas of medical science: (1) neuroanatomy, physiology, and biochemistry; (2) psychopathology and systems neuroscience; and (3) pathology, pharmacology, and radiology. Prerequisite: THSP students only. SPRING. [1]

HGEN 8385. Fundamentals of Genetic Analysis. [Formerly HGEN 385] This course is designed to accomplish three goals: (1) introduce students to critical topics of genetic research, (2) introduce students to important areas of genetic research not covered in first-year course work, and (3) promote an understanding of classical genetic analysis by learning genetics using the original literature. Emphasis will be placed on research problems that utilize the full power of genetic analysis.

HGEN 8390. Human Genetic Epidemiology. [Formerly HGEN 390] This course will cover in detail the study design and methods of modern genetic epidemiology. This will include concepts of familial aggregation, linkage analyses, population genetics as it is applied to studies of human traits, and association studies, both candidate genes and genome-wide association. The concept of linkage disequilibrium and its use in disease-gene studies will be extensively discussed. The underlying principles of each approach

will be developed and current methods and software programs used to perform these will be discussed. Emphasis will be placed on the advantages and disadvantages of each approach and how to best design a genetic epidemiology study. [3]

HGEN 8391. BioVU Study Design. [Formerly HGEN 391] This is a practical, hands-on course on the design of research projects using the de-identified version of Vanderbilt's electronic medical record (Synthetic Derivative, SD) and DNA bio-repository (BioVU). Students will go through the process of developing a BioVU project proposal, from initial project design through construction of a written proposal and application process. Topics covered will include an overview of the clinical data available in the Synthetic Derivative (SD), techniques for defining phenotypes within the SD, proper control definition, limitations of BioVU for research, available genetic data, common problem with study design and how to address them, population stratification, IRB approval procedures and other RCR topics, and the BioVU application workflow. The goal of this course is to guide the student through the process of developing a practical BioVU proposal to the point of application submission. Prerequisite: None. [3] Spring. Instructors: David Samuels and Quinn Wells.

HGEN 8392. Structure, Function, and Development. [Formerly HGEN 382] Structure, Function, and Development is designed to provide students with the means to develop an effective understanding of the normal micro and macroscopic structure, function, and development of the human body. The course employs a coordinated, integrated approach to the presentation and learning of the disciplines of human gross anatomy, cell and tissue biology (histology), human development (embryology), and physiology in a context of clinical application. Prerequisite: THSP students only. SPRING. [Variable credit: 1-3]

HGEN 8393. Introduction to the Vanderbilt Center for Undiagnosed Diseases. The Vanderbilt Center for Undiagnosed Diseases (VCUD) is one of six sites added to the NIH sponsored Undiagnosed Diseases Network (UDN). The purpose of the UDN is to bring together clinical and research experts from across the United States to solve the most challenging medical mysteries using advanced technologies. Interested patients apply to the network; if accepted, they undergo full phenotyping and if appropriate, whole exome- or whole genome-sequencing. The VCUD receives these data files and completes the analysis with a team of bioinformatics, biology, genetics, protein modeling, and clinical experts. The purpose of this course is to introduce students to the "needle in a haystack" problem of determining the causal genetic variants, out of the millions of variants carried by each individual, that underlie rare diseases. Students will attend two meetings per week in which new cases will be discussed. For a final project, the student will present one of the cases at the Genomics Meeting at the end of the semester. The student will describe the findings from sequencing data after investigating the evidence associated with the variants, and make a case for which variants are diagnostic or which should continue to be pursued in the evaluation of the UDN participant. This will require the student to integrate the sequencing results, data from model organisms, and information in published literature with the presenting features of the participant. Prerequisites: Enrolled in MPH, MSCI or PhD program or consent of instructor. Participants should have mastery of basic genetic concepts including inheritance patterns and sequencing modalities. Participants will need to maintain current IRB training for research with human subjects for the duration of the semester (CITI Course). FALL and SPRING. [2] Hamid.

HGEN 8394. Practical Python Programming and Algorithms for Data Analysis. This course is intended for students who are focused on big data analysis in the Python programming language, from large scale epidemiologic datasets, electronic medical records, or next generation sequence data. It will cover basic programming, including strings, arrays, dictionaries, conditional statements, data visualization, external data sources, and algorithms, with a focus on using programming to solve challenges within the students' own research projects. At the end of the course, students will have an understanding of the foundation of programming in Python. They will understand the importance and use of regular expressions and efficient data search tools and will demonstrate proficiency in algorithms and data visualization. Evaluations will be based on a midterm exam, homework, a final project, and class participation. The proposed course is not for

undergraduates or professional credit. Prerequisite: consent of instructor. SPRING. Instructor: Jennifer Below and staff. [3]

HGEN 8999. Non-Candidate Research. [Formerly HGEN 379] Research prior to entry into candidacy (completion of qualifying examination) and for special non-degree students. [Variable credit: 0-12]

HGEN 9999. Ph.D. Dissertation Research. [Formerly HGEN 399]

Interdisciplinary Graduate Program in Biomedical Sciences

IGP 8001. Bioregulation I. [Formerly IGP 300A] Fundamental aspects of the utilization of genetic material from DNA to RNA to protein. This includes macromolecular structure and function, cell biology, and the regulation of cell growth. FALL. [1-8] Patton and Staff.

IGP 8002. Bioregulation II. [Formerly IGP 300B] Fundamental aspects of cell-cell communication and information flow through multicellular organs and the overall regulation of these processes. Includes immunologic defense, endocrine signaling, neuroscience, and molecular aspects of disease. SPRING. [Variable credit: 1-8] Patton and Staff.

IGP 8004. Responsible Conduct in Research. [Formerly IGP 303] Formal lectures and small group discussions on a range of issues encountered in research activities. Included are responsibilities of the investigator and the university to the federal government; scientific misconduct, ethical use of animals in research; ethics of publication, lab management, and grant writing.

IGP 8005. Techniques and Preparations. [Formerly IGP 302] Eight-week modules conducting laboratory research on a project designed by a faculty preceptor. Includes technical instruction, critical data analysis, experimental design, and literature review. FALL, SPRING. [Variable credit: 1-5] Patton and Staff.

IGP 8999. Non-Candidate Research. [Formerly IGP 379] Research prior to entry into candidacy (completion of qualifying examination) and for special non-degree students. [Variable credit: 0-12]

IGP 9999. Ph.D. Dissertation Research. [Formerly IGP 399]

Interdisciplinary Materials Science

IMS 5320. Nanoscale Science and Engineering. [Formerly IMS 320] A multidisciplinary approach to the study of the fundamentals uniquely pertaining to the processing, structure, and performance of materials on the dimensional scale of tens to hundreds of atoms. The science and engineering of nanomaterials. Methods for synthesis and fabrication, techniques for characterization, and the attainment of special properties at the nanoscale. An examination of present and future applications in biotechnology, medicine, and engineering. FALL. [3]

Interdisciplinary Social and Political Thought

INTE 7999. Master's Thesis Research. [Formerly INTE 369]

INTE 8999. Non-Candidate Research. [Formerly INTE 379] Research prior to entry into candidacy (completion of qualifying examination) and for special non-degree students. [Variable credit: 0-12]

INTE 9999. Ph.D. Dissertation Research. [Formerly INTE 399]

Italian

ITA 8090. Special Topics in Italian Studies. [3]

Japanese

JAPN 5101. Elementary Japanese I. (Also listed as JAPN 1101) Acquisition of oral-aural skills and basic grammar. Introduction to reading and writing Japanese syllabaries and Chinese characters. Two hours of lecture and three hours of drill per week. No credit for students who have earned credit for a more advanced Japanese language course. No credit for students who have earned credit for 1101. [5]

JAPN 5102. Elementary Japanese II. (Also listed as JAPN 1102) Two hours of lecture and three hours of drill per week. No credit for students who have earned credit for a more advanced Japanese language course. No credit for students who have earned credit for 1102. [5]

JAPN 5201. Intermediate Japanese I. (Also listed as JAPN 2201) Development of conversational skills and linguistic competence. Syntax, writing, and reading. Two hours of lecture and three hours of drill per week. No credit for students who have earned credit for a more advanced Japanese language course. No credit for students who have earned credit for 2201. [5]

JAPN 5202. Intermediate Japanese II. (Also listed as JAPN 2202) Two hours of lecture and three hours of drill per week. No credit for students who have earned credit for a more advanced Japanese language course. No credit for students who have earned credit for 2202. [5]

JAPN 5301. Advanced Japanese I. (Also listed as JAPN 3301) Reading and writing in contemporary Japanese texts. Conversation, discussion, and development of pragmatic competence. No credit for students who have earned credit for a more advanced Japanese language course. No credit for students who have earned credit for 3301. [3]

JAPN 5302. Advanced Japanese II. (Also listed as JAPN 3302) No credit for students who have earned credit for a more advanced Japanese language course. No credit for students who have earned credit for 3302. [3]

JAPN 5851. Independent Study. (Also listed as JAPN 3851) A reading course which may be repeated with variable content according to the needs of the individual student. Primarily designed to cover materials not otherwise available in the regular curriculum. May be repeated for a total of 12 credits in 289a and 289b combined if there is no duplication in topic, but students may earn only up to 3 credits per semester of enrollment. [1-3; maximum of 12 credits total for all semesters of JAPN 289a and 289b]

JAPN 5852. Independent Study. (Also listed as JAPN 3852) A reading course which may be repeated with variable content according to the needs of the individual student. Primarily designed to cover materials not otherwise available in the regular curriculum. May be repeated for a total of 12 credits in 3851 and 3852 combined if there is no duplication in topic, but students may earn only up to 3 credits per semester of enrollment. [1-3; maximum of 12 credits total for all semesters of JAPN 3851 and 3852] No credit for students who have earned credit for 3852.

JAPN 5891. Special Topics in Advanced Japanese. (Also listed as JAPN 3891) Reading, writing, and discussion in authentic Japanese cultural, literary, and historical texts. Topics vary. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. No credit for students who have earned credit for 3891. [3]

Jewish Studies

JS 5000. Major Themes in Jewish Studies. (Also listed as JS 3000) The study of Jews, Judaism, and Jewish culture. History of Jewish Studies, core perspectives, key methodologies, critical debates. Classical literature, current trends. No credit for students who have earned credit for 3000. [3]

JS 5100. The New Testament in Its Jewish Contexts. (Also listed as JS 2100) Documents of the origin of Christianity and the social, literary, ideological, and theological contexts in which they emerged and which they reflect. Various critical methodologies employed in interpreting them. No credit for students who have earned credit for 2100. [3]

JS 5150. Issues in Rabbinic Literature. (Also listed as JS 2150) History of Rabbinic thought from its origins to the Middle Ages through the reading of central Rabbinic texts. Capital punishment, women in Rabbinic culture,

sectarianism, and the power structures of Roman Palestine and Sasanian Babylonia. May be repeated for credit more than once if there is no duplication in topic, but students may earn only up to 6 credits per semester of enrollment. No credit for students who have earned credit for 2150. [3]

JS 5210. Reading Across Boundaries: Jewish and Non-Jewish Texts. (Also listed as JS 3210) Jewish and non-Jewish literary and historical texts studied in parallel so as to discover the differences between them. The course will consider texts from the ancient world to the early modern period and ask what constitutes Jewish writing and how it has been defined through time and geography. All readings will be in English. No credit for students who have earned credit for 3210. [3]

JS 5250. Witnesses Who Were Not There: Literature of the Children of Holocaust Survivors. (Also listed as JS 2250W) Fiction and non-fiction produced by children of Holocaust survivors. No credit for students who have earned credit for 2250W. [3]

JS 5260. Coming of Age in Jewish Literature and Film. (Also listed as JS 2260) The transition of young Jewish protagonists into adulthood as portrayed in literary works and films from Europe, Africa, and the Americas. No credit for students who have earned credit for 2260 or 2260W. [3]

JS 5270. Jewish Storytelling. (Also listed as JS 2270) Twentieth-century short fiction and narrative traditions. The transition from religious to secular cultural forms. Immigration and ethnic literary forms. All works are in English or English translation from Yiddish, Hebrew, and Russian. No credit for students who have earned credit for 2270 or 2270W. [3]

JS 5300. Modern Jewish Thought. (Also listed as JS 2300) Jewish intellectual responses to major transformations of modernity. Impact of secularization, universalism, pluralism, nationalism, and gender theories on Jewish thought and identity. Conflicting perspectives of tradition, education, culture, and religion. Relationship between Israel and the diaspora. No credit for students who have earned credit for 2300. [3]

JS 5301. Jewish Language and Paleography. (Also listed as JS 4301) Advanced study in a language of the Jewish people with a particular focus on the linguistic and paleographic features that define its cultural context. Each section focuses on one of the following languages: Aramaic, Ladino, Judaeo-Arabic, Rabbinic Hebrew, or Yiddish. May be repeated for credit up to two times when the language studied differs. Consent of instructor required. No credit for students who have earned credit for 4301. [3]

JS 5320. Freud and Jewish Identity. (Also listed as JS 2320) Analysis of rhetoric and themes in selected writings of Sigmund Freud and his times, development of assimilation and of anti-Semitic repudiation. No credit for students who have earned credit for 2320. [3]

JS 5330. Is G-d Guilty? The Problem of Evil in Judaism. (Also listed as JS 2330) Origin, nature, and representations of evil from Scripture through the Hasidic masters. Reflections of modern thinkers. No credit for students who have earned credit for 2330. [3]

JS 5340. Jewish Philosophy after Auschwitz. (Also listed as JS 2340) Critical responses to social and political institutions and the corresponding modes of thought that made Auschwitz possible and continue to sustain the barbarism that many leading philosophers have identified at the heart of culture. No credit for students who have earned credit for 2340. [3]

JS 5520. Zionism: Politics, Religion, and Ethnicity. (Also listed as JS 2520) Tensions among religion, nationalism, and political activism. Translations of Messianism into a secular program. Criticism from within and without the movement. No credit for students who have earned credit for 2520. [3]

JS 5540. Power and Diplomacy in the Modern Middle East. (Also listed as JS 2540) History of the Middle East in the 19th and 20th centuries with an emphasis on U.S. involvement after 1945. U.S. relationship with Israel, and its impact on the region. No credit for students who have earned credit for 2540. [3]

JS 5560. Social Movements in Modern Jewish Life. (Also listed as JS 2560) How social movements shape contemporary American Jewish culture and politics. Explores movements internal to Judaism and those bringing religion into the public sphere. No credit for students who have earned credit for 2560. [3]

JS 5620. Jews in Egypt. (Also listed as JS 2620) Jewish life and experience under Egyptian, Greek, Roman, and Muslim rule in Egypt from the Ptolemies to 1956. Jewish self-government, economic life, and culture over twenty-two centuries, through letters, documents, and imaginative literature. No credit for students who have earned credit for 2620. [3]

JS 5640. Jews and Greeks. (Also listed as JS 2640) From the seventh century BCE to ca. 1500 CE. Sites of interaction, languages, cultural ties, religious tensions, political conflicts, and competing philosophies. Works by Elephantine, Alexander the Great, the Maccabees, the Septuagint, Aristaeus, Josephus, Philo, the rabbis, the New Testament, Ezekiel the Tragedian, Byzantium. No credit for students who have earned credit for 2640. [3]

JS 5840. Directed Readings. Advanced readings and research on a selected topic done under the supervision of a faculty mentor. [1-3]

JS 5890. Special Topics. (Also listed as JS 3890) Topics as announced. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. No credit for students who have earned credit for 3890. [3]

JS 5892. Topics in Ancient and Medieval Jewish History. (Also listed as JS 3892) From antiquity to 1492. Topics vary. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. No credit for students who have earned credit for 3892. [3]

JS 5894. Topics in Modern Jewish History. (Also listed as JS 3894) From 1492 to the present. Topics vary. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. No credit for students who have earned credit for 3894. [3]

K'iche'-Mayan Language

KICH 5101. Elementary K'iche' I. (Also listed as KICH 1101) Kaqchikel, K'iche', or Q'eqchi'. Basic speaking, reading, and writing skills. Offered on a graded basis only. Serves as repeat credit for students who have earned credit for ANTH 2612. No credit for students who have earned credit for 1101. [3]

KICH 5102. Elementary K'iche' II. Intermediate level course with advanced grammar. Counterfactual constructions, deixis, verbal derivations of positional roots, sound symbolic verbs, and verbal nominalizations. Vocabulary and idioms. Various literary genres. No credit for students who have earned credit for ANTH 2614. Offered on a graded basis only. Prerequisite: 5101 or ANTH 2612. [3]

KICH 5201. Intermediate K'iche' I. Vocabulary, listening, and speaking skills. Modern and colonial texts. Cultural context of linguistic practices in K'iche' communities. No credit for students who have earned credit for Anthropology 278. Offered on a graded basis only. Prerequisite: 5102. [3]

KICH 5202. Intermediate K'iche' II. Taught in K'iche'. Advanced vocabulary, grammar, syntax, reading, and writing. Colonial and modern texts. No credit for students who have earned credit for ANTH 3615. Offered on a graded basis only. Prerequisite: 5201 or ANTH 3614. [3]

Latin

LAT 6010. The Writings of Caesar. (Also listed as LAT 3010) Selections from *The Civil War* and *The Gallic War*. Literary style and historical context. No credit for students who have earned credit for 3010. [3]

LAT 6020. Cicero and the Humanistic Tradition. (Also listed as LAT 3020) Study of Cicero's career and thought, and of his contribution to the development of the concept of humanitas. Readings from his letters, speeches, or philosophical works. No credit for students who have earned credit for 3020. [3]

LAT 6030. Latin Letters. (Also listed as LAT 3030) The literary letters of Seneca and Pliny, with a brief introduction to the personal correspondence of Cicero and the letters discovered at Vindolanda. No credit for students who have earned credit for 3030. [3]

LAT 6040. The Roman Historians. (Also listed as LAT 3040) Selections from Sallust, Livy, and Tacitus, with attention to their objectives and methods; analysis of Roman historiography and its relation to Greek and early Christian historiography. No credit for students who have earned credit for 3040. [3]

LAT 6050. Suetonius. (Also listed as LAT 3050) Selections from the works of one of Rome's most important biographers, read in the context of the Latin biographical tradition as well as the political and social background. No credit for students who have earned credit for 3050. [3]

LAT 6060. Tacitus. (Also listed as LAT 3060) Selections from the works of one of Rome's most important historians, read in the context of historiographical tradition and political and social background. No credit for students who have earned credit for 3060. [3]

LAT 6100. Roman Comedy. (Also listed as LAT 3100) Reading of selected comedies of Plautus and Terence: study of the form of Roman comedy and its relation to the Greek New Comedy. No credit for students who have earned credit for 3100. [3]

LAT 6110. Catullus. (Also listed as LAT 3110) Reading and interpretation of Catullus' poems; aesthetic, political, and rhetorical contexts; fundamentals of Latin meter. No credit for students who have earned credit for 3110. [3]

LAT 6120. Lucretius: *De Rerum Natura*. (Also listed as LAT 3120) Lucretius' poem studied both in the tradition of Epicurean philosophy and as a landmark in the development of the Latin didactic epic; background material in the fragments of Epicurus and some treatment of the Epicurean movement in Italy and especially in Rome. No credit for students who have earned credit for 3120. [3]

LAT 6130. Vergil: *The Aeneid*. (Also listed as LAT 3130) An intensive study of the entire poem, in the context of the epic tradition. No credit for students who have earned credit for 3130. [3]

LAT 6140. The Lyric Poetry of Horace. (Also listed as LAT 3140) Reading and interpretation of Horace's Epodes and Odes; relation to the Greco-Roman lyric tradition and to Augustan politics. No credit for students who have earned credit for 3140. [3]

LAT 6150. Latin Elegy. (Also listed as LAT 3150) Authors who created a new type of love poetry during the rule of emperor Augustus: Tibullus, Propertius, Ovid, and Sulpicia. Construction and contestation of gender roles; political contexts; development of the elegiac couplet; modern responses. No credit for students who have earned credit for 3150. [3]

LAT 6160. Ovid. (Also listed as LAT 3160) Reading and interpretation of selections from the *Metamorphoses* or other works of Ovid. No credit for students who have earned credit for 3160. [3]

LAT 6170. Roman Satire. (Also listed as LAT 3170) The satires of Horace and Juvenal; the origins of Roman satire; history and conventions of the genre; background reading in other Roman satirists. No credit for students who have earned credit for 3170. [3]

LAT 6180. Neronian Writers. (Also listed as LAT 3180) Selections from authors in the literary renaissance during the reign of the artistic Emperor Nero, including Seneca, Lucan, Persius, and Petronius. Stylistic innovations, literary merits, and cultural contexts. No credit for students who have earned credit for 3180. [3]

LAT 6200. Early Christian Writers. (Also listed as LAT 3200) Selections from the writings of Latin Christians, from the account of Perpetua's martyrdom to the Confessions of Augustine. No credit for students who have earned credit for 3200. [3]

LAT 6890. Special Topics in Latin Literature. (Also listed as LAT 3890) May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

LAT 7000. Seminar in Classical Latin Prose. [Formerly LAT 313] May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

LAT 7010. Seminar in Classical Latin Poetry. [Formerly LAT 314] May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

LAT 7850. Independent Study. (Also listed as LAT 3850) Designed for majors wanting to familiarize themselves with works or authors not covered in the regular curriculum. Prerequisite: 6 hours above 2202. May be repeated for a total of 6 credits if there is no duplication in topic, but students may earn only up to 3 credits per semester of enrollment. No credit for students who have earned credit for 3850. [1-3; maximum of 6 credits total for all semesters of LAT 3850]

Latin American Studies

LAS 5101. Introduction to Latin America. (Also listed as LAS 2101) A multidisciplinary survey of Latin America from pre-Columbian times to the present emphasizing culture, economic and political patterns, social issues, literature, and the arts in a historical perspective. No credit for students who have earned credit for 2101. [3]

LAS 5301. Music of Protest and Social Change in Latin America. (Also listed as LAS 2301) Politics of musical culture. Music both as a marker of sociopolitical change and as an agent of political transformation. No credit for students who have earned credit for 2301. [3]

LAS 5601. Latin America, Latinos, and the United States. (Also listed as LAS 2601) Immigration of Latin American and Caribbean peoples to the United States and their experiences in this country. Required service work and a research project in the Nashville Latino community. No credit for students who have earned credit for 2601. [3]

LAS 5851. Independent Study. [Formerly LAS 390A] A program of independent readings and research in a minimum of two disciplines, to be selected in consultation with the center's graduate adviser. [3]

LAS 5852. Independent Study. [Formerly LAS 390B] A program of independent readings and research in a minimum of two disciplines, to be selected in consultation with the center's graduate adviser. [3]

LAS 5891. Special Topics in Latin American Studies. (Also listed as LAS 3891) Selected special topics suitable for interdisciplinary examination from the perspective of the social sciences and humanities. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. No credit for students who have earned credit for 3891. [3]

LAS 5901. Research Seminar. (Also listed as LAS 4901) Selected topics for the interdisciplinary study of Latin America. [3]

LAS 6010. Culture and Music in the Mexican Borderlands. [Formerly LAS 330] Ethnographies and interpretations of social-cultural life in the U.S.-Mexico borderlands. [3]

LAS 6020. Music, Spirituality, and Performance. [Formerly LAS 331] How religious events invoke music and dance to bond temporal humanity with spiritual eternity. Ways in which music reconstructs understandings of physical and metaphysical being and creates sacred identities and communities. [3]

LAS 6030. Fieldschool in Intercultural Education. [Formerly LAS 370] Provides training in field research directed to human, social, and community development issues. Student research sponsored and supervised by an interdisciplinary team from Vanderbilt University and the Latin American faculty of social sciences (FLACSO). Fluency in Spanish required. [3]

LAS 7999. Master's Thesis Research. [Formerly LAS 369] [0-12]

Latino and Latina Studies

LATS 5961. Seminar. Overview of cultural production, history, and political and socioeconomic experiences of Hispanic people living in the United States. Synthesis of issues, traditions, approaches, and problems. [3]

Law and Economics

LWEC 8349. Reading Course. [Formerly LWEC 349A] Designed to permit graduate students to do more intensive study in the area of their special interest than regular course offerings provide. Admission by consent of director of graduate studies and supervising professor. [Variable credit]

LWEC 8401. Law and Economics Theory I. [Formerly LWEC 401] Principles of economic analysis as applied to legal issues. Topics include, among others, torts, property, litigation, and government regulation. Pre- or corequisite ECON 8100. [3]

LWEC 8402. Law and Economics Theory II. [Formerly LWEC 402] Economic analysis of the law with applications from civil and criminal procedure, law enforcement, property, torts, decision making by courts, settlement negotiation, contracts, and antitrust. Prerequisite: LWEC 8401; pre- or corequisite: ECON 8110. [3]

LWEC 8403. Behavioral Law and Economics I. [Formerly LWEC 403] Economic principles underlying behavioral law and economics research. Analyses of the rationality of individual choice will be undertaken, including research that involves the interaction of economics, psychology, and decision sciences. Applications of behavioral law and economics methods will be applied to the analysis of jury behavior. Pre- or corequisite: ECON 8100. [3]

LWEC 8404. Behavioral Law and Economics II. [Formerly LWEC 404] Research contributions at the frontier of behavioral law and economics research. Each student will structure a controlled experiment to test the rationality of jury behavior, the effect of alternative jury instructions, or a similar kind of scientifically controlled study of behavior relating to the performance of the legal system. Students will administer and analyze the survey results and will prepare an original research paper on their chosen topic. Prerequisite: LWEC 8403. [3]

LWEC 8405. Econometrics for Legal Research. [Formerly LWEC 405] Analysis and critique of empirical legal research using advanced econometric techniques. Topics will be drawn from the program's core fields. Students will perform independent empirical research using primary data sources. Pre- or corequisite: ECON 8300, ECON 8310, LWEC 8401. [3]

LWEC 8406. Research in Law and Economics. [Formerly LWEC 406] Students will develop and complete an original research paper. The paper may pose an original research question or may be a replication of an existing empirical result. [3]

LWEC 8420. Labor Markets and Human Resources I. [Formerly LWEC 420] Economic, econometric, and legal analysis of the labor market. Topics include analysis of the economic impact of employment laws with a particular focus on antidiscrimination laws, use of labor market studies to estimate the value of statistical life, and behavioral labor economics and economic models of fairness in the employment relationship. Prerequisite: ECON 8100, ECON 8300, ECON 8310. [3]

LWEC 8421. Labor Markets and Human Resources II. [Formerly LWEC 421] Application of economic and legal analysis to labor market and demographic transformations, including changes in the gender composition of labor market participants, aging of the workforce, immigration, education, poverty, inequality, and provision of health services. Prerequisites ECON 8100, ECON 8300, ECON 8310. [3]

LWEC 8430. Risk and Environmental Regulation I. [Formerly LWEC 430] Analysis of the sources of market failure that create a rationale for risk and environmental regulation. Methodologies pertaining to appropriate valuation and enforcement of these regulatory policies. Applications include procedures for estimating the value of statistical life, perception of risk, the role of hazard warnings, risk analysis by government agencies, and the enforcement of regulatory programs. Prerequisite: ECON 8100, ECON 8300, ECON 8310. [3]

LWEC 8431. Risk and Environmental Regulation II. [Formerly LWEC 431] Risk and Environmental Regulation II. Analysis of the sources of market failure that create a rationale for risk and environmental regulation. Methodologies pertaining to appropriate valuation and enforcement of these regulatory policies. This course will focus on theoretical economic models of risk and environmental regulation. Among the topics included will be the

economics of risk and uncertainty, discounting, and benefit-cost analysis. Prerequisite: ECON 8100, ECON 8300, ECON 8310. [3]

LWEC 8440. Experimental Methods for Law and Economics. This short course will focus on how to use experimental economic methods to explore the behavioral and institutional underpinnings of public policy, especially as applied to environmental, natural resources, and health issues. The course will focus on market failure, risk, conflict, cooperation, incentive design, valuation, and prosperity. The course will be taught both with lectures and hands-on experience in examining how to frame, design, implement, and evaluate experimental results aimed at making good policy better, and preventing bad policy from getting worse. [1] Fall 2015. Adjunct Professors of Law Jason Shogren and Linda Thunstrom.

LWEC 8490. Ph.D. Law and Economics Workshop. [Formerly LWEC 490] Research workshop on the presentation and interpretation of research and literature on law and economics. Topics vary with student and faculty interest. [3]

LWEC 8999. Non-Candidate Research. [Formerly LWEC 379] Research prior to entry into candidacy (completion of qualifying examination) and for special non-degree students. [Variable credit: 0-12]

LWEC 9999. Ph.D. Dissertation Research. [Formerly LWEC 399] [0]

Leadership and Policy Studies

LPO 7100. Leadership in the Professions. [Formerly LPO 3460] Professions are distinct from ordinary occupations in that professional work involves the application of unique abstract knowledge as part of practice and doing so with integrity and a commitment to particular values that transcend any particular job or organization. Leadership in such contexts must go beyond generic leadership theories that focus solely individual or organizational performance to include theories that incorporate broader commitments to public, professional, and social values. In this course, leadership will be explored and supporting the dual roles of professionals as autonomous knowledge workers and as stewards of broader social values. [3]

LPO 7999. Master's Thesis Research. [Formerly LPO 3690] Master's Thesis Research for Graduate School Ph.D. masters in passing students only [0-6]

LPO 8100. History of American Education. [Formerly LPO 3460] This doctoral seminar will examine the social, political, intellectual, and organizational history of American education in the twentieth century. The class will read and analyze some of the best work on the history of K-12 and higher education together. My hope is to begin to erase the intellectually expedient but artificial boundary that scholars have erected between the two sectors by deploying a comparative approach. By thinking of the study of K-16 as a single pipeline, albeit a circuitous one with many blockages and leaks, this class will broaden students' understanding of the American education system writ large, alerting them to the distant origins of the nation's education debates and to the longstanding efforts to improve the system in the last century. At the end of this course, students will possess a more historically grounded conception of the American way of education—an appreciation of the system as an institution deeply rooted in the nation's history that endures despite the many calls for its reform if not reconstruction. [3]

LPO 8110. Economics of Education. [Formerly LPO 3530] This course focuses on key issues and challenges in education systems, drawing on theory, econometric methods and related social sciences research to investigate and understand their implications for educational effectiveness. We will study leading concerns in early education, K-12 and higher education policy, including the following topics: education as an investment in future productivity and returns to education; the education production function; the role of education in economic growth; the organization of education and education markets; school quality and choice, and education reforms efforts. [3]

LPO 8120. Governance and Politics in Education. [Formerly LPO 3540] This course deals with a central question in political science and public policy—how can public institutions be redesigned to improve accountability? This question is examined with particular attention to governance and politics in public school systems. Specifically, students will examine three sets of issues: (1) What is the role of politics in allocating resources in public

schools? (2) What are key political challenges in the governance of urban school systems? (3) What is the politics of school choice? (Ph.D. only) [3]

LPO 8130. Social Context of Education. [Formerly LPO 3600] Explores contemporary social, philosophical, and political dimensions of education and their relationship to leadership, including issues related to social class and culture, democracy and diversity, and equality and choice. Ph.D. students only. [3]

LPO 8140. International Issues in Education Policy. [Formerly LPO 3680] This course covers education outside the United States, including primary, secondary, and higher education. Depending on student demand, it can cover any country in any region. It is designed for those who intend to enter the field of education policy or administration and who need to be able to bring knowledge and experience with education in diverse global contexts to bear on issues of policy and practice. Ph.D. students only. [3]

LPO 8200. Ph.D. Proseminar. The purpose of this seminar is to inform and support LPO PhD students as they move through graduate school and in the transition to their future roles as education researchers and faculty members. Seminar topics vary each semester and are based on student and faculty input. [5]

LPO 8500. Special Topics in Leadership and Policy Studies. [Formerly LPO 3460] Explores special issues or topics related to leadership and policy studies. May be repeated with change of topic. [1-6]

LPO 8610. Ph.D. Seminar in K-12 Education Leadership and Policy. [Formerly LPO 3621] This required course for Ph.D. students in the K-12 Leadership and Policy Program focuses on research and policy issues that are studied in depth by LPO faculty. The content of the course changes each year, based on the research interests and focus of the faculty member teaching it. Rotating topics have included Measurement and Assessment; Instructional Leadership; Urban School Reform; and Teacher Policy. [3]

LPO 8620. Ph.D. Seminar in Higher Education Leadership and Policy. [Formerly LPO 3622] This required course for Ph.D. students in the Higher Education Leadership and Policy Program focuses on research and policy issues that are studied in depth by LPO higher education faculty. The content of the course changes each year, based on the research interests and focus on the faculty members teaching it. Rotating topics have included History of American Higher Education; Organization and Governance of Higher Education; The Academic Profession: Structure and Roles; The College Student: Structure, Processes, and Effects; and Comparative Issues in Higher Education Policy Reform. [3]

LPO 8810. Research Design and Methods of Education Policy. [Formerly LPO 3912] The purpose of this course is to provide an introduction to the practice of research and a survey of various research designs used in the study of education policy. The course develops understandings of the principles, processes and techniques used in educational research. The course is based on the premise that final published research develops and evolves through an iterative process. This research process requires decisions and judgements and careful consideration of alternatives. The goal for this course is for students to learn the formal principles of research design and to begin to understand how to conduct research by identifying and evaluating advantages and disadvantages and trade-offs of various research designs and data collection strategies. Ph.D. students only. [3]

LPO 8840. Modeling Context Effects in Educational Organizations. [Formerly LPO 3910] This seminar explores the methodological challenges and substantive implications of studying schools as complex organizations. Substantively, this course covers the literature on school effects, moving from early input-output studies to current research that examines the organizational context of schools, particularly the impact of within- and between-school stratification on student outcomes. Methodologically, this course provides an introduction to hierarchical linear modeling, including the conceptual background of hierarchical models, preparing data sets for use with HLM software, using the HLM software, strategies for analysis of data, applications of two- and three-level models, interpreting HLM output, and presenting results. Ph.D. students only. [3]

LPO 8851. Regression Analysis I. [Formerly LPO 3916] Regression analysis is a widely used technique that allows us to 1) to describe average patterns of association among multiple variables observed in a sample and 2) to make inferences about the patterns of association among these

variables in a population. The goal of this course is to develop an understanding of the basic methods, including their limitations, and to develop skill in using regression analysis to analyze non-experimental data. As an important part of any analysis is communicating the results to an audience, we will also place considerable emphasis on learning to present (in writing, tables, and figures) the results. [3]

LPO 8852. Regression II. [Formerly LPO 3918] This is a practical, Hands-on course in statistical research methods. The focus is on drawing casual inferences from observational (i.e., non-experimental) data, with particular emphasis on instrumental variables and longitudinal (panel) data estimators. Additional topics include binary and categorical dependent variables models and methods for dealing with missing data, including multiple imputation. [3]

LPO 8999. Non-Candidate Research. [Formerly LPO 3790] Research prior to entry into candidacy (completion of qualifying examination) and for special non-degree students. Ph.D. students only. [Variable credit: 0-12]

LPO 9951. Ph.D. Student Research Practicum. [Formerly LPO 3921] LPO 9951, 9952, and 9953 are a single practicum that is taken over three semesters (Fall, Spring, Maymester) by first-year PHD students in LPO. The three courses must be taken in sequence. This practicum is designed to introduce students to the practice of research, particularly the applied side of quantitative research. This class has a strong emphasis on using programming skills to aid in the replication of work and to simplify complex analyses. [1]

LPO 9952. Ph.D. Student Research Practicum. [Formerly LPO 3922] LPO 9951, 9952, and 9953 are a single practicum that is taken over three semesters (Fall, Spring, Maymester) by first-year PHD students in LPO. The three courses must be taken in sequence. This practicum is designed to introduce students to the practice of research, particularly the applied side of quantitative research. This class has a strong emphasis on using programming skills to aid in the replication of work and to simplify complex analyses. [2]

LPO 9953. Ph.D. Student Research Practicum. [Formerly LPO 3923] LPO 9951, 9952, and 9953 are a single practicum that is taken over three semesters (Fall, Spring, Maymester) by first-year Ph.D. students in LPO. The three courses must be taken in sequence. This practicum is designed to introduce students to the practice of research, particularly the applied side of quantitative research. This class has a strong emphasis on using programming skills to aid in the replication of work and to simplify complex analyses. [3]

LPO 9960. Readings and Research in Leadership Policy Studies. [Formerly LPO 3470] Semi-independent readings and research on selected topics in leadership policy studies. May be repeated. Consent of instructor required. [1-3]

LPO 9995. Part-Time Dissertation. [Formerly LPO 3995] For students who have completed 72 hours and devote a half-time effort to dissertation research. [0]

LPO 9999. Ph.D. Dissertation Research. [Formerly LPO 3990]

Liberal Arts and Science

MLAS 6100. Seminar in Humanities. [Formerly MLAS 260] Seminar in Humanities. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

MLAS 6300. Seminar in Social Science. [Formerly MLAS 270] Seminar in Social Science. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

MLAS 6500. Seminar in Natural Science. [Formerly MLAS 280] Seminar in Natural Science. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

MLAS 6700. Interdisciplinary Seminar. [Formerly MLAS 290] Interdisciplinary Seminar. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

MLAS 7340. Interdisciplinary Selected Topics. [Formerly MLAS 340] Interdisciplinary Selected Topics. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

MLAS 7999. Master's Thesis Research. [Formerly MLAS 369] [0-3]

Management (Owen)

MGT 6466. Professional Development in MMark. This course helps MMARK students develop strategic proficiency in defining vocational preferences. Students will develop an effective marketing recruiting strategy and activate tactical career skills necessary for success in the business world. Students will become familiar with the recruiting landscape, understand how to build networks and connections, engage with a diverse range of marketing career opportunities and align their recruiting focus with their professional goals. [1]

MGT 6494. IT For Business Leaders. This course will equip students with business decision-making skills regarding IT capabilities and strategies applicable to complex enterprises. It will balance strategic models with actionable insights drawn from real world examples across a variety of industries. Focus topics will include cybersecurity, emerging technologies, governance models, enterprise architectures, and policy and leadership implications for senior executives. [2]

MGT 6905. Maymester/Summer Study Abroad Opportunities. [Formerly MGT 906] Prior approval must be obtained from Jeri West, Academic Programs Office.

MGT 8999. Non-Candidate Research. [Formerly MGT 379] Research prior to entry into candidacy (completion of qualifying examination) and for special non-degree students. [Variable credit: 0-12]

MGT 9999. Ph.D. Dissertation Research. [Formerly MGT 399]

Materials Science and Engineering

MSE 6310. Atomic Arrangements in Solids. [Formerly MSE 310] Atomic arrangements in metals, ceramics, semiconductors, glasses, and polymers. Lattice geometry and crystal symmetry to describe crystal structures. Nanocrystalline materials. Scattering theory and diffraction phenomena for structural characterization. FALL. [3]

MSE 6343. Electron Microscopy. [Formerly MSE 343] Principles and applications of transmission electron microscopy in the study of materials. Electron scattering, image contrast theory, operation of electron microscope, and specimen preparation. Use of the electron microscope in experimental investigations. Two lectures and one laboratory period. FALL. [3]

MSE 6391. Special Topics. [Formerly MSE 391] Based on faculty research projects and highly specialized areas of concentration. FALL, SPRING. [Variable credit: 1-3 each semester]

MSE 6392. Special Topics. [Formerly MSE 392] Based on faculty research projects and highly specialized areas of concentration. FALL, SPRING. [Variable credit: 1-3 each semester]

MSE 7999. Master's Thesis Research. [Formerly MSE 369] [0-6]

MSE 8991. Seminar. [Formerly MSE 397] A required noncredit course for all graduate students in the program. Topics of special interest consolidating the teachings of previous courses by considering topics which do not fit simply into a single course category. FALL, SPRING. [0] Staff.

MSE 8992. Seminar. [Formerly MSE 398] A required noncredit course for all graduate students in the program. Topics of special interest consolidating the teachings of previous courses by considering topics which do not fit simply into a single course category. FALL, SPRING. [0] Staff.

MSE 8999. Non-Candidate Research. [Formerly MSE 379] Research prior to entry into candidacy (completion of qualifying examination) and for special non-degree students. [Variable credit: 0-12]

MSE 9999. Ph.D. Dissertation Research. [Formerly MSE 399] [0-12]

Mathematics

MATH 5000. History of Mathematics. (Also listed as MATH 3000) Major developments in mathematics from ancient times to the early twentieth century. Emphasis both on the historical perspective and the mathematics; assignments include many exercises and theorems. Highly recommended for teacher candidates. No credit for students who have earned credit for 3000. [3]

MATH 5100. Introduction to Analysis. (Also listed as MATH 3100) Properties of real numbers, compactness and completeness. Limits, sequences and series, uniform convergence, and power series. Basic properties of functions on the real line, and the elementary theory of differentiation and integration. Emphasis on methods of proof used in advanced mathematics courses. No credit for students who have earned credit for 3100. [3]

MATH 5110. Complex Variables. (Also listed as MATH 3110) Complex numbers, analytic and elementary functions, transformations of regions. Complex integrals, Cauchy's integral theorem and formula, Taylor and Laurent series. The calculus of residues with applications, conformal mappings. No credit for students who have earned credit for 3110. [3]

MATH 5120. Introduction to Partial Differential Equations. (Also listed as MATH 3120) Initial- and boundary-value problems for partial differential equations using separation of variables in conjunction with Fourier series and integrals. Explicit solutions of problems involving the heat equation, the wave equation, and Laplace's equation. No credit for students who have earned credit for 3120. [3]

MATH 5130. Fourier Analysis. Fourier series topics including convolution, Poisson kernels, Dirichlet kernels, and pointwise and mean-square convergence. Integral transforms including one-dimensional and multidimensional Fourier integrals, Fourier inversion formula and Plancherel theorem, Poisson summation formula, Radon transform, and X-ray transform. Fourier analysis on Abelian groups including finite Fourier analysis and fast Fourier transform. Applications to signal processing, Shannon sampling theory, and/or compressed sensing. Repeat credit for students who have earned credit for 267 section 1 in spring 2011 or spring 2013. [3]

MATH 5165. Advanced Calculus. (Also listed as MATH 3165) Advanced treatment of multivariable calculus. Differentiation of functions of several variables, including inverse and implicit function theorems. Vector differential calculus. Integration of functions of several variables. Vector integral calculus, including Stokes' theorem. No credit for students who have earned credit for 3600 [229]. No credit for students who have earned credit for 3165. [3]

MATH 5200. Introduction to Topology. (Also listed as MATH 3200) Open sets, closed sets, continuity, compactness, and connectivity. Subspaces, product spaces, and quotient spaces. Knot theory, topology of surfaces, and applications. No credit for students who have earned credit for 3200. [3]

MATH 5210. Transformation Geometry. (Also listed as MATH 3210) Transformations of the plane, groups of transformations, reflections, glide reflections, classification of the isometries of the plane, frieze groups, analysis of frieze patterns, wall paper groups, and analysis of wall paper patterns. Especially recommended for prospective teachers of mathematics. No credit for students who have earned credit for 3210. [3]

MATH 5220. Differentiable Manifolds. (Also listed as MATH 4220) Manifolds in n -dimensional Euclidean space, smooth maps; inverse and implicit function theorems. Regular value theorem, immersions and submersions, Sard's theorem, and transversality. Degree of a map; winding numbers and the Fundamental Theorem of Algebra; intersection theory modulo 2. No credit for students who have earned credit for 4220. [3]

MATH 5230. Introduction to Differential Geometry. Smooth maps, tangent space, and surfaces and hypersurfaces in n -dimensional Euclidean

space. Inverse and Implicit Function theorems. Sard's theorem. Transversality. Degree of a map; intersection theory modulo 2. Orientability and oriented intersection number. [3]

MATH 5300. Abstract Algebra. (Also listed as MATH 3300) Fundamental properties of integers and polynomials. Elementary properties of groups, rings, integral domains, fields, and lattices. No credit for students who have earned credit for 3300. [3]

MATH 5310. Introduction to Mathematical Logic. (Also listed as MATH 3310) Development of the first order predicate calculus and fundamental metamathematical notions. No credit for students who have earned credit for 3310. [3]

MATH 5320. Error-Correcting Codes and Cryptography. (Also listed as MATH 3320) Applications of algebra to reliability and secrecy of information transmission. Error-correcting codes, including linear, Hamming, and cyclic codes, and possibly BCH or Reed-Solomon codes. Cryptography, including symmetric-key, DES and RSA encryption. No credit for students who have earned credit for 3320. [3]

MATH 5600. Linear Algebra. [Formerly MATH 204] (Also listed as MATH 2600) Algebra of matrices, real and complex vector spaces, linear transformations, and systems of linear equations. Eigenvalues, eigenvectors, inner product spaces, and orthonormal bases. [3]

MATH 5610. Ordinary Differential Equations. (Also listed as MATH 2610) First- and second-order differential equations, applications. Matrix methods for linear systems; stability theory of autonomous systems; existence and uniqueness theory. Intended for mathematics and advanced science majors. No credit for students who have earned credit for 2400 or 2420. No credit for students who have earned credit for 2610. [3]

MATH 5620. Introduction to Numerical Mathematics. (Also listed as MATH 3620) Numerical solution of linear and nonlinear equations, interpolation and polynomial approximation, non-numerical differentiation and integration. Least-squares curve fitting and approximation theory, numerical solution of differential equations, errors and floating point arithmetic. Application of the theory to problems in science, engineering, and economics. Student use of the computer is emphasized. Familiarity with computer programming is expected. No credit for students who have earned credit for 3620. [3]

MATH 5630. Mathematical Modeling in Biology and Medicine. (Also listed as MATH 3630) Basic mathematical modeling tools, such as interpolation, least-squares regression, difference equations, and ordinary and partial differential equations. Statistical analysis of data, support vector machines, and computer simulation. Familiarity with computer programming is expected. No credit for students who have earned credit for 3630. [3]

MATH 5640. Probability. (Also listed as MATH 3640) Combinatorics, probability models (binomial, Poisson, normal, gamma, etc.), Stochastic independence, generating functions, limit theorems and types of convergence, bivariate distributions, transformations of variables. Markov processes and applications. Prerequisite: MATH 5820. [3]

MATH 5641. Mathematical Statistics. (Also listed as MATH 3641) Distribution theory, order statistics, theory of point estimation and hypothesis testing, normal univariate inference, Bayesian methods, sequential procedures, regression, nonparametric methods. No credit for students who have earned credit for 3641. [3]

MATH 5650. Financial Stochastic Processes. (Also listed as MATH 4650) The theory of stochastic processes and applications to financial economics. Brownian motion; martingales; Itô's Lemma; stochastic integration. Monte Carlo simulations with variance reduction techniques. Applications include discrete-time option pricing and delta hedging. No credit for students who have earned credit for 4650. [3]

MATH 5651. Evaluation of Actuarial Models. (Also listed as MATH 4651) Applications of statistics to the evaluation and selection of actuarial models. Severity, frequency, and aggregate models. Measure of risk. Applications of Bayesian analysis to credibility theory. Simulation and bootstrap methods. No credit for students who have earned credit for 4651. [3]

MATH 5660. Mathematical Modeling in Economics. (Also listed as MATH 3660) Modeling microeconomic problems of supply and demand,

profit maximization, and Nash equilibrium pricing. Auctions and bargaining models. Statistical models and data analysis. Computational experiments. No credit for students who have earned credit for 3660. [3]

MATH 5670. Mathematical Data Science. Linear methods for regression and classification, bias-variance tradeoff, and basis expansions and regularization. Kernel methods, support vector machines, dimension reduction, and clustering algorithms. No credit for students who completed Math 3890/5890 section 01 offered fall 2017. [3]

MATH 5700. Discrete Mathematics. (Also listed as MATH 3700) Elementary combinatorics including permutations and combinations, the principle of inclusion and exclusion, and recurrence relations. Graph theory including Eulerian and Hamiltonian graphs, trees, planarity, coloring, connectivity, network flows, some algorithms and their complexity. Selected topics from computer science and operations research. No credit for students who have earned credit for 3700. [3]

MATH 5800. Theory of Numbers. (Also listed as MATH 3800) Factorization of integers, Fundamental Theorem of Arithmetic, congruences, Wilson's theorem. Fermat's theorem, arithmetic functions, perfect numbers, Law of Quadratic Reciprocity. Diophantine equations, Pythagorean triples, sums of squares. No credit for students who have earned credit for 3800. [3]

MATH 5820. Introduction to Probability and Mathematical Statistics. (Also listed as MATH 2820) Discrete and continuous probability models, mathematical expectation, joint densities. Laws of large numbers, point estimation, confidence intervals. Hypothesis testing, nonparametric techniques, applications. Students taking 5820 are encouraged to take 5820L concurrently. No credit for students who have earned credit for 2810 or 2820. [3]

MATH 5821. Introduction to Applied Statistics. (Also listed as MATH 2821) Review of basic applied statistics. Development of the analysis of variance as a technique for interpreting experimental data. Generalized likelihood ratio principle, confounding, multiple comparisons, introduction to response surface methodology, and nonparameteric methods. Experimental design including: completely randomized, nested, orthogonal contrasts, randomized block, Latin squares, factorial, and fractional factorial. Prerequisite: 5820. [3]

MATH 5859. Independent Study. (Also listed as MATH 3859) Reading and independent study in mathematics under the supervision of an adviser. Designed primarily for honors candidates, but open to others with approval by department chair. No credit for students who have earned credit for 3859. [Variable credit: 1-3 each semester, not to exceed 6 without departmental permission]

MATH 5890. Selected Topics. Topics vary. May be repeated if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [1-3]

MATH 6100. Theory of Functions of a Real Variable. [Formerly MATH 330A] The real number system, transfinite numbers, spaces, point sets in metric spaces, sequences and series of functions, measure. Lebesgue integration, convergence theory, inversion of derivatives. Prerequisite: 3100. [3]

MATH 6101. Theory of Functions of a Real Variable. [Formerly MATH 330B] Continuation of 6100. The real number system, transfinite numbers, spaces, point sets in metric spaces, sequences and series of functions, measure. Lebesgue integration, convergence theory, inversion of derivatives. Prerequisite: 6100. [3]

MATH 6200. Topology. (Also listed as MATH 4200) Connectedness, compactness, countability, and separation axioms. Complete metric spaces. Function spaces. No credit for students who have earned credit for 4200. [3]

MATH 6201. Topology. (Also listed as MATH 4201) The fundamental group and covering spaces. Topology of surfaces. Simplicial complexes and homology theory. Homotopy theory. No credit for students who have earned credit for 4201. [3]

MATH 6210. Differential Topology. [Formerly MATH 370] Manifolds; submanifolds; tangent and vector bundles. Vector fields and flows, Lie brack-

ets, distributions, and the Frobenius theorem. Sard's theorem; transversality and intersection theory; degree theory and applications. Tensors and differential forms; the exterior derivative; Stokes' theorem and integration; de Rham cohomology. No credit for students who have earned credit for 270. Prerequisite: either 2410, 2600, or 2501, and either 3200, 4220, or 4200. [3]

MATH 6300. Modern Algebra. (Also listed as MATH 4300) Group theory through Sylow theorems and fundamental theorem of finitely generated abelian groups. No credit for students who have earned credit for 4300. [3]

MATH 6301. Modern Algebra. (Also listed as MATH 4301) Introductory theory of commutative rings and fields, and additional topics such as Galois theory, modules over a principal ideal domain and finite dimensional algebras. No credit for students who have earned credit for 4301. [3]

MATH 6310. Set Theory. (Also listed as MATH 4310) The basic operations on sets. Cardinal and ordinal numbers. The axiom of choice. Zorn's lemma, and the well-ordering principle. Introduction to the topology of metric spaces, including the concepts of continuity, compactness, connectivity, completeness, and separability. Product spaces. Applications to Euclidean spaces. Strongly recommended for beginning graduate students and for undergraduates who plan to do graduate work in mathematics. No credit for students who have earned credit for 4310. [3]

MATH 6600. Numerical Analysis. (Also listed as MATH 4600) Finite difference and variational methods for elliptic boundary value problems, finite difference methods for parabolic and hyperbolic partial differential equations, and the matrix eigenvalue problem. Student use of the computer is emphasized. No credit for students who have earned credit for 4600. [3]

MATH 6620. Linear Optimization. (Also listed as MATH 4620) An introduction to linear programming and its applications. Formulation of linear programs. The simplex method, duality, complementary slackness, dual simplex method and sensitivity analysis. The ellipsoid method. Interior point methods. Possible additional topics include the primal-dual algorithm, cutting planes, or branch-and-bound. Applications to networks, management, engineering, and physical sciences. No credit for students who have earned credit for 4620. [3]

MATH 6630. Nonlinear Optimization. (Also listed as MATH 4630) Mathematical modeling of optimization problems. Theory of unconstrained and constrained optimization, including convexity and the Karush-Kuhn-Tucker conditions. Derivative- and non-derivative-based methods. Familiarity with computer programming is expected. No credit for students who have earned credit for 4630. [3]

MATH 6700. Combinatorics. (Also listed as MATH 4700) Elements of enumerative analysis including permutations, combinations, generating functions, recurrence relations, the principle of inclusion and exclusion, and Polya's theorem. Some special topics will be treated as class interest and background indicate (e.g., Galois fields, theory of codes, and block designs). No credit for students who have earned credit for 4700. [3]

MATH 6710. Graph Theory. (Also listed as MATH 4710) The mathematical theory of networks. Traversing graphs using paths, cycles, and trails. Matchings and other graph factors. Coloring of vertices and edges. Connectivity and its relation to paths and flows. Embeddings of graphs in surfaces, especially the plane. Prerequisite: linear algebra. Students unfamiliar with basic ideas of graph theory, including paths, cycles, and trees, should take 5700 prior to 6710. No credit for students who have earned credit for 4710. [3]

MATH 7100. Theory of Functions of a Complex Variable. [Formerly MATH 331A] Complex integration, calculus of residues, harmonic functions, entire and meromorphic functions, conformal mapping, normal families, analytic continuation, Riemann surfaces, analytic functions of several complex variables. Prerequisite: 3110. [3]

MATH 7101. Theory of Functions of a Complex Variable. [Formerly MATH 331B] Continuation of 7100. Complex integration, calculus of residues, harmonic functions, entire and meromorphic functions, conformal mapping, normal families, analytic continuation, Riemann surfaces, analytic functions of several complex variables. Prerequisite: 7100. [3]

MATH 7110. Partial Differential Equations. (Also listed as MATH 4110) Classification of equations: equations of elliptic, parabolic, and hyperbolic type. Separation of variables, orthonormal series, solutions of homogeneous and nonhomogeneous boundary value problems in one-, two-, and three-dimensional space. Possible additional topics include subharmonic functions and the Perron existence theorem for the Laplace equation of Sturm-Liouville theory. No credit for students who have earned credit for 4110. [3]

MATH 7120. Functional Analysis. [Formerly MATH 362A] Function spaces, topological vector spaces, linear operators, conjugate spaces, Hilbert and Banach spaces, Banach algebras. Applications to function theory, differential equations, and integral equations. Prerequisite: 6100. [3]

MATH 7121. Functional Analysis. [Formerly MATH 362B] Continuation of 7120. Function spaces, topological vector spaces, linear operators, conjugate spaces, Hilbert and Banach spaces, Banach algebras. Applications to function theory, differential equations, and integral equations. Prerequisite: 7120. [3]

MATH 7130. Harmonic Analysis. [Formerly MATH 360] Fourier series; Wiener's Lemma; Fourier integral; Plancherel Theorem; Haar measure on an LCA group G , Dual group and the Fourier integral; Hausdorff-Young inequality; Hilbert transform; Hardy-Littlewood maximal functions; Marcinkiewicz Interpolation theorem; Singular integrals and the Calderon-Zygmund decomposition; multiresolution approximations; special topics from harmonic analysis, such as wavelets, frames, abstract harmonic analysis, symmetric spaces. Prerequisite: 6101. [3]

MATH 7140. Approximation Theory. [Formerly MATH 325] Best approximation in metric and normed vector spaces; Tchebycheff approximation, Weierstrass-type theorems, rational approximation, orthogonal polynomials, trigonometric approximation, moduli of continuity, spline approximation; expansions and bases in function spaces. Prerequisite: 3110 and 6100. [3]

MATH 7200. Algebraic Topology. [Formerly MATH 312] Homology, cohomology, homotopy theory. Prerequisite: 4201. [3]

MATH 7210. Riemannian Geometry. [Formerly MATH 313] Vector fields, brackets; Riemannian metrics; Riemannian connections; geodesic flow; curvature: sectional curvature, Ricci curvature, scalar curvature; Jacobi fields; Hopf-Rinow Theorem; Hadamard Theorem. Complex manifolds, Hermitian metrics, Kahler metrics, complex projective space, first Chern class of a line bundle. Prerequisite: 270. [3]

MATH 7300. Universal Algebra. [Formerly MATH 323] Theory of general algebraic systems. Concepts discussed will include subalgebras, congruences, automorphism groups, direct and subdirect products, ultraproducts, free algebras, varieties and quasi-varieties, with applications to groups, rings fields, lattices, Boolean algebras, semilattices, and semi-groups. Connections with model theory and category theory will be included as time permits. Prerequisite: 4300. [3]

MATH 7320. Lattice Theory and the Theory of Ordered Sets. (Also listed as MATH 4320) An introduction to basic concepts and theorems in lattice theory and the theory of ordered sets with connections to universal algebra and computer science. Boolean algebras, modular and distributive lattices, ordered topological spaces, algebraic lattices and domains, fixed point theorems, cosets, free lattices. No credit for students who have earned credit for 4320. [3]

MATH 7610. Methods of Mathematical Physics. (Also listed as MATH 4610) Linear operators on vector spaces, matrix theory, and Hilbert spaces. Functions of a complex variable and calculus of residues. Ordinary and partial differential equations of mathematical physics, boundary value problems, special functions. No credit for students who have earned credit for 4610. [3]

MATH 7899. Selected Advanced Topics. [Formerly MATH 367] Topics of special interest at a level suitable for graduate students in mathematics. [Variable credit: 1-3]

MATH 7999. Master's Thesis Research. [Formerly MATH 369] [0-12]

MATH 8100. Theory of Ordinary Differential Equations. [Formerly MATH 333] Existence and uniqueness theorems, systems of linear differential equations, self-adjoint eigenvalue problems, asymptotic behavior, stabil-

ity properties, perturbation theory, and applications. Prerequisite: 6100 and either 2420 or 2610. [3]

MATH 8110. Theory of Partial Differential Equations. [Formerly MATH 334] Equations of the first order. Classification of equations of second order, existence and uniqueness, methods for solving elliptic, parabolic, and hyperbolic equations. Prerequisite: 3120 and 6100. [3]

MATH 8120. Operator Algebras. [Formerly MATH 366] Banach algebras. The Gelfand transform. C^* -algebras and von Neumann algebras. Positivity. States. The Gelfand-Naimark-Segal construction. $*$ -representations of C^* -algebras. Von Neumann's bicommutant theorem. Kaplansky's density theorem. Comparison theory of projections. Examples and applications. Prerequisites: 6101 and 7120. [3]

MATH 8300. Combinatorial and Geometric Group Theory. [Formerly MATH 324A] Generators and defining relations of groups; Cayley graphs and Van Kampen diagrams; subgroups and automorphisms of free groups; graphs of groups; fundamental groups of topological spaces; Magnus embedding; homology of groups; residual properties of groups; hyperbolic groups; small cancellation groups; 1-relator groups; algorithmic problems in groups. Prerequisite: 4300. [3]

MATH 8301. Combinatorial and Geometric Group Theory. [Formerly MATH 324B] Continuation of 8300. Generators and defining relations of groups; Cayley graphs and Van Kampen diagrams; subgroups and automorphisms of free groups; graphs of groups; fundamental groups of topological spaces; Magnus embedding; homology of groups; residual properties of groups; hyperbolic groups; small cancellation groups; 1-relator groups; algorithmic problems in groups. Prerequisite: 8300. [3]

MATH 8310. Lie Groups and Lie Algebras. [Formerly MATH 310] Continuous groups; classical groups; real and complex Lie algebras; applications to physics, geometry, and mechanics. Prerequisite: 3300 or 4300. [3]

MATH 8997. Advanced Independent Study. [Formerly MATH 368] Reading and independent study in an advanced area of mathematics under the supervision of an adviser. Requires approval of director of graduate studies. [Variable credit: 1-3]

MATH 8999. Non-candidate Research. [Formerly MATH 379] Research prior to entry into candidacy (completion of Qualifying Examination) and for special non-degree students. [Variable credit: 0-12]

MATH 9100. Seminar in Analysis. [Formerly MATH 390A] Recent topics. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [1-3]

MATH 9101. Seminar in Analysis. [Formerly MATH 390B] Recent topics. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [1-3]

MATH 9200. Seminar in Topology. [Formerly MATH 372A] Recent topics. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [1-3]

MATH 9201. Seminar in Topology. [Formerly MATH 372B] Recent topics. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [1-3]

MATH 9300. Seminar in Algebra. [Formerly MATH 383A] Recent topics. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [1-3]

MATH 9301. Seminar in Algebra. [Formerly MATH 383B] Recent topics. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [1-3]

MATH 9600. Seminar in Applied Mathematics. [Formerly MATH 394A] Recent topics. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [1-3]

MATH 9601. Seminar in Applied Mathematics. [Formerly MATH 394B] Recent topics. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [1-3]

MATH 9700. Seminar in Discrete Mathematics. [Formerly MATH 375A] Recent topics. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [1-3]

MATH 9701. Seminar in Discrete Mathematics. [Formerly MATH 375B] Recent topics. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [1-3]

MATH 9800. Seminar in Number Theory. [Formerly MATH 381A] Recent topics. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [1-3]

MATH 9801. Seminar in Number Theory. [Formerly MATH 381B] Recent topics. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [1-3]

MATH 9996. Directed Study. [Formerly MATH 398] A reading course designed to give graduate students more background. [Variable credit: 1-3 each semester]

MATH 9999. Ph.D. Dissertation Research. [Formerly MATH 399] [0-12]

Mechanical Engineering

ME 5236. Linear Control Theory. [Formerly ME 336] (Also listed as ME 4236) Classical and modern approaches to the analysis and design of single-input/single-output (SISO) and multiple-input/multiple-output (MIMO) linear time invariant control systems. Classical (frequency-domain) and modern (state-space) approaches to SISO and MIMO control, including optimal control methods. No credit for students who have earned credit for 4236. [3]

ME 5251. Modern Manufacturing Processes. (Also listed as ME 4251) Manufacturing science and processes. A quantitative approach dealing with metals, ceramics, polymers, composites, and nanofabrication and microfabrication technologies. No credit for students who have earned credit for 4251. [3]

ME 5258. Engineering Acoustics. (Also listed as 4258) The wave equation and its solutions; acoustic sources; reflection and transmission of sound; propagation in pipes, cavities, and waveguides; noise standards and effects of noise on people; principles of noise and vibration control; signal processing in acoustics; environmental noise measurement and control; and various contemporary examples. No credit for students who have earned credit for 4258. [3]

ME 5259. Engineering Vibrations. (Also listed as ME 4259) Theory of vibrating systems and application to problems related to mechanical design. Topics include single degree of freedom systems subject to free, forced, and transient vibrations; systems with several degrees of freedom, methods of vibration suppression and isolation, and critical speed phenomena. No credit for students who have earned credit for 4259. [3]

ME 5260. Energy Conversion. (Also listed as ME 4260) Energy resources, use, and conservation are studied. The fundamentals of positive displacement machinery, turbo-machinery, and reactive mixture are introduced and used to examine various forms of power-producing systems. No credit for students who have earned credit for 4260. [3]

ME 5261. Basic Airplane Aerodynamics. (Also listed as ME 4261) Study of the atmosphere; analysis of incompressible and compressible flows, shock waves, boundary layer and skin friction drag, lift and drag forces over airfoils and wings, and flight performance; aircraft stability and control, wing icing, and parachute-based recovery; history of flight and aerodynamics. Corequisite: ME 3224. No credit for students who have earned credit for 4261. [3]

ME 5262. Environmental Control. (Also listed as ME 4262) Heating and cooling systems, energy conservation techniques, use of solar energy and heat pumps. No credit for students who have earned credit for 4262. [3]

ME 5263. Computational Fluid Dynamics and Multiphysics Modeling. (Also listed as ME 4263) Computational modeling of viscous fluid flows and thermal-fluid-structure interaction. Computational techniques including finite-difference, finite-volume, and finite-element methods; accuracy, convergence, and stability of numerical methods; turbulence modeling; rotating machinery; multiphase flows; and multiphysics modeling. No credit for students who have earned credit for 4263. SPRING. [3]

ME 5264. Internal Combustion Engines. (Also listed as ME 4264) Thermodynamics of spark ignition and compression ignition engines; gas turbines and jet propulsion. No credit for students who have earned credit for 4264. [3]

ME 5265. Direct Energy Conversion. (Also listed as ME 4265) The principles and devices involved in converting other forms of energy to electrical energy. Conversion devices: electro-mechanical, thermoelectric, thermionic, fluid dynamic, and fuel cell. No credit for students who have earned credit for 4265. [3]

ME 5267. Aerospace Propulsion. (Also listed as ME 4267) Application of classical mechanics and thermodynamics to rocket and aircraft propulsion. Design and performance analysis of air-breathing and chemical rocket engines. Advanced propulsion systems for interplanetary travel. Contemporary issues in aerospace propulsion; space exploration, renewable fuels. No credit for students who have earned credit for 4267. [3]

ME 5271. Robotics. (Also listed as ME 4271) History and application of robots. Robot configurations including mobile robots. Spatial descriptions and transformations of objects in three-dimensional space. Forward and inverse manipulator kinematics. Task and trajectory planning, simulation and off-line programming. No credit for students who have earned credit for 4271. [3]

ME 5275. Finite Element Analysis. (Also listed as ME 4275) Development and solution of finite element equations for solid mechanics and heat transfer problems. Commercial finite element and pre- and post-processing software. Two lectures and one three-hour laboratory each week. No credit for students who have earned credit for 4275. [3]

ME 5280. Advanced Dynamics of Mechanical Systems. (Also listed as ME 4280) Development of methods for formulating differential equations to model mechanical systems, including formalisms of Newton-Euler, Lagrange, and virtual work methods to two- and three-dimensional systems. No credit for students who have earned credit for 4280. [3]

ME 5284. Modeling and Simulation of Dynamic Systems. (Also listed as ME 4284) Incorporates bond graph techniques for energy-based lumped-parameter systems. Includes modeling of electrical, mechanical, hydraulic, magnetic and thermal energy domains. Emphasis on multi-domain interaction. No credit for students who have earned credit for 4284. [3]

ME 7899. Master of Engineering Project. [Formerly ME 389]

ME 7999. Master's Thesis Research. [Formerly ME 369] [0-6]

ME 8320. Statistical Thermodynamics. [Formerly ME 320] Old and modern quantum theory, including H atom, rigid rotor, and harmonic oscillator. Atomic and molecular structure and spectra. Maxwell-Boltzmann statistical model for ideal, chemically reacting, electron, or photon gas. Gibbs method. Prerequisite: ME 2220. [3]

ME 8323. Micro/NanoElectroMechanical Systems. [Formerly ME 323] Fabrication techniques and mechanical behavior of modern MEMS/NEMS structures. Application of NEMS/MEMS devices to sensing and actuation. [3]

ME 8326. Gas Dynamics. [Formerly ME 326] Study of compressible fluid flow from subsonic to supersonic regimes in confined regions and past bodies of revolutions. Includes heat transfer, frictional effects, and real gas behavior. Prerequisite: ME 3224. [3]

ME 8327. Energy Conversion Systems. [Formerly ME 327] An advanced study of energy conversion systems that include turbomachinery, positive

displacement machinery, solar energy collection and combustion, with consideration for optimizing the systems. [3]

ME 8331. Robot Manipulators. [Formerly ME 331] Dynamics and control of robot manipulators. Includes material on Jacobian matrix relating velocities and static forces, linear and angular acceleration relationships, manipulator dynamics, manipulator mechanism design, linear and nonlinear control, and force control manipulators. Prerequisite: ME 4271. [3]

ME 8333. Topics in Stress Analysis. [Formerly ME 333] An investigation of thermal stress, transient stress, and temperatures in idealized structures; consideration of plasticity at elevated temperatures; and some aspects of vibratory stresses. [3]

ME 8340. Wireless Mechatronics. [Formerly ME 340] Design of mechatronic devices with emphasis on miniaturization and wireless transmission of data. Programming of wireless microcontrollers with data acquisition and transmission from sensors and to actuators. Group design project to simulate, fabricate, and test a miniaturized wireless robot. [3]

ME 8348. Convection Heat Transfer. [Formerly ME 348] A wide range of topics in free and forced convection is discussed. Solutions are carried out using analytical, integral, and numerical methods. Internal and external flows are considered for both laminar and turbulent flow cases. Convection in high speed flow is also studied. Prerequisite: ME 3248. [3]

ME 8351. Adaptive Control. [Formerly ME 351] Real-time parameter estimation methods. Self-tuning regulators. Model reference adaptive control. Adaptive control for nonlinear systems. A research project is required. Prerequisite: ME 5236. [3]

ME 8352. Non-linear Control Theory. [Formerly ME 352] Phase plane analysis, nonlinear transformations, Lyapunov stability, and controllability/observability calculations. A multidimensional geometric approach is emphasized. Prerequisite: MATH 2410. [3]

ME 8353. Design of Electromechanical Systems. [Formerly ME 353] Analog electronic design for purposes of controlling electromechanical systems, including electromechanical sensors and actuators, analog electronic design of filters, state-space and classical controllers, and transistor-based servoamplifiers and high voltage amplifiers. Significant laboratory component with design and fabrication circuits to control electromechanical systems. Implementation of digital controllers. Prerequisite: ME 3234. [3]

ME 8359. Advanced Engineering Vibrations. [Formerly ME 359] The development and application of Lagrange's equations to the theory of vibrations. Nonlinear systems and variable spring characteristics are analyzed by classical methods and by digital computer techniques. Applications to the design of high speed machines are emphasized. Prerequisite: ME 4259; MATH 3120, MATH 4110. [3]

ME 8363. Conduction and Radiation Heat Transfer. [Formerly ME 363] A comparative study of available methods for solution of single and multidimensional conduction heat transfer problems. Both steady and transient problems are considered. Mathematical and numerical methods are stressed. Radiant exchange between surfaces separated by non-participating media is studied. Numerical methods are developed and discussed for non-isothermal surfaces and combined radiation and conduction problems are solved. Prerequisite: ME 3248. [3]

ME 8364. Nanophotonic Materials. Physics, design, modeling, and applications of nanophotonic materials in modern optical systems. Topics include waveguides and chip-based photonics, photonic crystals, plasmonics, and metamaterials. [3]

ME 8365. Micro/Nano Energy Transport. [Formerly ME 365] Theoretical examination of energy transport by electrons and phonons and modeling of transport phenomena in crystalline solids at reduced length scales. Particle transport models and solution methods for energy carriers in the context of semiconductor electronics, direct energy conversion devices and nanostructure. [3]

ME 8366. Combustion. [Formerly ME 366] Processes, thermodynamics, chemical kinetics, premixed flame theory, diffusion flame theory, ignition and detonation. Prerequisite: ME 3224, ME 4221. [3]

ME 8391. Special Topics. [Formerly ME 391] A course based on faculty research projects and highly specialized areas of concentration. [Variable credit: 1-3 each semester]

ME 8393. Independent Study. [Formerly ME 393] Readings and/or projects on advanced topics in mechanical engineering under the supervision of the faculty. Consent of instructor required. [Variable credit: 1-3 each semester]

ME 8991. Seminar. [Formerly ME 397] [0]

ME 8999. Non-Candidate Research. [Formerly ME 379] Research prior to entry into candidacy (completion of qualifying examination) and for special non-degree students. [Variable credit 0-12]

ME 9999. Ph.D. Dissertation Research. [Formerly ME 399]

Medical Scientist Training Program

MSTP 8310. MSTP Seminar Series. [Formerly MSTP 310] The MSTP Seminar Series is a student-driven course in research guided by faculty preceptors. Formal objectives are to: (1) foster development of critical-thinking skills by appraisal of contemporary scientific literature; (2) enhance scientific creativity through discussion of experimental approaches and techniques; and (3) develop oral presentation skills. The seminar series is interdisciplinary in scope with topics drawn from all areas of biomedical research. The primary focus is on cutting-edge, discovery-based, and hypothesis-driven science. Students in the MSTP have primary responsibility for choosing the manuscripts to be presented as centerpieces of the seminars. More advanced students are expected to play a key role in mentoring before, during, and after junior student presentations. Prerequisites: None. MSTP students only. Other students with specific permission of the Course Director. [1]

MSTP 8313. Clinical Preceptorship Program — Foundations of Healthcare Delivery (CPP-FHD). MSTP students will complete Advanced Communication (AC) 1 & 2, Interprofessional Education (IPE) 1, & Population Health and Prevention (PHP) during G-phase by completing readings, online didactic modules, clinical assignments within the CPP course, and selected CELA experiences. Topics covered will include health literacy/numeracy, communicating medical errors, facilitating shared decision making, the health care professions, and population health. All requirements must be complete prior to moving into the School of Medicine Curriculum 2.0 Immersion Phase. Completion of the didactic material and project work will total approximately 16-20 curricular hours. Course will be listed on the transcript as part of the CPP and will be graded as pass/fail. [0]

MSTP 8314. MSTP Clinical Preceptorship Program. [Formerly MSTP 314] The MSTP Clinical Preceptorship Program (CPP) provides MSTP students with exposure to clinical medicine during the period of research training. CPP course objectives are to: (1) provide exposure to clinical medicine for MSTP students during research training; (2) retain competency in history-taking and physical-examination skills; and (3) facilitate the transition from Graduate School to the clinical years of Medical School. The program is a required component of the MSTP curriculum for all students initiating graduate studies following completion of the second year of Medical School. Each class is assigned two clinical mentors, an internist and a pediatrician, who work with the class for the duration of their graduate training. One-half of each class works with the internist in the fall semester, and the other works with the pediatrician. The classes switch mentors for the spring semester. Students meet with mentors monthly during the academic year. Students are provided with written feedback by the clinical mentors following each semester. The course is P/F. Prerequisites: None. For MSTP students only.

MSTP 8315. Foundations of Biomedical Research I. [Formerly MSTP 315] The major goals of Foundations of Biomedical Research I (form MSTP students in their first year of Medical School) will be: 1) to aid MSTP students in the selection of a thesis mentor and understanding of appropriate expectations for both mentor and mentee, and 2) to gain familiarity in working with the primary research literature. These goals will be accomplished in small group, informal setting through interactions with potential MSTP-eligible faculty and lab members, consultation with the course directors,

and through primary literature paper discussions. Students will be assessed based upon attendance, course presentations, and class contributions. Prerequisites: MSTP students only. FALL, SPRING. [2]

MSTP 8316. Foundations of Biomedical Research II. [Formerly MSTP 316] The major goals of Foundations of Biomedical Research II (for MSTP students in their second year of Medical School) will be to: 1) enhance critical analysis skills with primary research literature, including emphasis on understanding statistical techniques; 2) assist in understanding of appropriate mentor/mentee expectations; and 3) begin to discuss effective pre-doctoral fellowship strategies. These goals will be accomplished in a small group, informal casual setting through discussion with course faculty and peers and through primary literature analysis. Students will be assessed based upon attendance, presentations, and class contributions. Prerequisites: For MSTP students only. FALL, SPRING. [2]

MSTP 8317. Responsible Conduct of Research Training, Phase I. [Formerly MSTP 311A] The MSTP RCR Training Phase I course is offered at the end of June to coincide with the arrival of the entering class of MSTP students and immediately prior to the first laboratory rotation. The course consists of four two-hour sessions. The topics covered include: (1) Mentor/Trainee Responsibilities; (2) Research Misconduct, (3) Publication Practices, Responsible Authorship, and Peer Review; and (4) Data Acquisition, Management, Sharing, and Ownership. Each session consists of didactic presentations, followed by small-group case-based discussions focusing on the issues presented. The course is P/F. Prerequisites: None. For MSTP students only. Others with permission of the course director.

MSTP 8318. MSTP Responsible Conduct of Research, Phase II. [Formerly MSTP 311B] The MSTP RCR Phase II course is offered at the beginning of the first year of graduate research. This component of the RCR curriculum is offered in a single four-hour session, which begins with a brief review of the RCR Phase I course. The topics covered in this session include: (1) Ethics of Human Research; (2) Ethics of Animal Welfare and Use of Animals in Research; (3) Conflict of Interest; and (4) Collaborative Science. Similar to the format for the RCR Phase I course, topics in the Phase II course are presented first in didactic form, followed by small-group case-based discussions for analysis and debate. All nine topics in the NIH RCR guidelines are covered during the two courses. The course is P/F. Prerequisites: None, but MSTP RCR Phase I normally completed first. For MSTP students only. Others with permission of the course director.

MSTP 8999. Non-candidate Research. [Formerly MSTP 379] Research prior to entry into candidacy (completion of Qualifying Examination) and for special non-degree students. [Variable credit: 0-12]

Medicine, Health, and Society

MHS 5010. Global Health Principles and Practice. (Also listed as MHS 3010) Introduction to major global health principles and practices in the developing and developed world. Perspectives of public health practitioners and critical thinking about global health challenges and solutions. [3]

MHS 5020. U.S. Public Health Ethics and Policy. (Also listed as MHS 3020) Critical perspectives on ethical and policy issues in U.S. public health. No credit for students who have earned credit for 3020. [3]

MHS 5030. Community Health Research. (Also listed as MHS 3030) Conceptual and methodological challenges. Focus on descriptive studies and intervention research to address health disparities in chronic diseases and psychiatric disorders. No credit for students who have earned credit for 3030. [3]

MHS 5120. Medicine, Technology, and Society. (Also listed as MHS 3120) Tensions between art and science in medicine. The effect of science and technology on the doctor-patient relationship. Social and ethical issues raised by new biomedical developments. No credit for students who have earned credit for 3120. [3]

MHS 5140. Afrofuturism and Cultural Criticisms of Medicine. (Also listed as MHS 3140) Exploration of Afrofuturism as a literary genre and its critique of the impact of techno-science and medicine on black health, life, and futurity. Multidisciplinary approach in understanding novels, memoirs, and secondary texts. No credit for students who earned credit for 290 sec-

tion 3 in fall 2013. No credit for students who have earned credit for 3140. [3]

MHS 5230. Masculinity and Men's Health. (Also listed as MHS 2230) Interdisciplinary approach to men's health issues and to perceptions of masculinity. The history of men's diseases. Men in clinical settings. Social policies that affect men's health behaviors. No credit for students who earned credit for 290 section 5 in fall 2012. No credit for students who have earned credit for 2230. [3]

MHS 5240. Bionic Bodies, Cyborg Cultures. (Also listed as MHS 2240) Historical and cultural evolution of prosthetics, artificial limbs, and other assistive technologies. Shifts in social views resulting from war, economics, and art and design. Critical texts, films, art practices, and technological advancements. No credit for students who have earned credit for 2240. [3]

MHS 5250. War and the Body. (Also listed as MHS 2250) Impact of war on the human body. Anthropology of the body and theories of bodily experience. Production, representation, and experience of war and of military and medical technologies on a bodily level. Acceptable and unacceptable types of harm. No credit for students who earned credit for 290 section 2 in fall 2012. No credit for students who have earned credit for 2250. [3]

MHS 5330. Men's Health Research. (Also listed as MHS 2330) Concepts and theories of men's health. Global and domestic issues. Effect of men's social and economic advantages on health outcomes. Strategies to improve men's health; relationships between cultural values and health policy; and cultural explanations that shape men's health campaigns. No credit for students who earned credit for 290 section 14 in spring 2013. No credit for students who have earned credit for 2330. [3]

MHS 5350. Perspectives on Trauma. (Also listed as MHS 3250) Trauma as a framework for understanding individual and collective suffering. Trauma in the context of medicine, war, and politics, and of racial, sexual, and gender inequalities. Alternative ways of conceptualizing feeling, memory and loss. No credit for students who earned credit for 295 section 02 in spring 2013. No credit for students who have earned credit for 3250. [3]

MHS 5410. HIV/AIDS in the Global Community. (Also listed as MHS 2410) Medical, social, political, economic, and public policy dimensions of HIV/AIDS. Prevention and treatment strategies, social stigma, and discrimination. No credit for students who have earned credit for 2410. [3]

MHS 5420. Economic Demography and Global Health. (Also listed as MHS 2420) Economic consequences of demographic change in developing and developed countries. Links between socioeconomic status and health; relationship between health and economic growth; determinants of fertility, mortality, and migration. [3]

MHS 6010. Psychiatry, Culture, and Globalization. (Also listed as MHS 4010) Cross-cultural analysis of mental illness; the emergence of cultural psychiatry; and the globalization of biopsychiatry and neuroscience. No credit for students who earned credit for 295 section 2 in fall 2012. No credit for students who have earned credit for 4010. [3]

MHS 6100. Theories and Methods in Critical Health Studies. [Formerly MHS 300] Introduction to graduate-level research and professionalization. Core social theories and forms of evidence. Practical skills related to scholarly engagement, presentation, and writing. [3]

MHS 6150. Death and Dying in America. (Formerly MHS 5150, also listed as MHS 3150) Interdisciplinary introduction to thanatology; changes in medicine and attitudes towards dying as they reshape the American way of death in a multicultural landscape. No credit for students who have earned credit for 3150. [3]

MHS 6200. Concepts and Methods in Health Disparities Research. Conceptual and methodological challenges faced in conducting studies on racial/ethnic, SES, and gender disparities. Descriptive and intervention research with emphasis on community-based studies. No credit for students who have earned credit for MHS 6500-01 offered spring 2016. [3]

MHS 6300. Social Studies of Science and Medicine. Technologies, social groups, institutions, and other factors shaping the human and natural sciences. Qualitative research methods. No credit for students who have earned credit for MHS 6500-01 offered fall 2015. [3]

MHS 6400. Quantitative Research Methods. Basic skills in generating, interpreting, and presenting statistical evidence. Emphasis on applied skills. No credit for students who have earned credit for 6500 section 02 offered fall 2016. [3]

MHS 6500. Special Topics in the Social Foundations of Health. [Formerly MHS 320] May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [1-3]

MHS 7000. Interdisciplinary Research Methods. [Formerly MHS 310] Key methods in the analysis of health and medicine from epidemiology, anthropology, sociology, history, and philosophy. No credit for students who earned credit for 295 section 1 in fall 2013. [3]

MHS 7100. Research Workshop. [Formerly MHS 302] Research presentations by faculty members, visiting scholars, and graduate students. Assists students in the selection of research topics and in the presentation of research. May be repeated for credit. [1]

MHS 7200. Thesis Seminar. [Formerly MHS 370] Preparation of a thesis proposal and development of a thesis. May be repeated for credit. [1]

MHS 7305. Foundations of Global Health. [Formerly MHS 305] Determinants of health and interventions used to better health, particularly in low-resource settings. Core research and evaluation methodologies used in the field. [3]

MHS 7306. Essential Skills in Global Health. [Formerly MHS 306] Core field tools, needs assessment, implementation techniques, and methodologies in global health program implementation. Determinants of global health and development from an interdisciplinary perspective. Global health theories and practices with an emphasis on collective, partnership-based action. No credit for students who have earned credit for IGHM 5240 or PUBH 5550. [3]

MHS 7308. Ethics, Law, and Medicine. [Formerly MHS 308] Explores intersection of ethical, legal, and medical concerns in the modern world of health care. Case-based and discussion format. Serves as repeat credit for students who have completed DIV 3452, MED 5240, or LAW 9078 [3]

MHS 7311. Ethics in Global Health. [Formerly MHS 311] Overview of ethical issues and standards in global health, particularly ethics in international research. Serves as repeat credit for students who have completed VIGH 5244 or IGHM 5244. [1]

MHS 7312. Informatics for Global Health Professionals. [Formerly MHS 312] Medical informatics with emphasis on a global health care setting. As global health bridges both patient care and public health, so informatics. Patient-based information systems and public health information systems. Serves as repeat credit for students who have completed VIGH 5242 or IGHM 5242. [1]

MHS 7313. Introduction to Medical Anthropology. [Formerly MHS 313] The study of illness, suffering, and healing in cultures around the world. Medical anthropology topics, theoretical approaches, and research techniques. Case studies on chronic illness, sorcery and traditional healing, modern pandemics, and treatment/illness expectations. Serves as repeat credit for students who have completed PUBH 5548 or IGHM 5248. [1]

MHS 7314. Global Health Politics and Policy. [Formerly MHS 314] Global health problems facing the world's populations today and efforts taken to improve health at a global level. Political movements of global health issues in the US and among the G8 nations from 2000-2011. Serves as repeat credit for students who have completed PUBH 5550 or IGHM 5250. [1]

MHS 7315. Leadership and Development in Global Health. [Formerly MHS 315] Leadership theory and practice in the area of global health. Serves as repeat credit for students who have completed VIGH 5246 or IGHM 5246. [1]

MHS 7316. Case Studies in Tropical Diseases. [Formerly MHS 316] Tropical diseases and parasitology in a clinical case study format. Serves as repeat credit for students who have completed VIGH 5249 or IGHM 5249. [1]

MHS 7317. Introduction to Quality Improvement. [Formerly MHS 317] Concept and methodology of Quality Improvement (QI) science as it applies

to health care delivery in the U.S. and in the developing world. Serves as repeat credit for students who have completed VIGH 5252 or IGHM 5252. [1]

MHS 7319. Laboratory Technologies in Low Resource Settings. [Formerly MHS 319] Core laboratory principles, technologies, and applications used in the delivery of care and the performance of clinical research in resource-limited settings. Strengths, limitations, and appropriate use of laboratory technologies in the changing landscape of international research and clinical care. [3]

MHS 7830. Graduate Service Learning. [Formerly MHS 394A] Must be taken concurrently with 7831 and/or 7832. After completing the experience, all students must write a thorough report. [1-3].

MHS 7831. Service Learning Research. [Formerly MHS 394B] Students will write a substantial research paper under the supervision of a Vanderbilt faculty member, on a topic related to their service learning experience. [1-3]

MHS 7832. Service Learning Readings. [Formerly MHS 394C] Readings and a substantial interpretive essay on topics related to the service learning experience, under the supervision of a Vanderbilt faculty member. [1-3]

MHS 7850. Independent Study. [Formerly MHS 390A] Readings and research in a minimum of two disciplines, to be selected in consultation with a faculty adviser and subject to the approval of the program director. [1-3]

MHS 7851. Independent Study. [Formerly MHS 390B] Readings and research in a minimum of two disciplines, to be selected in consultation with a faculty adviser and subject to the approval of the program director. [1-3]

MHS 7880. Internship Training. [Formerly MHS 393A] Must be taken concurrently with 7881 and/or 7882. [1-3]

MHS 7881. Internship Research. [Formerly MHS 393B] Students will write a substantial research paper under the supervision of a Vanderbilt faculty member. [1-3]

MHS 7882. Internship Readings. [Formerly MHS 393C] Readings and a substantial interpretive essay on topics related to the internship training, under the supervision of a Vanderbilt faculty member. [1-3]

MHS 7999. Master's Thesis Research. [Formerly MHS 369] [0-12]

Microbe-Host Interactions

M&IM 8327. Experimental Methods in Microbiology. [Formerly M&IM 327] Laboratory work concerned with (a) regulation of gene transcription; (b) signal transducing molecules and pathways; (c) entry and replication of mammalian viruses; (d) techniques in nucleic acid and peptide chemistry, rapid methods of DNA sequencing, gene knock-out in transgenic animals, design of probes, antigens, and synthetic vaccines; and (e) structure-function analysis of ligands, receptors, toxins, and transcription factors. Available only to M&IM students. Admission to course, hours, and credit by arrangement. FALL, SPRING, SUMMER. [2-4].

M&IM 8328. Molecular Virology. [Formerly M&IM 3282] This course focuses on interactions of animal viruses with their host cells, discussed at the molecular and cellular level as model systems. Special emphasis is placed on current literature and methodology. Prerequisite: IGP 8001 or an undergraduate course in biochemistry or microbiology. FALL. [2] (Aiken)

M&IM 8329. Principles of Immunology and the Immune System in Disease. The immune system plays a vital role to protect from pathogens and is intimately linked to a wide range of diseases. The goal of this course is to provide an introduction to the basics of immunology through discussion of principles of immunobiology and clinical cases where the immune system plays a key role in the disease process. Topics to be covered include principles of innate and adaptive immunity, antigen recognition and signaling, immune disease processes, discussion of clinical cases including immunodeficiencies, autoimmunity, inflammation, and tumor immunology. SPRING. [3]

M&IM 8332. Foundations in Microbiology and Immunology I. [Formerly M&IM 332] The objectives of this course are to alert students to important original research articles in microbial genetics and pathogenesis, to apply methods of scientific logic for critical analysis of the knowledge

presented in the articles, and to help students present complex data and conclusions to an audience. SUMMER. [2]

M&IM 8334. Special Topics in Molecular Pathogenesis. This course provides Ph.D. students in the biomedical sciences with the opportunity to study various topics of relevance to their thesis research and within their broader field of study. Class time will be devoted to a discussion of those topics with peers and faculty who share similar interests (topic leaders). In consultation with the course director and the research mentor, students will select from a menu of two-week modules to create a personalized course syllabus. Credit hours: variable (1-4). Students will receive one credit hour per two course modules completed. Students in the MHI and MPI programs must have completed Foundations II prior to this course. Students in the MPI program must have taken either the Fall Immunology of Pathophysiology course. For students in other Ph.D. programs, completion of the first-year IGP or QCB curriculum and permission of the course directors are required. [1-4]

M&IM 8335. Research Proposals: Preparation and Critical Review. [Formerly M&IM 335] An essential skill for scientists in an academic setting is the ability to obtain extramural research funding through peer reviewed grant applications. This course will offer didactic sessions in which the process of preparing and reviewing grant applications is discussed. Each student will write a grant application using the NRSA format for postdoctoral fellowships. The student should propose research in one of the four major emphasis areas of the department: microbial genetics, virology, immunology, or microbial pathogenesis. The initial grant submission will be reviewed by the faculty thesis mentor and a course instructor. The student will amend the application according to the reviewer's comments and submit a final version. Procedures for reviewing grant applications will then be discussed. A student and a faculty member will provide a written review for each of the final grants. The course will conclude with a mock NIH study section in which grants are reviewed orally and scored. SPRING. [2]

M&IM 8350. Bacteriology Through the Lens of NanoMachines. [Formerly M&IM 350] The objective of this course is to provide learners with in-depth knowledge on core processes of bacterial physiology in the context of bacterial motors and machines that drive them. In addition, examples will be provided in which such bacterial motors are deployed and regulated (to the benefit of the bacteria) during the course of infection. FALL. [2] (Hadijfrangiskou)

M&IM 8351. Functional Genomics and Proteomics: Applications to Immunobiology. [Formerly M&IM 351] Biological applications of functional genomics and proteomics in immunology. Topics include: 1) proteomic analysis of blood cells, vascular endothelial cells, and smooth muscle cells involved in immunity and inflammation, 2) functional genomics of immunobiology using genome-wide mutagenesis, 3) gene expression profiling of immune/inflammatory responses based on DNA microarray technology, 4) peptide/protein transduction and its applications to cell-based proteomics and intracellular protein therapy, 5) proteomic analysis of MHC antigens, 6) genomics and proteomic analysis of host-pathogen interactions, 7) genomic and proteomic analysis of immunological diseases, and 8) development and application of new genomic and proteomic strategies in immunology. SPRING. [2]

M&IM 8353. Microbial Diseases. [Formerly M&IM 353] Microbial Diseases is a 1 credit lecture based course that will survey the infectious diseases that are of the greatest importance to global public health. Infectious diseases are responsible for tremendous morbidity and mortality, and the diseases covered in this course are the most common causes of lethal infection in the world. Microbial Diseases is open to all graduate students and postdoctoral fellows and there are no prerequisites for this course. The course will survey the leading causes of infection with a focus on incidence, route of infection, symptoms, and treatment. Upon completion of this course, students will have a strong understanding of the infectious diseases of global medical significance.

M&IM 8999. Non-Candidate Research. [Formerly M&IM 379] Research prior to entry into candidacy (completion of qualifying examination) and for special non-degree students. [Variable credit: 0-12]

M&IM 9999. Ph.D. Dissertation Research. [Formerly M&IM 399]

Molecular Pathology and Immunology

PATH-GS 8322. Experimental Methods in Pathology. [Formerly PATH-GS 322] Special techniques and preparations. Topics include electron microscopy, tissue culture, histochemistry, cytochemistry, and molecular biology. Admission to course, hours, and credit by arrangement. FALL, SPRING, SUMMER. [1-4]

PATH-GS 8331. Seminar in Experimental Pathology. [Formerly PATH-GS 331] Students and faculty participate in a weekly discussion of current research projects and literature. FALL. [1] Hoover and Staff.

PATH-GS 8332. Current Topics in Experimental Pathology. [Formerly PATH-GS 332] Students and faculty participate in a weekly discussion of current research projects and literature. SPRING. [1] Hoover and Staff.

PATH-GS 8339. Foundations of Immunology. [Formerly PATH-GS 339] This course is a comprehensive study of Immunology in the Molecular Pathology and Immunology Ph.D. program. Students in other programs may enroll with consent of the course director. Instructor: Luc Van Kaer [2-3] Fall.

PATH-GS 8345. Human Biology and Disease. This course will use an organ-based approach to teach basic science students about a broad range of human physiologies and common diseases. There will be 20 topics taught covering 16 organ systems, each over two hour blocks coordinated by a physician or physician scientist involved in treating patients with common diseases affecting that organ system. Students will be instructed to register with Medscape, an online portal for students, physicians and healthcare professionals, and use this to read about and write brief reports on clinical topics being discussed each day. The last session of each block will be in a case report format in which instructors bring along a patient suffering from the disease being discussed, so that students can develop an intimate understanding of what it is like to suffer from the disease being discussed during that teaching block. Students will be expected to attend 10 mornings of didactic and interactive teaching blocks over the two-week Human Biology and Disease immersion course. At the end of each morning, the course directors will hold a Q&A session in which we will go over the cases that have been discussed that day, answer questions students may have, and direct them toward further reading using Medscape (or other clinical resources). There are no prerequisites for attending this course other than being a PhD student or post-doctoral fellow enrolled in one of the biomedical sciences programs at Vanderbilt University. The course will be graded as pass or fail based on attendance and on completion of daily entries for each of the topic areas using a time stamped, online course management system that has been developed for the Vanderbilt Program of Molecular Medicine. [3]

PATH-GS 8352. Cellular and Molecular Basis of Disease. An introduction to human disease and the accompanying changes in normal structure and function. The course consists of modules focused on a physiologic system and its related diseases. Each module includes a review of normal anatomy and physiology and the pathological changes occurring with the disease, an in-depth discussion of the molecular and cellular mechanisms of the disease along with clinical correlates, as well as a discussion of high-profile papers relevant to the disease. 8351 (Spring) and 8352 (Fall) are offered as a series, but they can be taken in any order. Prerequisite: basic knowledge of biochemistry, cell, and molecular biology. [2] Organizers: Drs. Tom Stricker and Oliver McDonald. Instructors: Staff.

PATH-GS 8355. Clinical Rounds for Basic Scientists. This interactive course will relate clinical problems/diseases with basic science research. During the semester, the course will involve six different disease topics, with each topic covered over two successive weeks. During the first week, a basic scientist will discuss patient pathophysiology, current treatments, and current state of research on the condition (including known gaps). In the second week of a topic, a physician will introduce 1-2 patients with the disease and discuss the condition from the perspective of a patient and a clinician. [1]

PATH-GS 8999. Non-Candidate Research. [Formerly PATH-GS 379] Research prior to entry into candidacy (completion of qualifying examination) and for special non-degree students. [Variable credit: 0-12]

PATH-GS 9999. Ph.D. Dissertation Research. [Formerly PATH-GS 399]

Molecular Physiology and Biophysics

MP&B 7999. Master's Thesis Research. [Formerly MP&B 369]

MP&B 8322. Physiological Techniques and Preparations. [Formerly MP&B 322] Students sign up for this course number for research credits prior to admission into candidacy for Ph.D. degree. FALL, SPRING, SUMMER. Hours and credit by arrangement. Cone and Staff.

MP&B 8323. Advanced Neurophysiology. [Formerly MP&B 323] (Also listed as Pharmacology 323 and Neuroscience 324) This class is a tutorial in methods for recording electrical signals in neurons. We will begin with a crash course on ion channels and transporters, spending a significant proportion of class time on discussion of recent primary research papers. In the latter part of the semester, we will move on to live demonstrations and personal training in the details of electrophysiological recording methods in several preparations. By the end of the course, students will be prepared to perform electrophysiological experiments as part of their dissertation research.

MP&B 8324. Tutorials in Physiology. [Formerly MP&B 324] The class meets once weekly. In the fall semester, graduate students critically evaluate research publications in areas of active research in the department (e.g., gene transcription, molecular biology, electrophysiology, membrane transport, intercellular signaling, beta cell biology, and regulation of intermediary metabolism). Also, there are faculty presentations on ancillary science skills, such as oral and poster presentations, and grant and proposal writing. In the spring semester, each student presents and defends a short research proposal based on their current research area in preparation for their Candidacy Examination. FALL, SPRING. [1] Hasty, Kenworthy, Colbran, Stein, and Staff.

MP&B 8326. Exercise Physiology. [Formerly MP&B 326] The responses of different physiological systems to exercise. The effect and role of exercise under special conditions such as diabetes, reproduction, heart disease, and orthopedics and rehabilitation. Invited speakers will discuss the clinical and scientific aspects of the above topics. Prerequisite: consent of instructor. SPRING, even-numbered years. [1] Wasserman.

MP&B 8327. Molecular Endocrinology. [Formerly MP&B 327] A survey of the molecular biology of hormone action from the target cell surface to the nucleus. Special emphasis on (i) diabetes and obesity and (ii) how receptors and intracellular messengers mediate hormone action, (iii) how hormones regulate gene expression, and (iv) signaling in adipocytes. Discussion of the use of genetic, molecular biology, and biochemical techniques to study hormone action. The faculty encourage an interactive atmosphere in the class through the discussion of seminal papers. This is an advanced course so some prior background in cell signaling is recommended. FALL. [2] O'Brien, Colbran, Vickers, Niswender and Bingham.

MP&B 8329. Experimental Statistics Short Course. [Formerly MP&B 329] The goal of this course is to insure basic proficiency in statistical concepts, methods for analysis of experimental data, and enhance statistical communication skills. Core concepts to be discussed are: (1) Sources of data variation, data types that lead to different analyses (e.g. parametric vs nonparametric); (2) Variation in samples and populations, real world vs theoretical data distributions; (3) Importance and use of confidence intervals, effect size, power related to experimental design; (4) Meaning of statistical vs functional significance; and (5) Aspects of data analysis pitfalls (e.g., outliers, multiple tests, clustered data). Prerequisite: Permission of faculty. [1] Summer.

MP&B 8330. Human Physiology and Molecular Medicine. [Formerly MP&B 330] Lectures and research correlations on advanced aspects of human physiology, with emphasis on communication between and control of the major tissue types and organ systems. Recent biochemical and molecular biology research findings will be incorporated into the study of normal physiology and pathophysiology. This course is required of all graduate students majoring in Molecular Physiology and Biophysics. Prerequisite: consent of instructor. FALL. [3] Cobb.

MP&B 8332. Scientific Reasoning and Logic in Gene Regulation. [Formerly MP&B 332] (Also listed as Cell and Developmental Biology CBIOS 332) Objective: To gain a detailed understanding of rigorous approaches to experimental design, strategies, and data interpretation using one of

the most developed fields in modern biology - gene regulation - as a contextual backdrop. Drawing on over 40 years of primary research papers in gene control, this course will dissect how important problems are identified, how questions are framed to give rigorous answers, and how data are interpreted and new hypotheses generated. The topics to be covered include eukaryotic RNA polymerase and basal factor structure and function, chromatin and nucleosome structure, DNA and nucleosome modification and the effects of these components and factors on transcription, cell- and tissue-specific transcription factors and molecular mechanisms of gene control. As these topics are discussed, particular emphasis will be placed upon accessing the appropriateness of controls, techniques, data interpretation, and formulation of future experimentation in these areas. Class meetings are fully interactive, and require extensive input and critical evaluation from students. All class meetings revolve around the detailed discussion of assigned reading materials and require students to perform extensive reading of the original research literature. Prerequisite: IGP Bioregulation I. SPRING. [2] Stein, Tansey, Weil.

MP&B 8333. Molecular Aspects of Obesity and Diabetes. [Formerly MP&B 333] This course is designed to introduce first-year IGP students to some of the major areas of interest in the fields of obesity and diabetes research. In the first part of the course the lecturers will discuss the characteristics of diabetes and obesity in terms of whole-body metabolism. The use of mouse models, a major tool to study metabolism, will be emphasized. The second part of the course will focus on the insulin-producing cells of the pancreas: how they develop, how insulin secretion is regulated, and how insulin gene transcription is controlled. The third part of the course will focus on the mechanism of insulin action at the molecular level. The final part of the course will focus on the regulation of lipid metabolism and the latest theories on the molecular causes of insulin resistance and obesity. Each lecture will be presented by faculty followed by a discussion of a research paper on a related topic led by a current IGP student. The NIH-funded Molecular Endocrinology Training Program (METP) provides support for eight IGP students in the second and third years of their graduate studies. The METP strongly encourages students who wish to be considered for METP funding take this Spring Elective. JANUARY-FEBRUARY. [2] O'Brien and Staff.

MP&B 8335. Assessment of Metabolism in vivo: A Laboratory Course. [Formerly MP&B 335] The objective of the course is to give students the tools needed to assess whether an experimental intervention (pharmacologic, genetic, dietary, or environmental) alters macronutrient metabolism, energy balance, cardiovascular homeostasis, or animal behavior. Students will learn how to measure whole body and tissue specific kinetics, the principles of which can be applied to the kinetics of drugs, substrates, and hormones. To accomplish this, we will use a combination of lectures, hands-on laboratories, demonstrations, and data-problem sessions.

MP&B 8340. Human Genetics I. [Formerly MP&B 340] (Also listed as Human Genetics 8340) Designed to cover background and latest advances in human molecular genetics. Topics will include an overview and in-depth look at molecular genetics including DNA, RNA, and chromosome basics. Gene structure and transcriptional processing. Mutational mechanisms, biochemical genetics (gene defects in biochemical pathways). Topics will be discussed with use of real-world examples and relevance to human research. FALL. [3] Summar, Mortlock, and Staff.

MP&B 8341. Human Genetics II. [Formerly MP&B 341] (Also listed as Human Genetics 8341) This course will cover the statistical, population, and analytical aspects of modern human genetics research. Topics to be covered include human population genetics, quantitative genetics, disease gene discovery (emphasizing design, statistical and molecular techniques), linkage and association analyses, computational genetics, and evolutionary genetics. Clinical examples, subject ascertainment, and study design will also be emphasized. Students must have a strong understanding of Mendelian genetics and basic biostatistics. Prerequisite: consent of instructor. SPRING. [3] Haines and Staff.

MP&B 8342. Introduction to Physiology, Metabolism and Endocrinology. This course is designed to introduce first-year students in the "Master's Program in Biomedical Sciences" to essential basic concepts in the fields of physiology, metabolism and endocrinology. In the first part

of the course the lecturers will discuss basic concepts in physiology with respect to: the circulatory system, heart, the pulmonary system, kidney, acid/base balance, muscle, liver and the autonomic nervous system. In the second part of the course the lecturers will discuss basic concepts in metabolism with respect to: glycolysis, the citric acid cycle, fatty acids and amino acids. This section will use exercise to illustrate how metabolism changes under different physiological conditions. In the third part of the course the lecturers will discuss basic concepts in endocrinology with respect to: thyroid hormone, insulin, glucagon and glucocorticoids. This section will also describe the critical role of the hypothalamic-pituitary axis in regulating secretion of multiple hormones with an emphasis on the regulation of energy balance and how this balance is perturbed in obesity. This course is designed to prepare students for two, more advanced second year courses: MPB 8330 (Human Physiology and Molecular Medicine) and MPB 8327 (Molecular Endocrinology). This course will be held in the Spring Semester. For students other than those in the Master's program, prior approval of the course director is required before signing up for this class. O'Brien and Staff. [2]

MP&B 8345. Cellular and Molecular Neuroscience. [Formerly MP&B 345] (Also listed as Cell Biology 8345, Neuroscience 8345, Pharmacology 8345) This course is a required entry-level course for students in the Cell and Molecular Track of the Neuroscience Graduate Program at Vanderbilt that should be taken in the first graduate school year. It also serves as an elective for medical students and graduate students in a number of other programs. Its goal is to expose students to fundamental concepts and techniques in molecular and cellular neuroscience and provide a theoretical context for experimental analysis of brain function and disease. The course is divided into three modules. Module I: Neural Anatomy and Development provides an overview of the anatomy of the nervous system and neurotransmitters and examines concepts in neural pattern formation, neuronal migration, axon guidance, and synapse formation. Module II. Signaling, Plasticity, and Modulation reviews biophysical and molecular concepts relating to neuronal membrane excitability, secretion, and plasticity. Module III: Neural Diseases and Disease Models focuses on specific brain disorders such as epilepsy, pain disorders, Alzheimer's disease, depression, and schizophrenia and current models used to investigate their origin and/or treatment. This course combines faculty lecture with discussion of original articles, with an emphasis on fundamental concepts and the elucidation of important research paradigms in the discipline. Faculty and assistants guide students through important research paradigms with a critical analysis of the primary literature in the topic area. Prerequisite: Bioregulation I (IGP 8001) or consent of instructor. Course directors may consider undergraduate course work in cell biology or biochemistry to meet this requirement. SPRING. [4] Currie, Carter, and Staff.

MP&B 8349. Genetics of Model Organisms. [Formerly MP&B 349] (Also listed as Cell and Developmental Biology 8349, Human Genetics 8349) Basic genetic principles across a broad range of organisms (yeast, *C. elegans*, *Drosophila melanogaster*, plants, mouse, zebrafish) that are used in genetic analyses to investigate molecular pathways of interest for human disease will be presented. This course will provide students with in-depth terminology and understanding of the advantages, applications, and approaches specific to each organism. Genomic and bioinformatics tools that facilitate genetic analysis in each species will be emphasized. Specific examples of how each model organism has successfully contributed to elucidation of a human disease gene, pathway, or genetic principle will be presented. Course combines faculty lectures with student presentation and discussion of original articles to emphasize the uniqueness of each model system. Prerequisite: one statistics course at the upper undergraduate level or higher and Fundamentals of Genetic Analysis (MPB 8385), or permission of instructor. Offered every other year. SPRING. [3] Southard-Smith and Staff.

MP&B 8350. Independent Study. [Formerly MP&B 350] Independent Study may be repeated.

MP&B 8370. Tutorials in Human Genetics. [Formerly MP&B 370] A weekly seminar critically evaluating current and past scientific literature focusing on study design and molecular genetics. The focus will be on study methods and analysis. FALL. [1] Canter and Kearney.

MP&B 8371. Tutorial In Statistical and Population Genetics. [Formerly MP&B 371] The class meets once weekly. Graduate students criti-

cally evaluate research publications in areas of statistical methods in human genetic analysis and in the area of human population genetics. Also, there are faculty presentations on ancillary science skills, such as oral and poster presentations, and grant and proposal writing. SPRING. [1] Li, Crawford.

MP&B 8381. Molecular Foundations of Medicine. [Formerly MP&B 381] Molecular Foundations of Medicine is designed to familiarize students with the cellular structures, biomolecules, and processes that constitute life, human health, and disease at the molecular level. The course employs an integrated approach to teach underlying principles of biochemistry, cell and tissue biology, and genetics with an emphasis on human systems and medical conditions. The inclusion of clinical correlation sessions, small groups, and laboratory sessions will further integrate and broaden course material and relate molecular processes to the study of human disease. Prerequisite: MSTP students only. FALL. [Variable credit: 1-5] Osheroff, George, Pettepher.

MP&B 8382. Structure, Function, and Development. [Formerly MP&B 382] Structure, Function, and Development is designed to provide students with the means to develop an effective understanding of the normal micro and macroscopic structure, function, and development of the human body. The course employs a coordinated, integrated approach to the presentation and learning of the disciplines of human gross anatomy, cell and tissue biology (histology), human development (embryology), and physiology in a context of clinical application. Prerequisite: MSTP students only. SPRING. [Variable credit: 1-4] Dalley, Strom, Pettepher.

MP&B 8384. The Brain and Behavior. [Formerly MP&B 384] Brain and Behavior provides a basic understanding of the human central nervous system and human behavior. The format includes lectures, lab exercises, small group discussions, and patient and case presentations. Brain and Behavior integrates three areas of medical science: (1) neuroanatomy, physiology, and biochemistry; (2) psychopathology and systems neuroscience; and (3) pathology, pharmacology, and radiology. Prerequisite: MSTP students only. SPRING. [Variable credit: 1-2] Norden, Heckers.

MP&B 8385. Fundamentals of Genetic Analysis. [Formerly MP&B 385] This course is designed to accomplish three goals: (1) introduce students to critical topics of genetic research, (2) introduce students to important areas of genetic research not covered in first-year course work, and (3) promote an understanding of classical genetic analysis by learning genetics using the original literature. The approach will be to use classic literature that defined significant problems in genetic research. Specific topics will include: genetic analysis (segregation, independent assortment and locus mapping), human pedigree analysis and disease gene mapping, and population/quantitative genetics. FALL. [4] Williams and Staff.

MP&B 8999. Non-Candidate Research. [Formerly MP&B 379] Research prior to entry into candidacy (completion of qualifying examination) and for special non-degree students. [Variable credit: 0-12]

MP&B 9999. Ph.D. Dissertation Research. [Formerly MP&B 399] This course is used for research following entry into Ph.D. candidacy (following successful completion of the Candidacy Examination).

Neuroscience (NSC)

NSC 5260. Psychopharmacology. (Also listed as NSC 3260) Actions of therapeutic drugs for psychiatric disorders and of drugs of abuse. Molecular mechanisms of effects on perception, cognition, and emotion. No credit for students who have earned credit for 3260. [3]

NSC 5269. Developmental Neuroscience. (Also listed as NSC 3269) Normal and abnormal brain development. Cell division, migration, and death; synapse formation and plasticity; and clinical syndromes. No credit for students who have earned credit for 3269. [3]

NSC 5270. Computational Neuroscience. (Also listed as NSC 3270) Theoretical, mathematical, and simulation models of neurons, neural networks, or brain systems. Computational approaches to analyzing and understanding data such as neurophysiological, electrophysiological, or brain imaging. Demonstrations simulating neural models. No credit for students who have earned credit for 3270. [3]

NSC 5272. Structure and Function of the Cerebral Cortex. (Also listed as NSC 3272) Classic and current concepts of cerebral function. Species differences, receptive field organization, neurotransmitters, modifications by experience, and behavioral effects. No credit for students who have earned credit for 3272. [3]

NSC 5274. Neuroanatomy. (Also listed as NSC 3274) Functional and comparative anatomy of nervous systems, emphasis on vertebrate brains. Fundamental concepts, organizational principles, structure, connectivity, and how these relate to function and behavior. Demonstrations using plates with human brain sections. Prerequisite: 5201. [3]

Neuroscience (NURO)

NURO 8302. Techniques and Preparations. [Formerly NURO 302] Laboratory rotations undertaken by Integrative Track students that culminate in the selection of a thesis adviser. May be repeated for credit more than once if there is no duplication of topic. Students may enroll in more than one section of this course each semester. FALL, SPRING. [0-6]

NURO 8320. Neuroscience Research Forum. [Formerly NURO 320] Required of all students, and second-year students are required to take this course for credit. Students make oral presentations and are evaluated based on the clarity of the presentation and visual aids, as well as the ability of the presenter to answer questions. The course meets every other week for one hour with two students presenting at each session. FALL, SPRING. [0]

NURO 8324. Advanced Neurophysiology. [Formerly NURO 324] (Also listed as Molecular Physiology and Biophysics 8323 and Pharmacology 8323) This class is a tutorial in methods for recording electrical signals in neurons. We will begin with a crash course on ion channels and transporters, spending a significant proportion of class time on discussion of recent primary research papers. In the latter part of the semester, we will move on to live demonstrations and personal training in the details of electrophysiological recording methods in several preparations. By the end of the course, students will be prepared to perform electrophysiological experiments as part of their dissertation research. SPRING. [3] Galli.

NURO 8325. Experimental Design and Statistical Methodology. [Formerly NURO 325] The course provides an understanding of statistical methodology relevant to contemporary neuroscience research and uses computer software packages. Experimental design, constructing and deconstructing hypotheses are built into the course work. Statistical topics include descriptive statistics, analysis of variance, regression, correlation, contingency analysis, and the testing of methods for sampling natural populations. The course supports the goal of the Vanderbilt Neuroscience Program to produce a cohort of quantitatively savvy neuroscientists prepared to become future leaders in their area of research interest. FALL. [2] Konradi, Leich, Hillbun

NURO 8326. Neuroscience Grant Writing. This self-guided course provides applied training in grant writing. Students will write an NRSA proposal and are assigned two faculty reviewers who will provide feedback. Input from the mentor is essential but needs to be limited to verbal discussions with the student. The proposal will be written and submitted to the reviewers in stages, with three required face-to-face meetings. Passing of the course depends on the final quality of the proposal, the ability of the student to incorporate suggestions and to respond to criticism, and the adherence to deadlines laid out by the course directors at the beginning of the course. Course directors: Christine Konradi and Blythe Corbett. Eligible students: Neuroscience Direct Admit students in their first year, IGP students in their first year in the Neuroscience program, second overall year in graduate school. SPRING. [1]

NURO 8327. Graduate Neuroanatomy. [Formerly NURO 327] This is a course on functional and comparative neuroanatomy, that is, on the structure of nervous systems and their commonalities and differences across different types of animals, including humans, and how that structure underlies function and behavior. The course is offered to up to 40 undergraduate and 10 graduate students, and consists of lectures that will also be heavily based on the discussion of reading materials that must be read prior to each class. Anatomical demonstrations will occur in the classroom. [3]

NURO 8330. Cognitive Neuroscience. [Formerly NURO 330] This course provides a broad understanding of the state of our knowledge in cognitive neuroscience. The emphasis is on the findings and concepts in the major branches of cognitive neuroscience, rather than techniques (although these will be discussed). The level of analysis will focus on human and non-human primate systems. Prerequisite: an introductory-level undergraduate course in neuroscience or physiological psychology. Basic knowledge of experimental cognitive psychology is desirable but not necessary. FALL. [3] Marois.

NURO 8331. Mammalian Developmental Neurobiology. [Formerly NURO 331] This seminar course emphasizes classic and cutting-edge research in mammalian brain development, with a particular emphasis on the forebrain. It is also intended to introduce the students to modern techniques used to examine the generation of proper brain architecture and connectivity. Prerequisite: NURO 8345

NURO 8332. Experimental Statistics Short Course. [Formerly NURO 332] The goal of this course is to insure basic proficiency in statistical concepts, methods for analysis of experimental data, and enhance statistical communication skills. Core concepts to be discussed are: (1) Sources of data variation, data types that lead to different analyses (e.g. parametric vs nonparametric); (2) Variation in samples and populations, real world vs theoretical data distributions; (3) Importance and use of confidence intervals, effect size, power related to experimental design; (4) Meaning of statistical vs functional significance; and (5) Aspects of data analysis pitfalls (e.g., outliers, multiple tests, clustered data). Prerequisite: Permission of faculty. [1] SUMMER.

NURO 8340. Fundamentals of Neuroscience II. [Formerly NURO 340] This is the second part of a two-semester course required for all Neuroscience graduate students. Parts I and II can be taken individually as electives for medical students and graduate students in other programs. The goal is for students to learn the general organization of the nervous system and its circuitry and understand the fundamental molecular and cellular bases underlying its development and function in normal and pathological conditions. In addition, the students learn how the cellular systems in the brain relate to the major branches of cognitive neuroscience. There are three themes that will be woven into the course to provide a continuum from molecules to cognition and disease: sensory systems, motor systems and memory. This course combines faculty lecture with discussion of original articles with an emphasis on fundamental concepts and the elucidation of important research paradigms in the discipline. Part I (NURO 8345) will emphasize the cellular and molecular aspects of neuroscience. Part II (NURO 8340) will emphasize systems in the brain and principles of cognition. FALL. [3]

NURO 8342. Seminar In The Neurobiology Of Hearing And Multi-sensory Processes. [Formerly NURO 342] (Also listed as Hearing and Speech Sciences 8342) Study at the doctoral level of the neural processes underlying auditory and multisensory perception. The course will focus on critical readings of recently published findings that emphasize the connection between plasticity, neural systems, and behavior. May be repeated for credit. Prerequisite: consent of instructor. FALL, SPRING. [Variable credit: 1-2] Polley, Wallace.

NURO 8345. Fundamentals of Neuroscience I. [Formerly NURO 345] This is the first part of a 2-semester course required for all Neuroscience graduate students. Parts I and II can be taken individually as electives for medical students and graduate students in other programs. The goal is for students to learn the general organization of the nervous system and its circuitry and understand the fundamental molecular and cellular bases underlying its development and function in normal and pathological conditions. In addition, the students learn how the cellular systems in the brain relate to the major branches of cognitive neuroscience. There are 3 themes that will be woven into the course to provide a continuum from molecules to cognition and disease: sensory systems, motor systems and memory. This course combines faculty lecture with discussion of original articles with an emphasis on fundamental concepts and the elucidation of important research paradigms in the discipline. Part I (NURO 8345) will emphasize the cellular and molecular aspects of neuroscience. Part II (NURO 8340) will emphasize systems in the brain and principles of cognition. Prerequisite:

Undergraduate coursework in cell biology or biochemistry or permission of the course directors. SPRING [4]. Currie, Carter and staff.

NURO 8346. Advanced Molecular Neurobiology. [Formerly NURO 346] (Also listed as Pharmacology 8346) This course examines molecular components and interactions that regulate neuronal development, signaling, and disease. Topics include development of neuronal identity, axonal transport, growth factors and cell death, axon guidance and synapse formation, electrical and chemical transmission, regulation of neuronal excitability and genetic analysis of signaling and neural disorders. Didactic and literature discussions provide students with a sound foundation for understanding the molecular bases underlying the development and function of the nervous system. Prerequisite: Neuroscience 8345 or Pharmacology 8320, or consent of instructor. SPRING. [3] Emeson and Staff.

NURO 8347. The Visual System. [Formerly NURO 347] (Also listed as Cell and Developmental Biology 8347, Psychology 5780) An interdisciplinary approach to how humans see and interpret their visual environment. Topics include the structure of the eye and brain (including optics), the physiology of individual cells and groups of cells, machine vision and models of visual function, visual attention, and mechanisms of complex visual perception. Lectures by faculty from Psychology and Cell and Developmental Biology. Graduate students attend one hour discussion section per week in addition to lecture, and turn in a more extensive paper than undergraduates. SPRING. [3] Roe.

NURO 8350. Independent Study. [Formerly NURO 350] Qualified students work with individual faculty members in areas not covered in available courses. Prerequisite: approval by individual faculty member and program director. FALL, SPRING, SUMMER. [Variable credit: 1-3, with total credit limited to 3]

NURO 8352. Methods and Experimental Design in Neuroscience Research. [Formerly NURO 352] This course will focus on professional development and early-career planning, as well as guide students in the independent production of a National Science Foundation Graduate Research Fellowship Program grant, which will be submitted as part of the course. The class meets weekly to discuss topics including scientific ethics, communication, time management, as well as hear presentations on career options. [1]

NURO 8365. Neurobiology of Disease. [Formerly NURO 365] Neurobiology of Disease. The goal of this graduate-level neuroscience course is to provide comprehensive understanding of pathology and pathophysiology of neuropsychiatric disorders. The course is divided in three modules: neurodevelopmental, neurological/neurodegenerative and psychiatric/addiction diseases. The course prepares students for intensive collaborations along the basic-translational-clinical continuum. The lectures will discuss clinical presentation and pathological features epidemiology, treatment, status of clinical research, animal models, and postulated cellular/molecular bases for >30 diseases. This course is mandatory for Neuroscience majors. Prerequisite: NURO 8340 and 8345 and consent of instructor. SPRING. [3] Deutch.

NURO 8366. Molecular Basis of Neural Disease. [Formerly NURO 366] This advanced course covers current concepts and models for neuropsychiatric disorders, including schizophrenia, depression, and autism, as well as Parkinson's Disease, trinucleotide repeat disorders, and stroke. Didactic presentations will focus on the molecular and genetic bases of these disorders, and will be complemented by presentations of new papers as well as patient interviews when possible. Prerequisite: 8345 or consent of instructor. SPRING. [2] Deutch.

NURO 8383. Seminar in Auditory and Vestibular Neuroscience. [Formerly NURO 383] The course is a full semester course that combines a small amount of didactic teaching with seminar discussions to introduce students to the neuroscience of the auditory and vestibular systems. For each topic, the short didactic component introduces/refamiliarizes the students with the basic knowledge requisite for that particular topic; the seminar component following the didactic material involves a presentation of both classic papers as well as recent papers that represent the state of art in the field. The seminar component will train students to critically read primary literature, to present scientific information in clear and concise fashion, and provide a theoretical foundation for understanding sensory coding and

its relationship with perception using the auditory brain as a model system. The group discussion will also explore the impact of the findings in the papers on various aspects of the field. NOTE: For Ph.D. students, completion of an introductory neuroscience course, or advisor approval required. For other students, permission of instructor required. FALL [3]

NURO 8999. Non-Candidate Research. [Formerly NURO 379] Research prior to entry into candidacy (completion of qualifying examination) and for special non-degree students. [Variable credit: 0-12]

NURO 9999. Ph.D. Dissertation Research. [Formerly NURO 399]

Nursing Science

NRSC 8302. Advanced Doctoral Seminar I. [Formerly NRSC 302] This course consists of a series of seminars focusing on issues related to qualifying examinations, the dissertation, and continued development of a program of research. The topics are selected by course faculty and the students who plan to take the comprehensive examinations within the next 9-12 months. Topics and experiences may include proposal development, grant applications, mock proposal reviews, qualifying examination situations, and dissemination of research findings. The seminar is required for two consecutive semesters. Prerequisite: Core Ph.D. course completion consistent with ability to complete the qualifying examination within 9-12 months after registration. [1] SPRING

NRSC 8303. Advanced Doctoral Seminar II. [Formerly NRSC 303] This is the second seminar course in this series. Prerequisite: completion of NRSC 8302: Advanced Doctoral Seminar I. [1] SUMMER

NRSC 8304. Ethical and Legal Issues in Research. [Formerly NRSC 304] This course provides an overview of issues related to the responsible conduct of research, including data management, vulnerable populations, authorship and publication, conflicts of interest and collaboration. Federal and institutional guidelines are included. Prerequisite: enrollment in the Ph.D. program or consent of faculty. [2] SPRING

NRSC 8305. Informatics and Scholarly Inquiry. [Formerly NRSC 305] This course provides an overview of informatics, a specialty that joins nursing science with information and analytical sciences throughout the data, information, knowledge, wisdom continuum. To take advantage of the current data-rich healthcare environment, scholars need to understand core informatics principles in order to use data for knowledge generation. In addition, this course familiarizes the student with technology tools to organize, interpret, and present data. [2 credits]. FALL

NRSC 8306. Research Design and Statistics I. [Formerly NRSC 306] This course focuses on understanding and applying the basic concepts of descriptive and relational research design and statistics. Students will be introduced to the full range of designs available to address research aims, moving from descriptive to experimental and quasi-experimental. After examining the relationship of research aims to research design, the nature of measurement, and causal inference, relevant statistical methods for visualizing, describing, and making inferences from data will be introduced. The focus will be on univariate and bivariate descriptive methods. Statistical computing packages will be used. Published research will be used to develop the student's ability to evaluate the design and statistical methods used to describe health care phenomena as well as relationships among them. Prerequisite: enrollment in the Ph.D. program or consent of faculty. [3] FALL

NRSC 8307. Research Design and Statistics II. [Formerly NRSC 307] The course expands the concepts and applications of RD&S I including an introduction to longitudinal and randomized control design issues. Topics related to internal validity, experimental designs, and issues in comparing individuals and groups cross-sectionally and longitudinally will be detailed. Students will be introduced to issues in external validity and the relationships between internal and external validities. Parametric and non-parametric univariate comparative statistical methods used to analyze data resulting from cross-sectional and randomized controlled designs will be included. Students will be expected to generate and interpret results from statistical software and present relevant information in figures, tables, and text. Concepts will be studied within the context of evaluating published research.

Prerequisite: completion of Research Design and Statistics I or consent of faculty. [3] SPRING

NRSC 8308. Research Design and Statistics III. [Formerly NRSC 308] This course is focused on advanced designs and multivariate statistical techniques. Design topics include advanced issues in external validity, field experimentation versus laboratory experiments, quasi-experimental and blended designs as well as special considerations for nested and complex longitudinal designs. Related statistical topics include advanced multiple linear regression methods (e.g. path and structural equation modeling), log-linear models and advanced techniques in survival and longitudinal data analysis. These methods and concepts will be discussed and evaluated through educational resources and published research using them. Students will have the opportunity to develop advanced skills in statistical applications most commonly used in their respective areas of interest. Prerequisite: completion of Research Design and Statistics II or consent of faculty. [3] SUMMER

NRSC 8309. Special Topics in Quantitative Methods. [Formerly NRSC 309] This course provides an overview of varied and timely topics in the field of quantitative methods. Exemplar topics may include issues in data collection methods such as using online or other resources, an examination of how quantitative data collection methods influence data management and analytic approaches, collection methods for physiological or psychosocial outcomes, and the benefits and drawbacks of using public data sets, conventional and new analytic techniques, as well as broader issues in the evolution of quantitative methods. Prerequisites: NRSC 8308, NRSC 8313; NRSC 8352 or NRSC 8382; or with permission from instructor(s). [2] FALL

NRSC 8310. Health, Health Care, Research, and Public Policy. [Formerly NRSC 310] This course explores and critically analyzes theoretical and empirical approaches to understanding dynamic synergies between research, nursing practice, health care organization, and public policy and their impact on health. Strategies for dissemination, translation, and evaluation of evidence-based research findings to support health care practices and public policies to measurably improve health outcomes for selected populations and the student's phenomenon of interest will be discussed. Local, national, and global implications will be explored. Prerequisite: enrollment in the Ph.D. program or consent of faculty. [2] SPRING

NRSC 8311. Role of Scientist in Academe, Community, and World. [Formerly NRSC 311] This seminar course assists the student to develop a personal framework for behavior within academe, the scientific community, and the world beyond. Through readings and discussions, the student will explore a variety of viewpoints about the duties and responsibilities of an educated citizen scientist in an interdependent world. Prerequisite: enrollment in the Ph.D. program or consent of faculty. [1] SPRING

NRSC 8312. Programs of Research and Grantsmanship. [Formerly NRSC 312] This course provides the foundational information necessary for developing a program of research. Focus is placed on acquiring practical skills necessary to develop a program of research, narrowing the focus of student's area of research, and for basic grantsmanship. Focus is placed upon developing the knowledge and practical skills necessary to investigate an area of research interest and draft a research proposal appropriate to current level of career development needs and/or phenomenon of interest. Prerequisite: enrollment in the Ph.D. program or consent of faculty. [2] FALL

NRSC 8313. Theories of Science. [Formerly NRSC 313] This course provides students with an introduction to the central theoretical and philosophical issues concerning the nature of science, the patterns of knowing and knowledge development, criteria for evaluating knowledge claims, and philosophy of science. The course will enable students to become knowledgeable about the forces affecting the development of knowledge and critical analyses of theories commonly used in nursing research. Prerequisite: enrollment in the Ph.D. program or consent of faculty. [2] FALL

NRSC 8350. Conceptual Foundations for Clinical Research. [Formerly NRSC 350] Critical analysis of theories, concepts, and research related to the promotion, protection, and restoration of health across the lifespan at individual, family, and community levels. Emphasis will be on the individual level. Students conduct a critical analysis of existing and emerging scientific knowledge in a chosen field of study. Prerequisite: enrollment in the Ph.D. program or consent of faculty. [3] SPRING

NRSC 8352. Measurement in Clinical Research. [Formerly NRSC 352] This course examines the principles of measurement, sources of measurement error, and procedures used for critical evaluation of the psychometric properties of clinical measures including techniques for assessing validity and reliability. Selected measures, commonly used in clinical research and specific to student research interests, will be evaluated for psychometric properties and fit with a proposed focus of study. Prerequisite: enrollment in the Ph.D. program and completion of NRSC 8307 and NRSC 8350; or consent of faculty. [3] SUMMER

NRSC 8353. Designing and Testing Clinical Interventions. [Formerly NRSC 353] Analysis of methodological, ethical, and practical issues related to the design and implementation of theory-based intervention studies. Students conduct a critical analysis of existing and emerging interventions related to their chosen field of study. Prerequisite: enrollment in the Ph.D. program or consent of faculty. [3]

NRSC 8366. Curriculum Strategies for Health Professional Education. [Formerly NRSC 366] This course introduces the student to the foundations of learning theory and learning styles. The impact of technology on learning practices and the appropriate use of technology to facilitate learning is emphasized. Students will create electronic elements for effective learning and use a course management system. Copyright and fair use issues are discussed. Overall curriculum strategies that integrate content, organization, informatics, and sequencing of courses are discussed. Students will design a learning program that integrates learning styles, technology use, and a course management system. Prerequisite: enrollment in the Ph.D. program or consent of faculty. [3]

NRSC 8368. Contextual Nature of Health and Health Behaviors. [Formerly NRSC 368] This course explores and critically analyzes theoretical and empirical approaches to understanding the interaction of health and environment in affecting health by examining contextual factors that impact health and health behaviors of various system levels. Examines disparity (e.g., social and economic) as a determinant of health among individuals and sub-populations. Critique selected models of health, health behavior, community organization, and health care delivery and their usefulness to understand and impact selected health phenomena and various ethnocultural populations and communities. Students critically analyze and synthesize the literature related to a selected phenomenon of interest. Prerequisite: enrollment in the Ph.D. program or consent of faculty.

NRSC 8371. Advanced Concepts in Nursing Education. This course is designed to facilitate expertise in the application of advanced educational concepts, principles, and theories related to nursing education in the academic setting. The underlying premise for the value of such knowledge is that nurse educators encounter situations and issues that warrant systematic consideration, and reflection. Moreover, students will acquire competence in facilitating learner development and role socialization, review accreditation parameters for nursing programs, and explore various aspects and topics such as legal, ethical and socio-cultural factors related to the role of the nurse educator. Prerequisites: 366, 367 [3] FALL

NRSC 8377. Special Topics in Nursing Science. Students will discuss research and current developments of special interest to faculty and students (may be repeated for credit). Prerequisite: enrollment in the Ph.D. program or consent of faculty. [Variable credit: 1-3]

NRSC 8380. Knowledge Synthesis in Nursing Science. [Formerly NRSC 380] This course provides a critical appraisal of the theoretical and empirical basis of nursing science. Theories and research generated to study phenomena related to nursing are evaluated and synthesized. Strategies for synthesizing extant knowledge in nursing are discussed. Prerequisite: enrollment in the Ph.D. program or consent of faculty. [3] SPRING

NRSC 8381. Current Topics in Health Services Research. [Formerly NRSC 381] This course assists the student's development of expertise in knowing and applying resources (scholarly, organization, theoretical and methodological) to her/his health services research (HSR) foci as well as the position of her/his research interest within the current HSR environment. [3 credits]. SPRING. Prerequisite: enrollment in the PhD program or consent of faculty.

NRSC 8382. Measuring Outcomes: Issues in Health Service Research Designs. [Formerly NRSC 382] In this course, the student will develop expertise in the design, measurement, and analysis of studies employing the five generic outcomes of greatest interest in outcomes studies: satisfaction, cost-effectiveness, mortality, health-related quality of life, and morbidity. The student will also be expected to develop an overview including measurement and analysis plans for a condition-specific outcome. The impact of the researcher's decisions regarding conceptual models, treatment definition, risk adjustment strategies, and the application of statistical techniques will be explored. At least one controversy attendant to each of the five generic outcomes will be debated in class. Prerequisite: completion of Research Design and Statistics I and II. [3]

NRSC 8383. Issues in Health Services Research Intervention Studies. [Formerly NRSC 383] The student will develop expertise in the design and execution of intervention studies in health services research. Emphasis will be placed on the selection of interventions and the valid and reliable execution of the interventions through examination of issues such as treatment fidelity, intervention duration, location and interventionist expertise. The intervention categories studied include: labor, capital and processes (e.g., working conditions and work design.) Strategies of attending to the execution and analysis of multilevel, multi-organizational studies will be addressed. [3] Fall.

NRSC 8390. Independent Study in Nursing Science. [Formerly NRSC 390] Individualized study and reading in areas of mutual interest to the student and faculty member. Prerequisite: consent of instructor. [Variable credit: 1-3]

NRSC 8394. Qualitative Research Methods. [Formerly NRSC 394] This course introduces and explores qualitative research methods, including their theoretical and methodological foundations, and practical applications. Course participants will explore and pilot test one method in the context of their topic of interest. Prerequisite: enrollment in the Ph.D. program or consent of faculty. [3]

NRSC 8395. Research Practicum. [Formerly NRSC 395] This course provides students with exposure to and involvement in the research process. Learning activities are based on student need and interest and determined according to best fit with available faculty research programs. Prerequisite: enrollment in the Ph.D. program or consent of faculty. [Variable credit: 1-3]

NRSC 8999. Non-Candidate Research. [Formerly NRSC 379] Research prior to entry into candidacy (completion of qualifying examination) and for special non-degree students. Prerequisite: enrollment in the Ph.D. program or consent of faculty. [Variable credit: 0-6]

NRSC 9999. Ph.D. Dissertation Research. [Formerly NRSC 399] Prerequisite: Enrollment in the Ph.D. program and consent of faculty. [Variable credit: 0-6]

Pharmacology

PHAR-GS 8320. Targets, Systems, and Drug Action-Part I. [Formerly PHAR-GS 320] Introduction to human physiology is integrated with the pathophysiology, pathological manifestations, and therapeutic interventions. Lectures and laboratories emphasize the molecular and cellular underpinnings of normal organ function and disease. Mechanisms of drug action are discussed in a systemic fashion and supported by guided readings on drug discovery and design. Paradigm shifting experiments will be discussed to illustrate clarity of thinking, how focused experimental strategies lead to discovery, and potential difficulties in interpretation of experimental results. FALL. [1-3]

PHAR-GS 8321. Targets, Systems, and Drug Action-Part II. [Formerly PHAR-GS 320B] [Formerly PHAR-GS 320B] Introduction to human physiology is integrated with the pathophysiology, pathological manifestations, and therapeutic interventions. Lectures and laboratories emphasize the molecular and cellular underpinnings of normal organ function and disease. Mechanisms of drug action are discussed in a systemic fashion and supported by guided readings on drug discovery and design. Paradigm shifting experiments will be discussed to illustrate clarity of thinking, how focused

experimental strategies lead to discovery, and potential difficulties in interpretation of experimental results. SPRING. [1-7]

PHAR-GS 8322. Scientific Communications Skills I. [Formerly PHAR-GS 322A] Techniques in effective oral communication of scientific research as well as practical experience in research and literature presentation and in the preparation of grant proposals. During the fall course, a draft Specific Aims page is written and critiqued and will be used in the spring course PHAR-GS 8323. Pre-requisite: Enrollment in the Ph.D. program or consent of faculty. FALL. [1]

PHAR-GS 8323. Scientific Communication Skills II. [Formerly PHAR-GS 322B] This course will leverage the writing assignments of the fall Scientific Communications course (8322) to accelerate preparation of a draft NRSA fellowship (or equivalent such as AHA) application. During the fall course, a draft Specific Aims page is written and critiqued. In this spring course, students will write the next two sections of their application and have it peer-reviewed. These writing assignments are intended to be self-guided with significant support by the student's mentor. The applications will subsequently be submitted for funding to the proper agency. Pre-requisite: Completion of PHAR-GS 8322 and Enrollment in the Ph.D. program. SPRING. [1]

PHAR-GS 8324. Fundamentals of Pharmacology: Receptor Theory and Cell Signaling. [Formerly PHAR-GS 324] Structure and function of cell-surface receptors and the molecular bases by which they activate cellular function. Topics include receptor identification; quantitation of simple and complex binding phenomena; molecular bases for receptor coupling to GTP-binding proteins; the structure and function of ligand-operated ion channels, receptor-tyrosine kinases and receptor-induced signal transduction cascades receptors as oncogenes and proto-oncogenes. Prerequisite: Enrollment in the Ph.D. program or consent of faculty. SUMMER. [1-3]

PHAR-GS 8326. Drug Metabolism and Pharmacokinetics. The course will provide an introduction and overview of drug metabolism and pharmacokinetics (DMPK). Focus will be on drug distribution and drug elimination concepts, drug absorption, bioavailability, and multiple dosing, and clearing concepts, as well as various case studies. FALL [2]

PHAR-GS 8327. Modern Drug Discovery. [Formerly PHAR-GS 327] The course will provide an introduction and overview to the drug discovery process. Focus will be on target selection, target validation, and the process of discovery early drug leads and optimization of those leads into compounds suitable for clinical development. This will include approaches used to transition from discovery to the early clinical development phase of a program as well as medical and market considerations that impact launching and progress of a drug discovery program. FALL. [2] Conn.

PHAR-GS 8328. Experimental Design for the Biomedical Sciences. The overall goal of this course is to provide comprehensive instruction in the theory and practice of rigorous and reproducible scientific methods. It combines traditional didactic presentations, small group discussions, and practical exercises. The practical exercises include the use of REDCap and Labnodes; attendance at a biostatistics clinic; in-class data analysis exercises; and a capstone exercise in which groups of students designed a hypothetical experiment. SPRING [2]

PHAR-GS 8330. Advanced Neurophysiology. Dubbed as "Fundamentals of the Excitable Membrane for Biologists", this course will begin with an introduction to electrical properties of excitable cell membranes and tools to study those properties. It will be followed by a series of lectures on the structure, function and types of ion channels accompanied with lab sessions and paper discussions. In the latter part of the semester, it will focus on synapse formation, its biophysical properties, and a role in storing memory within a neuronal network, ending with an overview on and available tools to study of in vivo neurophysiology of primates. Overall, this course is designed to provide basic knowledge of generation, regulation and propagation of electrical signals to IGP students. By the end of the course, students will have a foundation to understand and critique Research Articles in the field of Neurophysiology. [3]

PHAR-GS 8332. Experimental Statistics Short Course. [Formerly PHAR-GS 332] The goal of this course is to insure basic proficiency in statistical concepts, methods for analysis of experimental data, and enhance statistical communication skills. Core concepts to be discussed are: (1)

Sources of data variation, data types that lead to different analyses (e.g. parametric vs nonparametric); (2) Variation in samples and populations, real world vs theoretical data distributions; (3) Importance and use of confidence intervals, effect size, power related to experimental design; (4) Meaning of statistical vs functional significance; and (5) Aspects of data analysis pitfalls (e.g., outliers, multiple tests, clustered data). Prerequisite: Permission of faculty. [1] Summer.

PHAR-GS 8345. Fundamentals of Neuroscience I. [Formerly PHARGS 345] This course can be taken as an elective for graduate students in Pharmacology. It emphasizes the cellular and molecular aspects of neuroscience. The goal is for students to learn the general organization of the nervous system and its circuitry and understand the fundamental molecular and cellular bases underlying its development and function in normal and pathological conditions. In addition, the students learn how the cellular systems in the brain relate to the major branches of cognitive neuroscience. There are 3 themes that will be woven into the course to provide a continuum from molecules to cognition and disease: sensory systems, motor systems and memory. This course combines faculty lecture with discussion of original articles with an emphasis on fundamental concepts and the elucidation of important research paradigms in the discipline. Prerequisite: Undergraduate coursework in cell biology or biochemistry or permission of the course directors. SPRING [4].

PHAR-GS 8346. Advanced Molecular Neurobiology. [Formerly PHARGS 346] (Also listed as Neuroscience 8346) This course examines molecular components and interactions that regulate neuronal development, signaling, and disease. Topics include development of neuronal identity, axonal transport, growth factors and cell death, axon guidance and synapse formation, electrical and chemical transmission, regulation of neuronal excitability and genetic analysis of signaling and neural disorders. Didactic and literature discussions provide students with a sound foundation for understanding the molecular bases underlying the development and function of the nervous system. Prerequisite: Neuroscience 8345 or Pharmacology 8320, or consent of instructor. SPRING. [3] Emeson and Staff.

PHAR-GS 8350. Independent Study. [Formerly PHAR-GS 350] Qualified students work with individual staff members in areas not covered in other available courses. Prerequisite: approval of staff member and department chair. FALL, SPRING, SUMMER. [Variable credit: 1-2, with total credit limited to 2 hours] Staff.

PHAR-GS 8360. Current Issues In Pharmacology. [Formerly PHAR-GS 360] Presentation of current advances, paradigm shifts, and problems in pharmacology with an emphasis on experimental approaches and their interpretation. Prerequisite: consent of instructor. SPRING. [Variable credit: 1-3] Staff.

PHAR-GS 8999. Non-Candidate Research. [Formerly PHAR-GS 379] Research prior to entry into candidacy (completion of qualifying examination) and for special non-degree students. [Variable credit: 0-12]

PHAR-GS 9999. Ph.D. Dissertation Research. [Formerly PHAR-GS 399]

Philosophy

PHIL 7999. Master's Thesis Research. [Formerly PHIL 369] [0-12]

PHIL 8000. Teaching and Research Methods. [Formerly PHIL 301] Survey of methods of research in philosophy and examination and discussion of teaching methods. Required of all first-year graduate students. [2]

PHIL 8001. Philosophical Readings in French. [Formerly PHIL 302] Selected major philosophical works or a selected bibliography about a major philosophical problem, read in French. A translation examination and appropriate reports. Prerequisite: department approval. [3]

PHIL 8002. Philosophical Readings in German. [Formerly PHIL 303] Selected major philosophical works or a selected bibliography on a major philosophical problem. A translation examination and appropriate reports. Prerequisite: department approval. [3]

PHIL 8003. Philosophical Readings in Classical Languages (Latin or Greek). [Formerly PHIL 304] Reading in Latin or Greek of selected major

philosophical works or a selected bibliography on a major philosophical problem. A translation examination and appropriate reports. Prerequisite: department approval. [3]

PHIL 8050. Readings in Philosophy. [Formerly PHIL 350] Selected major philosophical works or a selected bibliography about a major philosophical problem. Appropriate reports and examination. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

PHIL 8999. Non-candidate Research. [Formerly PHIL 379] Research prior to entry into candidacy (completion of Qualifying Examination) and for special non-degree students. [Variable credit: 0-12]

PHIL 9000. Figures in Philosophy. [Formerly PHIL 353] Survey of figures in the history of philosophy. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

PHIL 9010. History of Philosophy. [Formerly PHIL 351] Survey of figures and/or topics in history of philosophy. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

PHIL 9020. Topics in Philosophy. [Formerly PHIL 352] Survey of topics in philosophy. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

PHIL 9999. Ph.D. Dissertation Research. [Formerly PHIL 399] [0-12]

Physics

PHYS 5200. Statistical Physics. Temperature, work, heat, and the first law of thermodynamics. Entropy and the second law of thermodynamics. Kinetic theory of gases with applications to ideal gases and electromagnetic radiation. Serves as repeat credit for students who have completed 5207. No credit for students who have earned credit for 3200 or 3207. Prerequisite or corequisite: 5270 or 5275. [3]

PHYS 5210. Classical and Modern Optics. (Also listed as PHYS 2210) Geometrical optics, including reflection, refraction, ray tracing, aberrations, and interference. Physical optics, including wave theory, absorption, dispersion, diffraction, and polarization. Properties of light from lasers and synchrotron sources. Photodetectors and optical technology. No credit for students who have earned credit for 2210. [3]

PHYS 5237. Computational Physics. (Also listed as PHYS 2237) Topics in modern physics analyzed exclusively with computer programs. Three-body solar system orbits. Random walk diffusion and entropy growth. Magnetism in the second order using model, non-equilibrium molecular dynamics. Solutions to the Schrödinger equation with numerical methods. No credit for students who have earned credit for 2237. [3]

PHYS 5250. Concepts and Applications of Quantum Physics. (Also listed as PHYS 2250) Atomic and molecular structure, interaction of light with atoms and molecules, and spectroscopy. One three-hour laboratory per week. No credit for students who have earned credit for 2250 or 2250W. [4]

PHYS 5260. Modern Physics. (Also listed as PHYS 2260) Condensed-matter physics, biophysics, special theory of relativity, and nuclear and particle physics. One three-hour laboratory per week. No credit for students who have earned credit for 2260 or 2260W. [4]

PHYS 5290. Electricity, Magnetism, and Electrodynamics I. (Also listed as PHYS 2290) Electrostatic fields and potentials. Gauss's law. Electrical properties of insulators, semiconductors, and metals. The Lorentz force. Magnetic fields and forces. Electromagnetic induction, Maxwell's equations, and electromagnetic waves. No credit for students who have earned credit for 2290. [3]

PHYS 5291. Electricity, Magnetism, and Electrodynamics II. (Also listed as PHYS 2291) Continuation of 2290a. Electromagnetic waves in dielectrics and conductors. Electromagnetic radiation in waveguide structures.

Relativistic electrodynamics. Magnetism as a relativistic phenomenon. No credit for students who have earned credit for 2291. [3]

PHYS 5640. Physics of Condensed Matter. (Also listed as PHYS 3640) Crystal structure and diffraction. Phonons and lattice vibrations. Free-electron theory of metals. Elementary band theory of solids. Semiconductors. Optical properties of insulators. Applications to solid-state devices, magnetism, and superconductivity. No credit for students who have earned credit for 3640. [3]

PHYS 5651. Advanced Quantum Mechanics I. (Also listed as PHYS 3651) Wave-particle duality, indeterminacy, superposition, the Schrödinger equation, angular momentum, the hydrogen atom, and spin and indistinguishability. No credit for students who have earned credit for 3651. [3]

PHYS 5652. Advanced Quantum Mechanics II. (Also listed as PHYS 3652) Time-independent and time-dependent perturbation theory, matrix theory, scattering, applications to atomic physics, condensed matter physics, and astrophysics. No credit for students who have earned credit for 3652. [3]

PHYS 5660. Introduction to Particle Physics. (Also listed as PHYS 3660) Weak, strong, and electromagnetic forces as evidenced by the interactions of elementary particles. Classification of particles and experimental techniques. No credit for students who have earned credit for 3660. [3]

PHYS 5890. Selected Topics. (Also listed as PHYS 3890) No credit for students who have earned credit for 3890. [1-3]

PHYS 7007. Radiation Dose Assessment. [Formerly PHYS 307] Advanced physics of radiation interactions, shielding, and dosimetry. Gamma ray and neutron shielding; internal and external dosimetry methods and models; radiation protection regulations; environmental monitoring for radioactive materials; and response to radiation accidents and emergencies. Use of specialized computer programs. Prerequisite: 3125. [3]

PHYS 7125. Health Physics. (Also listed as PHYS 3125) Theory and instrumentation in health physics and radiological physics. Radiation shielding design, methods of external and internal dosimetry, and radiation regulatory issues. No credit for students who have earned credit for 3125. [3]

PHYS 7645. Radiation Detectors and Measurements. (Also listed as PHYS 3645) Basic physics principles and applications of radiation detecting instruments, with laboratory exercises. Techniques and instrumentation for nuclear radiation detection and measurements as they relate to health physics (radiation safety) and nuclear physics. No credit for students who have earned credit for 3645. [4]

PHYS 7999. Master's Thesis Research. [Formerly PHYS 369] [0-13]

PHYS 8000. Seminar. [Formerly PHYS 300] [1]

PHYS 8001. Physics Colloquium. Weekly colloquium attendance and mandatory participation in online discussion forum. Required evaluation of presentations based on content, visual aids, and delivery. Offered on satisfactory/unsatisfactory basis. [0]

PHYS 8002. Learning to Teach, Teaching to Learn. [Formerly PHYS 302] Directed readings and discussion of topics in the teaching of science and engineering. Practical application of best teaching practices will be emphasized. Intended primarily for first-time teaching assistants and first-year graduate students. [1]

PHYS 8003. Teaching Practicum. Discussion of best teaching practices in weekly meeting with instructor. Application of teaching strategies via teaching undergraduate lab or leading homework help-desk sessions. Offered on satisfactory/unsatisfactory basis. [0-1]

PHYS 8005. Mathematical Methods for Physicists. [Formerly PHYS 308] Linear spaces and operators; matrix algebra; differential equations; Green's function; and complex analysis. May include variational calculus; perturbation methods; group theory. [3]

PHYS 8010. Particle and Continuum Mechanics. [Formerly PHYS 305] Least action principle, Lagrange formalism, conservation laws, two-body problem, small-amplitude vibrations, non-inertial reference frames, canonical formalism, rigid body motion, continuous media, and field theory. In-

cludes programming on scientific work stations. Prerequisite or corequisite: 8005. [3]

PHYS 8020. Advanced Electrodynamics. [Formerly PHYS 329A] Electrostatics, potentials, boundary value problems, multipole moments, polarization, magnetostatics, Maxwell's equations, electromagnetic wave propagation, dissipative and conductive media. Prerequisite or corequisite: 8005. [3]

PHYS 8021. Advanced Electrodynamics. [Formerly PHYS 329B] Continuation of 8020. Covariant formulation, least-action principle and Lagrange density, energy momentum tensor, charges in external fields, radiation from accelerated charges, multipole radiation. Prerequisite: 8020. [3]

PHYS 8030. Quantum Mechanics. [Formerly PHYS 330A] Underlying assumptions. Schrodinger equation: interpretation, discrete and continuous basis, change of basis. One-dimensional examples: square potential, harmonic oscillator. Uncertainty relations, symmetries and their implications, angular momentum, hydrogen atom, spin, systems with N-degrees of freedom; time independent perturbation theory, Fermi's golden rule. Corequisite: 8005. [3]

PHYS 8031. Quantum Mechanics. [Formerly PHYS 330B] Continuation of Phys 8030. Variational method, degenerate second order perturbation theory. Brief introduction to group theory with rotation group and Lorentz group as examples, addition of angular momentum, Wigner-Ekharth theorem, derivation of covariant spin-half wave functions. Potential scattering theory: angular momentum decomposition, T-matrix, S-matrix, Lippman-Schwinger equation, scattering by two potentials, local and separable potentials. Dirac equation: current conservation; completeness; parity, time reversal, and charge conjugation symmetries; co-variant solution of the hydrogen atom; Feynman propagator. Prerequisite: 8030. [3]

PHYS 8040. Statistical Mechanics. [Formerly PHYS 341] Phase space, entropy and reversibility; ensemble theory; Fermi and Bose Statistics; systems of interacting particles; equation of state, critical phenomena, and phase transitions; pairing and superfluidity. [3]

PHYS 8100. Selected Topics in Theoretical Physics. [Formerly PHYS 350] Topics such as Lie groups and symmetry principles in quantum mechanics, quantum electrodynamics of strong field, phenomenological modes of nuclear structure. Prerequisite: consent of instructor. [3]

PHYS 8105. Special Topics in Experimental Physics. [Formerly PHYS 352A] Current topics in experimental physics relevant to research areas in the department, such as biological, condensed-matter, elementary-particle, nuclear, and optical physics, astronomy, astrophysics and cosmology. [Variable credit: 1-3]

PHYS 8120. Biomolecular Physics. [Formerly PHYS 306] Physical principles applied to the structure and dynamics of biological molecules on the nanometer scale. Emphasis on the random Brownian motion that dominates at all length scales, and how bimolecular structures move, function, and interact amid chaotic thermal fluctuations. Selected measurement techniques. [3]

PHYS 8122. Physics of Living Systems. Physical principles applied to biological phenomena. Development of physical models of biological systems on scales ranging from molecules to organisms. Biological applications of mechanics, thermodynamics, and dynamical systems. [3]

PHYS 8124. Physical Measurements on Biological Systems. [Formerly PHYS 325] (Also listed as Biomedical Engineering 7425) A survey of the state of the art in quantitative physical measurement techniques applied to cellular or molecular physiology. Topics include the basis for generation, measurement, and control of the transmembrane potential; electrochemical instrumentation; optical spectroscopy and imaging; X-ray diffraction for determination of macromolecular structure; magnetic resonance spectroscopy and imaging. One lecture and one recitation. [3]

PHYS 8126. Theoretical and Experimental Systems Biology. [Formerly PHYS 326] Introduction to systems biology from the perspective of the emergence of complexity in toy models. Simple biological subsystems, their reductionist and equivalent models, and measurements required to specify model architecture and parameters. Multiple interconnected organs-on-chips as dynamic biological systems that can model organismal biology. [3]

PHYS 8128. Biophysical Electrodynamics. [Formerly PHYS 356] The physics of bioelectric phenomena: the mechanisms that lead to the transmembrane resting and action potentials in nerve and muscle cells, the differential equations describing propagation of the nerve action potential, and the relationship between the transmembrane and extracellular potentials in nerve and cardiac muscle. [3]

PHYS 8140. Nuclear Theory. [Formerly PHYS 340A] Basic experimental facts and phenomenological models (shell model and collective model). Nucleon-nucleon interaction, mean-fields theories of nuclear structure (Hartree-Fock, BSC pairing, HFB, RPA, and QRPA). Ab-initio calculations for light nuclei. Time-dependent Hartree-Fock calculations of heavy-ion reactions. Prerequisite or co-requisite 8030. [3]

PHYS 8142. Relativistic Heavy Ion Physics. [Formerly PHYS 340B] Basic experimental facts and phenomenological models of ultra-relativistic heavy-ion collisions. Quark-gluon plasma formation, signatures, and properties. Thermodynamics and hydrodynamical evolution of nuclear matter in extreme conditions. Prerequisite or corequisite: 8030, 8040. [3]

PHYS 8144. Experimental Nuclear Physics. [Formerly PHYS 303] Interactions of charged particles and photons in matter, coordinate transformations, statistics of nuclear processes, radiation detectors and analyzers, and selected topics in the design and application to experiments of particle accelerators and instrumentation used in nuclear and high energy physics. [3]

PHYS 8150. Electromagnetic Spectroscopy. [Formerly PHYS 353] Interaction of electromagnetic radiation with matter as a function of photon energy and flux. Mechanisms of absorption, emission, and scattering of light within the visible, infrared, ultraviolet, and x-ray wavelength regimes. Experimental and computational techniques and instrumentation for assessing and analyzing spectroscopic information. Prerequisite: 8030. [3]

PHYS 8152. Quantum Mechanics of Solids. [Formerly PHYS 354] Free-electron theory of metals; elementary band theory of solids; quantum theory of the harmonic crystal; elementary excitations; optical properties of materials; electronic basis of magnetic interactions; density-functional theory; relativistic band structure; electronic localization and amorphous solids; two-dimensional phase transitions and superlattices. Consent of instructor required. [3]

PHYS 8154. Nanoscale Condensed Matter. [Formerly PHYS 355] Evolution of elementary excitations; optical, magnetic, electronic, and mechanical characteristics of matter at nanometer length scales. Effects of one, two, and three dimensional electron confinement. Novel single-particle and collective properties of nanometer-size objects, including optical, magnetic, thermal, and transport phenomena. Prerequisite: 8030. [3]

PHYS 8156. Surface Structure and Dynamics. [Formerly PHYS 359A] Geometrical and electronic structure of surfaces, including surface reconstruction, density of states, and effects of adsorbates, impurities, and electronic defects. Prerequisite: 8030-8031. [3]

PHYS 8158. Interactions of Photons with Atoms, Molecules, and Solids. [Formerly PHYS 362] Macroscopic optical properties of solids. Lorentz model of optical excitation, radiative and non-radiative relaxation. Coherence and dephasing in two-level systems. Interband transitions and luminescence. Optical properties of quantum-confined systems. Excitons, phonons, plasmons, and polaritons. Lasers, Raman and Brillouin scattering, nonlinear optical phenomenology. Prerequisite: 5651, 5640 or CHEM 5360. [3]

PHYS 8159. Experimental Nanoscale Fabrication and Characterization. [Formerly PHYS 366] Laboratory introduction to nanofabrication and characterization. Preparation for independent and original research in nanotechnology and nanoscience. Review of nanomaterials, nanofabrication, characterization, nanoelectronics, and photonics. [3]

PHYS 8160. General Relativity and Cosmology. [Formerly PHYS 360A] Einstein's geometric theory of gravity in terms of tensor analysis and differential geometry. Einstein's field equations are derived and solutions are discussed. Applications of general relativity are explored, including those to very strong gravitational fields, gravitational collapse, neutron stars, black holes, and quantum gravity. Topics in cosmology will include red shifts and cosmic distance relations, big bang cosmology, primordial nucleosynthesis,

the very early universe and inflationary cosmologies. Prerequisite: consent of instructor. [3]

PHYS 8161. General Relativity and Cosmology. [Formerly PHYS 360B] Continuation of 8160. Einstein's geometric theory of gravity in terms of tensor analysis and differential geometry. Einstein's field equations are derived and solutions are discussed. Applications of general relativity are explored, including those to very strong gravitational fields, gravitational collapse, neutron stars, black holes, and quantum gravity. Topics in cosmology will include red shifts and cosmic distance relations, big bang cosmology, primordial nucleosynthesis, the very early universe and inflationary cosmologies. Prerequisite: consent of instructor. [3]

PHYS 8164. Many-Particle Quantum Theory. [Formerly PHYS 365] Nonrelativistic theory of atoms, solids, and nuclei; operators in second quantization, fermions and bosons, pair correlation function, interacting electron gas (metal), propagators, Wick's theorem and Feynman diagrams, Hartree-Fock theory, shell model, pairing forces in nuclei, and superconductivity. Prerequisite: 8031. [3]

PHYS 8170. Quantum Field Theory. [Formerly PHYS 370A] Relativistic quantum mechanics, canonical and path-integral field quantization, relativistic scattering theory, perturbation expansions; Feynman diagrams and radiative corrections, renormalization and regularization, with applications to quantum electrodynamics and non Abelian gauge theories. Prerequisite: 8010, 8020, 8030, and 8031. Corequisite: 8021. [3]

PHYS 8171. Quantum Field Theory. [Formerly PHYS 370B] Relativistic quantum mechanics, canonical and path-integral field quantization, relativistic scattering theory, perturbation expansions; Feynman diagrams and radiative corrections, renormalization and regularization, with applications to quantum electrodynamics and non Abelian gauge theories. Prerequisite: 8170. [3]

PHYS 8190. Independent Study. [Formerly PHYS 390A] May be repeated for credit more than once, but students may earn only up to 3 credits per semester of enrollment. [1-3]

PHYS 8999. Non-candidate Research. [Formerly PHYS 379] Research prior to entry into candidacy (completion of Qualifying Examination) and for special non-degree students. [Variable credit: 0-13]

PHYS 9995. Half-time Ph.D. Dissertation Research. [Formerly PHYS 3995] For students who have completed 72 hours and devote a half-time effort to dissertation research. [0]

PHYS 9999. Ph.D. Dissertation Research. [Formerly PHYS 399] [0-13]

Political Science

PSCI 5202. Ancient Political Thought. (Also listed as PSCI 2202) Greek and Roman political traditions. Plato, Aristotle, Cicero, and early Christian thinkers. Questions of justice, equality, democracy, and political knowledge. No credit for students who have earned credit for 2202. [3]

PSCI 5203. History of Modern Political Philosophy. (Also listed as PSCI 2203) Intensive analysis of the principal political philosophers in the modern tradition. No credit for students who have earned credit for 2203. [3]

PSCI 5205. Contemporary Political Theory. (Also listed as PSCI 2205) Debates in contemporary political thought. Justice, democracy, freedom, identity, and individualism. Includes emerging contemporary theories. No credit for students who have earned credit for 2205. [3]

PSCI 5207. Liberalism and Its Critics. (Also listed as PSCI 2207) The liberal tradition in political theory and its major challengers. Critical debates surrounding the relationship between individuals and political community, rights, freedom and equality. No credit for students who have completed 2207 or 2207W. [3]

PSCI 5208. Law, Politics, and Justice. (Also listed as PSCI 2208) Contemporary and classical theories of law and society: rights theories, gender and the law; law and transitions to democracy; law between nations. No credit for students who have earned credit for 2208. [3]

PSCI 5209. Issues in Political Theory. (Also listed as PSCI 2209) Topics vary from semester to semester. May be repeated once if there is no

overlap with previous offerings. No credit for students who have earned credit for 2209. [3]

PSCI 5210. West European Politics. (Also listed as PSCI 2210) Analysis of political development, social forces, institutions, and public policy in Great Britain, France, Germany, Italy, and Sweden. No credit for students who have earned credit for 2210. [3]

PSCI 5213. Democratization and Political Development. (Also listed as PSCI 2213) Comparative study of political development, with a focus on institutions. The effect of political choices about voting systems, executive and legislative powers, cabinet formation, and other institutions on political competition, parties and government stability. Cases from established democracies and countries undergoing democratization. No credit for students who have earned credit for 2213 or 8317. [3]

PSCI 5215. Change in Developing Countries. (Also listed as PSCI 2215) Comparative study of political and economic change in developing countries. Political implications of ethnicity, economic dependency, and environmental degradation. No credit for students who have earned credit for 2215. [3]

PSCI 5216. The Chinese Political System. (Also listed as PSCI 2216) Governmental institutions and political processes in the People's Republic of China with emphasis upon the interaction of traditional and revolutionary elements. Some attention to Taiwan since 1950 and to the overseas Chinese as parts of the Chinese political universe. No credit for students who have earned credit for 2216. [3]

PSCI 5219. Politics of Mexico. (Also listed as PSCI 2219) A survey of contemporary Mexican politics from a comparative perspective. Interaction of economic, social, and political forces that led to the demise of one of the world's most durable one-party political regimes and the prolonged transition to democracy. No credit for students who have earned credit for 2219. [3]

PSCI 5220. Crisis Diplomacy. (Also listed as PSCI 2220) Foreign policy decision making and strategy. Emphasis on differences between crises that lead to war and those that do not. Foreign relations of Britain, France, Germany, Russia, and Japan. No credit for students who have earned credit for 2220. [3]

PSCI 5221. Causes of War. (Also listed as PSCI 2221) Scientific study of the onset of expansion and consequences of war; conditions of peace, emphasizing alliances, arms races, and crisis escalation. No credit for students who have earned credit for 2221. [3]

PSCI 5222. American Foreign Policy. (Also listed as PSCI 2222) Critical analysis of major international and domestic factors shaping U.S. foreign relations as reflected in selected twentieth- and twenty-first-century experiences. No credit for students who have earned credit for 2222. [3]

PSCI 5224. Theories of World Politics. (Also listed as PSCI 2224) Analysis of major theories of the basic factors underlying global relations. No credit for students who have earned credit for 2224. [3]

PSCI 5225. International Political Economy. (Also listed as PSCI 2225) Survey of major issues involving the interaction of political and economic forces at the global level. Particular attention to theories of interdependence and imperialism, the position of developing countries in the international system, multinational corporations, and the economic origins of war. No credit for students who have earned credit for 2225. [3]

PSCI 5226. International Law and Organization. (Also listed as PSCI 2226) The role of international law and international organizations in the contemporary global political system. Focus on the evolution and impact of international law, the United Nations, the International Monetary Fund (IMF), and selected regional organizations. No credit for students who have earned credit for 2226. [3]

PSCI 5240. Political Parties. (Also listed as PSCI 2240) Theories of party formation, organization, and behavior. Historical development of party systems. Criteria for the comparative evaluation of party systems. Parties as instruments of citizen control. Implications for electoral outcomes, coalition formation, legislative decision making, and public policy. No credit for students who have earned credit for 2240. [3]

PSCI 5243. Political Campaigns and the Electoral Process. (Also listed as PSCI 2243) Theories of representation and democratic accountability; electoral strategies and tactics, including political polling and analysis. No credit for students who have earned credit for 2243. [3]

PSCI 5245. The American Presidency. (Also listed as PSCI 2245) Constitutional, historical, and political aspects. Attention to electing and nominating president, presidential leadership and personality, governing, and relations with Congress and the public. No credit for students who have earned credit for 2245. [3]

PSCI 5255. Public Policy Problems. (Also listed as PSCI 2255) Specific problems of public policies and their relations to political and institutional structures. Particular policy problems vary from semester to semester. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. No credit for students who have earned credit for 2255. [3]

PSCI 5259. Political Strategy and Game Theory. (Also listed as PSCI 2259) Campaigns and elections, legislative politics, political bargaining, and political organization. Applications of decision and game theory. Models of complete and perfect information, and games of incomplete information. No credit for students who have earned credit for 2259 or 8359. [3]

PSCI 5262. The Judicial Process. (Also listed as PSCI 2262) Functioning of the judiciary in the American political process; operation and powers of the courts; non-legal aspects of the judicial process; political role and effects of judicial decisions. No credit for students who have earned credit for 2262. [3]

PSCI 5263. Religion and Politics. (Also listed as PSCI 2263) Religion in democratic societies. Abortion, gay marriage, faith-based initiatives, and the Pledge of Allegiance. Historical works and contemporary contributions to debates. No credit for students who have earned credit for 2263. [3]

PSCI 5267. Voting and Political Representation in America. (Also listed as PSCI 2267) The history of voting rights and the efficacy of representation in the American political system. Political participation, voting rights, felony disenfranchisement, redistricting, and alternative electoral systems. No credit for students who have earned credit for 2267. [3]

PSCI 5270. Conducting Political Research. (Also listed as PSCI 2270) Research sources, designs, and methods used by political scientists. Locating and accessing data, the logic of causal inferences, and basic data presentation and analysis. No credit for students who have earned credit for 2270. [3]

PSCI 6211. The European Union. (Also listed as PSCI 3211) Political and economic integration. Origins, institutions, decision processes, policies, achievements, and prospects of the European integration movement. No credit for students who have earned credit for 3211. [3]

PSCI 6217. Latin American Politics. (Also listed as PSCI 3217) Cross-national analysis of political institutions, cultures, and processes of change in Latin America. No credit for students who have earned credit for 3217. [3]

PSCI 6228. International Politics of Latin America. (Also listed as PSCI 3228) Examination of Latin America's role in the international and inter-American system. Special attention to the international response to revolutionary change in the area, and to the region's major actors and their changing relationship with the United States, with other major powers, and with other actors such as multinational corporations and international financial institutions. No credit for students who have earned credit for 3228. [3]

PSCI 6229. Strategy and International Politics. (Also listed as PSCI 3229) Strategic behavior and strategic choices arising from interactive decision making within the context of international politics. General principles of strategy. In-class experiments and game playing. No credit for students who have earned credit for 3229. [3]

PSCI 6241. American Public Opinion and Voting Behavior. (Also listed as PSCI 3241) The development and dynamics of political opinion and its effects on voting and public policy. Models of political behavior. No credit for students who have earned credit for 3241. [3]

PSCI 6244. The Legislative Process. (Also listed as PSCI 3244) Legislative organization and processes in the U.S. Congress. Attention to parties,

elections, institutional structure, interest groups, and other branches of government as they relate to the legislative process. No credit for students who have earned credit for 3244. [3]

PSCI 6247. American Political Culture. (Also listed as PSCI 3247) Content, historical development, and political consequences of the American public's deeply rooted values concerning how the political system ought to work and the ends it ought to serve. Attention to regional variation. No credit for students who have earned credit for 3247. [3]

PSCI 6253. Ethics and Public Policy. (Also listed as PSCI 3253) Political and moral values in assessing policy-making, public policies and processes, and policy impacts. No credit for students who have earned credit for 3253. [3]

PSCI 6260. Introduction to American Law. (Also listed as PSCI 3260) Law as a component of public policy and the political system; the elements and rationale of private law. No credit for students who have earned credit for 3260. [3]

PSCI 6265. Constitutional Law: Powers and Structures of Government. (Also listed as PSCI 2265) U.S. constitutional system and fundamental principles of constitutional interpretation. Judicial development of principles of distribution and scope of governmental powers. Case method. No credit for students who have earned credit for 2265. [3]

PSCI 6266. Constitutional Law: Civil Liberties and Rights. (Also listed as PSCI 2266) Supreme Court's interpretation of the Bill of Rights and the Fourteenth Amendment. Case method. No credit for students who have earned credit for 2266. [3]

PSCI 6891. Topics in Contemporary Politics. (Also listed as PSCI 3891) Political, governmental, and policy issues. May be repeated for credit when topics vary. No more than three hours may be counted toward the major. No credit for students who have earned credit for 3891. [1-3]

PSCI 7238. Comparative Political Parties. (Also listed as PSCI 4238) Political parties and their role in the democratic process of modern liberal western democracies, focusing on party systems and party organizations. No credit for students who have earned credit for 4238. [3]

PSCI 7999. Master's Thesis Research. [Formerly PSCI 369] [0-12]

PSCI 8300. Political Theory. [Formerly PSCI 300] Basic course in political theory. Surveys major texts in political theory, as well as central concepts and debates in the current literature. [3]

PSCI 8301. Human Rights. [Formerly PSCI 301] Provides a historical and contemporary context for reflection on the meaning of human rights. Focus on the theory of human rights. [3]

PSCI 8302. Democratic Theory. [Formerly PSCI 302] Growth of democratic theory in political philosophy and historical application. Connections between democratic theory and political institutions. [3]

PSCI 8304. Identity Politics: From Democracy to Conflict. Economic, social, and psychological theories of identity. Studies of ethnic, partisan, class and religious identities. Identity's impact on policy, patronage, collective action, and conflict. [3]

PSCI 8305. Feminist Social and Political Thought. [Formerly PSCI 305] Feminist political theorists, both as critics of the history of political thought and as authors of contemporary social and political theory. [3]

PSCI 8308. Studies in Historical Political Thought. [Formerly PSCI 308] Major texts and themes focusing on a single thinker, a school of thought, or a theme. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

PSCI 8309. Research in Political Theory. [Formerly PSCI 309] Supervised individual research and reading on selected topics in political theory. [3]

PSCI 8310. Studies in Comparative Analysis. [Formerly PSCI 310] A survey of important literature and concepts in the field of comparative politics. [3]

PSCI 8311. Regional and International Dimensions of European Integration. [Formerly PSCI 311] Theories of political and economic integration; key actors in the European Union (including national and subnational governments, EU institutions, interest groups, and citizens); principal EU policy arenas and issues (including economic and monetary union, the single market, the common agricultural policy, regional policies, joint foreign and security policies). [3]

PSCI 8314. Comparative Political Parties. [Formerly PSCI 314] Origin of political parties, party organizations and ideologies, party systems, democratic representation. [3]

PSCI 8315. Research in Latin American Politics. [Formerly PSCI 315] Recurring and novel topics in Latin American politics, such as the relation between economic growth and political regimes, the role of the Church, human rights, and U.S. foreign policy. Particular issues vary from semester to semester. [3]

PSCI 8317. The Political Economy of Development. [Formerly PSCI 317] The causes of international and national inequalities in the distribution of wealth. Factors related to economic development and tied to domestic and international income distribution, such as geography, natural resources, culture, democracy, and dependency. Examples from throughout the world, especially Asia and Latin America. [3]

PSCI 8319. Research in Comparative Analysis. [Formerly PSCI 319] Supervised individual research and reading on selected topics in comparative politics. [3]

PSCI 8320. Political Economy of Conflict. [Formerly PSCI 320] Surveys research on interstate and intrastate conflict, political violence, and war. Theories of conflict and war, microfoundations and economic dimensions of political violence, and political and economic implications of conflict. [3]

PSCI 8321. International Conflict: Theories and Methods. [Formerly PSCI 321] Analysis of international conflict and war. [3]

PSCI 8328. Ideas and International Security. [Formerly PSCI 328] Role of collectively-held meanings and shared ideas (identity, norms, beliefs, values) in national security and political behavior. Texts from political science, economics, philosophy, military strategy and history, and sociology. Real world applications include perceptions of war and war outcomes, security strategy formulation, and impact of identity on international relations. [3]

PSCI 8329. Research in International Politics. [Formerly PSCI 329] Supervised individual research and reading on selected topics in international politics. [3]

PSCI 8330. Studies in American Politics. [Formerly PSCI 330] A survey of important literature and concepts in the field of American politics. [3]

PSCI 8331. Party Politics. [Formerly PSCI 331] Structure and functions of political parties; theories of partisan change, party formation, and party organization. Influence on rules and the behavior of politicians on party policies. [3]

PSCI 8332. Electoral Behavior and Public Opinion. [Formerly PSCI 332] Theories of voting and behavior of candidates in American elections; models of electoral change; the development and dynamics of public opinion. Effects of elections and public opinion on policy and governmental action. [3]

PSCI 8333. Political Culture, Opinion, and Behavior. [Formerly PSCI 333] Politics as a contest of meaning; how issues, structures, and events are signified; the patterns and distributions of core beliefs as the foundation of individual and collective political behavior and institutional politics. [3]

PSCI 8334. Political Psychology. [Formerly PSCI 334] The psychological roots of individual choice and judgment in politics. Cognitive and affective theories of political decision-making. Survey responses, political identity, and explicit or implicit attitudes. [3]

PSCI 8335. Politics of American Legislation. [Formerly PSCI 335] The structure and function of American legislative institutions, especially Congress, and their relation to the wider setting. [3]

PSCI 8338. Comparative Representations and Accountability. [Formerly PSCI 338] Political representation and democratic accountability in advanced industrial societies and in developing democracies. [3]

PSCI 8339. Research in American Politics. [Formerly PSCI 339] Supervised individual research and reading on selected topics in American politics. [3]

PSCI 8340. Gender, Institutions, Behavior. [Formerly PSCI 340] Empirical research on gender, political institutions, elite and citizen behaviors. [3]

PSCI 8342. Race and Racism in American Politics. Political construction of race in the United States. Racial animus in policy making, group-identity politics, and racial connections to wealth distribution and political power. No credit for students who earned credit for 8370 section 1 in Spring 2017. [3]

PSCI 8355. Research Design. [Formerly PSCI 355] Introduction to Analysis of Tables, Measures of Association, OLS regression. Coverage of research design. Experimental design, survey research, elite interviewing, in-depth interviewing, aggregate data, field research, content analysis, case studies, and small-n analysis. Emphasis on concept formation and measurement. [3]

PSCI 8356. Statistics for Political Research I. [Formerly PSCI 356] Introduction to statistical analysis with applications in political science, statistical distributions, statistical inference, bivariate and multiple regression, logit, and probit. [3]

PSCI 8357. Statistics for Political Research II. [Formerly PSCI 357] Advanced topics in statistical analysis with research applications in maximum likelihood estimation, logit and probit analysis, simultaneous equation models, generalized least squares, and introductory time series concepts. [3]

PSCI 8358. Topics in Political Methodology. [Formerly PSCI 358] May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

PSCI 8359. Introduction to Formal Theory and Modeling. [Formerly PSCI 359] Social choice and game theory. Instability and disequilibria of group decisions under different decision-making rules. Theoretical model building as a way to generate hypotheses. Rules in decision making, manipulability of outcomes, bargaining strategies and the evolution of cooperation. [3]

PSCI 8360. Topics in Formal Theory and Modeling. [Formerly PSCI 360] May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

PSCI 8361. Writing Proposals and Securing Grants in the Empirical Social Sciences. [Formerly PSCI 361] [3]

PSCI 8362. Data Collection Methods. Data collection methods to build theory and investigate theory empirically. Creating a pre-analysis plan. Practical skills to undertake surveys, focus groups, semi-structured interviews, archival or web data collection, and behavioral tasks. Role of experimental intervention. Ethics on working with human subjects. Access and collaboration with NGOs and policymakers. Logistics such as timelines, budgets, grant proposals, data management, and incentivizing or managing employees. Repeat credit for 370-03 offered fall 2013. [3]

PSCI 8363. Survey Research Methods. Questionnaire design, sampling, data analysis, longitudinal surveys, and experimental techniques. No credit for students who have earned credit for 8370 section 08 offered spring 2017. [3]

PSCI 8364. Formal Political Theory II: Advanced Modeling and Applications. Advanced game theory and formal modeling with applications in political science. Not open to students who have earned credit for 8360 offered spring 2019. [3]

PSCI 8365. Topics in Network Analysis. Methods for studying role of social networks in political behavior. Applications to international relations, comparative politics, and American politics. Overview includes survey methods, statistical methodology, experiments, agent-based models, and game theory. Prerequisite: 8356 and 8359. [3]

PSCI 8370. Topics in Political Science. [Formerly PSCI 370] An inquiry into selected topics. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

PSCI 8398. Dissertation Seminar. [Formerly PSCI 398] Focus on developing the theoretical, empirical, and normative aspects of each student's dissertation research. [3]

PSCI 8901. Independent Study. [Formerly PSCI 390A] [Variable credit: 1-3 each semester]

PSCI 8902. Independent Study. [Formerly PSCI 390B] [Variable credit: 1-3 each semester]

PSCI 8999. Non-candidate Research. [Formerly PSCI 379] Research prior to entry into candidacy (completion of Qualifying Examination) and for special non-degree students. [Variable credit: 0-12]

PSCI 9995. Half-time Ph.D. Dissertation Research. [Formerly PSCI 3995] For students who have completed 72 hours and devote a half-time effort to dissertation research. [0]

PSCI 9999. Ph.D. Dissertation Research. [Formerly PSCI 399] [0-12]

Portuguese

PORT 5203. Intermediate Portuguese. (Also listed as PORT 2203) Review of Portuguese grammar with emphasis on conversation, composition, and reading of modern Portuguese literary texts. No credit for students who have earned credit for a higher level Portuguese language course. No credit for students who have earned credit for 2203. [3]

PORT 5205. Portuguese and Global Health. Speaking, reading, and writing; advanced grammar. Health in Brazil and Lusophone Africa, through literary texts, films, articles, and public health publications. Virtual language-learning partnerships with medical students in Lusophone Africa. Prerequisite: 5203. [3]

PORT 5301. Portuguese Composition and Conversation. (Also listed as PORT 3301) Expository writing and development of speaking skills. Emphasis on pronunciation, vocabulary, and grammar. No credit for students who have earned credit for 3301. [3]

PORT 5302. Brazilian Pop Culture. (Also listed as PORT 3302) Development of written and oral communication skills through the study of Brazilian popular culture. Movies, music, television, and magazines. No credit for students who have earned credit for 3302. [3]

PORT 5303. Introduction to Luso-Brazilian Literature. (Also listed as PORT 3303) Critical readings and methods of literary analysis. Masterpieces from Portugal and Brazil from all genres in several periods. Conversation and writing. No credit for students who have earned credit for 3303. [3]

PORT 5350. Brazilian Culture through Native Material. (Also listed as PORT 4350) Differences between spoken and written Portuguese in Brazil. Modern culture, including popular music, film, politics, family life, and sports. No credit for students who have earned credit for 4350. [3]

PORT 5420. Brazilian Literature through the Nineteenth Century. (Also listed as PORT 4420) Main literary trends, principal writers and works of Brazilian literature, from colonial beginnings through the nineteenth century. Study of the works of Gregório de Matos, Gonçalves Dias, Alencar, Machado de Assis, and Euclides da Cunha. No credit for students who have earned credit for 4420. [3]

PORT 5425. Modern Brazilian Literature. (Also listed as PORT 4425) Brazilian literature from the Semana de Arte Moderna to the present. Modernist and neo-Modernist movements. No credit for students who have earned credit for 4425. [3]

PORT 5850. Independent Study. (Also listed as PORT 3850) A reading course, the content of which varies according to the needs of the individual student. Primarily designed to cover pertinent material not otherwise available to the student in the regular courses of the curriculum. No credit for students who have earned credit for 3850. [Variable credit: 1-3 hours, not to exceed 12 over a four-semester period]

PORT 5892. Special Topics in Portuguese Language, Literature, or Civilization. (Also listed as PORT 3892) May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. No credit for students who have earned credit for 3892. [3]

PORT 5900. Brazilian Civilization through English Language Material. (Also listed as PORT 2900) The cultural heritage of Brazil from its earliest days to the present. National identity, race relations, and Brazil's emergence as a major force in the Americas and beyond. Taught in English. No credit for graduate students in Spanish and Portuguese. No credit for students who have earned credit for 2900. [3]

PORT 6010. Literary Analysis and Theory. [Formerly PORT 301] (Also listed as Spanish 6010) Methods of literary analysis for the teaching of literature. The systematic application of contemporary theories - structuralist and poststructuralist - in the analysis of poetry and narrative. [3]

PORT 6020. Ibero-Romance Philology. [Formerly PORT 302] (Also listed as Spanish 6020) Study of the evolution of the languages and dialects of the Iberian Peninsula. Analysis of selected linguistic developments and readings from medieval texts. [3]

PORT 6030. Foreign Language Learning and Teaching. [Formerly PORT 310] (Also listed as Spanish 6030) Principles and practices of teaching a second language with concentration on recent interactive and communicative models of foreign language instruction. Classroom observations, journal writing, development of materials, and a small action research project are expected. Required of all entering teaching assistants. [3]

PORT 7050. Introduction to Latin American Colonial Studies. [Formerly PORT 314] (Also listed as Spanish 7050) Provides a panoramic introduction to the canonical works of the colonial period from "discovery" to "independence," as well as an overview of the theoretical debates in colonial studies within the Latin American context. Topics include the construction and reshaping of identities and otherness through various stages of Latin American cultural history, the emergence of what has been called the American consciousness during the "New World Baroque," and the discourses of "independence" and early nation building. [3]

PORT 7070. Spanish American and Brazilian Literature I. [Formerly PORT 341] (Also listed as Spanish 7070) Literature in a comparative perspective: from the conquests to the end of the nineteenth century. Authors may include Sor Juana, Matos, Alencar, Assis, and Carrasquilla. [3]

PORT 7071. Spanish American and Brazilian Literature II. [Formerly PORT 342] Literature in a comparative perspective: twentieth century to the present. Texts may include: *Os Sertões*, *La Guerra del Fin del Mundo*, *Ficciones*, *Perto do Coração Selvagem*, and *Água Viva*. [3]

PORT 8200. Seminar: Studies in Colonial Literature. [Formerly PORT 338] (Also listed as Spanish 8200) May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

PORT 8210. Seminar: Hispanic American Essay. [Formerly PORT 340] (Also listed as Spanish 8210) May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

PORT 8400. Seminar: Studies in Inter-American Literature. [Formerly PORT 374] (Also listed as Spanish 8400) Comparative approaches to literary texts from such New World cultures as Brazil, Spanish America, the United States, the Caribbean, and Canada (both its French and English traditions). Fluency in Spanish and/or Portuguese required; reading competency in English and French. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

PORT 8999. Non-candidate Research. [Formerly PORT 379] Research prior to entry into candidacy (completion of Qualifying Examination) and for special non-degree students. [Variable credit: 0-12]

PORT 9300. Comparative Methodology. [Formerly PORT 351] (Also listed as Spanish 9300) Comparative methodology of the literatures of the Spanish and Portuguese speaking world; emphasis on issues of theme, genre, period and movement, translation, and the relationship of literary

scholarship to other humanistic endeavors, such as music, film, philosophy, painting, and the plastic arts. [3]

PORT 9520. Seminar: Studies in Contemporary Literature of the Portuguese-Speaking World. [Formerly PORT 385] Variable topics to be announced. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

PORT 9660. Special Studies in Portuguese Literature. [Formerly PORT 397] [Variable credit: 1-6]

PORT 9670. Special Studies in Brazilian Literature. [Formerly PORT 398] May be repeated for credit more than once if there is no duplication in topic, but students may earn only up to 6 credits per semester of enrollment. [1-6]

PORT 9995. Half-time Ph.D. Dissertation Research. [Formerly PORT 3995] For students who have completed 72 hours and devote a half-time effort to dissertation research. [0]

PORT 9999. Ph.D. Dissertation Research. [Formerly PORT 399] [0-12]

Psychology (A&S)

PSY 5780. The Visual System. [Formerly PSY 336] (Also listed as Cell and Developmental Biology 8347 and Neuroscience 8347) An interdisciplinary approach to how humans see and interpret their visual environment. Topics include the structure of the eye and brain (including optics), the physiology of individual cells and groups of cells, machine vision and models of visual function, visual attention, and mechanisms of complex visual perception. Lectures by faculty from Psychology, Engineering, and Cell and Developmental Biology. Graduate students attend one hour discussion section per week, in addition to lecture, and turn in a more extensive paper than undergraduates. [3]

PSY 6104. Quantitative Methods and Experimental Design. [Formerly PSY 304B] Principles and methods for the design and analysis of experiments and for the investigation of individual differences. Principles of experimental design and descriptive and inferential statistics. [3]

PSY 6218. Computational Cognitive Modeling. Human perception and cognition. Model implementation, parameter estimation, statistical model evaluation. Developing and testing new models: stochastic processes; simulation and Monte Carlo methods; high-performance computing. [3]

PSY 6300. Research Seminar. [Formerly PSY 300A] [Variable credit: 1-4]

PSY 6310. Advanced General Psychology. [Formerly PSY 301A] Physiological psychology, perception and sensation, learning, complex processes, developmental, personality, social psychology, and psychopathology. Participation in various sections determined by each student's background and career interests. [3]

PSY 6370. Independent Study. [Formerly PSY 370] May be repeated for credit more than once if there is no duplication in topic. [1-6]

PSY 7031. Advanced Investigational Techniques. [Formerly PSY 331A] A non-thesis research project. [0-6]

PSY 7032. Advanced Investigational Techniques. [Formerly PSY 331B] A non-thesis research project. [0-6]

PSY 7033. Second-Year Research. [Formerly PSY 365] Second-year research project in psychological sciences. May be repeated for credit more than once if there is no duplication in topic, but students may earn only up to 12 credits per semester of enrollment. [0-12]

PSY 7034. Advanced Research in Psychological Sciences. [Formerly PSY 367] Advanced research project in psychological sciences leading to the dissertation proposal. May be repeated for credit. [0-12]

PSY 7999. Master's Thesis Research. [Formerly PSY 369] [0-12]

PSY 8120. Categorical Data Analysis. [Formerly PSY 320] Analysis of categorical data. Statistical analysis of binary, nominal, ordinal, and count data from the perspective of generalized linear models. Logistic and Poisson

regression models. Population-averaged and subject-specific approaches to repeated measures. Prerequisite: 6104, 8310, or equivalents. [3]

PSY 8216. Brain Imaging Methods. [Formerly PSY 316] Principles and methods used in human neuroimaging, with emphasis on functional magnetic resonance imaging (fMRI). [3]

PSY 8218. Computational Modeling. [Formerly PSY 318] Developing and testing computational models of human cognition and brain function. How to implement models, recognize good modeling, fit models to data, evaluate models, contrast competing models, develop and test new models. Discussion of Monte Carlo simulations, statistical numeric methods, and high-performance computing. [3]

PSY 8219. Scientific Computing for Psychological and Brain Science. [Formerly PSY 319] Computer programming, numerical and computational methods, and high performance computing applied to psychological and brain sciences, such as experimental control, automated data analysis, and model simulation. Some familiarity with introductory programming is expected. [3]

PSY 8305. Linear and Nonlinear Mixed Effects Models. [Formerly PSY 305] The analysis of data from hierarchical and multilevel designs. Theory and computational methods, specification and testing of fixed effects, random effects and residuals, assessment of fit, graphical examination, applications to repeated measures data, and missing data models. Prerequisite: 6401 or equivalent. [3]

PSY 8310. Research Methods in Clinical Psychology. [Formerly PSY 310] Major methodological and quantitative issues in clinical psychology, including statistical significance testing and its alternatives; threats to internal and external validity; psychometric theory; quantitative approaches to classification; behavioral, genetic, and psychophysiological methods; animal models; analysis of change, mediation, and moderation. [3]

PSY 8312. Psychological Assessment. [Formerly PSY 312] Major techniques of psychological assessment, with an emphasis on the rationale, administration, and interpretation of measures assessing personality and psychopathology. [3]

PSY 8315. Theories of Psychotherapy. [Formerly PSY 315] Advanced study on the major principles, concepts, techniques, and issues relevant to the theory and practice of psychotherapy. Experience in supervised clinical settings or observation of clinical sessions is provided to further understanding of psychotherapeutic processes. [3]

PSY 8323. Practicum in Psychological Assessment. [Formerly PSY 323] [Variable credit: 1-5 each semester]

PSY 8324. Practicum in Psychotherapy. [Formerly PSY 324] [Variable credit: 1-5 each semester]

PSY 8325. Advanced Standing in Psychological Assessment. [Formerly PSY 325] [Variable credit: 1-5 each semester]

PSY 8326. Advanced Standing in Psychotherapy. [Formerly PSY 326] [Variable credit: 1-5 each semester]

PSY 8352. Seminar: Clinical Psychology. [Formerly PSY 352] May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

PSY 8353. Professional Ethics in Clinical Psychology. [Formerly PSY 353] Issues and practical applications of ethical principles in clinical and research settings. Cultural context for clinical and ethical issues. [3]

PSY 8354. Clinical Neuropsychology. [Formerly PSY 354] Cognitive and behavioral disorders associated with brain injury and disease. Methods of neuropsychological assessment. Prerequisite: PSY-GS 8300 or permission of instructor. [3]

PSY 8355. Diversity and Differentness. [Formerly PSY 355] Theory, issues, and practical application of cultural sensitivity and competency in research and clinical settings. [1-3]

PSY 8360. Seminar in Clinical Science. [Formerly PSY 360] Integration of the subareas of clinical science. Includes history and systems of psychology as related to clinical science, ethical issues, and problems encountered in professional psychology. May be repeated for credit more than once if

there is no duplication in topic. Students may earn only up to 2 credits per semester of enrollment. [0-2]

PSY 8398. Internship. [Formerly PSY 398] [0]

PSY 8503. Models of Human Memory. [Formerly PSY 303] Survey of contemporary models of human memory, especially formal models. Methods of fitting models to data will be discussed. Prerequisite: graduate course on cognition. [3]

PSY 8505. Judgment and Decision-Making. Historical origins and development of human judgment and decision-making as a specialty within cognitive psychology. Expected utility theory; heuristics and biases; decision-making in clinical psychology; neurobiology of decision-making; neuroeconomics. No credit for students who have earned credit for 8551 section 01 in spring 2016. [3]

PSY 8543. Seminar: Perception. [Formerly PSY 343] In-depth discussion and exploration of a specialized topic in Perception. The topic can cover any and all aspects of perception, from the molecular neurobiology of retinal processing to the phenomenology of consciousness, and can emphasize particular methodological approaches (e.g. single-cell recording, neuroimaging). May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

PSY 8551. Seminar: Cognitive Psychology. [Formerly PSY 351] May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

PSY 8557. Seminar in Cognitive Science. [Formerly PSY 357] Integration of the subareas of cognitive science. May be repeated for credit more than once if there is no duplication in topic. Students may earn only up to 2 credits per semester of enrollment. [0-2]

PSY 8744. Seminar: Neuroscience. [Formerly PSY 344] May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

PSY 8750. Scientific Writing in Psychology and Neuroscience. [Formerly PSY 350] Journal articles, grants, scientific papers, press releases, and dissertations. Revising and editing. [3]

PSY 8758. Seminar in Neuroscience. [Formerly PSY 358] Integration of the subareas of neuroscience. May be repeated for credit more than once if there is no duplication in topic. Students may earn only up to 2 credits per semester of enrollment. [0-2]

PSY 8901. Teaching Practicum. Discussion of teaching practices in weekly meeting with instructor. Application of teaching strategies through hands-on experience with undergraduates. [0-1]

PSY 8906. Evolutionary Psychology. [Formerly PSY 306] Interdisciplinary analysis of the origins of mind, with particular emphasis on the mind/brain as a product of biological evolution. [3]

PSY 8942. Seminar: Social. [Formerly PSY 342] In-depth investigation of a specialized topic in Social Psychology. The topic might cover any and all aspects of social psychology, emphasize intra-personal and/or extra-personal perspectives, and focus on theoretical and/or experimental approaches. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

PSY 8999. Non-candidate Research. [Formerly PSY 379] Research prior to entry into candidacy (completion of Qualifying Examination) and for special non-degree students. [Variable credit: 0-12]

PSY 9999. Ph.D. Dissertation Research. [Formerly PSY 399] [0-12]

Psychology and Human Development (GS)

PSY-GS 7999. Master's Thesis Research. [Formerly PSY-GS 369] Open only to candidates for the Master of Science degree engaged in thesis research and writing. Consent of major professor required. [Variable credit: 1-6]

PSY-GS 8100. Behavioral Pediatrics and Child Health Psychology.

[Formerly PSY-GS 336] Behavioral pediatrics and child health psychology for advanced predoctoral and postdoctoral trainees. Topics include the scope and definition of behavioral pediatrics, measurement of child behavior, children's health beliefs and understanding of illness, theories of psychosomatic illness, immunologic and endocrinologic aspects of stress, compliance, psychological effects of physical illness, families' responses to stress, and psychological intervention strategies. [3]

PSY-GS 8120. Psychological Intervention with Children.

[Formerly PSY-GS 386] Various intervention approaches with children, including parent training, behavior therapy, group therapy, psychopharmacological intervention, individual psychotherapy, cognitive behavioral intervention, psychoanalytic play therapy, and residential treatment. [3]

PSY-GS 8200. Psychopathology.

[Formerly PSY-GS 340] Focuses on descriptive, epidemiological, and casual psychopathology research, with an emphasis on developmental and cultural influences. The course goal is to increase students' ability to think creatively and critically about psychopathology research and to conduct their own psychopathology-related research. Prerequisite: Consent of instructor [3]

PSY-GS 8300. Psychological Assessment.

[Formerly PSY-GS 343] A general introduction to clinical assessment, with a particular emphasis on children. The major purpose is to familiarize students with the theoretical issues and psychometric properties of several different methods of assessment including objective and projective personality measures, behavior checklists, behavioral observation, and clinical interviews. Required before taking practica. Prerequisite: consent of instructor. [3]

PSY-GS 8350. Individual Differences.

[Formerly PSY-GS 318] Focuses on traditional concepts and findings in the area of individual differences broadly defined. The psychological content will primarily involve abilities, interests, and personality; methodological issues encountered in assessing these attributes will be stressed throughout; and particular attention will be devoted to how these concepts can enhance research programs in both applied and theoretical areas. The specific variables discussed within each domain will be restricted to those that have empirically "panned out" (viz., variables that are reliable and related to meaningful behaviors and outcomes that psychologists are interested in predicting and better understanding), rather than theoretical constructs and measures whose external validity is unknown. [3]

PSY-GS 8360. Human Cognition.

[Formerly PSY-GS 352] Current research and theory in cognitive psychology. Emphasis on memory, perception, and language. Some applications of cognitive theories are explored. [3]

PSY-GS 8400. Developmental Psychology.

[Formerly PSY-GS 360] Central issues, theories, and methods. [3]

PSY-GS 8410. Advanced Seminar in Educational Psychology.

[Formerly PSY-GS 339] May be repeated with change of topic. [Variable credit: 1-3]

PSY-GS 8420. Advanced Seminar in Clinical Psychology.

[Formerly PSY-GS 349] May be repeated with change of topic. [3]

PSY-GS 8430. Advanced Seminar: Cognitive Studies.

[Formerly PSY-GS 353] Special topics in cognitive studies. May be repeated with change of topic. [3]

PSY-GS 8440. Seminar in Behavioral Biology.

[Formerly PSY-GS 357] Selected topics in behavioral biology-e.g., ethology. Content varies according to student needs and interests. May be repeated. [3]

PSY-GS 8450. Seminar in Cognitive Development.

[Formerly PSY-GS 361] Major theoretical and conceptual issues in cognitive development. Emphasis in current research topics like memory development, reading, conceptual development, semantic development, problem solving, and reasoning. Recommended background: 352P and/or 8400 [3]

PSY-GS 8460. Advanced Seminar in Developmental Psychology.

[Formerly PSY-GS 368] May be repeated with a change of topic. [3]

PSY-GS 8470. Cognitive Science to the Classroom.

[Formerly PSY-GS 362] This course focuses on the interplay between basic research in cognitive science and educational innovation. There is a major push to design

learning environments that are based on cognitive science research and theory and to rigorously evaluate these environments. How do we go about doing this? We will use a case study approach of successful educational innovations, the basic research behind them, and their impact on basic research in turn. This will allow us to develop a framework for developing and evaluating educational innovations. [3]

PSY-GS 8480. Educational Neuroscience.

[Formerly PSY-GS 367] Seminar that examines the interdisciplinary intersection between cognitive neuroscience investigations of the development of brain structure and function and studies of cognitive development relevant to education. Topics including the emerging theoretical and empirical contribution of neuroscience approaches to understanding the typical and atypical development of domain specific academic skills such as reading and mathematics, as well as the neural basis of domain general processes crucial for educational success such as working memory, motivation, attention, and social cognition. [3]

PSY-GS 8500. Special Topics in Psychology.

[Formerly PSY-GS 396] May be repeated with change of topic. [Variable credit: 1-4]

PSY-GS 8600. Seminar in Social and Personality Development.

[Formerly PSY-GS 363] Development of personality and social processes, with emphasis on methods of inquiry. Trait theory, socialization processes, origins of gender differences, cultural differences in childbearing practices, experimental and observational methods in developmental research, and development of motivational systems. [3]

PSY-GS 8690. Cognitive Science of Learning and Development Research Forum.

[Formerly PSY-GS 365] The Cognitive Science of Learning and Development Research Forum serves as a venue for delivering and hosting research presentations relevant to cognitive science, learning and development hosted by graduate students and faculty within the Psychological Sciences program, as well as researchers from other departments and Universities. May be repeated for credit. This is a 1 credit year-long course. Students register for 0 credit hours in the Fall and 1 credit hour in the Spring.

PSY-GS 8751. Exploratory Data Analysis.

Exploratory Data Analysis (EDA) is a modern statistical paradigm developed by John Turkey in the 1970's. EDA emphasizes fitting mathematical models to data as preliminary to the traditional hypothesis testing approach used in confirmatory analyses. Hallmarks of EDA include graphical methods, residual analysis, robust/resistant statistical methods, and data re-expression/transformation. But EDA is actually a whole philosophy of data analysis, and includes treatment of ethics and propriety in research. In this class we study EDA, as it has developed over the past four decades. We also do a great deal of EDA. An "EDA Portfolio" is developed by each student of different data analysis and graphical analysis projects. Included within the course is treatment of "big data" and data mining approaches, and also discussion of the current "replication crisis" and its emphasis on Questionable Research Practices (QRP's); EDA provides a certain type of prescriptive treatment of QRP's. Prerequisites: PSY-GS 8861 and PSY-GS 8870 or equivalent. [3]

PSY-GS 8810. Methods of Psychological Research.

[Formerly PSY-GS 301] Methods for collecting and analyzing empirical information about behavior. Serves as a base upon which to build research competence through more advanced courses and research apprenticeships. [3]

PSY-GS 8815. Advanced Research Methods in Developmental Psychology.

[Formerly PSY-GS 303] Major empirical approaches to the study of development. Emphasis on human behavioral development, although elements from comparative psychology and biomedical sciences included. [3] (Offered by independent study)

PSY-GS 8820. Program Evaluation.

[Formerly PSY-GS 315] The evaluation of social programs. The design of evaluations to produce both theoretically meaningful and practical information about the program and its effectiveness. Such topics as needs assessment, monitoring, impact assessment, and cost/effectiveness evaluations. Covers programs in education, health, and human services. [3]

PSY-GS 8850. Advanced Seminar in Measurement, Statistics, and Evaluation.

[Formerly PSY-GS 319] Special topics in measurement, statis-

tics, and program evaluation. May be repeated with change of topic. Prerequisite: consent of instructor. [3]

PSY-GS 8855. Quantitative Methods Forum. [Formerly PSY-GS 300] The Forum serves as a venue for delivering and hosting methodological research presentations by graduate students and faculty within the Quantitative Methods program, as well as researchers from other departments. Periodically, the Forum will also provide workshops on methodological topics, feature panels on professional development topics, and host invited talks by visiting scholars. May be repeated for credit. [0-1]

PSY-GS 8858. Introduction to Statistical Inference. [Formerly PSY-GS 309] Introduction to statistical methods for graduate students in education and psychology with minimal undergraduate statistical background. The course will present descriptive and inferential methods for assessing distributional shape, central tendency, variability, and association. An introduction to statistical computing with popular general purpose statistical computer programs will be provided. [3]

PSY-GS 8861. Statistical Inference. [Formerly PSY-GS 310] Introductory course designed to familiarize doctoral students with the principles and procedures of statistical inference and to prepare them for more advanced work in research design and analysis. [3]

PSY-GS 8864. Experimental Design. [Formerly PSY-GS 311] Application of statistical concepts and inferential techniques to the design and analysis of experiments in the behavioral sciences. Advanced procedures for analysis of variance and analysis of covariance. Prerequisite: 8861 or equivalent. [3]

PSY-GS 8867. Multivariate Statistics. [Formerly PSY-GS 312] Psychological measurement theory, along with correlational and regression analysis techniques essential to the development of that theory. Prerequisite: 8861 or equivalent. [3]

PSY-GS 8870. Correlation and Regression. [Formerly PSY-GS 313] Fundamental concepts in bivariate and multiple regression and correlation techniques. Emphasizes the theory and assumptions underlying OLS and logistic regression, computational procedures, and interpretation of results. Specific applications include: (1) coverage of the full range of correlation indices; (2) a range of regression strategies (e.g., reduced-form regression, path analysis, ordered and unordered step-wise inclusion); (3) statistical power; (4) regression diagnostics; (5) nonlinear regression and linearizing transformations; (6) testing interactions; and (7) conditions for causal analysis and analysis of change. [3]

PSY-GS 8873. Structural Equation Modeling. [Formerly PSY-GS 314] This course introduces the basic principles of path analysis, confirmatory factor analysis, and latent variable structural modeling, which constitute a powerful set of statistical tools for examining correlational, observational, and even experimental data in the social sciences. Computer techniques for conducting these analyses will also be taught: the LISREL program in particular, but AMOS will also be introduced. [3]

PSY-GS 8876. Psychological Measurement. [Formerly PSY-GS 317] Fundamental concepts, methods, and principles of psychological measurement. Particular attention will be devoted to reliability and validity issues underlying psychometric theory, and how psychometric theory relates to the assessment of individual differences or human variation more generally. Topics will include multiple regression, factor analysis, and item response theory. [3]

PSY-GS 8878. Statistical Consulting. The objective of this course is to prepare students for providing statistical consulting in collaborative applied research settings. Statistical consulting skills are increasingly vital for research and analytic jobs in industry, education, medicine, and academia. Yet a variety of data analysis experiences beyond formal methodological coursework are needed to hone statistical consulting skills. Students work in a mentored environment on statistical and theoretical problems confronted by applied researchers in real data analysis settings within the social sciences and education. Students work in small groups or individually on consulting projects and also have opportunities for providing constructive feedback on others' projects. This course will synthesize and further develop students' understanding of how to translate subject-matter questions into statistical language, select an appropriate statistical method, research

and develop workable solutions to new problems, write an analysis plan, and effectively communicate results through oral and written reports. This course will not only focus on the content of statistical consulting but also on the process - covering how to communicate effectively, professionally, and ethically with clients about expectations, responsibilities, hypotheses, analyses, and results. Permission of Instructor required. [3]

PSY-GS 8879. Factor Analysis. [Formerly PSY-GS 320] This course covers primarily Exploratory Factor Analysis (EFA), which is extensively used in psychology, education, medicine, and management. The course covers the theory behind factor analysis, hands-on application to data, exposure to uses of factor analysis in the applied literature, and instruction in popular EFA software. Key topics include model specification, fit and evaluation, rotation methods, questionnaire development, sample size and power issues, and extensions to confirmatory factor models. [3]

PSY-GS 8880. Introduction to Item Response Theory. [Formerly PSY-GS 326] In this course, students are introduced to the basic concepts of educational and psychological measurement, classical test theory (CTT), and item response theory (IRT). These concepts will be taught with the practice by illustrating the construction of instruments using the 'Four Building Blocks' approach (Wilson, 2005) and investigating their measurement properties (e.g., validity and reliability). This class will present both the 'how to' and the 'why' of IRT. The primary objective of the course is to sharpen the skill, sophistication, and intuition of the student in the interpretation of educational and psychological test data, and in the construction and use of tests as instruments of educational and psychological theory and as tools in the practical problems of selection, evaluation, and guidance in the light of IRT. [3]

PSY-GS 8881. Item Response Theory II. [Formerly PSY-GS 318] Item Response Theory (IRT) II covers IRT models commonly used in education and psychology and their parameter estimation techniques using currently available software. This course will focus on developing a conceptual understanding of the mathematical concepts underlying the IRT models in so far as this is necessary for appropriate use of IRT models. In addition, the class covers topics in applications of IRT including equating/linking (as preliminary procedures for complex IRT models) and differential item functioning (DIF) analysis. [3]

PSY-GS 8882. Multilevel Modeling. [Formerly PSY-GS 321] This course covers multilevel (or hierarchical linear) modeling, which is used extensively in psychology, education, sociology, and medical research. The course covers the theory behind multilevel modeling, hands-on application to data, exposure to uses of multilevel modeling in the applied literature, and instruction in popular multilevel modeling software. Key topics include random effects ANOVA, random slopes, cross-level interactions, multivariate and multi-group models, centering, growth models, discrete outcomes, and dealing with cross-classified data. [3]

PSY-GS 8885. Applied Latent Class and Mixture Modeling. [Formerly PSY-GS 323] Often social science and educational researchers hypothesize that there are unobserved groups—or latent classes—of persons who show different behavioral patterns, or different patterns of change over time. This course covers mixture modeling, a statistical approach that allows assessment of the number and size of classes, as well as class homogeneity or heterogeneity. Longitudinal mixture models are also covered, which allow classes to transition between states at different rates and/or have different functional forms of change. [3]

PSY-GS 8888. Latent Growth Curve Modeling. [Formerly PSY-GS 322] The analysis of longitudinal data (repeated measurements on the same people over time) is central for evaluating many theories in social science and educational research. This applied course will focus on one flexible and powerful approach for analyzing within-individual change over time, and between-individual differences in change: the latent growth curve model. Emphasis will be placed on attaining a solid understanding of the statistical model, applications to real data, and interpretation of results. [3]

PSY-GS 8999. Non-Candidate Research. [Formerly PSY-GS 379] Research prior to entry into candidacy (completion of qualifying examination) and for special non-degree students. [Variable credit: 0-12]

PSY-GS 9950. Clinical Applications and Practicum I. [Formerly PSY-GS 390] This two-semester sequence is required for doctoral students in clinical psychology. The sequence involves applications of theoretical principles of behavior change in clinical settings. Didactic meetings will integrate the empirical and theoretical literatures with problems in clinical application. Students will participate in clinical practice (assessment and intervention) under program faculty supervision. Prerequisite: psychopathology, clinical assessment, and intervention, as well as consent of instructor. [1-3]

PSY-GS 9951. Clinical Applications and Practicum II. [Formerly PSYGS 391] This two-semester sequence is required for doctoral students in clinical psychology. The sequence involves advanced application of theoretical principles of behavior change in clinical settings. Students will participate in clinical practice (assessment and intervention) under the joint supervision of program faculty and adjunct faculty in community settings. Prerequisite: 9950 [1-3]

PSY-GS 9960. Readings and Research in Psychology. [Formerly PSY-GS 397] Individual programs of reading or empirical research in psychology. Prerequisite: consent of faculty supervisor. May be repeated. [Variable credit: 1-3]

PSY-GS 9980. Clinical Psychology Internship. [Formerly PSY-GS 392] Required of all Ph.D. students in the clinical program. Specialty rotations, generalized training, didactic instruction, and supervised research are offered during one full year of clinical experience in an academic clinical setting or similar internship facility accredited by the American Psychological Association (APA). Credit hours: students register for zero hours to reflect full-time involvement in supervised clinical psychology internship. Grading is on a Pass/Fail basis. [0]

PSY-GS 9995. Half-Time Ph.D. Dissertation Research. [Formerly PSY-GS 3995] For students who have completed 72 hours and devote a half-time effort to dissertation research. [0]

PSY-GS 9999. Ph.D. Dissertation Research. [Formerly PSY-GS 399]

Religion

REL 5101. Elementary Biblical Hebrew, Part I. [Formerly REL 2500] This is the first course in a two-semester sequence leading to a reading knowledge of the Hebrew Bible; concentration is on the basic elements and grammatical study of the language, leading students to begin reading from the original texts. [3] Staff.

REL 5102. Elementary Biblical Hebrew, Part II. [Formerly REL 2501] This is the second course in a two-semester sequence leading to a reading knowledge of the Hebrew Bible; concentration is on the basic elements and grammatical study of the language, leading students to begin reading from the original texts. [3] Staff.

REL 5103. Beginning Greek I. [Formerly REL 2600] Elements of ancient Greek. Reading of simplified texts from authors of the Classical, Hellenistic, and Imperial period, including religious scripture and related genres. [3]

REL 5104. Beginning Greek II. [Formerly REL 2601] This is the second course in a two-semester sequence of study leading to a knowledge of the New Testament. [3] Staff.

REL 5105. Intermediate Greek I. [Formerly REL 2602] Classical and Koine Greek. Review of Greek grammar and readings from classical and biblical texts. Open for credit to M.A. students only. [3] Gaca.

REL 5106. Elementary Modern Hebrew I. [Formerly REL 2514] Introduction to alphabet, the basics of grammar, and elementary conversation. [3] Staff.

REL 5107. Elementary Modern Hebrew II. [Formerly REL 2515] Emphasis on conversation and grammar. [3] Staff.

REL 5108. Intermediate Modern Hebrew I. [Formerly REL 3102] Modern Hebrew reading, conversation, and advanced grammar. Spring: greater emphasis on reading and writing. Prerequisite: one year of Modern Hebrew or its equivalent. [3] Staff.

REL 5109. Intermediate Modern Hebrew II. [Formerly REL 3103] Modern Hebrew reading, conversation, and advanced grammar. Spring: greater

emphasis on reading and writing. Prerequisite: one year of Modern Hebrew or its equivalent. [3] Staff.

REL 5120. Intermediate Biblical Hebrew. [Formerly REL 3814] Designed for students who have completed an elementary course in Hebrew and need more work in the areas of grammar, syntax, and reading of Hebrew texts. [3]

REL 5125. Ugaritic. [Formerly REL 3815] Elements of Ugaritic grammar, with reading in selected texts. Prerequisite: Elementary Biblical Hebrew. [3]

REL 5126. Arabic of the Qur'an and Other Classical Texts. Syntactical and morphological features of classical Arabic. Differences and similarities with modern standard Arabic in vocabulary usage, semantic extensions, and context; vocabulary borrowing. Texts drawn from the Qur'an, Hadith, and Sira (biographical) literature. [3]

REL 5247. Religion in the Global Context. This course explores the evolving relationships of religious traditions in the context of globalization. Religion, both theoretically and in practice, is a "global" phenomenon, and the world's religions are now recognized as major players in an increasingly interconnected world. This course, thus takes globalization as its orienting theory or description of social reality, and examines the role and place of religion in that context. What is globalization, and what is religion's relationship to it? How have religious traditions furthered globalization? How have they resisted it? What has globalization meant for religious identity and practice? What does it mean to be religious in the context of globalization? Over the course of the semester, we will: 1) study the key aspects of globalization as a social process; 2) examine the global religious landscape, and 3) identify and research key trends of religion in this context. 4) Finally, we will consider issues of global concern for religions: global health, poverty, and issues of gender and sexuality. [3] Mr. Reside

REL 5279. The Sacred and the Secular. Ethnographies of ritual and religious life. Politics of secularism and religious revival. Issues in anthropology, literature, and philosophy. Christianity, Hinduism, Islam, and Native American Religions. [3] FALL. Taneja.

REL 5353. Baptist History and Polity. [Formerly REL 2857] Investigates the origins, development, and theological positions throughout the history of the Baptist tradition and examines current trends in the tradition's polity. [3] Byrd.

REL 5355. History and Theology in the Christian Church, Disciples of Christ. [Formerly REL 3215] Study of the Disciples' origins and developments with particular emphasis on polity and current issues confronting the church. [3] M. Miller-McLemore.

REL 5411. Songwriting from a Theological Perspective. [Formerly REL 2566] This is a studio class where students concentrate on the production of songs in a theologically reflective environment. The course aims to meet the needs of students who come to VDS each year with an interest in communicating and educating through music.

REL 5412. Survey of Christian Congregational Song. This course will survey the various styles of congregational song that have been used in Christian worship from the beginnings of Christianity to the present day. By analyzing the texts and music of congregational songs from a global and ecumenical perspective, the goal is to prepare students for the variety of settings in which they will be charged to choose congregational songs for their specific contexts (whether inside or outside the church walls). Particular attention will be given to congregational songs from the 21st century and how they address topics including violence, poverty, immigration, and natural disasters, as well as justice issues of race, class, ethnicity, ability, sex, gender identity, and sexual orientation. [3] Ms. Budwey

REL 5432. Women and Religion. This course will explore the ways that femaleness and woman-gendered identities configure religious consciousness and performance across cultures and chronologies. Through an examination of women's sacred productions and roles in Native American, West African, Hindu, Muslim, Christian, Vodou, and other religious traditions, we will interrogate how religion shapes gender identity, and conversely, how woman-gendered identity informs religiosity. Finally, the course will analyze woman-centered movements, such as feminism and womanism, in light of religious women's experiences and seek new ways to categorize these experiences. [3]

REL 5434. Religious Narrative and the Self. [Formerly REL 3531] This course addresses a number of issues raised by autobiographical narrative in general, and by religious autobiography in particular. These include motivations (personal salvation, testimony or witness, therapy, to mobilize believers, to proselytize); relationships among self, family, God, and religious tradition; relationships among life, death, and afterlife; life before and after conversion; role of memory and narrative; multiple selves (remembered, remembering, writing, and presupposed, as well as the recovered or false); mind and body; oral vs. written; fact vs. truth; privacy vs. publicity; Ego vs. Self vs. non-Self; cultural, ethnic, gender, sexual, and religious differences; genre (confession, diary, memoir, novel, biography); as well as fundamental questions about the nature of autobiography: is it the narrative of how a self endeavors to know itself or, as understood from one contemporary critical perspective, by which a self constructs its own identity or, as understood by another contemporary perspective, how a narrative generates a fictitious self? In addition to the classic exemplars of the genre like Augustine and Rousseau, emphasis will be placed on the autobiographies of those for whom the dominant society has denied a self (in particular, African American and Jewish European,) as well as on the demands that an event like the Holocaust makes on the autobiographical and religious consciousness of those who have as it were survived their own deaths. [3] Geller.

REL 5440. Anti-Semitism and Jewish Identity. An historical and cultural analysis of the dilemmas Jewish emancipation presented to both Jews and non-Jews in Europe, examined through the study of a variety of popular and elite cultural representations of Jews. How anti-Semitism became entangled with the problems raised by modern understandings of gender, sexual, racial, class, and self identity. [3] Mr. Geller

REL 5456. Islam in Africa. Social and cultural development of Islam across Africa from the eighth century to the present, as illuminated by historical, ethnographic, and literary sources. Interplay between Muslims and outside religious groups, jihads in pre-colonial Africa, and Islam during European colonization. Attention to Sub-Saharan Africa. [3] Ms. Bell

REL 5458. The Golden Age of Islam. The history and origins of Islam are topics of increasing public interest and concern. Many have heard of Islam's Golden Age, the brilliant works of art and architecture, the medical and astronomical discoveries, the advances in literature, philosophy, and history writing, the spiritual subtleties of Sufism. Students wonder how the flowering of Islam led to today's rivalry between Shi'ites and Sunnis, or how the fierce partisanship of militants and extremists colored or pushed aside the cosmopolitan openness of an earlier age. This course aims to open up a richer, fuller appreciation of Islamic civilization than will be seen in the daily news feeds. It will provide the background needed to appreciate the rich diversity of Islamic culture and history indispensable for an informed encounter with our present world. Illustrated lectures, discussions, distinguished visiting speakers, and key artifacts will be part of the course experience. [3]

REL 5460. East Asian Buddhism. East Asian Buddhism is a vast subject. Many scholars have spent their entire careers working in just a corner of it. Rather than attempting a comprehensive survey, this course focuses on aspects of East Asian Buddhism carefully chosen to illuminate the powerful, variegated, long-lasting religion it was and still is. Readings include the Lotus Sutra and the famous Zen text known as the Platform Sutra. [3] Mr. Campany

REL 5466. Through the Eyes of the Other: A History of Muslim-Christian Relations. Charting the trajectory of mutual discovery through the following criteria: (1) official religious and political texts that delineate the contours of each religion vis-à-vis the other; (2) histories and narrative of significant episodic moments of rupture in the relationship between Islam and Christianity; (3) travelogues written from the Muslim and Christian vantage points to describe the other, and in so doing deepening the process of self-discovery and/or defending the salutariness of their own religion. [3] Mr. P. Lim and Mr. R. McGregor

REL 5475. Daoist Tradition. Historical and thematic survey of the Daoist tradition in China. Philosophical classics and religious scriptures, as well as social history are covered. Daoism today. [3] Mr. Campany

REL 5476. Myth and History in Religious Biography. Religious biography and hagiography as distinct literary genres. Hero mythology and narrative patterning. Ways religions construct unique biographical images

by combining the historical life with religious belief. Examples from lives of Jesus, Buddha, Muhammad, Luther, Caitanya, Shinran, and Mama Lola. Interpretive strategies include hermeneutic theory, modes of history, structuralism, and feminism; additional theoretical perspectives on translation, orality, and reader response criticism. [3] Mr. Stewart

REL 5477. Anthropology of Dis/Enchantment: Studying Religion in the Anthropocene. Problems, themes, or issues in anthropological theory and methods. [3] Mr. Taneja

REL 5492. Dante and Theology. Dante's poetic, philosophical, critical, and political work will be considered especially from the standpoint of the theological vision it promulgates and of the possibilities for aesthetic theology that it discloses. The course serves also as an introduction to Literature and Religion. The emphasis will be placed on Dante's *Paradiso* but also on the pertinence of his pre-modern theological ideas and passions as developed in *Convivio*, *De monarchia*, and *De vulgari eloquentia* for our contemporary and postmodern world. Dante's theology will be developed in its own context by comparison especially with Thomas Aquinas, Bonaventure, Meister Eckhart, and Duns Scotus, the last being his exact contemporary. Dante's own pioneering of a modern approach to theology in the context of an incipient secular world will be brought out, but also the implications of his expressly imperialist political theology for our global age and the tension between claims of universal truth and of negative theology. We will scrutinize, for example, issues of Transgression and Transcendence, or What Makes Religion Radical. [3] Mr. Franke

REL 6013. Warrior Chants and Unquiet Spirits. [Formerly REL 4013] A focus upon the Christian protest tradition, in historical and contemporary contexts, through the autobiographies of men and women who have used their voices and actions to address and to make significant differences in church and society. Analysis of personal descriptions and basic commitments for social justice form the framework for integrating spirituality with social witness. We study the relationship of the work of such movements within and beyond church structures. [3]

REL 6080. Womanist Thought in Religion and Psychology. [Formerly REL 3082] This seminar course will introduce students to, and deepen their engagement with, womanists' thought, and the methods, aims, approaches, and sources of womanist scholarship in religion and psychology. Womanist scholars situate black women's experience as the epistemological starting place for reflection, theory building and praxis; therefore, a primary presupposition of this course is that black women's particularity, and the challenges their experiences pose for existing perspectives, is integral to womanist approaches to psychology and religion and is the privileged source of knowledge building in this class. FALL. [3] Sheppard.

REL 6087. Psychology and Religion in Butch, Femme, and Queer Women's Ethnographies and Narratives. [Formerly REL 3087] This course is concerned with identity/identities, the formation of subjectivities in the midst of highly defined spaces as well as broader self-defined inclusive spaces. Questions related to religion, psychology, and culture will guide us as will questions such as what/who is a woman, what is butch-femme, and queer. All will be subjected to the contribution, challenge, and critique of lived experience. Pre-requisites: Graduate student in Religion or advanced DIV student. [3]

REL 6100. Ethics in Theological Perspectives. [Formerly REL 2758] This class will examine the central themes of morality, moral agency, deliberation, and moral discernment that define ethics as a discipline; students investigate the moral arguments from teleological, deontological, and utilitarian perspectives and study the philosophical and theological figures and different theological ethics that have had a sustaining influence on Christian ethics in the West. [3] Snarr.

REL 6177. Song of Songs. [Formerly REL 3177] The Song of Songs text, analysis of the literature, study of the religious significance and social background of the book, and its place in the theology of the Hebrew Bible. Prerequisite: knowledge of biblical Hebrew. [3]

REL 6500. The Hebrew Bible. [Formerly REL 2503] The life and thought of ancient Israel, with emphasis on the community's understanding of itself and of its role in history, are addressed in this course; concentration is upon both the problems of historical and literary interpretations and the Israelites'

religious practices and faith. Not available for Ph.D. credit in biblical studies. [3]

REL 6501. Literary Analysis of the Hebrew Bible. [Formerly REL 2513] This course focuses on narrative criticism of the Hebrew Bible, comparing it to similar methodologies (poetics, rhetorical criticism, etc.) and contrasting it with other forms of exegesis (historical criticism, deconstruction, etc.). Students will study key literary terms and discuss the elements that work together to form a story. The class will consider the narrator's voice in relation to the text and the reader, examining narrative omniscience, key type scenes, and themes in the Hebrew Bible and ancient Near Eastern literature.

REL 6502. Leadership in Hebrew Bible. [Formerly REL 3122] Using Jotham's fable (Judges 9) as a paradigm for leadership, this course examines various types of leaders in the Hebrew Bible and ancient Near East. Employing folkloristics, socio-historical criticism, and other methodologies, students will study the roles of kings, queens, priests, prophets, prophetesses, and other leaders in the ancient world. As students compare and contrast the ideologies and imagery associated with different types of authority, the class invites them to explore practical applications in their own vocations. [3]

REL 6503. History of Ancient Israel. [Formerly REL 3813] Examination of the major areas of debate in the reconstruction of the history of ancient Israel and analysis of the important extra-biblical sources that have contributed to the scholarship on ancient Israel's history. The course will also address the roles that ancient Israel's Near Eastern neighbors played in the development of ancient Israel's history. [3] Azzoni.

REL 6504. Modern Interpreters of Ancient Israel. [Formerly REL 3811] Characteristic approaches to the history and religion of ancient Israel, as seen in selected writings by prominent scholars since the Enlightenment. Attention to the presuppositions of each scholar and to the view of Israel afforded in each study. [3] Marbury.

REL 6505. Biblical Law and Ancient Israel. [Formerly REL 3116] The legal materials in the Pentateuch, their relation to the prophetic movement, and the role of law in ancient Israel's thought and society against the ancient Near Eastern background. [3] Knight.

REL 6506. Politics and the Economy in Ancient Israel. [Formerly REL 3120] The political and economic systems of ancient Israel, with attention to the impact of the centralized monarchic government on the economy of the country. Political processes, rights, and obligations are examined, as well as economic options, stratification, and commercial and property law. Biblical evaluations, especially prophetic critiques of the abuse of power, are explored. [3] Knight.

REL 6508. Death and Transfiguration in Pharaonic Egypt. [Formerly REL 3143] This course explores the conceptual world of Ancient Egyptian mortuary religion: how the ancient Egyptians viewed death and the afterlife, prepared the body for eternity, and created lasting funerary monuments. Attention will be given to how these concepts are evoked in Ancient Israel, and how they are presented today through museum exhibitions and in popular culture.

REL 6509. Exegesis Seminar. [Formerly REL 3802] Study of the principles, methods, and tools used in the critical study of the Hebrew Bible, including textual, historical-critical, ideological, literary, and other exegetical methods. [3] Seow

REL 6510. Empire and Canon. [Formerly REL 3806] Arguably, two eras of imperial domination, the Persian and Hellenistic periods, are the most literarily active in the formation of the Hebrew Bible. This advanced-level seminar looks at the Persian imperial context as the social world from which much of the Hebrew Bible emerged. Its seminal question, "How much did Persian imperial policy shape the writings of the early Second Temple priesthood?" will guide both the discussions and the readings. With this in mind, the course examines struggles between the priesthood, imperial authorities, and the Jerusalem populace and raises questions about specific biblical texts which may provide insights into these relationships. [3] Mr. Marbury

REL 6511. Book of Genesis. [Formerly REL 3125] General exegesis of the Book of Genesis, concentrating on the definition of its major themes and purposes. Hebrew language not required. [3] Sasson.

REL 6513. The Book of Exodus. [Formerly REL 3123] General exegesis of the Book of Exodus, concentrating on the definition of its major themes and purposes. If necessary, additional time may be allotted for those requiring extra work in Hebrew or in textual criticism. [3] Sasson.

REL 6514. The Exodus in African American Biblical Interpretation. [Formerly REL 3110] This seminar surveys the politics of African American biblical interpretation and the Book of Exodus in the 19th and 20th centuries. The seminar will rely entirely upon primary source materials. [3]

REL 6515. The Book of Deuteronomy. [Formerly REL 3825] An exegesis class on the Book of Deuteronomy, concentrating on defining the book's major themes and purposes as well as examining the book's poetry.

REL 6516. The Book of Numbers. [Formerly REL 3119]

REL 6517. The Book of Joshua. [Formerly REL 3829] An exegesis of the book of Joshua, with special attention paid to literary features, issues of historiography and archaeological evidence, ideological and religious concerns and relation to other texts of the Hebrew Bible, especially the Deuteronomistic History. [3] Knight.

REL 6518. Book of Job. [Formerly REL 3133] A study of the book of Job, attending to its literary features, religious themes, internal disputes regarding theodicy, and its relation to other texts from the region. [3] Seow.

REL 6519. Book of Qoheleth. [Formerly REL 3805] Israelite skepticism, with emphasis on the literary form, thematic coherence, and religious viewpoint of Job and Qoheleth, interpreted within the broad spectrum of Israelite wisdom and consideration of Greek influence. [3]

REL 6520. Book of Daniel. [Formerly REL 3828] An in-depth analysis of the Book of Daniel, with particular attention to the text's historical background and literary form. The place of the Book of Daniel within Prophetic and Apocalyptic literature will also be explored. [3] Mr. Seow

REL 6522. Sexuality in the Hebrew Bible and ANE. [Formerly REL 3135] Explores how various sexual practices (prostitution, homosexuality, heterosexuality, rape, sodomy, incest) are dealt with in the Hebrew Bible and in the larger context of the ANE. [3]

REL 6523. The Cultures of Mesopotamia and Anatolia. [Formerly REL 3148] Students will consider the cultural and religious milieus of Mesopotamia and Anatolia before Alexander the Great and their relationship to the Hebrew Bible. [3] Sasson.

REL 6524. From the Invention of Writing to Literary Classics. [Formerly REL 3823] This course will begin with the invention of writing in ancient Sumer and Egypt; the development of the writing systems in Mesopotamia, Egypt, Anatolia, and the origin and development of the alphabet in the Levant and its reflexes in Greek and Latin. The course will then explore various literary classics in that cradle of world literature. [3] Mr. Seow

REL 6525. Ancient Goddesses. [Formerly REL 3808] This course will examine how ancient cultures (Mesopotamia, Egypt, Ancient Israel, and beyond) conceived of the feminine divine, primarily through a survey of the available literature (myths, hymns, and prayers) and iconographic evidence (statues, plaques, figurines). The roles of specific goddesses, their spheres of influence, and their place in the various pantheons will be taken into account, while also paying attention to cultic practices and religious syncretism across the cultures.

REL 6526. Jewish Life in Persian Egypt. [Formerly REL 3824] The Aramaic documents from the island of Elephantine offer a unique portrayal of the life of a Jewish community in fifth-century Egypt BCE. In this seminar, students will learn to read the papyri and ostraca in the original language and script, and explore the historical, linguistic, and cultural implications of the documents in relationship with relevant Biblical material.[3]

REL 6527. Hellenistic Jewish Literature. [Formerly REL 3827] In the Second Temple period, Israel's ancient library of sacred texts was becoming the Bible. This period witnessed a proliferation of enormously versatile literary texts with religious themes written in the dominant languages of the time: Aramaic, Hebrew, and Greek. Those works that are left out the Hebrew Bible, but became a part of the canonical literature of the early Christian churches, we call here Apocrypha. Pseudepigrapha, conversely, is a vague term for the ancient Jewish national literature that grew around

biblical figures and events but was left out of the ancient scriptural traditions. In this course we will examine most of the Apocrypha and a selection of the Pseudepigrapha, in English, and compare them with the literature of a similar genre and period, such as testaments (Testament of Abraham, The Testament of 12 Patriarchs), romances (Joseph and Aseneth), tales of adventure (Books of Tobit, Judith, Esther), letters, apocalyptic literature, historiographies (1-2 Maccabees, Josephus), and philosophical essays (Philo). In these numerous readings of the primary sources, we will also look at the main contemporary methods of interpretation: midrash and allegory. The canonical issues, the scriptural and ecclesiastical authority of the Apocrypha and Pseudepigrapha, and their use and function in the confessional and academic setting will receive due attention.

REL 6529. Eighth-Century Prophecy. [Formerly REL 3108] A study of the prophetic literature against its ancient Near Eastern background; emphasis placed on the eighth-century B.C.E. prophets and on the contemporary significance of their message. [3] Marbury.

REL 6532. Marriage in the Beginning. An examination of different aspects (religious, legal, socio-economic) of marriage, through a survey of ancient Sumerian, Assyrian, Babylonian, Egyptian sources and the relevant sections of the Hebrew Bible. The variety of literary and historical texts will reveal a complex picture of how this institution developed at the very beginning of recorded history. [3]

REL 6534. Job, Literature, and Visual Arts. After an orientation of the book of Job as a literary work of art, the course will consider the reception of the story in literature. Lectures will include broad surveys of literature from various periods, cultures, and genres. Students will have opportunities to explore topics that are commensurate with their interests and areas of study, including English literature (or French, German, Spanish, Japanese), Jewish studies, theatre, and music. [3] Mr. Seow

REL 6535. Hebrew Poetry. This course explores the nature and modes of poetry in the Hebrew Bible in various genres through lectures, secondary literature, and close reading of selected poems. Prerequisite: knowledge of Biblical Hebrew. [3] Mr. Seow

REL 6543. Religion, Ecology, and Power in Africa. [Formerly REL 3543] As people increasingly worry over the environmental challenges that the world faces, this course will guide students through an exploration of the interwoven destinies of human beings, animals, and land across Sub-Saharan Africa. To begin, we shall consider how ideas about the divine origin and development of the earth and its peoples have influenced African social structure, ethnically-based occupations, and stewardship over the environment. From here students will examine further how power relations in pre-colonial Africa through the present-day have determined human-earth relations and how resources are cared for and consumed. We also shall discuss and debate the role of ritual in addressing environmental problems alongside ongoing issues regarding the management and ownership of African resources. [3]

REL 6546. Secularism. [Formerly REL 3546] As a cultural phenomenon commonly associated with the contemporary world, especially the modern Western world, secularism is not mere atheism or anti-religion. Rather, it advocates or assumes a separation of government, education, and other social institutions from religious authority. The course aims to survey the complexities of secularism from a variety of angles: history, geographical variations, philosophy, religion, ethics, law, sociology, economics, psychology, education, literature and art. Prerequisite: Prior coursework in the humanities and social sciences. SPRING. [3]

REL 6548. Middle Egyptian Hieroglyphs. [Formerly REL 3141] Ancient Egyptian culture has captivated western societies for centuries, and the hieroglyphic writing system is particularly fascinating. In this class, we will focus on Middle Egyptian, the "classical" language of Pharaonic Egypt. You will acquire a solid grounding in Middle Egyptian grammar and be able to sample hieroglyphic texts that were written during four millennia. Additionally, you will gain valuable insights into ancient Egypt culture. [3] Ms. Azzoni

REL 6550. Akkadian I. [Formerly REL 3831] Elements of Akkadian (Assyro-Babylonian) grammar, with reading in selected texts. Consent of the instructor required. [3] Sasson.

REL 6551. Akkadian II. [Formerly REL 3832] Reading in selected historical, mythical, legal, and epistolary texts. Consent of the instructor required. [3] Sasson.

REL 6552. Introduction to Classical Syriac. [Formerly REL 3821] Classical Syriac (also called "literary" Syriac—*ktabanaya*) is a dialect of Aramaic that flourished for over a millennium in the Middle East and Asia. Today, perhaps more than ten thousand manuscripts written in Classical Syriac survive; many are unique sources for the history of Judaism, Christianity, and Islam. Reading classical Syriac literature is thus of interest to a variety of scholars including ancient and medieval historians, classicists, scholars of religious studies, biblical scholars, and comparative linguists. In this course students will learn the basic structure of Classical Syriac grammar and learn to read simple texts from the Syriac translations of Christian and Jewish scriptures. Students will learn Syriac using J.F. Coakley's revision of Robinson's *Paradigms and Exercises in Syriac Grammar*, rev. ed. (2013). No specific linguistic pre-requisites are required, but students must have previously studied at least one language besides their native language. [3] Michelson.

REL 6553. Historical Hebrew Grammar. The course will offer a diachronic overview of the Hebrew Language, tracing its origin in connection and comparison with other Semitic languages, particularly within the Northwest Semitic subgroup. Different theoretical models will be discussed, and comparative Semitics data will be offered to examine linguistic features, with specific focus on phonology, morphology, and the lexicon. [3]

REL 6554. Readings in Reception Theory. A directed reading course in reception theory. [1] Mr. Seow

REL 6555. Consequences of Scripture. This course considers the "history of consequences" (variously called "history of interpretation," "history of reception," and "history of effects") of the Hebrew Bible/Old Testament, as evident in Jewish, Christian, and Islamic commentaries, theological writings, literature, liturgy, music, and visual arts. [3] Mr. Seow

REL 6571. African American Biblical Hermeneutics. [Formerly REL 3882] Surveys the field of discourse in African American biblical scholarship from its beginnings through the twenty-first century; students will analyze the work of the most prominent hermeneutics; discussions will emphasize the social and ideological currents that have contributed to the development of African American biblical hermeneutics as resistance discourse. [3] Marbury.

REL 6575. Old Testament Theologies. [Formerly REL 3107] Traces Old Testament Theology in modern biblical criticism from the late 18th century through the mid 20th century. The class will turn to primary sources to engage both the major expressions and major critiques of the enterprise. [3]

REL 6580. North-West Semitic Epigraphy. [Formerly REL 3820] Participants in this course will read from Hebrew, Aramaic, Phoenician, and Moabite texts, and emphasis will be placed upon relevant grammatical analyses. Prior to enrolling in this language course, students must demonstrate a proficient knowledge of Hebrew. [3] Azzoni.

REL 6600. The New Testament. [Formerly REL 2511] How the New Testament shows the main characteristics of early Christianity as compared and contrasted with early Judaism and with Hellenistic religions. Religious authority in early Christian communities and the types of faith and ethics found within the New Testament traditions. [3]

REL 6603. The Gospel of Mark. [Formerly REL 3170] This course addresses various theories concerning Mark's historical context, narrative art, Christology, depiction of the disciples, political views, and presentations of gender, ethnicity, and social status. Students taking this course will consider the Gospel in its Roman imperial context, economics (e.g., money and trade, rich and poor), social groups (e.g., slaves, military, government officials, religious leaders, patrons and clients, beggars, women and children, families), Christology, and ecclesiology. Discussion will attend both to what the text might have meant in its first-century context and what it might mean for how it has been used by readers today. [3] Levine.

REL 6604. The Gospel of John. [Formerly REL 3164] This course addresses various theories concerning John's historical context, narrative art, Christology, depiction of disciples, dualistic language and depictions of those outside the circle of Jesus-believers (e.g., "the world" "the Jews"), presentations of gender, ethnicity, and social status; eschatology (futur-

ist, realized), and use/misuse within Christian teaching and preaching. [3] Levine.

REL 6605. Readings in Greek: The Gospel of John. [Formerly REL 3183] This upper-level course focuses on the Greek text of the Fourth Gospel. Along with exegetical questions prompted by thesaurus of biblical approaches, attention will be focused on the style, nuances, and intertextual echoes of John's narrative. The pre-requisite for enrolling in the course is successful completion of course work in the Greek language. [3] Levine.

REL 6607. Acts of the Apostles. [Formerly REL 3347] Exegesis of selected passages from Acts 1-15 with foci on various methodological perspectives. Greek required. [3] Levine.

REL 6608. Jewish/Christian Relations. [Formerly REL 3510] This course offers a brief history of relations between Christians and Jews and invites participants into critical engagement with present practices in light of that history. [3] Ms. Levine and Mr. Lim

REL 6609. Feminist Interpretations of Scripture. [Formerly REL 3169] Examination of the representations of women, religious and ethnic "others," and sexuality in biblical and contemporary noncanonical (ANE, Pseudepigrapha, Gnosticism) texts, utilizing various approaches (literary, historical, anthropological, ideological, Womanist, Mujerista). [3] Levine.

REL 6610. The Pauline Interpretation of Christianity. [Formerly REL 3162] Pauline Christianity and its place in the early church, using the letters of Paul, the deutero-Pauline letters, and the portrait of Paul in Acts. Attention to the problems of method. Greek not required. [3] Patte.

REL 6611. Global Interpretations of Christian Scriptures. [Formerly REL 3845] This course will compare the interpretations of biblical texts by Christians in Africa, Asia, Latin America, and Oceania-where at present two-thirds of the readers of the Bible are-with those by Orthodox Christians in Eastern Europe and the Middle East, and by Catholic and Protestant Christians in Western Europe and North America.

REL 6612. Semiotics and Biblical Studies. [Formerly REL 3159] Why are several, different, and often opposed interpretations of the same biblical text equally legitimate and plausible? (This is the question raised by Ricoeur in *The Conflict of Interpretations*, and by Fish in *Is There a Text in This Class?*, and also raised by the shelves of diverging scholarly commentaries on the same biblical book.) Thus, why do interpreters of the Bible have the moral responsibility of choosing among these legitimate and plausible interpretations one which "does no harm" and to take the risk of choosing an interpretation which will be helpful, liberating, and constructive by challenging systemic evil? Semiotic theories address these questions by providing theories of the way meaning is produced through the interaction of texts, intertexts, contexts, and readers. Most helpful in biblical studies are the semiotic theories of Umberto Eco (*A Theory of Semiotics* and *The Role of the Reader*), A.-J. Greimas (*Semiotics and Language*), who opens the possibility to account for *The Religious Dimensions of Biblical Texts*), and their applications in biblical studies by Mieke Bal, in *Narratology: Introduction to the Theory of Narrative; On Meaning-Making: Essays in Semiotics*; and her spectacular study of Judges 4 and 5, *Murder and Difference: Gender, Genre, and Scholarship on Sisera's Death*; and *Loving Yusuf: Conceptual Travels from Present to Past*, in which she reads biblical texts together with modern literature, feminist issues, visual art, and other religious texts (in the latter case, the Qur'an). [3]

REL 6614. Readings in Greek: The Parables of Jesus. [Formerly REL 3161] Examining the nature of parable as form, the history of the interpretation of parables, the study of parables in the setting of the ministry of Jesus and the theology of the Evangelists, and literary criticism and the interpretation of parables. [3] Levine.

REL 6616. Greek Readings: The Gospel of Matthew. [Formerly REL 3165] Through analytical approaches such as historical-critical, literary, sociological, and ideological, students will reconstruct Matthew's audience, both actual and ideal, and explore the topics of Christology, ecclesiology, debates with the synagogue, politics, and artistry of composition. [3] Levine.

REL 6617. Gospel According to Luke. Exploration of Luke's compositional techniques, possible sources, Christology, community formation, and ethics, utilizing a variety of approaches (socio-historical, literary, ideological, feminist). Knowledge of Greek required. [3] Levine.

REL 6618. Christian-Jewish Relations in Medieval and Early Modern Europe. Political and cultural history from the medieval persecutions to the expansion of legal toleration in the Enlightenment; close consideration of legal toleration, banishments, re-admissions, and the impact of Christian reform movements. [3] Mr. Price

REL 6641. New Testament Studies: Ethos and Locus, Methods and Theories. [Formerly REL 3830] Current methods of New Testament analysis, including textual, source, form, redaction, sociological, semiotic, and literary criticisms. [3]

REL 6642. New Testament Studies II: Ideological and Cultural Criticisms. [Formerly REL 3839] This course constitutes the second part of a two-part introduction to New Testament Studies as presently conceived and practiced. It is an advanced course, presupposing previous and substantial work in the field and designed primarily for students in the Graduate Department of Religion. The course is also open to advanced and students in either the M.Div. or the M.T.S. degree program, although with permission of the instructor required. Contemporary biblical criticism may be approached in terms of five interpretive paradigms, each with its own distinctive though complex mode of discourse: historical criticism; literary criticism; sociocultural criticism; ideological criticism; cultural criticism. This second part will examine the role and future of biblical criticism in general as well as the methods and theories at work in the paradigms of ideological and cultural criticism. Its goal is to provide a comprehensive, critical picture of the discipline in terms of differential formations and relations of power as well as of different traditions of reading. The course will encompass three major components. First, a general introduction to the history of the discipline from the 1970s through today, with a focus on the questions raised by ideological and cultural criticisms. Second, sustained analysis of various ideological approaches (feminist and materialist criticisms, ethnic-racial and queer criticisms, postcolonial criticism, disability and ecological criticism) as well as focused consideration of cultural criticism, problematics, trajectories, critiques, interdisciplinary conversations. Finally, a brief view at both the role and the future of biblical criticism.[3]

REL 6643. Materialist Biblical Criticism. [Formerly REL 3550] Focuses on the question of political economy and the resultant constructions and relations of social class, an angle of vision closely associated with the liberation criticism of the 1970s and beyond but also with roots in earlier Marxist approaches to the Bible; the course deals with the juncture between economic studies and biblical criticism, both with regard to the texts and contexts of early Christianity and the interpretations/interpreters of such texts and contexts in modernity and postmodernity; course will consider a study of political economy, approaches to the political economy of the Roman Empire, and the trajectory of materialist criticism. [3] Mr. Segovia

REL 6644. Racial-Ethnic Biblical Criticism. [Formerly REL 3344] Students participating in this seminar will analyze the juncture between Early Christian Studies and Racial-Ethnic Studies with a focus on the problems of race and ethnicity in biblical texts and contexts as well as in modern and postmodern interpretations and interpreters. The grounding phenomenon of migration; representations of Self and Others, signification of race and ethnicity, approaches to race and ethnicity in the Roman Empire; approaches to race and ethnicity in early Christian texts and contexts are among the topics students will explore. [3] Mr. Segovia

REL 6645. Political Biblical Criticism. [Formerly REL 3345] An analysis of the methods and goals of contemporary Biblical interpretation in Latin America. [3]

REL 6646. Postcolonial Criticism. Analysis of the juncture between Early Christian Studies and Postcolonial Studies, with a focus on geopolitics and imperial-colonial formations and relations, in biblical texts and contexts as well as in modern-postmodern interpretations and contexts. [3] Mr. Segovia

REL 6648. Imperial Biblical Criticism. This course addresses the problematic of geopolitics-the differential formations and relations of power revolving around the axis of imperial-colonial frameworks-and the tradition of imperial biblical criticism. As such, the course deals with the juncture between Early Christian Studies and Empire Studies. Its focus is twofold: the world of production-the texts and contexts of early Christianity; and the world of reception-the texts and contexts of geopolitical interpretations and interpreters of early Christianity. Topics to be addressed include: (1) the tra-

dition of Empire Studies as a field of studies; (2) the analysis of the imperial-colonial framework of Rome, including its religious-theological dimensions; (3) overview of geopolitical approaches to the texts and contexts of the New Testament; and (4) the significance and relevance of such study in our contemporary social-cultural world, especially our religious-theological world. [3] Mr. Segovia

REL 6700. History of Global Christianities I. [Formerly REL 2701] This course surveys key themes in the origins, spread, and diversity of the various movements that identified themselves as “Christian” from the second century of the current era to year 1700. Students will be introduced to selected cultural, social, political, religious, and intellectual contexts in which Christian communities formed in the Middle East, Africa, Europe, Asia, and the Americas. Throughout the course, students will learn and apply historical methods of inquiry. The primary purpose of the course is for students to use primary sources to investigate questions of doctrine and practice, religion and politics, the creation of institutions, and varieties of Christian experience and identity. These questions are examined within a wider context of pre-modern to early modern global history. Special attention will be given to recovering voices and perspectives lost or muted in the sources. This is the first of the two-course sequence in History of Global Christianities. The course focuses especially on two formative periods: Christian formation in Late Antiquity and again surrounding the reformations beginning in the 1500s. [3]

REL 6701. Introduction to Christian Worship. [Formerly REL 2706] This course will examine the history, theology, and practices of Christian worship from global and ecumenical perspectives with the goal of preparing students for ministry (broadly defined), including the planning of worship, occasional services, and other rituals. Particular attention will be paid to helping students think critically as practical and pastoral theologians as they design and lead worship in their specific contexts while also being attentive to how justice issues such as race, class, ethnicity, ability, sex, gender identity, and sexual orientation affect and are affected by worship. [3] Ms. Budwey

REL 6702. Art and Empire from Constantine to Justinian. [Formerly REL 2713] Participants in this course will engage in an interdisciplinary study of Roman social, political, religious, and art historical developments in the fourth through sixth centuries. [3]

REL 6703. Mary, Mary Magdalene, and Eve in Christian Art, Text, and Tradition. [Formerly REL 2707] Christian art historically has depicted the Madonna and her “sisters”, Eve and Mary Magdalene, in diverse ways that largely reflected their distinct but related roles in Christian theology and devotional practice. Recently, fiction writers, art historians, theologians, feminists, and even archaeologists have focused renewed attention on all three figures. This course will consider the many variations and intersections of their stories along with the visual and material culture associated with them. It also will consider contemporary assessments of their place in visual art and Christian tradition, addressing questions about the ways their images have been deployed as archetypes of feminine purity, sensuality, independence, and penitence. [3]

REL 6704. Gods, Rulers, and Saints: Portraits in Roman and Christian Art. [Formerly REL 2714] A study of the social, political, and religious function of portraits from the first century through the sixth century C.E., this course considers various problems of representing physical appearance, including the construction of identity, social status, and mediation of presence through image. Other issues that will be addressed include portraits as memorials, as objects of veneration, and as idealized models. The course will conclude with a brief discussion of the ways in which ancient portraits continue to influence or guide the visual construction of likeness. [3] Ms. Jensen

REL 6706. The History of Monasticism. [Formerly REL 3175] This course examines the rise of Christian asceticism in Late Antiquity. Students will study the specific historical and geographic contexts of the development of monasticism in Syria, Egypt, and its spread across the Mediterranean and beyond. The course will be primarily focused on interpreting the large body of ascetic literature which developed from the fourth through sixth centuries. Students will read various genres and monastic theologians including the sayings of the Desert Fathers and Mothers, Athanasius’ *Life of Anthony*, Gerontius’ *Life of Melania the Younger*, the works of Evagrius

Ponticus, Isaac of Nineveh, Philoxenos of Mabbug and others. The course will also examine the legacy of desert spirituality for later Christian traditions and for contemporary theology and monastic practice (such as in the work of Roberta Bondi or Thomas Merton) [3] Michelson

REL 6708. History of Global Christianities II. [Formerly REL 2703] This course aims to acquaint divinity students with the history of the North American religious cultures and those of the global South as recipients and participants in a broader movement of Christianities in time and across space. Key moments to be explored include colonialism, slavery, interchristian rivalry, evangelicalism, participation in democratic, reform, and military institutions, and the world missionary movements—old and new. The term begins with the transmission of European and African peoples and religious traditions to the Western hemisphere in contact and interaction with indigenous peoples. Key moments to be explored include colonialism, slavery, interchristian rivalry, evangelicalism, participation in democratic, reform, and military institutions, and the world missionary movements—old and new. The second half of the semester moves with much of the modern Christian population to the so-called global South. Growth of 19th century colonial mission field and earlier Christian churches will be tracked in Africa, Asia, and Latin America. The growth of worldwide Pentecostalism and indigenous churches will figure strongly, along with the Western Christian traditions of Roman Catholicism and Protestantism but also to Eastern Christian churches and the global Christian communities of the modern era. Throughout the semester students will explore the distinctions of East or West, North or South, national or transnational, marginalized or majority, lay or clerical, as well as the dynamics of gender, race, class, sexuality which have influenced variegated Christianities around the globe. [3]

REL 6709. Religion, Culture, Politics in Post Reformation England. [Formerly REL 3978] The course will examine the interaction between religious change and politics in the period after the reformation. The focus will be on the Elizabethan and early Stuart periods. Emphasis will be given to questions of “political culture”; the ways in which the peculiar exigencies of the Elizabethan regime, in Collinson’s phrase “the Elizabethan exclusion crisis,” led to various experiments in the ways in which politics was conducted. Central here will be the notion of the monarchical republic of Elizabeth I and the politics of popularity and the various monarchical reactions thereby provoked. The doings of both catholics and puritans will be examined and a wide range of primary sources will be consulted. Various literary texts will also be used.

REL 6710. History of Anti-Trinitarian Theology. [Formerly REL 3250]

REL 6711. The History of Theodicy in the Christian Traditions. [Formerly REL 3234] The story of Christianity has the notion of God who suffers with and in our place at its crux. This course surveys the variegated histories of Christian attitudes toward and responses to evil and suffering: both individually, ecclesially, both in its theology and praxis. Readings will range from Dorothy Day to Irenaeus of Lyons, from Toni Morrison to Shusaku Endo, from Karl Barth to Hannah Arendt. Particular attention will be given to the contemporary issue of human trafficking and global economic disparity and its global impact.

REL 6713. Seminar in Late Antiquity. [Formerly REL 2716] This course is a survey of the scholarly literature on the transformation of the Roman world (its state apparatus, society, and culture) from the third through seventh centuries of the current era. We will study the end of the classical world and the origins of Byzantium, the Islamic world, and the medieval West. This class will review historiography on the questions of the fall of Rome and the birth of the heirs to Roman civilization. The course will present key themes for analysis of late Roman society such as wealth and poverty, the crisis of the third century, Roman imperial ideology, gender roles and family structures, the rise of Christianity, the geographic divisions of the Empire, and the last great war of antiquity. Particular attention will be paid to religious practices, communities, and institutions in the later Roman world. Students will gain an overview of scholarly literature on Greek and Roman religious institutions, Jewish, Christian, Manichean, and Muslim communities and a wide range of religious practices. Together, we will traverse recent scholarship concerning a variety of evidence including geography, material evidence, and primary source texts. Students will be encouraged to formulate their own positions with regard to current scholarly debate on the following

questions: How did the Roman world change in late antiquity? Why did these changes develop and what alternative trajectories existed? [3]

REL 6715. Images of Mary in Christian Thought and Practice. The first half of this course will survey the history of Marian theology and devotion from an ecumenical perspective. The second half will focus on engaging with contemporary explorations of how Mary can be reclaimed and seen as a liberating figure, drawing from feminist, Latinx, queer, and womanist perspectives. Particular attention will be paid to how the art—particularly music and the visual arts—have been and are being used to both reinforce oppressive views of Mary as well as create new and liberating views of Mary. [3] Ms. S. Budwey

REL 6722. History of Syriac Christianity. [Formerly REL 2722] This course is a seminar on Syriac Christian traditions. Syriac is a dialect of Aramaic which was influential in the spread of Christianity across the Middle East and Asia. By the time of the rise of Islam, Syriac-speaking Christian communities could be found in what today would be a region stretching from modern day Lebanon across Iraq and the Persian Gulf on to India, Central Asia, and China. In the Middle Ages, Syriac culture and literature flourished as a cultural bridge between the Byzantine Empire and the Islamic states of the Middle East. In the modern era, Syriac communities have continued to persist to the present as minorities in the Middle East and India and in a global diaspora. This course surveys the history of these communities, the theological literature that they produced, and historiographical debates about their origins and development. [3]

REL 6723. History of Early Christian Poetry. This course explores the writing and reception of Christian verse from Late Antiquity and the early Middle Ages. Students will study the specific historical, cultural, and geographic contexts for the development of early Christian poetry (roughly from the New Testament era to the 9th century). The course will examine a variety of genres including classical Greek and Roman styles (e.g. epic poetry, elegiac couplets, epigrams, and Virgilian imitations) and emerging early Christian forms (e.g. translations of Biblical psalms and verse, hymns, poetic sermons and Biblical interpretations, liturgical texts, and verses in praise of Christians saints). All readings will be done in English translations of texts from variety of the linguistic traditions including Syriac, Greek, Latin, Armenian, and Old English. Readings will include the work of Ephrem the Syrian, Proba, Gregory of Nazianzus, Basil of Caesarea, Prudentius, Romanos, Rade Gund, Kassia and anonymous texts including the Dream of the Rood. Students will also examine the impact of early Christian poetry on later Christian imagination including its influence on later authors and musicians such as in the work of J.M. Neale, Christina Rossetti, and John Tavener. Lastly, students will have the opportunity to add their own voices to the long legacy of Early Christian verse through interpretation, composition, or other engagement with the tradition. [3] Mr. Michelson

REL 6729. The Historiography of American Religion. [Formerly REL 3251] This course focuses on the major important interpretive accounts of the history of American Religion. The course is designed especially for graduate students who intend to specialize within, or take a doctoral exam on, the field of American religious and church history, key problems and significant monographs in the field. [3] Hudnut-Beumler, Byrd, Flake.

REL 6730. The History of Religion in America. [Formerly REL 2750] The history of the religions in America beginning with colonial religious experiments in the New World. Examines American "church history" as well as the influence of non-Christian religions in American culture. [3] Dickerson.

REL 6731. Religion and War in American History. [Formerly REL 3230] An examination of complex interactions between religion and war in American history. Considers the various functions of religion in social and political crises, contrasting theological interpretations of violence, and the religious construction of national identity through warfare. [3] Byrd.

REL 6732. Theology in America 1630-1865. [Formerly REL 3233] Theology in America from the arrival of the Puritans through the Revolutionary period was a complex mixture of academic doctrines and popular beliefs. The scope of theological ideas extended beyond religious institutions to influence cultural patterns and social issues such as war, slavery, religious persecution, and the nature of citizenship. This intermediate-level seminar examines various theologies in America, including an examination of key theologians (broadly considered) and important themes and traditions, in-

cluding the Reformed Tradition, Antinomianism, political theologies, revivalism, and Deism. [3] Byrd.

REL 6733. Seminar: American Revivals. [Formerly REL 3853] This course examines selected revivals in American Christianity from the colonial period through the twentieth century. We will focus on the varieties of revival practice, including the ways in which revivals have interacted with views of ministerial authority, doctrine, the body in worship, social reform, and church architecture. Primary and secondary resources will include texts and audio-visual representations of revival experience.

REL 6734. American Apocalyptic Thought and Movements. [Formerly REL 3207] This course explores apocalyptic and millennial ideas and movements in North America from the colonial period to the present. The primary focus will be on apocalyptic themes in relation to social and political crises in the history of the United States. Particular attention will be given to apocalyptic images and ideas in popular culture.

REL 6736. America's Bibles. [Formerly REL 3218] This course asks why and to what ends have Americans produced so many kinds of Bibles; not just different translations, but different versions of the same translation? Students will examine that history of Bible creation to understand better what it tells us about particular religious communities and American religion generally. In doing so, students will consider the broad themes of American religious history, such as race, gender, nationalism, millennialism, and science and will use such theories as narrative criticism and material Christianity. Most broadly this course invites students to consider the significance of the Christian Bible to the creation and display of a variety of religious and no-so-religious meanings throughout U.S. history. Thus, students will study the Bible as both a sacred text for some and an unavoidable cultural object for all Americans. [3] Mr. Byrd

REL 6738. Jesus in Modern America. [Formerly REL 3212] The period from 1880 to 2000 featured a high level of American cultural interest in Jesus of Nazareth. More books were produced on Jesus during this period than on any other biblical figure. Through various modes of cultural production—plays, novels, movies, biblical commentaries, theologies, and moral essays—Americans depicted Jesus to meet their needs and conceptions of who this man was and what he represented for their congregations. Students will examine a wide range of "American Jesuses." [3] Hudnut-Beumler.

REL 6739. American Religious Intolerance. [Formerly REL 3221] This course studies the art of religious defamation as evidenced by 19th and 20th century exposés and memoirs. The following questions guide our study: what are the enduring anxieties that beget and tropes that express religious prejudice; what do they tell us about American society and culture; and how may these anxieties and prejudices be recognized in contemporary culture and ourselves. Memoirs and exposés comprise the focus of course readings, while secondary literature provides the context and theoretical frame for our study of intolerance more generally. This term, anti-Catholicism and anti-Mormonism will provide our chief case studies, but the assignment structure and some reading assignments encourage application to other groups. Class discussion will be oriented to identifying the manner in which past and present religious prejudices continually inform one another, both sustaining and imaginatively reshaping meanings to fit instant anxieties and disparate religious groups. At the end of the course, students will better understand the history of religious intolerance in America; recognize the enduring tropes of religious intolerance; be able to critically engage such tropes as applied to different religions; and be more adept in identifying their own prejudices. Grades will be based on contribution to seminar discussions and completion of a research paper. [3]

REL 6741. Contemporary Issues in American Religion. [Formerly REL 3210] This course invites students to reflect upon our inheritance from the late twentieth century. We will not march through the years but will consider important themes, key developments, pivotal moments, and still significant writings in order to understand better our contemporary situation. Specifically, we will study how religion has and is responding to recent social crises and cultural developments. Three themes will frame our subject. We will look at the state of organized religion, as well as consider what it means to be "spiritual not religious." Second, by examining civil rights and wrongs, including but not limited to race, we will attempt to better understand the

diverse political strategies employed by religious people. Finally, not just the public, but also the private sphere deserves attention. We will look at religious interests in the sexual revolutions (broadly construed) of the last few decades. This allows us to consider, among other things, the continuing challenge science poses to religious values and worldviews. Certainly, other topical frameworks could be developed and additional sub-topics explored. The reading done for the paper assignments will facilitate your working on topics of particular interest or delving more deeply on ones listed here. Moreover, there will be room on the syllabus for the class to suggest additional themes. A book review, two short papers, and an even shorter class presentation will be required. [3]

REL 6744. The Evangelical Protestant Movement In America. [Formerly REL 3227] An examination of evangelical traditions from the colonial period to their present manifestations in twentieth century America, with some attention to the European background. Special attention is devoted to debates concerning the authority and inerrancy of scripture, theology, church-state relations, the role of the Christian in society, education, the relationship between science and religion, the church and racism, the moral character of America, and other areas of cultural cleavage. Cultural conflict or “wars of faith” between conservative black and white Christians studied in terms of their historical significance and political implications. [3] Baldwin.

REL 6745. Evangelicalism, Pentecostalism, and the Shape of World Christianity. [Formerly REL 3226]

REL 6746. Material History In American Religion. Enables students to become familiar with the use of non-textual sources to help recover the historical record, and aid in the interpretation, of people and movements in American religious history. The first half of the seminar will consist of analysis of exemplary techniques for reading the material culture and evidence of the religious past. The second half will consist of hands-on fieldwork and interpretation of aspects of American religion such as dress, architecture, food ways, rituals, money practices, visual imagery, music, and the use of time. [3] Hudnut-Beumler.

REL 6747. Christianity and Secularity in Conversation: Past, Present, and Future. One of the most interesting aspects of Christianity is its seemingly contradictory nature. On the one hand it appears to be capable of an almost indefinite number of theological and institutional expressions, and on the other hand it is often spoken of as an important, if not primary, source of the alleged unitary social imagination of “Modern Western” society (viz., individualism, rationalism, secularism, etc.). The purpose of this course is to equip students to engage differences among Christians by better understanding the history of the theological and social causes of those differences, with the hope that such understanding will prepare students to better engage members of the various Christian traditions as well as the relationship between Christianity and modernity. The course will begin by considering the variety of sixteenth-century Christian reforms, tracing their legacies through the social and political turmoil of the 17th century. It will then examine the role of Christianity in the variety of theories of secularization and their critics. Finally, it will trace the rise and evolution of the varieties of evangelicalism, considering their complex relationships with other Christian traditions and Islam, particularly in North America. [3] Mr. Martin

REL 6748. History of Religion in the American South. This seminar examines the religious history of the American South from colonization to the present with an emphasis on racial, regional, and gendered aspects of the history. Readings will focus on the interpretation of religion in the South by diverse contemporary historians. Topics include: slave religion, “lost cause” religion, Jewish life in the South, the freedom movement, gospel and blues music, megachurches and the prosperity gospel. [3] Mr. Hudnut-Beumler

REL 6762. Religions of the African Diaspora. [Formerly REL 2864] This course is a survey of the religious traditions of people of African descent by exploring the historic and phenomenological connections among diverse religious beliefs, values, rituals, institutions, and worldviews throughout the African Diaspora. Using several methodological and theoretical approaches, the course will explore various forms of experiences and practices that provide a deep understanding and appreciation of the sacred meaning of human existence (myth, doctrine, prayers, rituals, institutions, and symbols) drawn from African-derived faith communities dispersed across the Atlantic World such as indigenous African religions, Christianity, Judaism, Islam, Vo-

dun, Santería, alternative religious movements, and humanism amongst others.

REL 6763. Religion, Slavery, and the American Civil War. [Formerly REL 3243] This seminar examines slavery in relation to the religious history of the American Civil War. Based on reading and discussion of primary and secondary sources, the seminar will begin by assessing the development of slavery in colonial America and its relation to religious groups through the American Revolution and the early republic. The seminar will examine religious themes in the debates, protests, and revolts over slavery in the nineteenth century. In addition, the seminar will examine broadly the religious history of the Civil War and its aftermath. [3]

REL 6764. Slave Religion and Culture in the American South. [Formerly REL 3852] The cosmologies, theologies, ethics, rituals, and material realities of enslaved Africans and African-Americans beginning in pre-colonial Africa and ending in the Civil War. Music, Movement, Myth, Magic, and Sexuality. [3].

REL 6765. Black Church Studies. [Formerly REL 2863] This course is an introductory exploration of the historical legacy, progressive traditions, spiritual depth, and social witness of the Black Church as it has been studied through theories and methods that make up the interdisciplinary field of Black Church Studies. Towards this end, we will take a definitive look at the various Black Church Studies sub-disciplines, namely: Black Church History; African American Biblical Hermeneutics; Black Theologies; Black Church, Culture, and Society; African American Social Ethics; African American Pastoral Care, Black Christian Education; African American Worship; and Black Preaching.. The course will also facilitate opportunities for the intellectual, professional, and inspirational development of transformational leadership for students interested in working in or in collaboration with African-American Christian churches and communities. [3] Mr. Floyd-Thomas

REL 6766. Black Religion in Context: Harlem. [Formerly REL 2867] This course examines the dynamic issues of racial identity and religious diversity within a specific social context. New York City’s Harlem will serve as a case study to focus our religious imaginations on the issues of race, religion and social transformation in the United States. Special emphasis will be paid to the Black religious tradition in Harlem and how its religious communities are adapting to pressing social issues and other elements of change such as immigration, urbanization, poverty, and globalization. Also critical to this examination are the ways in which the Black Church tradition adapts to different cultural settings and interacts with other world religions as it attends to the religious pluralism of the twenty-first century world. The course is designed as an interdisciplinary study, and a wide range of methodologies and perspectives will be utilized to investigate these issues. [3]

REL 6767. Cultural Significations and Black Religion. [Formerly REL 3545] This course focuses on the origins and varieties of religious experience—scriptural interpretations, ritual practices, mythical narratives, symbolic representations, cultural artifacts, vernacular folk traditions, sociopolitical ideologies, and power dynamics—that historically have been subsumed under the heavy-laden concept of “Black religion.” Utilizing the work of pioneering historian of religion Charles H. Long, considerable attention will be paid to the process of signifying as a system of general theorizing about the ways in which human beings communicate, seek, and negotiate meaning and social power in both the sacred and secular spheres. Through an interdisciplinary examination of sources drawn from across the African diaspora, this course will emphasize the study of religion in the modern world as both a mode of orientation as well as a process of meaning-making, but with the description and critical analysis of Black religious phenomena--the complex matrix of sights, sounds, movements, and other sensory stimuli--in contradistinction to the invisibility and invalidation imposed upon subjugated peoples around the world by normative Western discourses. [3]

REL 6768. Critical Readings in African American Religion: W. E. B. Du Bois. [Formerly REL 2865] This course is designed to survey the genealogy of African American religious thought. As an intense reading discussion of fundamental texts of W. E. B. Du Bois, the pioneering African American historian, sociologist, activist, and critical theorist, this course will focus on the relationship of his research and the study of African American

religious thought in light of the historic and contemporary problems associated with race, class, and gender oppression. [3] Mr. Floyd-Thomas

REL 6769. The Religious Thought of Howard Thurman. [Formerly REL 3541] This course will explore the prophetic ministry of Howard Thurman (1900-1981) as a minister, scholar, poet, theologian, pastor, and mystic by focusing on key themes in Thurman's thought through an interrogation of his intellectual foundations, spiritual formation, his particular vision of justice-making, mysticism, theological praxis, homiletics, liturgy, and doxology. There will be critical insights into Thurman's intellectual and spiritual growth as well as offering a window onto the landscape of the defining issues, events, movements, institutions, and individuals that shaped his sacred worldview.

REL 6770. Religion and the Civil Rights Movement. [Formerly REL 3236] Students who enroll in this course should note that the seminar carries four semester hours. The seminar will examine the religious ideas and individuals that played pivotal roles in the civil rights movement by exploring the theological foundations of the black freedom struggle, the crucial impact of religion in debates about social change, and the participation of religious institutions and organizations in an effort to achieve racial equality. [4] Dickerson.

REL 6771. New Religious Movements. [Formerly REL 3254] The rise and development of new religious movements in nineteenth- and twentieth-century America. Emphasizes the following themes: utopian, restorationist, and social reform movements in relation to American primitivism and political orders; the role of text and ritual in creating and maintaining religious order and community; and the problematic nature of the sociological categories "sect" and "cult." [3] Ms. Flake

REL 6772. Race, Religion, and Protest Music. [Formerly REL 2866] This course examines how music and other related forms of art emerge from a particular social location in order to: help define pressing social issues; galvanize mass social movements; and function as symbols of protest. Using several methodological and theoretical approaches, the course will explore a wide variety of musical genres such as the spirituals, the blues, gospel, jazz, rhythm and blues, rock and roll, folk music, soul music, punk rock, reggae, Afrobeat, and hip hop in order to determine how racial identity and religious themes have articulated themselves within protest music. Various historical and contemporary examples derived from cross-cultural perspectives will be used to illustrate the impact of race and religion on social protest music.

REL 6773. Reel Black Faith: Race, Religion, and Film. [Formerly REL 3540] This course is an examination of the religious and spiritual dimensions of films selected from across the African diaspora through from the silent film era to contemporary cinema. The emphasis of this course will focus on race, gender, class, sexuality, nationality, and other aspects of social location juxtaposed with theological concepts, spiritual concerns, religious imagery, and moral values to better understand the interplay of cinematic representation of Black religious experience. [3]

REL 6777. Black Prophetic Witness: Martin Luther King, Malcolm X, and James Baldwin. This course is a study of Martin, Malcolm, and Baldwin as the three distinctly Modern US prophetic voices that have not only marked the distinctive and diverse genius of the civil rights movement to which they greatly contributed but also the ways in which their writings, theologies, and activism inform the depths of theological education and religious studies for this present generation as their religious heritage, cultural context, spiritual/personal formation and global leadership have expanded and evolved to include the scholarly trajectories and political platforms of countless marginalized groups who strive to reconcile social justice with divine justice. In this class we will see how these three modern day prophets have inspired countless marginalized groups-women, immigrants, LG-BTQ people, the disabled and the working poor to name a few-who found themselves the beneficiaries of new laws, social customs, and religious perspectives due to their legacy. Through an examination of their respective religious worldviews and writings, this course will compare and contrast the personal, political and religious basis of the formation of their Black prophetic discourses. [3] Mr. Floyd-Thomas

REL 6790. African American Methodism. Examines how African Americans interpreted and implemented their understanding of Wesleyan theo-

gy and blended it with their African and African American religious sensibilities. The impact of black Methodists in both African American and majority white bodies and upon freedom movements in the United States and the world will be explored. [3]

REL 6791. The History of the United Methodist Tradition. [Formerly REL 3191] The history of United Methodism from its rise in England in the eighteenth century to the present. Forces that have shaped the movement and its impact on its own culture. Consideration of John Wesley and English Methodism (to 1790). Examination of Methodism on the American scene. [2-3]

REL 6793. Topics in Digital Humanities. [Formerly REL 3986] The course provides an introduction to the theory and methods of the digital humanities. This course is designed for graduate and professional students across the disciplines of the humanities. Students engage with theoretical questions concerning the application of digital methods to research in the humanities, they will be trained in practical digital research skills such as the guidelines of Text Encoding Initiative. By the conclusion of the course, students will have built a working prototype of a digital database specific to their research needs. [3] Mr. D. Michelson and Ms. M. Taylor

REL 6794. Art, Pagans, Christians, Jews. [Formerly REL 2715] Visual art reflecting religious beliefs and practices. Greco-Roman cults, early Christianity, and Rabbinical Judaism. [3]

REL 6796. Human Rights, Human Trafficking, and Re-making of Global Christianity. Issues surrounding human rights advocacy, especially regarding human trafficking, have become a key contemporary ethical concern. This course will offer a historical survey on the way global Christian communities-particularly the Pentecostals and evangelicals-have been evolving in its attitude toward social justice and commitment to eradication of human trafficking. A crucial interpretive key is identifying the contribution made by Christians from the Global South in resisting neocolonial encroachments from the West, and situating their biblical hermeneutical praxis of subverting trends-economic, ethical, political and cultural-that further perpetuate human rights violations and trafficking of persons. Particular attention will be given to Christian communities in Kenya, India, South Korea and the United States. [3] Mr. Lim

REL 6801. Introduction to Christian Theology. [Formerly REL 2656] In this introduction to the discipline of theology, students will gain practice in reading, thinking, discussing, and writing critically and constructively about central themes, questions, and issues in Christian life, faith, and thought. Students will reflect on and with important historical and contemporary theological texts in light of past and present challenges. Themes include the nature and tasks of theology, revelation, God, human being, Christology, pneumatology, ecclesiology, and eschatology. (The prerequisites are Divinity 6500, Hebrew Bible; Divinity 6600, New Testament; Divinity 6700, History of Global Christianities, Part I; Divinity 6708, History of Global Christianities, Part II.) [3]

REL 6802. Constructive Christian Theology II. [Formerly REL 2657] In this introduction to the discipline of theology, students will gain practice in the reading of important texts in the field, formulating critical positions, and enhancing theological inquiry and writing skills. The emphasis will be on the constructive development and reformulation of the major interconnected themes of Christian theology considered in relation both to the doctrinal tradition and to challenges of the contemporary context. Themes for the first semester will include the nature and tasks of theology, Scripture and authority, the doctrine of God, Creation and the relation of God to the world, soteriology, and Christology. [3] Staff.

REL 6803. The Skill and Practice of Theological Conversation. [Formerly REL 2655] This course is an introduction to the skills that inform theological literacy and to the critical thinking that sustains theological reflection. The primary focus will be on introducing students to the habit of theological reflection, and it presupposes very little background knowledge of Christian theology or the Christian theological tradition(s). Students will engage in short, close readings of a wide variety of primary sources, ancient and contemporary, in order to analyze the logic of theological claims, and the varying ways theological discourse addresses its ever-changing situation. Attention will be paid to the function of doctrine in theological discourse, the

sources and norms employed in theological formulation, and the theologian's relationship to philosophical, cultural, and political contexts.

REL 6805. Christian Praxis: Liturgy and Ethics. [Formerly REL 3314] This seminar seeks to understand the interrelated roles of sacrament, word, and ethics in the praxis of Christian faith in church and society. Methodologically focused, the course attends to history, major theologians, and current constructive proposals in the areas of early Christian sources, fundamental and political theology, and liturgical and sacramental theology. [3]

REL 6807. Suffering, Politics, and Liberation. [Formerly REL 3405] Close reading of biographical and theological texts to explore the practical role religious faith plays in people's experiences and responses to suffering caused by systemic injustice in societies. Primarily focused on Christianity in North and South America and Europe, along with examples of indigenous American religion and Islam, study includes perspectives of women and men of a variety of races.

REL 6808. Eschatology and Apocalypse in Modern/Postmodern Theology. [Formerly REL 3328] The development of eschatological and apocalyptic theology in relation to the modern and postmodern experience of evil, guilt, and death. [3] Meeks.

REL 6809. Eucharistic Theology. This course examines Eucharistic theology and practice as the sacramental source and summit of Christian life in community and its individual members. Study of historical and contemporary sources will encourage the development of a critical appreciation of what liturgy does, a constructive theology of the faith revealed in symbol and ritual, and why this all matters ecclesially, pastorally, and ethically. [3] Morrill.

REL 6810. Theories of Race, Gender, Sexuality, And Disability. [Formerly REL 3909] Recently many subfields of religious studies, including theology, have taken up theories of race, gender, and sexuality generated by scholars in the humanities and social sciences. This course will cover important texts in the theoretical literature with an eye toward their import for constructive work in theology and other subfields. In addition to critical race theory, gender theory, and queer theory, we also will explore the emerging field of disability theory. [3] Armour.

REL 6811. Participation: Ritual Theory and Theology. A reading-intensive graduate seminar studying historical and contemporary Christian theologies of participation (koinonia/communio) and a selection of current ritual theories with a view toward constructive proposals for various theological sub-disciplines. [3] Morrill.

REL 6812. Theologies of Salvation. From the origins of Christianity, salvation has been a fundamental symbol for expressing and reflecting upon experiences and proclamation of what God has done for humanity (and all creation) in the person and ongoing mission of Christ Jesus, in the power of the Spirit. This course surveys theologies of salvation—both theories and practices—through Christian history and in selected diverse contemporary contexts. [3] Mr. Morrill

REL 6820. God in the Western Tradition. [Formerly REL 3923] The major philosophical and theological texts of the Western tradition from Plato to the twentieth century. The changing history of the interpretation of God from Christian neoplatonism to nineteenth- and twentieth-century challenges of classical approaches. [3] DeHart.

REL 6821. Thomas Aquinas. [Formerly REL 3858] Systematic investigation of Aquinas' major theological and philosophical assertions by considering his conception of the two disciplines and their relationships. All readings will be available in English translations. [3] DeHart.

REL 6822. Theology In The Nineteenth Century. [Formerly REL 3325] Major movements during the nineteenth century, from Schleiermacher to Troeltsch. [3] DeHart.

REL 6823. Kierkegaard the Theologian. [Formerly REL 3346] An advanced exploration of Kierkegaard's philosophy of Christian belief, with particular attention to his analysis of faith, the relation of ethics and religion, sin and human existence, and his metaphysical and theistic assumptions. Based on close reading and classroom analysis and discussion of selected texts from the pseudonymous authorship. [3] DeHart.

REL 6824. Theology of Karl Barth. [Formerly REL 3333] An introduction to the thought of one of the most important and controversial theologians of the twentieth century. [3] DeHart.

REL 6825. Seminar in Rahner, Schillebeeckx, and Metz. [Formerly REL 3326] This reading-intensive seminar provides the opportunity to study works by three of the most significant Roman Catholic theologians of the second half of the twentieth century. Study of these three authors, then, will access a certain trajectory in systematic-theological content and methods that emerged from the era of the Second Vatican Council. [3]

REL 6826. Political Theology and the Philosopher's Paul. This class brings students into engagement with a series of texts at the boundary between theology and philosophy, all of which are concerned with rethinking the meaning of the state and of political agency, in modernity and beyond, in light of religious faith, particularly Jewish or Christian monotheism. Most of these texts have become influential as touchstones in the developing conversations around so-called "political theology." Primary course goals: Through close reading and discussion students will gain a sense of the history and possibilities of these ongoing discussions. They will also be encouraged to think more deeply and critically about their assumptions concerning the nature of political existence in light of the God of Christian belief. [3] Mr. DeHart

REL 6827. Theology of Dietrich Bonhoeffer. Through close reading and discussion students will gain a sense of the development and unity of Bonhoeffer's thought, and also of the relation of that thought to his biography. They will also be encouraged to think more deeply and critically about their assumptions concerning the nature of moral and political existence in light of the God of Christian belief. [3] Mr. DeHart

REL 6840. Seminar in Systematic Theology. [Formerly REL 3908] An advanced seminar (required for doctoral students in the theology area) deals with a topic or figure of general theological importance; instructor and topics change yearly. [3]

REL 6841. Process Theology. [Formerly REL 3321] Contributions made to Christian theology by the tradition of process thought, and the questions raised for process thought by the character of Christian theology. [3]

REL 6842. Practical Theology. [Formerly REL 3600] This seminar explores the development of practical theology as an academic discipline, focusing primarily on its revitalization in the last half-century, current debates, and future potential. [3]

REL 6843. Theology in the United Methodist Tradition. [Formerly REL 3192] A survey of theological developments in the United Methodist tradition, beginning with John Wesley and the rise of the Methodist movements, and ending with current debates. This course will consider the distinct contributions of Methodist theology in the context of Christianity, other religious traditions, and the world. United Methodist doctrinal statements are explored in light of the difference they are making and have made, both locally and globally. [2] Mr. Rieger

REL 6844. Contemporary Theology. [Formerly REL 3327] The major movements in Christian thought from the beginnings of dialectical theology to the present. [3] Meeks.

REL 6845. Feminist Womanist Theology. [Formerly REL 3340] Introduce students to the classic texts and themes of feminist, womanist, and mujerista theologies as well as to current issues and important texts on the relationships among sexuality, gender, and race, the validity of "women's experiences" as sources for feminist theological reflection, and feminist critiques and reconstructions of traditional theological loci. [3] Armour.

REL 6846. Queer Theology. [Formerly REL 3348] This course examines emergent queer theology in relationship to the theological and cultural issues (historical and contemporary) that it seeks to address.

REL 6847. Theology and Contemporary Continental Philosophy. [Formerly REL 3330] Certain continental philosophers are central to the so-called "return of the religious" in contemporary thought. This course will explore the this development through readings in major figures in the field and in appropriations of and responses to their work by theologians.

REL 6848. Religion, Economics and Labor. Growing disparities between those who have to work for a living (the 99 percent) and those whose

wealth and power derives from other sources affect all of us. This course is designed to engage students in explorations of how these disparities shape us all the way to the core in religion, politics, and economics, and what viable alternatives might look like. Traditions from the three Abrahamic religions, Judaism, Christianity, and Islam, will be presented in order to conceptualize justice from the perspective of the exploited and the oppressed, considering possible divine options for the margins, and how emerging movements of solidarity along the lines of class might shape deep solidarity along the lines of race, ethnicity, gender, and sexuality. This course will combine theological reflection, ethical imagination, and practical suggestions for organizing. [3] Mr. Rieger

REL 6850. God, Economy, and Poverty. [Formerly REL 3313] This course will focus on the ways Christian Scripture, tradition, and contemporary theology relate to poverty. Attention will be given to theology's task of criticizing deformed concepts of God that mask or justify conditions of poverty and theology's constructive task of articulating alternative ways of viewing the poor and eliminating the conditions of poverty. There also will be focus on ecclesial practices of life with the poor in relation to business, legal, and political solutions in the sphere of public policy. Among issues of the culture of our market society that address the exclusion or inclusion of the poor, these will be considered: lending and debt, property rights, comparative advantage, competition, consumerism, health care delivery, education, and the culture of despair. [3] Meeks.

REL 6851. Visions of the Future. [Formerly REL 3341] Critical and post-modern theories in gender, colonialism, race and sexuality emphasize dystopic possibilities for the future, whereas religious traditions emphasize eutopic eschatologies. Examination of the intersection of theories and imagination on the theological question of the future. [3]

REL 6854. Native American Philosophies and Theologies. An in-depth study of key concepts and shared principles in philosophical, theological, and anthropological texts by selected Native American writers (Cordova, Waters, Bruchac, Grande, Norton-Smith); social, historical, and political contexts, and the challenges and contributions they offer to contemporary philosophical, ethical, and religious questions. [3] Ms. Schneider

REL 6855. Theologies of Multiplicity. Exploration of recent theological and philosophical works relating to multiplicity and relationality. Emphasis on questions of ontology and new materialisms, embodiment, liberation, poetics, and Christian ideas of incarnation. [3]

REL 6856. Theology Between God and the Excluded. Four major turns have shaped theology since the beginnings of modern theology in the eighteenth and nineteenth centuries: the turns to the self, the divine Other, the texts of the church, and to other people. This course provides a critical and constructive engagement of these turns in light of the location between God and the increasing numbers of persons excluded from the resources of life, in which religious communities find themselves today. Here, theology becomes a matter of life and death. What contributions can theological discourses make to support life? What are the potential pitfalls and challenges? What are the options for the future of theology and religion more broadly conceived? The goal is to explore and develop constructive theological paradigms and liberative practices that emerge in the creative tensions of various theologies and the multiple pressures of life. [3] Mr. Rieger.

REL 6857. Derrida's Death Penalty Volume II. This seminar examines the philosophical argument against the death penalty presented in the "teaching lectures" delivered by Jacques Derrida. [3] Ms. Armour and Ms. Oliver

REL 6858. Theology, Religion, and Postcolonialism. This seminar explores postcolonial/decolonial theories and their interconnections with the study of religion and theology. The goal is to engage in critical conversations that develop religious and theological discourses in the context of particular postcolonial/decolonial struggles in global perspective. Of particular interest are constructive proposals that do not merely reproduce or copy existing theories. [3] Mr. Rieger

REL 6859. Theology, Visual Culture, and New Media. In recent years, a dramatic change has occurred in our media landscape. Online social media outlets—Facebook, Twitter, Instagram and the like—are now ubiquitous. Legacy media players (newspapers, magazines, television news) have

moved online as well often partnering with social media to share content and attract readers and viewers. Faith communities are part of this shift, as well, using on-line platforms as auxiliaries to brick and mortar presence and/or to create new and experimental forms of community. Drawing on scholarship on visual culture and new media, this course explores the theological, political, and communal import of these changes. [3] Ms. Armour

REL 6860. Aquinas, Rahner, and Metz. [Formerly REL 3859] The study of one trajectory in 20th century Roman Catholic thought beginning with the rise of transcendental Thomism, investigating closely the method and content of Karl Rahner, followed by J. B. Metz's critique of transcendental-idealism in constructing a political theology of the subject.

REL 6861. Feminism, Religion, and Race: Mary Daly and Audre Lorde. This is a figure seminar on two mightily formative writers of the 20th century in theology and literature. This means that the reading list will be entirely composed of their own works. We will focus on their individual developments and will reflect on various issues in gender, religion, and race that they appear to share, as well as those that publicly divide them. [3] Ms. Schneider

REL 6862. Ethical Approaches to Preaching. [Formerly REL 3012] This course investigates four ethical approaches to preaching: the social gospel and activist ethics within the preaching of the civil rights movement, the countercultural ethic within post-liberal homiletics, the communicative ethic within conversational and collaborative homiletics, and the ethic of risk and solidarity in liberationist homiletics. Students will preach sermons that make use of these theoretical and theological approaches. [3] Mr. McClure

REL 6870. The Craft of Academic Writing in Theology and Religion. [Formerly REL 3870] This course is focused on the craft of academic research and writing in theology and religion and is designed around opportunities for practicing the craft, giving and receiving feedback, honing a publishable article, and reading memoirs on writing and literature on the craft of research and writing. Restricted to graduate students. Divinity students by request only. [3]

REL 6893. African American Biblical Interpretation. [Formerly REL 3893] This seminar attends to the aesthetics and politics of African American Biblical interpretation during the Harlem Renaissance, the eras of Civil Rights and the Black Power Movements, and within the rise of Black Academic Biblical Interpretation. [3]

REL 6900. Introduction to Homiletics. [Formerly REL 2801] The course is an examination of the theologies and methods of preparing sermons from Biblical texts and an exploration of hermeneutical approaches, oral/aural skills, rhetorical strategies, narrative and connective logic; students are responsible for developing a working theology of the Word, reviewing major homiletic theories, completing exegetical assignments, skill-building exercises, sermon sketches, and sermon manuscripts; in-class preaching is required. [3]

REL 6903. Worship Across Traditions and Cultures. [Formerly REL 3002] Working to expand our familiarity with preaching and worship across denominational and cultural patterns and across faith traditions, this course will study preaching and worship practices and formation that embrace the ever-increasing experience of multiculturalism or pluralism within and between faith communities. [3]

REL 6906. Worship, Race and Culture. Modern Christian worship occurs in a globalized world with complex multicultural dynamics and ongoing racial injustice. Hence, this course examines worship with attention to its various racial contexts and cultural expressions. Critical race theory will inform our investigation of the ways in which race impacts patterns of worship. We will study how to "make room at the table" for various racial and liturgical cultures in a manner that fosters justice and peace, both in homogeneous congregations and multicultural congregations. We will also explore how to create multicultural liturgies that reflect the equality and diversity of Christians of different races, nationalities, languages, and denominations. Through exposure to cross-cultural worship experiences, key literature in liturgics, and classroom conversations at the nexus of race, culture, and worship, students will gain new liturgical insights and develop theologies of worship that are racially responsible and culturally sensitive. [3] Mr. N. Schoonmaker

REL 6921. Oratory and Rhetoric for Proclamation. [Formerly REL 3007] This course studies the formulaic oratory structures of folk traditions among oral cultures and rhetorical structures of public discourse among classical and contemporary traditions for homiletics and the preaching event. [3]

REL 6922. Ministry, Voice, and Vocation: Civil Rights, Martin Luther King Jr., and Preaching. [Formerly REL 3013] This course will integrate study in the social and preaching ministries of Martin Luther King Jr. The course will explore the social and cultural contexts of King's life from a national and global perspective, giving careful attention to the secular and sacred elements that shaped both his life and the Civil Rights movement. The critical theological voices and practical theological influences that shaped his ministry and mission will serve as evaluative material for analysis of his voice in American religion. This course will also weigh this important dialectic for preaching and social justice ministry in the contemporary Church extending between cross-cultural and multi-cultural public ministries. Primarily, our examination of the sacred-secular dialectic in public ministry, exemplified by King and the Civil Rights era, will be oriented to issues of race, gender, and class, which in the end evaluates or explores the pastoral-prophetic dialectic of preaching and public ministry to deal with social conflict or oppressive conditions today. [3]

REL 6924. Preaching in the African American Tradition. [Formerly REL 3011] The theology and styles of black preaching. Sermons of the most effective black preachers of today and yesterday. Methodologies for effective outlining, manuscript development, and use of illustrations are discussed. [3]

REL 6925. Preaching Theology. [Formerly REL 3032] In-depth exploration of the ways that theology comes to play in sermon preparation and preaching. Particular attention is given to the presence in preaching of theological methods, authorities (scripture, reason, experience, and tradition), theistic worldviews, theodicies, models of church and culture, ideas of atonement, the relationship between religions, and personal and historical eschatologies. Graduate students will be expected to do sermon analyses and/or preach twice for the class. [3] J. McClure.

REL 6927. New Perspectives on Preaching. [Formerly REL 3009] Homiletic theory and practice have undergone tremendous changes in the past century. This course traces developments from the deductive and propositional homiletics of the late nineteenth century, through the liberal topical and "project" method of the early twentieth century, new-orthodox and Barthian emphases, inductive homiletics, narrative homiletics, structuralist and phenomenological models, and more recent postmodern construals of homiletic theory. Students will read and analyze sermons using these theories, and opportunity will be given to construct sermons using these methods as well. [3] J. McClure.

REL 6928. Non-pulpit Preaching: Homiletics in Popular Culture. [Formerly REL 3005] What religious themes are prevalent in popular music today? How does popular music shape religious identity? How does faith shape popular music? What religious and spiritual experiences shape how music is heard, performed, consumed, or otherwise experienced? How is the music industry shaped by, and a shaper of, religious truth and identity today? These are among the questions this course will seek to address. [3] J. McClure.

REL 6940. Homiletic Analysis. [Formerly REL 3010] Students will learn criterion and skills for analyzing, evaluating, and providing feedback on sermons. The course will focus on establishing essential criteria for sermon evaluation, learning methods for offering sermon feedback in small groups, and developing skills for individual sermon supervision.

REL 6941. Practical Theology and the Public Church. [Formerly REL 3040] This course studies practical theology topics and methods/methodology for the church's role in society/public arena, dealing with public theology and a range of social, cultural, economic, and political issues.

REL 6942. Liturgy and Preaching. [Formerly REL 3042] An exploration of the historical roots of liturgical preaching, preaching and sacraments, preaching the Church Year and other calendars, lectionary preaching, preaching inclusivity and worship, preaching performance and worship arts, and occasional sermons in liturgical context.

REL 6944. Language, Communication, and Practical Theology. [Formerly REL 3043] Most works in the field of practical theology contain normative assumptions about the nature of language and communication. These assumptions inform the analysis of situations, persons, or contexts, and influence the theology shaped in light of those analyses. This course will look especially at the ways in which poetics (theories of myth, symbol, and metaphor), speech act theory, semiotics, rhetoric, narrative theory, communicative action theory, cultural hermeneutics, and ritual theory inform a range of texts in practical theology. Scholars of language and communication under consideration are Suzanne Langer, Kenneth Burke, Claude Levi-Strauss, James Carey, J. L. Austin, Paul Ricoeur, Catherine Bell, Northrop Frye, Gregory Bateson, Ferdinand de Saussure, Alfred Schutz, Jean Piaget, C.S. Pierce, Ian Barbour, and Victor Turner. Practical theologians under consideration include James Fowler, James Hopewell, Denham Grierson, Robert Shreiter, Alex Garcia-Rivera, Don Browning, Elaine Ramshaw, Herbert Anderson, and Edward Foley, James Loder, Mary Fulkerson, Johannes A. Van der Ven, Gerrit Immink, and Gerben Heitink.

REL 7000. Pastoral Theology and Care. [Formerly REL 2550] This course introduces students to basic theories and methods of pastoral care, especially in the ecclesial context. This course assumes that care is mediated through acts of pastoral leadership, liturgy, preaching, and the forming of congregational life and programming as well as through specific individual conversations. Special attention is paid to the person of the pastor as caregiver and leader of a community of faith and care. [3]

REL 7002. Pastoral Care and Global Consumerism. [Formerly REL 3098] This course delineates the salient features of late capitalism, often designated by the term neoliberalism, and its profound effects upon global politics and economics, societies, communities, and institutions. It focuses particularly on how contemporary technologies and cultural assumptions extend the influence of free markets into interpersonal relationships and individual selves, as well as into religious congregations, theological reflection, and the practices of pastoral care and counseling. In each instance it asserts that the effects include distorted notions of freedom, identity and tolerance, as well as affective alterations, all of which erode or even corrupt these areas of life and thus contribute to widespread human suffering. Finally, it explores possible practices for congregations and pastoral caregivers that might oppose and alleviate these effects, as well as theories that might guide such practices. [3]

REL 7003. Theology and Personality. [Formerly REL 3057] This seminar from the pastoral theology and counseling discipline explores variable topics. [3]

REL 7004. Theories of Personality. [Formerly REL 3069] A study of representative theorists within each of the four forces of psychology to clarify alternative understandings of the nature of personality and approaches to the psychological sciences. Attention is given to relationships with pastoral theology and counseling. [3] B. Miller-McLemore.

REL 7005. Methods in Theology and the Social Sciences. [Formerly REL 3757] A study of the relationship of theology and science in general and religion and personality theory specifically. Uses several classic models as illustrative of the ways that persons have attempted to bring these two disciplines and enterprises together. [3] B. Miller-McLemore.

REL 7021. Women, Psychology, and Religion. [Formerly REL 3079] An exploration of the psychological and religious ideas that support a system of advantage based on gender and sexuality, with particular focus on women's development, self-concept, and altered views of counseling and religious practice. [3] B. Miller-McLemore.

REL 7022. Men, Psychology, and Religion. [Formerly REL 3310] This course undertakes an examination and critique of culturally dominant forms of "masculinity" and explores alternative versions, utilizing contemporary social theories, historical perspectives, psychological theories, religious practices and theology. [3] Rogers-Vaughn.

REL 7023. Bodies and Theological Knowledge. [Formerly REL 3063] This class will be conducted as a seminar based on shared reading and discussion rather than lecture and will explore the question of how theological knowledge is shaped in and through the body, focusing on exploratory

reading in human science research, critical theory, constructive theology, and practical theology. [3]

REL 7024. Theology and Health in a Therapeutic Culture. [Formerly REL 3062] Introduces the empirical study of the relationship between health and religion. The ways in which the disciplines of theology, religion, psychology, and medicine inform these studies are examined. [3]

REL 7026. Self and Social Context. [Formerly REL 3052] Pastoral theology and practices of care are aided and directed by operative understandings of the self. What is the self? Is it real? Is it universal? How does it come into being? How does it develop, and how does it relate to the divine? These are fundamental questions in pastoral theology. Responding to the insights of feminists, social theorists, and philosophers, contemporary pastoral theologians have been revising their theological anthropologies to include an understanding of the self that takes more seriously its social dimensions. What does attention to the situated self tell us about effective pastoral care, the meaning of healing/salvation, and the nature of God? In this course we will read social scientific, philosophical, and theological accounts of a self formed within its social, institutional, and cultural contexts. We will also explore the implications of this theological anthropology for a variety of practices. [3]

REL 7029. Evil, Aggression and Cultural Trauma. This advanced course is concerned with the lived experience—and life shaping reality—of evil, aggression and cultural trauma. The course will concern itself with the “habitus” of evil and aggression and the trauma of culture as well as traumas acted against, upon and throughout the cultural landscapes in which we are embedded. Religion, Psychology and Culture course aimed at advanced masters level students and doctoral students in need of a course on trauma and religion. Doctoral students will, in addition to other course requirements, write a research paper appropriate for submission for publication and/or presentation at a guild conference.

REL 7037. Shame and Guilt. [Formerly REL 3059] Students enrolled in this seminar will examine the dynamics of shame and guilt in social and personal life from theological, psychological, and pastoral perspectives. [3] Flesberg.

REL 7038. Sexuality: Ethics, Theology, and Pastoral Practice. [Formerly REL 3067] A critical investigation of selected readings in the general area of sexuality, intimacy, and relationships as they inform pastoral practice. Uses autobiography and case study methods in conversation with theories in social sciences, ethics, and theology. [3] Flesberg.

REL 7039. Gender, Sexuality, and the Family. [Formerly REL 3070] Addresses such issues as divorce, custody, blended families, reproductive issues, infidelity and adultery, unpaid labor in the household, rape, incest, domestic violence, and coming out. The class will focus on the delivery of pastoral care and counseling related to these issues and will also address the utilization of community resources to facilitate further care. The course’s design seeks to equip those who intend to be front-line care providers; an introductory course in pastoral care is a prerequisite unless approval is given by the instructor. [3] Flesberg.

REL 7040. Pastoral Theology for Transitions and Crises. [Formerly REL 3072] Examines various pastoral responses to persons facing transitions (e.g., birth, vocational choice, partnering, marriage, aging, and dying) and crises (e.g., illness, bereavement, and interpersonal discord). Close attention paid to the theological and psychological dimensions of these experiences. Current research in coping and religious coping theory to develop strategies for theological reflection and pastoral action. Prerequisite: 7000. [3] Flesberg.

REL 7041. Pastoral Care for Persons with Mental Disorders and Addictions. [Formerly REL 3099] In this seminar, students engage in a rigorous examination of the behavioral patterns that characterize addictions and study the effects of the addictive behavior not only on the patient but upon the patient’s family and peers. The course will also explore the different approaches to pastoral care both to the patient and to those who are affected by the patient’s illness.

REL 7042. Seminar in Pastoral Care: Death and Dying. [Formerly REL 3071] Addresses the issues of theology and pastoral practice that pertain to ministering to the dying and the bereaved. Participants will have opportuni-

ties to consider and to clarify their theological postures regarding theodicy, eschatology, sin and sickness, prayer, suicide, euthanasia, and hope. The course also will examine how ones’ theological commitments translate into authentic acts of care such as accompanying the dying, offering support to the bereaved, and assisting the family in making decisions.

REL 7049. The Religious Self According to Jung. The religious core of human existence as related to the concepts of the archaic unconscious and the birth of the self in C. G. Jung’s analytical psychology. Study of the life and thought of Jung as illustrated by his autobiography, *Memories, Dreams, Reflections*. Critical assessment of his theory as a means of understanding religious phenomena. [3]

REL 7050. Psychology of Ritual and Myth. [Formerly REL 3065] Examination of religious rituals and myths from both Christian and other traditions. Critical review of major psychological theories of ritual and myth and their relevance to an understanding of myth and ritual as religious phenomena. To be offered alternately with 3752. [3] Gay.

REL 7051. Freudian Theories and Religion. [Formerly REL 3060] An intense reading and discussion of fundamental texts in psychoanalysis and their relationship to Freud’s critique of religion. The basic requirements and texts are introductory; more advanced students can use supplementary texts and approaches. [3] Gay.

REL 7052. Post-Freudian Theories and Religion. [Formerly REL 3061] An examination of the Object Relations school of contemporary psychoanalysis (M. Klein, D. Winnicott, W. R. D. Fairbairn, Otto Kernberg, Heinz Kohut). Focus on both the clinical and the explanatory theories as they relate to the examination of religious experience and similar self states. [3]

REL 7053. Contemporary Psychotherapy and Pastoral Counseling. [Formerly REL 3053] Recent trends in psychotherapy. Theories of personality and personality change, as do strategies for psychotherapy. Students will assess critically the implications of these theories for pastoral counseling.

REL 7054. Critical Issues in Psychotherapy. [Formerly REL 3755] Examination of key areas of psychotherapy including patient’s experience of therapy, unconscious thought processes in therapy, interpretation as intervention, transference and the interpretation of transference. [3] Gay.

REL 7055. Play, Subversion, and Change. [Formerly REL 3754] Designed for those pursuing pastoral leadership, this seminar explores play and its liminal quality as foundational to social life in general and a spiritual/religious life in particular. Play is a practice that restores and rejuvenates even as it facilitates emotional, relational, and spiritual well-being. As a form of knowing, play teaches, informs, and invites discoveries. Through select readings, seminar participants will become knowledgeable about the anthropological and sociological roots of play, the neuroscience and psychodynamics behind play, play and human development, and various other dimensions of play (such as ritual, fantasy, rough-and-tumble, and technological play). Playful practices will be explored and special attention will be given to play within pastoral leadership and religious education. [3] Mr. Hamman

REL 7056. Pastoral Care and Community Justice. This course situates pastoral care as communal in nature and invested in pastoral theology and practices that seek to listen to and effectively collaborate with those in communities subjected to structural and interpersonal injustices. [3] Ms. Sheppard

REL 7057. Franz Fanon’s Psychology: Race, Gender, and Religion. This course is an introduction to the work of Franz Fanon and will explore his critical psychology as a resource for understanding the psycho-cultural dynamics of racial and gender oppression, anti-colonial resistance, and the contemporary implications and potential of his work in psychology and society. [3] Ms. Sheppard

REL 7058. Religion, Science and Evolution. The course is designed into five sections: Section one is on Darwin’s core concepts of evolution; two is on the response to Darwin by religionists, among many; three is on contemporary uses of Darwinian theory to model religion and other value systems; four is on attempts to mimic human cognition using immense computing power, e.g., IBM’s “Watson” system which won a famous “Jeopardy” game

against human opponents; five is on ethical implications and further questions. [3] Mr. Gay

REL 7064. Humanity and Technology. A critical exploration of how especially handheld and virtual technologies (phones, tablets, gaming consoles, VR headsets) and computer technologies are shaping persons, relationships, communities, societies and our engagement with nature. By addressing themes such as: the gendered, sexual and racial self; the relational self; the economic self, the discerning self, the real and the virtual; violence and acts of reparation; and living creatively, this graduate seminar seeks to empower students to build a personal anthropology. One question drives the seminar: What does it mean to be human in a technologically driven world? The seminar draws primarily on psychodynamic, neuroscientific, social, philosophical, economic, and theological theories. [3] Mr. Hamman

REL 7065. Pastoral Method in Ministry. [Formerly REL 3056] Critical examination of pastoral method in the ministry of care and counseling. Close attention given to the place of the social sciences in pastoral method. Considers issues in the use of quantitative and qualitative research methods. [3]

REL 7066. Method and Evaluation. [Formerly REL 3054] The use of the social sciences in the investigation of religious phenomena. The psychological analysis of religion. Representative studies and empirical investigations are sampled. [3] Gay.

REL 7067. Pastoral Theologies and Ethics of the Streets. This course takes as its point of departure the local-of the streets-contexts of the pastoral theologies and ethical impulses that shape and guide individuals and communities' public theologies and practices. Too frequently these kind of explicit and implicit motivations undergirding local-on the ground-responses to community concerns fail to make their way in to academic and scholarly discourse. The end result is that, except with rare exception, local-of the street and on the ground-pastoral theologies and ethical categories are not represented in most of the scholarship appropriated for pastoral theological education. This course is demanding in its requirement that students spend significant time listening to those whose vocational practices are lived out in their own communities and represent their commitment to individual and social transformation. [3] Ms. Sheppard

REL 7068. Vocation: Composing a Life. To what are people called in each phase of life, and how do these callings evolve and transform as we change and develop? How do we discern our callings, and how do we help others do so? What are some of the unspoken complexities and challenges of callings that we hesitate to name? In a word, how do people compose their lives despite or amid impediments, failures, and diverse pressures and demands? This class focuses on a classic Christian theme—vocation. But it disrupts conventional understandings and invites fresh engagement with life choices as a living breathing evolving reality, shaped by culture, time, and our physical embodiment, a matter of composition and recurrent recreation rather than simply a once-in-a-lifetime summons, a lofty religious aspiration, or a vague doctrinal claim. The class provides tools to analyze and explore your own vocational desires and those of others, resources to understand how vocation arises at different life phases, and a sampling of spiritual life writing in which other people recount their efforts to reach vocational clarity about life. [3] Ms. Miller-McLemore

REL 7076. Theories of Inequality, Diversity, and Social Justice. The course reflects the multi-level orientation of the department and includes readings that critically address structural, community, and individual levels of analysis. The focus of the course will be on careful reading and critical evaluation of classic and contemporary texts about inequality with the goal of helping students develop a sophisticated theoretical grounding from which to approach their studies. [3] Ms. Barnes

REL 7078. Heinz Kohut, Self-Psychology, and Religion. Investigates the writings on self psychology of the theorist and analyst Heinz Kohut, with attention to the implications of his ideas about the formation and fragmentation of the self for individual health and development, cultural context, psychotherapy, and pastoral care and counseling. Evaluation of the theory in conversation with various critical theological perspectives. [3] Ms. Miller-McLemore

REL 7079. Faith, Film and Pastoral Care. This course offers an alternative avenue to learning and practicing pastoral care in a variety of institu-

tional settings and capacities. It uses film, reading, and experiential learning, all in dialogue with one another, to stimulate and enrich imagination, understanding, and capacity to practice care. Following a general introduction, the class meets for four extended Friday/Saturday sessions approximately every other week to review and analyze the film; explore the assigned reading; and engage in exercises to learn specific pastoral skills, strategies, and practices. [3] Ms. B. Miller-McLemore

REL 7080. Spiritual and Social Activism. This course is designed for students interested in integrating spirituality and social activism and for those who recognize the power of spirituality to sustain individuals and communities in the pursuit of social transformation. In addition to visiting community sites where integrative perspectives are embodied, students will become familiar with and deepen their knowledge of contemporary perspectives on spirituality and social activism; and engage in integrative practices as well as theo-ethical reflection on practice. Finally, students will have opportunity to engage in discernment concerning vocation in light of the course learning. [3] Ms. P. Sheppard

REL 7081. Young Adult Faith, Spirituality and Leadership. This seminar explores the faith, spirituality, and leadership of the “nones” and the “somes”—young adults who do not (readily) identify with traditional and/or mainline religious identities. Drawing on primarily a postfoundationalist spirituality, young adults are creating alternative communities, ministries, and non-profits of social, economic, and ecological justice. As such, the seminar asks the question: What is the young adult witness (or testimony) to human life discovered in the narratives of personal, political, and societal resistance to structures of abuse and oppression? The seminar suggests that the witness can be summarized as: embracing anxiety, loss, and trauma; believing in belonging (or community); nurturing one's spiritual life; seeking racial, social, political, economic, and environmental accountability while working toward a just society; and, making a positive difference in the world. In these foci lie hidden *The Good Life*, which can be distinguished from *The Good News* (of personal salvation in Jesus Christ and the traditional focus of mainline Christianity). The seminar draws primarily on philosophical, sociological/cultural, ethnographic, anthropological, psychological, economic, theological, and biblical sources. Guests of and visits to innovative ministries and non-profit work in Nashville will explore the importance of place. Students will be encouraged to identify and create an action plan to guide their cause engagement, advocacy, activism, and leadership. [3] Mr. J. Hamman

REL 7101. Methods in Ethics. [Formerly REL 3951] A survey of various methods, styles, and contexts under which moral philosophy has been developed and transmitted in Western thought. Topics treated are classical moral philosophy (Plato, Aristotle, Cicero), Christian sources (Augustine, Thomas Aquinas), modern philosophical ethics (Spinoza, Kant, Mill, and several twentieth century thinkers). [3] Anderson.

REL 7102. Ethics for Human Development Professionals. [Formerly REL 2813]

REL 7103. Ethics in Crisis. This course is an intensive examination of what has been most famously referenced as the “seven deadly sins:” pride, envy, gluttony, sloth, wrath, lust, and greed, and how these transgressive principles actually have shaped the moral character and sociopolitical condition of American society and culture. We will examine how the innermost workings of US society are informed and ultimately beholden to these “capital vices.” Furthermore, given Gandhi's summative reassessment of these vices as the “world's seven great blunders,” his framework will serve as an important schema for self-examination, social analysis, and moral formation for the central foci of the course. By utilizing liberative ethics, liberation theology, critical race theory, and feminist-womanist thought, this course will equip students with critical methodological skills and theological competencies associated with ethical theory and moral practices necessary for effective conflict analysis and crisis intervention in service of social transformation as well as justice making efforts. [3] Ms. Floyd-Thomas

REL 7120. Modern Christian Political Thought. [Formerly REL 2817] Surveying Christian Political Thought from the late nineteenth century to contemporary debates, we will analyze theo-ethical understandings of the relation of Christianity to political life. Some questions the course will focus on are: Is there a necessary and important relationship between Christian-

ity and democracy? What is the role of the public theo-ethicist in political debates? In what ways do various ecclesial and theological assumptions impact the political engagement of the church? Social gospel, Christian Realist, Anabaptist, Liberation, Catholic Social Thought, Feminist, and Fundamentalist approaches will receive particular attention. A theory-practice option for those who want to study the concurrent U.S. campaign season is available. [3] Snarr.

REL 7121. Religion and Social Movements. [Formerly REL 2815] This course focuses upon the roles of religious organizations, persons, and resources in social-political movements for change. Students will be engaged in the interdisciplinary conversations on the contributions and constraints that religious groups provide for social movements. Among the questions students will investigate are: What makes an activist? In what ways do religions provide resources-materially, ideationally, and culturally for the emergence and maintenance of social movements? In what ways are religious groups transformed by their interaction with the political process?

REL 7122. Religion and War in an Age of Terror. [Formerly REL 3411] Looking at both Christian and Islamic political thought, this course will wrestle with questions such as: When, if ever, is it appropriate to go to war? How has the emergence of "terrorism" as a form of war challenged traditional just war and pacifist theories? Are there ways in which religion and violence are inherently connected? How have religion and war been linked historically? In what ways do religious worldviews challenge or complement contemporary efforts at peacemaking? [3] Snarr.

REL 7123. Christian Social Ethics. [Formerly REL 3412] This course is a critique of selected readings from contemporary Christian social ethical perspectives. We will employ historical and ethical analyses of case studies in order to gain some orientation to doing ethical reasoning on current perennial social issues and pursue reading in the literature of the field. The fundamental problems guiding our inquiry will be: (1) the way in which each account interprets morality as the relation between justice and good; (2) the social theoretical assumptions and views that make each of these accounts intelligible and help explain their differences, this will include special attention to the relevant intellectual and social history of each issue and its public advocates; and (3) the theological warrants for how a just society may reside in religious and secular communities of moral discourse.

REL 7124. Twentieth-Century North Atlantic Ethics. [Formerly REL 3419] An examination of figures and movements that influenced the discourse on religious ethics in both Europe and North America. Special attention to representatives of History of Religions School (Troeltsch, Ott); logical positivism, political theology (Moltmann, Metz, Habermas); neo-orthodox and existential theologies (Brunner, Barth, Buber, Reinhold Niebuhr); as well as ethics influenced by Wittgenstein. [3] Anderson.

REL 7125. American Pragmatism and Empirical Theology. [Formerly REL 3403] Explores the philosophical, theological, and ethical legacies of American philosophers and theologians who have significantly influenced theology and ethics in the United States and American public discourse. Students may encounter the traditions of American pragmatism, American Empirical Theology, Theology of the Social Gospel, American Neo-Orthodoxy, and American Public Theology and figures from William James and R. and H. R. Niebuhr to James M. Gustafson. [3] Anderson.

REL 7126. Political Ethics: The Tradition of Political Liberalism. [Formerly REL 3410] An examination of the political thought of prominent thinkers. [3] Anderson.

REL 7127. Liberation Ethics. [Formerly REL 3960] An examination of how religious commitments, particularly Christian sensibilities, work to ameliorate or perpetuate the oppression resulting from race, class, and gender.

REL 7128. Critical Race Theory and Social Ethics. [Formerly REL 3423] Drawing on literature from criminology, critical race theory, social ethics and feminist/womanist thought, this seminar will reflect on the religious, legal, and intellectual context out of which white supremacy, hypermasculinity, and economic exploitation pervade our understanding of normativity. Students will map and critically examine the multiple trajectories along which the moral authority of the state is engendered by the convergence of racism, sexism and classism under the guise of normality, social order, common good and the will of God. Further we will explore how to develop

social interventions that disrupt these normative patterns of discrimination and facilitate the elimination of racially-based, gender biased structures and practices in order to facilitate critical pedagogy, moral leadership, legal practice, and social movement organizing. [3] Ms. Floyd-Thomas.

REL 7129. Moral Philosophy of Black Popular Culture. [Formerly DIV 3959] A critical examination of aesthetics and moral philosophical traditions as a lens by which to understand black popular culture; this course explores the cultural currency of a black aesthetic, its significance to and dissonance with the religious. [3] Ms. Floyd-Thomas and Mr. Floyd-Thomas

REL 7130. Ethics and Feminism. [Formerly REL 3467] Ethics and Feminism. Implications of gender theory for understanding the Judeo-Christian moral traditions. Topics include: the nature of the moral subject, the social construction of gender, patriarchal consciousness, the abuse of women, black feminism, motherhood, and feminist ecology. [3]

REL 7131. Feminist Theological Ethics. [Formerly REL 3415] Using resources from feminist traditions (womanist, mujerista, Asian, white), the course focuses on some major methodological, theoretical, and policy issues in feminist theological ethics. After tracing the historical development of the field of feminist theological/social ethics, we will analyze how feminists choose/use theo-ethical resources, the impact of varying theoretical frameworks on feminist analysis, major policy foci of feminists, and whether/how to stay with a "patriarchal" religious tradition. Readings from Christian, post-Christian, pagan, Islamic feminist. [3] Snarr.

REL 7132. Womanist Ethics and Theology. This seminar places the moral agency and theological reflections of African American women at the center of human social relations and ecclesiastical institutions. Using various womanist ethical methods and theories, we will develop a range of tools, conceptual and practical, by which to assess ways for going beyond normative reflections of theology and dominant ethical systems which often discount the exigencies of tripartite oppression. This course will explore and analyze the insights into the relationship between black women and the Divine and the ways this relationship shapes their moral agency in attaining wholeness, integrity, and meaning. Issues under our investigation will include womanist explorations of: the Divine or ultimate reality; the origin and purpose of human existence; authority and freedom in religious understanding; pluralism and religious truth; embodiment and sexuality, evil, suffering and death; compassion, joy, and hope; and Divine involvement in human history. [3] Ms. Floyd-Thomas

REL 7133. Womanist Literature. [Formerly REL 3428] This seminar examines the Black women's literary tradition as a repository for doing constructive ethics. Attention will be given to how Black women of various periods, cultures, and literary traditions have brought distinctive imaginative and critical perspectives to bear on "the sacred." In addition to addressing the complicated presence of religious themes, biblical references, and theological issues in these texts, literary and religious methods of "reading" and "writing" will be employed by comparing constructive and hermeneutical approaches among both literary writers and womanist ethicists. [3]

REL 7134. Women's Bodies, Politics and Policy Making. [Formerly REL 3414] In this course, students will be active participants in exploring the many dimensions of politics in the United States and abroad concerning how women have organized to subvert the oppression of women's bodies in an effort to have a greater role in politics and the skills women need to fully participate in politics and policymaking. Students explore how politics and government, morality and religion, church and state affect women's lives today, and examine the ways that women participate in the social and religious political process in order to influence the course of public policy. Readings and class discussion on the intersection of race/ethnicity and gender/sexuality, work/class and ability/aesthetics in policies are central to the theoretical perspectives that provide the foundation of this course.

REL 7135. Race, Sexuality, Class, and Inequality. [Formerly REL 3427] This seminar considers practical applications for religious leaders. [3]

REL 7139. What Is in a Text? A detailed examination of one formative text in Christian ethics to explore a thinker's ideas and how he or she states a theme, develops an argument, and is able to argue his or her case in a persuasive manner. Attention to consistency, reasoning, style, and rhetoric are also a part of the course. Finally, we consider the book in relation to the

renewal of the church, its implication for ministry, and its place in enriching scholarly debate and thought. Students may repeat the course as different texts are studied. [3] Ms. Townes

REL 7141. The Political Economy of Misery. [Formerly REL 3144] An examination of the ways in which the intersections of various forms of oppression; such as racism, sexism, ageism, heterosexism, and classism; coalesce to form lifestyles of misery that produce social patterns of domination & subordination. [3] Emilie Townes

REL 7142. Vexations: Religion and Politics in the Black Community. This course explores the theo-ethical perspectives of the intersection between religion and politics in Black communities in the United States that forms a matrix of vexation—the complex encounter with social problems on a multi-dimensional basis. We take up the challenge of how to use Christian ethics to examine contemporary social issues, how to identify basic elements of Christian ethical reflection in political discourse, how to consider a variety of ethical perspectives for decision-making, and how to evaluate Black ethical thinkers as they respond to concrete political and social issues. Our conversations may be informed by social issues such as mass incarceration, gang violence, health care, poverty, drugs, voting rights, education, unemployment, and police brutality as entry points to the matrix, the impact of these social issues on Black communities in the U.S., and their implications for prophetic witness in the academy, community, church, and society. [3] Ms. Townes

REL 7144. Metaphors of Evil. This course is an examination of the ways in which metaphors and symbols function at the intersections of various forms of oppression that coalesce into lifestyles of misery to produce social patterns of domination and subordination. We will consider how conversations between Christian ethics and theology as well as other disciplines help frame possible trajectories of justice and justice making. [3] Ms. Townes

REL 7145. African American Social Ethics. This course is an introduction to the African American moral landscape as espoused by Black moral thinkers and the real-lived plight of Black people. This broad experience will be explored via social ethics and through the collective quest for freedom, the struggle for liberation, the meaning agency, and the nature of moral faith and witness. In depth study will be given to particular contestable ethical issues (namely, sexuality, violence, rage, racism, sexism, poverty, and justice) via the religious rationale of Black people whose efforts have been to link divine justice and social justice. This course is taught with a commitment to social change through attention to anti-racism, diversity, and multiculturalism. [3] Ms. Floyd-Thomas

REL 7221. Healthcare Ethics: Theory and Practice. [Formerly REL 3465] This seminar examines contemporary healthcare ethics in the U.S. and the disciplinary perspectives that inform this field. Attention is given to the political and cultural forces that have shaped the chief ethical problems in healthcare and to the philosophical, religious and social scientific tools used to address them. A major aim of the seminar is to gain critical purchase on these tools, and to assess their uses and limits. We will explore a range of practical issues, probing the ways these concerns shape professional and public life beyond their immediate sphere of occurrence. This seminar serves as a gateway for additional work in the field. [3]

REL 7222. Ethics in Healthcare: Theological and Philosophical Perspectives. [Formerly REL 3464] This course examines a broad range of theological and philosophical methods for addressing ethical questions in American healthcare. Texts will be drawn from Protestant and Catholic Christianity, Jewish thought, contemporary Anglo-American philosophy and the virtue traditions. Issues to be considered will include those at the beginning and ending of life, routine patient care and questions of health policy and social justice. FALL. [3] Churchill and Meador.

REL 7240. Seminar in Sociology of Religion. [Formerly REL 3953] Religion is a constitutive feature of social life, always shaping and being shaped by its particular social context. Indeed, the very content and form of religion itself is always and necessarily formed from the stuff of the socio-cultural world (language, symbols, ritual interactions, resources, organizations, norms, etc.). The sociology of religion has focused on this relationship of religion and its broader socio-cultural world, and has developed a particular set of preoccupations: secularization, modernization, myth and meaning-making, and the role of religion in social ordering, for example.

In this course, we hope to examine and experiment with some of the core assumptions of the sociological study of religion. What does it mean to be religious? What is the relationship of religion and culture? Do we live in a secular society? How do we enact religious life? How is religion produced and re-produced? [3]

REL 7999. Master's Thesis Research. [Formerly REL 3690] [0-6]

REL 8000. Theology and Practice Colloquy. [Formerly REL 2001] The colloquy provides a social space for deliberation about the goods of theological education. Driven by student presentations, the colloquy considers especially questions of vocation, teaching, and research. Enrollment is limited to fellows in the Program in Theology and Practice. Fellows are required to enroll in the colloquy in each semester of their first three years of doctoral study. Pass/Fail. [1, awarded at the end of each full year] [0-3]

REL 8001. Theology and Practice Core Seminar: Research for Ministry. [Formerly REL 2002] Various topics. [3] Staff.

REL 8002. Theories and Practices in Critical Pedagogy: Identity Politics in Teaching Theology and Religion. [Formerly REL 3602] This doctoral seminar explores critical, liberative and emancipatory pedagogies, and interrogates their applicability for teaching theological education and religious studies. Particular attention will be devoted to critical theories grounded in race, gender, and class analysis, as well as to the promise and problems posed by doing critical pedagogy on the margins of academe and religious life. This seminar will also survey inter/multi/disciplinary pedagogical approaches in order to demonstrate the manner in which subject matter impacts both knowledge production and concrete, everyday life experience. Finally, students will begin working on intellectual design and course development skills in an effort to articulate their own signature pedagogy.

REL 8003. Qualitative Research. [Formerly REL 3619] This doctoral seminar introduces qualitative research methods geared to practical theological methodologies. Students will encounter a range of research methods and exercises drawn from various qualitative designs, but often regarded as shared practices among respective disciplines. This course weighs the philosophical and practical bases of said designs and their theories to construct or study research questions. Students will develop skills in conceptualizing and conducting a qualitative research project: determining a research question and research design, accessing a research site, collecting and analyzing data, writing up the findings, and weighing the challenges of theory building. Students will also learn about a range of ethical considerations involved in conducting research. [3]

REL 8004. Practicum in the Online Teaching of Religion. As a response to a shifting landscape within the field of Religious Studies, this practicum experience has been designed to prepare PhD students in the Graduate Department of Religion for future careers in online teaching. Over the course of this semester-long hybrid experience, learners will be introduced to core elements of teaching and learning and think critically about how these principles might apply to teaching in virtual spaces. To demonstrate their understanding of course materials and discussions, participants will develop a personal philosophy of online teaching; design, build and teach an online module; and be prepared to articulate how their online teaching philosophy would apply in different workplace settings. [0]

REL 8005. Clinical Seminar. [Formerly REL 3760] This two-semester (fall/spring required) 3-hour credit supervisory course focuses on discussion of readings from a clinical practice orientation (the first hour) and presentation of cases from a context in which students provide care or counseling (the second hour). Requirements include critical engagement with the assigned texts, rigorous clinical discussion, and the submission and presentation of written case reports. Participants must be actively engaged in pastoral ministry or other care-giving roles. Enrollment is limited to six doctoral and upper level divinity students. Divinity students are admitted only after interview and confirmation by clinical seminar faculty. [0-3] Instructors: Drs. S. Bruce Rogers-Vaughn and Evon O. Flesberg.

REL 8006. The History of the Study of Religion. [Formerly REL 3525] Introduction to the history of the discipline through the study of a specific theme such as body, dreams, image, fetish, or ritual. Relates the theme to the construction of religious studies as an academic discipline. Significant

attention to interdisciplinary origins of religious studies through readings from disciplines such as anthropology, history, philosophy, psychology, sociology, and theology. Specific theme will be announced each semester. May be repeated. [3] Staff.

REL 8007. Theology and Practice Core Seminar-Teaching for Ministry. Various topics. [3] Staff.

REL 8050. Special Topics in Religion. [Formerly REL 3880]

REL 8600. Winnicott and Interpretation Religion and Psychology Seminar. [Formerly REL 3068] This graduate seminar will explore the work of the post-Freudian pediatrician and psychoanalyst D. W. Winnicott (1896–1971) and his significance for psychodynamic theory and psychology of religion. Winnicott is the leading theorist of the Independent Group in British psychoanalysis (who located themselves between Anna Freud and Melanie Klein). Winnicott has been described as “intriguing, intellectually invigorating, startlingly innovative, clinically helpful, and sometimes frustrating to read and understand.” He informs our understanding of especially, children, families, play, and the creative impulse. Besides, reading a significant amount of Winnicott’s work, the seminar will discuss works by contemporary interpreter and critics. [3] Hamman.

REL 8801. Martin Luther King, Jr. [Formerly REL 2564] King’s role as a religious leader and as an agent of social change, with some attention to the intellectual sources of his thought and social activism. His views concerning the social roles of religion are seen against the background of classical Christian views, late nineteenth-century dissenting traditions, the early twentieth-century American Social Gospel Movement, and the more radical ideas of Malcolm X and Albert B. Cleage, Jr., during the 1960s. Critical evaluations of King are also made in terms of classical Christian views (e.g., Aquinas, Luther, Calvin, Wesley). [3]

REL 8802. Modern Critics of Religion. [Formerly REL 3311] This seminar examines the relationship between the critique of religion and the understanding of modernity under the aegis of Marx’s famous apothegm: “the criticism of religion is the prerequisite of all criticism.” To that end, it first traces the genealogy of Marx’s remark in the Hegelian tradition’s tie of religion and society as well as explores the notion of critique. Then after analysis of Marx’s own work, in particular his appropriation of religious discourse to undertake social criticism, the seminar considers critiques of religion that appear to belie the optimistic assessment that preceded Marx’s dictum: “For Germany, the criticism of religion has been essentially completed.” The work of the two leading critics of modernity who follow Marx-Freud and Nietzsche are addressed. [3] Geller.

REL 8803. Postmodern Theory: In the Wake of the Death of God. [Formerly REL 3351] If modernism is understood to be the age of the subject, the age that begins when self-consciousness says, “I think, therefore I am” (Descartes, 1638), making itself the foundation of its very existence, postmodernity begins when this postulate of the autonomous, self-grounding subject enters into crisis and collapses. Without the individual subject as secure foundation, the presumably stable values of modern tradition since the Renaissance are undermined in all domains from market economies based on the free choices of independent individuals to aesthetic styles of subjective self-expression familiar, for example, in Romantic and Expressionist art. The new sense of a lack of foundations, of no tangible or knowable reality underlying and grounding the flux of appearances in experience, opens thought and praxis in the diverse directions that have come to be characterized as postmodern. Simulacra, inauthenticity, lack of origins or originals, hence proliferating pluralities which nevertheless evince no real distinctions from one another in a consumer society of mass production are some of the typical manifestations of this postmodern milieu. We will undertake to survey important theoretical responses to this predicament particularly from philosophers of religion, primarily those in the continental tradition writing currently.

REL 8804. The Nature of Evil. [Formerly REL 3404] Human evil as expressed in the Shoah, religious fundamentalism, and ethnic cleansing. Theological, philosophical, biological, and literary texts. Evil transformed by scientific inquiry since 1600.

REL 8805. Jewish Theories of Religion. [Formerly REL 3507] Critical analysis and discussion of modern Jewish constructions of religion: politi-

cally, symbolically, ethically, normatively, and aesthetic-mystically. Selected readings from Cohen, Buber, Rosenzweig, Kaplan, and social philosophers such as Simmel and Habermas on the function, nature, and meaning of religion in secular culture.

REL 8807. Mythologies and Epics of South Asia. [Formerly REL 3511] Classical Hindu and Buddhist mythologies of South Asia; Sanskrit Mahabharata and Ramayana epics; regional adaptations of mythical themes in vernacular languages; Buddhist and Islamic narratives of romance and chronicle; interpretive and performative strategies, orality, literacy, and modes of visual representation; political deployment of mythic tropes. [3]

REL 8808. Devotional Traditions of South Asia: Hindu, Muslim, Sikh. [Formerly REL 3512] Mythology of Hindu pantheon and worship through devotion or bhakti. Techniques for inculcating devotion through meditation, temple rituals, and pilgrimage. Entry of Islam into South Asia. Shi’i and Sufi practices. Sikh traditions. Role of vernacular languages in creating local traditions. Hindu-Muslim interaction, syncretism, and shared sacred space. Challenges to orthodoxy. [3] Taneja.

REL 8809. Buddhism and the State. [Formerly REL 3514] Models relating Buddhism and the state in ancient and modern Asia. Kingship and spiritual leadership; sacred territory and national identity; legitimization theory and its alternatives; and religious responses to the modern state. Case studies from India, Nepal, Thailand, Burma, Tibet, Mongolia, China, and Japan. [3] Ms. Lin

REL 8810. Zen Buddhism. [Formerly REL 3515] A study of the development of Zen Buddhism in China and Japan with special attention to its basic philosophy, its position within Mahayana Buddhism, its meditational techniques and its contemporary significance. [3] Lowe

REL 8811. Mysticism in Islam. [Formerly REL 3517] A survey of the origins and development of Islamic mysticism, the rise of asceticism, the development of the Sufi orders, the gradual systematization of Sufi teachings, and modern forms of Sufism. The spread of Islamic mysticism was primarily due to the teachings of great thinkers such as Ibn Arabi, Rabi’a, al-Hallaj, Rumi, al-Ghazali, and others. No prior knowledge of Islam is required. [3] McGregor.

REL 8812. The Qur’an and Its Interpreters. [Formerly REL 3518] This course will focus upon the Qur’an and the Islamic tradition of interpretation through a critical examination of the treatment of the biblical prophets, Jesus, and Satan. Interpretations will be drawn from the earliest period to the modern era. Rationalist, dogmatic, Shi’i, and mystical schools of interpretation will be discussed. [3] McGregor.

REL 8813. Foundations in Hindu Traditions: Ritual and Text. [Formerly REL 3519] The course traces the ongoing experiments of ritual processes which sought to resolve or ameliorate the inexorable migratory effect of simple human action (karma). Over the last several thousand years these experiments have followed four fundamentally different trajectories that provide us with a broad historical frame: the sacrifice/yajna of the Vedic period, meditation/yoga, devotion/bhakti, and tantra/transgressive practices. Students will examine translations of the foundational texts that justify each of these four alternatives, pairing those with the persistence of material culture, from the sites used for consecrating kings, temple construction and iconography, domestic organization and rites of passage to sacred geography that becomes the object of pilgrimage. At the completion of the class, the student should have the conceptual vocabulary and analytical tools necessary to interpret intelligently any manifestation of the Hindu traditions they may encounter, from the ancient to the contemporary. [Stewart]

REL 8814. Asian Conceptions of Wisdom, Liberation, and Enlightenment. [Formerly REL 3520] Philosophical conceptions and practices as found in classical works, including the Bhagavad Gita, the Confucian Analects, the Tao Te Ching, and Buddhist texts that have functioned as religious life-guides in India, China, and Japan for thousands of years.

REL 8815. Chinese Religion through Stories. [Formerly REL 3521] Analysis of narratives from various religious traditions and genres within early and medieval China. The role of narrative in Chinese religious, cultural, and political life. Primary texts in English translation. Offered on a graded basis only. [3] Campany.

REL 8816. Sacred Space in the Tibetan World. [Formerly REL 3523] How is sacred space created, mediated, and reproduced in the greater Tibetan world? To investigate this question, we proceed through loci of increasing scale, from religious icons and bodies to build structures to sacred geographies. In the process, we analyze how sacred space is formed and affirmed through narrative, ritual, cosmology, and interaction with natural environments. We will attend to interactions between Buddhist, Bön, and local religious traditions, as well as to continuities and changes from pre-modern to modern periods. Our case studies will extend beyond the current political borders of Tibet to include ethnically Tibetan communities in India and Nepal, historically significant sites in China and Bhutan, and the circulation of Tibetan objects and bodies in America and worldwide.

REL 8817. The Holocaust: Its Meanings and Implications. [Formerly REL 3524] This course examines the systematic destruction of European Jewry and other groups during World War II, its background, and its aftermath. It addresses the attempts by victims, bystanders, perpetrators, and their descendants—and we are all their descendants—to create meaningful narratives about an event that appears to lack discernible meaning. To that end it focuses upon historical accounts, case studies, memoirs, fiction, and theology and such issues as history, memory, witness, conscience, language, evil, and otherness that they raise. Particular emphasis is upon the many roles of film in both the Third Reich and the postwar world. National Socialism employed films to mobilize support for its rule and to inculcate its racial-eugenic worldview. In the wake of the Holocaust, film has been employed for other purposes: to document, to bear witness, to mitigate or reduce its import, to provide meaning, to unmask attempts to mystify or suppress the past, to explore relationships between those events and contemporary societies, to say the unsayable, to examine the life of the traumatized victim. No prior study is presupposed of these events that have come to be known as the Holocaust. [3] Geller.

REL 8819. Religion and Film. [Formerly REL 3530]

REL 8820. Freud and Jewish Identity. [Formerly REL 3534] This course examines selected writings of Sigmund Freud within the context of contemporary Viennese Jewish life and anti-Semitic discourses. Through an analysis of Freud's rhetorical figures, topoi, exemplar, emphases, omissions, and anomalies, students will explore how psychoanalytic theory developed in response to the traumas of Jewish assimilation and of anti-Semitic repudiation—whether by acting them out or working through them. [3] Mr. Geller

REL 8822. The Holocaust: Representation and Reflection. [Formerly REL 3537] Explores fundamental questions about the nature of history and representation, the nature of the human and the divine, that the Holocaust raises. [3] Geller.

REL 8823. Japanese Mythology. [Formerly REL 3542] Antiquity to the present. Classic myths and re-tellings over time. Introduction to theoretical frameworks including comparative and historical. Politics, gender, and performance. [3] Lowe.

REL 8824. Apophatic Mysticism. [Formerly REL 3910] Unsayable or negative, theology from Plato and Neoplatonism through medieval mysticism, Kabbalah and Sufism. Baroque expressions in Silesius Angelus and John of the Cross. Romantic authors and modern and postmodern writers. Chinese Taoism, Advaita Vedanta, and the Buddhism of Nagarjuna. [3]

REL 8825. Jewish Animals. [Formerly REL 3961] Throughout the centuries verbal and visual images of animals (pigs, dogs, vermin, rodents, apes, etc.) have been used to debase and bestialize Jews. What then is going on when Jewish writers employ such animal figures in their narratives and poems? After examining the history of such anti-Jewish representations, this course will analyze the animal tales of, among others, Heinrich Heine, Franz Kafka, Gertrude Kolmar (*Animal Dreams*), H. Leivick ("The Wolf"), Bernard Malamud, Felix Salten (*Bambi*), Moacir Scliar (*The Centaur in the Garden*), Curt Siodmak (*The Wolf Man*), and Art Spiegelman. Mr. Geller [3]

REL 8830. Islam in South Asia. History of Islam in South Asia. Cultural memory of conquest. Inter-religious interactions. Sufism and Bhakti. Mughal traditions of cosmopolitanism. Legacy of colonialism. Impact of Partition. Shared popular culture and shared sacred spaces. [3]. Taneja.

REL 8835. Islam in the Modern World. Impact of colonialism on Muslim societies and everyday life in the cities of the Middle East. Analysis through

literary, religious, political, and ethnographic texts. Relationship of Sharia to the modern state; impact of modernity on the understanding and practice of religion. [3]

REL 8900. The Study of Religion. [Formerly REL 3601] Required of entering Ph.D. students in their first semester. Discussion of such topics as the methods, diversities, connections, purposes, and contexts of religious studies. [3]

REL 8999. Non-Candidate Research. [Formerly REL 3790] Research prior to entry into candidacy (completion of Qualifying Examination) and for special non-degree students. [Variable credit: 0-12]

REL 9100. Reading Course in Ethics. [Formerly REL 3976] May be repeated. [1-3] Staff.

REL 9150. Reading Course in Medical Ethics. [Formerly REL 3977] May be repeated. [1-3] Staff.

REL 9200. Reading Course in Hebrew Bible. [Formerly REL 3974] May be repeated. [1-3] Staff.

REL 9300. Reading Course in Homiletics. [Formerly REL 3972] May be repeated. [1-3] Staff.

REL 9350. Reading Course in Liturgics. [Formerly REL 3973] May be repeated. [1-3] Staff.

REL 9400. Reading Course in American Church History. [Formerly REL 3979] May be repeated. [1-3] Staff.

REL 9415. Reading Course in Reformation History. [Formerly REL 3991] [1-3] Staff.

REL 9425. Reading Course in Modern European Church History. [Formerly REL 3988] May be repeated. [1-3] Staff.

REL 9450. Reading Course in Early Church History. [Formerly REL 3980] May be repeated. [1-3] Staff.

REL 9475. Reading Course in Historical Theology. [Formerly REL 3981] [1-3] Staff.

REL 9500. Reading Course in New Testament. [Formerly REL 3975] May be repeated. [3] Staff.

REL 9600. Reading Course in Religion, Psychology, and Culture. [Formerly REL 3970] May be repeated. [1-3] Staff.

REL 9650. Reading Course in Pastoral Theology. [Formerly REL 3971] May be repeated. [1-3] Staff.

REL 9675. Readings in Religion/Gender/Sexuality. [Formerly REL 3987] May be repeated. [1-3] Staff.

REL 9700. Reading Course in Systematic Theology. [Formerly REL 3983] May be repeated. [1-3] Staff.

REL 9750. Reading Course in Philosophical Theology. [Formerly REL 3984] May be repeated. [1-3] Staff.

REL 9800. Reading Course in Judaism. [Formerly REL 3982] May be repeated. [1-3] Staff.

REL 9820. Reading Course in History and Critical Theories of Religion. [Formerly REL 3985] May be repeated. [1-3] Staff.

REL 9999. Ph.D. Dissertation Research. [Formerly REL 3990] May be repeated. [0-12] Staff.

Religious Studies

RLST 5142. Slave Thought and Culture in the American South. (Also listed as RLST 3142) The religious thought of African American slaves as expressed through folklore, literature, and art. Creative ideas about the cosmos, the supernatural, transcendent spiritual reality, natural social reality, and the human condition. Offered on a graded basis only. No credit for students who have earned credit for 3142. [3]

RLST 5178. Native American Religious Traditions. (Also listed as RLST 3178) Diversity of First Nation religious traditions in North America, especially Eastern Woodlands and Plains. Spiritual and cultural dimensions of

diversity, cosmologies, stereotypes, cultural resilience, creativity and storytelling, humor, rituals and practices, healing, and sovereignty. No credit for students who have earned credit for 3178. [3]

RLST 5225. Sexuality in the Hebrew Bible and the Ancient Near East. (Also listed as RLST 3225) Issues of sexuality in the Hebrew Bible in the context of the Ancient Near East. Homosexuality, virginity, and incest. No credit for students who have earned credit for 3225. [3]

RLST 5270. Jewish Theories of Religion. (Also listed as RLST 3270) Critical analysis and discussion of modern Jewish constructions of religion: politically, symbolically, ethically, normatively, and aesthetic-mystically. Selected readings from Cohen, Buber, Rosenzweig, Kaplan, and social philosophers such as Simmel and Habermas on the function, nature, and meaning of religion in secular culture. No credit for students who have earned credit for 3270. [3]

RLST 5371. Through the Eyes of the Other: A History of Muslim-Christian Relations. Travelogues and interpretive accounts of encountering the religious and cultural 'Other,' Christian or Muslim. Increased awareness of long-standing relationship between two major religious traditions. [3]

RLST 5459. Buddhist Traditions. [Formerly RLST 244] Historical and thematic survey of foundational, Mahayana, and esoteric Buddhist traditions. Mythology, doctrine, meditation, devotional practices, and institutions. Contemporary case studies from Asia and North America. [3]

RLST 5461. Islam in Africa. (Also listed as RLST 2461) Social and cultural development of Islam across Africa from the eighth century to the present, as illuminated by historical, ethnographic, and literary sources. Interplay between Muslims and outside religious groups, jihads in pre-colonial Africa, and Islam during European colonization. Attention to Sub-Saharan Africa. No credit for students who have earned credit for 2461. [3]

RLST 5472. Religion, Ecology, and Power in Africa. (Also listed as 2472) The interrelationship between religion and ecology in Africa; the ways power relations in pre-colonial Africa through the present have determined human-Earth relations. Divine origin and development of the Earth and its peoples; influence on African social structure, ethnically-based occupations, and stewardship over the environment. No credit for students who have earned credit for 2472. [3]

RLST 5552. Reformers of the Islamic Tradition. (Also listed as RLST 4552) Historical survey of Muslim reformists. Religious responses to crises in the pre-modern debates over orthodoxy and heresy; modern (Western colonialism) and recent periods. No credit for students who have earned credit for 4552. [3]

RLST 5562. Culture, Religion, and Politics of the Arab World. (Also listed as RLST 4562) Diversity and unity in Arab culture. Religious, socio-political, and historical factors shaping Arab identity in the modern age. Encounters and relationships between Arabs and the Western world. The Israeli-Palestinian conflict. No credit for students who have earned credit for 4562. [3]

RLST 5592. Advanced Seminar in Arabic. (Also listed as RLST 4592) Analysis of style and forms. Poetry, novels, popular literature, and historical chronicles. Topics vary. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. No credit for students who have earned credit for 4592. [3]

RLST 5593. Advanced Seminar in Islamic Tradition. (Also listed as RLST 4593) Analysis of original Arabic texts, manuscript reading, and research methods. Topics vary. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. No credit for students who have earned credit for 4593. [3]

RLST 5665. Mythologies and Epics of South Asia. (Also listed as RLST 4665) Classical Hindu and Buddhist mythologies of South Asia. Sanskrit Mahabharata and Ramayana epics. Regional adaptations of mythical themes in vernacular languages. Buddhist and Islamic narratives of romance and chronicle. Interpretive and performance strategies. Oral, liter-

ary, and visual modes of representation. Political deployment of myths. No credit for students who have earned credit for 4665. [3]

RLST 5666. Devotional Traditions of South Asia: Hindu, Muslim, Sikh. (Also listed as RLST 4666) Mythology of Hindu pantheon and worship through devotion or bhakti. Techniques for inculcating devotion through meditation, temple rituals, and pilgrimage. Entry of Islam into South Asia. Shi'i and Sufi practices. Sikh traditions. Role of vernacular languages in creating local traditions. Hindu-Muslim interaction, syncretism, and shared sacred space. Challenges to orthodoxy. No credit for students who have earned credit for 4666. [3]

RLST 5669. Sacred Space in the Tibetan World. (Also listed as RLST 3669) Creation, mediation, and reproduction of sacred space from artifacts to built structures to geographies. Narrative, ritual, and cosmological aspects of Tibetan Buddhist, Bön, and local religious traditions. Cases include premodern to modern periods, and local to global contexts. No credit for students who have earned credit for 3669. [3]

RLST 5670. Buddhism and the State. (Also listed as RLST 3670W) Models relating Buddhism and the state in ancient and modern Asia. Kingship and spiritual leadership; sacred territory and national identity; legitimation theory and its alternatives; and religious responses to the modern state. Case studies from India, Nepal, Thailand, Burma, Tibet, Mongolia, China, and Japan. No credit for students who have earned credit for 3670W. [3]

RLST 5747. Daoist Tradition. (Also listed as RLST 3747) Historical and thematic survey of the Daoist tradition in China. Philosophical classics and religious scriptures, as well as social history are covered. Daoism today. No credit for students who have earned credit for 3747. [3]

RLST 5753. East Asian Buddhism. (Also listed as RLST 3753) East Asian Buddhist texts. Key Buddhist ideas, values, practices, and institutions. Chronological surveys of key developments in major historical periods. No credit for students who have earned credit for 3753. [3]

RLST 5775. Chinese Religions through Stories. (Also listed as RLST 3775) Analysis of narratives from various religious traditions and genres within early and medieval China. The role of narrative in Chinese religious, cultural, and political life. Primary texts in English translation. Offered on a graded basis only. No credit for students who have earned credit for 3775. [3]

RLST 5900. Mysticism and Spirituality, Comparative Study. (Also listed as RLST 3900) Philosophical, historical, and textual perspectives. Key mystical traditions, philosophies, texts, and figures from Hindu, Buddhist, and Christian traditions. The popular emergence of spirituality as a contemporary mode of religiosity in advanced capitalist societies. No credit for students who have earned credit for 3900. [3]

RLST 5921. Ethics and Ecology. (Also listed as RLST 3921) Relationships among humans, nature, and the sacred. Focus on understandings of our 'dominion' over non-human nature. The role of religion in shaping attitudes and behaviors regarding the environment. Topics include eco-centered ethics, 'creation care,' reliance on fossil fuels, and alternative sustainable scenarios. [3]

RLST 5926. Ancient Goddesses. (Also listed as RLST 3926) Ancient concepts of the feminine divine in literature and iconographic evidence. Specific goddesses, their spheres of influence, and their place in the various pantheons. Cultic practices and religious syncretism across cultures, including Mesopotamia, Egypt, and Ancient Israel. Offered on a graded basis only. No credit for students who have earned credit for 3926. [3]

RLST 5938. Marriage in the Ancient Near East and the Hebrew Bible. (Also listed as RLST 4938) Religious, legal, and socio-economic aspects of marriage. Survey of ancient Sumerian, Assyrian, Babylonian, and Egyptian sources, and relevant sections of the Hebrew Bible. Marriage as an institution at the beginning of recorded history. No credit for students who have earned credit for 4938. [3]

RLST 5940. The Nature of Evil. (Also listed as RLST 3940) Human evil as expressed in the Shoah, religious fundamentalism, and ethnic cleansing. Theological, philosophical, biological, and literary texts. Evil transformed by scientific inquiry since 1600. No credit for students who have earned credit for 3940. [3]

Responsible Conduct in Research

RCRG 6303. Responsible Conduct of Research. [Formerly RCRG 303A] Responsible Conduct of Research: Lectures and small group discussions about responsible conduct of research including individual and group responsibilities, recording and use of data, intellectual property and technology transfer, ethical questions in and about research, societal responsibility of researchers, and Federal and institutional guidelines.

RCRG 6304. Peer Review and Publication. [Formerly RCRG 303B] Discussion, case studies dealing with publication standards and plagiarism.

RCRG 6305. Mentor/Trainee and COI Discussion. [Formerly RCRG 303C] Discussion and case studies on the relationship between students and mentors and conflict of interest.

RCRG 6306. Data Management/Research Misconduct Discussion. [Formerly RCRG 303D] Discussion and case studies on proper data archival and protection, fraud and honesty in research.

RCRG 6307. Special Topics Discussion. [Formerly RCRG 303E] Special Topics Discussion

RCRG 6308. Responsible Conduct of Research in the Humanities. Preparation for the responsible conduct of research in the humanities through discussion of case studies and issues. [0]

Russian

RUSS 5231. Jews in Russian Culture: Survival and Identity. (Also listed as RUSS 3231) A course on the history of Jewish contributions to Russian culture, including literature, the visual arts, theatre, and film. Questions of assimilation, the rise of Jewish national consciousness, and interest in Jewish heritage are discussed. No knowledge of Russian required. No credit for students who have earned credit for 3231. [3]

Scientific Computing

SC 5250. Scientific Computing Toolbox. (Also listed as SC 3250) Use of computational tools in multiple science and engineering domains. Simulations of complex physical, biological, social, and engineering systems, optimization and evaluation of simulation models, Monte Carlo methods, scientific visualization, high performance computing, or data mining. No credit for students who have earned credit for 3250. FALL. [3]

SC 5260. High Performance Computing. (Also listed as SC 3260) Parallel computing, grid computing, GPU computing, data communication, high performance security issues, performance tuning on shared-memory architectures. SPRING. [3]

SC 5890. Special Topics. (Also listed as SC 3890) No credit for students who have earned credit for 3890. [1-3]

Second Language Studies

SLS 6030. Foreign Language Learning and Teaching. [Formerly SLS 310] (Also listed as Spanish 6030, Portuguese 6030, French 6030, German 5310) Principles and practices of teaching a second language with concentration on recent interactive and communicative models of foreign language instruction. Classroom observations, journal writing, development of materials, and a small action research project. [3]

SLS 7040. Second Language Acquisition Theories and Research. [Formerly SLS 312] (Also listed as French 7040 and German 5311) A review of current sociocultural and cognitive theories and research. [3]

SLS 8090. Special Topics in Second Language Studies. [Formerly SLS 395] Topics in applied linguistics including second language acquisition, curriculum design, and assessment. [3]

Sociology

SOC 6301. Classical Theory. [Formerly SOC 301] Theoretical perspectives and theorists in the early history of sociology, focusing primarily on Durkheim, Marx, and Weber. [3]

SOC 6302. Contemporary Theory. [Formerly SOC 302] Modern developments including neo-Marxist, functionalist, structuralist, conflict, interactionist, exchange/rational choice, and feminist theories. [3]

SOC 6310. Sociological Inquiry. [Formerly SOC 310] Introduction to research methods, including theory construction, sociological reasoning, study design, and specific research techniques. Normally limited to graduate students in the department. [3]

SOC 6311. Multivariate Analysis I. [Formerly SOC 311] Basic concepts in probability and statistical analysis. Multivariate analysis of sociological data, with special attention to regression analysis. The use of computers. Prerequisite: enrollment in graduate program in sociology or permission of the instructor. [3]

SOC 6312. Multivariate Analysis II. [Formerly SOC 312] The general linear model in analyzing sociological data, including analysis of variance, regression, path analysis, and parametric techniques for contingency-table analysis. Practice in the use of computers. Prerequisite: 6311 or an equivalent statistics course approved by the instructor. [3]

SOC 7400. Teaching Workshop. [Formerly SOC 323] For students wanting to improve their teaching skills. Students visit the classrooms of outstanding teachers on campus and discuss their approach to teaching; deliver lectures in the presence of critics; examine their own lectures on videotape; discuss methods of evaluation; read outstanding books on college teaching; and survey teaching materials produced by the American Sociological Association. Normally limited to graduate students in the department. Graded P/F only. [3]

SOC 7500. Workshop on Sociological Criticism. [Formerly SOC 373] Intensive introduction to peer review for publication, using materials from journal submissions to editorial correspondence. [3]

SOC 7600. Quantitative Methods Workshop. [Formerly SOC 313] Analysis of large data sets from the social sciences or of data brought to the course by students. Scaling and measurement; nonparametric analysis of contingency tables; and advanced topics in regression and path analysis. Prerequisite: 6312 or an equivalent statistics course approved by the instructor. [3]

SOC 7700. Qualitative Methods Workshop. [Formerly SOC 315] Organization and execution of research in natural settings. Processes of collecting, analyzing, and reporting qualitative social data and documentary evidence. Theoretical and methodological bases of comparative-historical sociology. [3]

SOC 7999. Master's Thesis Research. [Formerly SOC 369] [0-12]

SOC 8329. Survey Seminar on Gender and Sexuality. [Formerly SOC 329] Recent contributions to the field, including micro- and macro-level theories of the development of gender ideology/roles, labor force stratification, gender and social protest, and feminist methodologies. Attention to research on sexual meanings, identities, and behaviors. [3]

SOC 8331. Survey Seminar on Collective Behavior and Social Movements. [Formerly SOC 331] Theories accounting for causes, dynamics, and consequences of collective behavior and/or social movements. Critiques of such theories for understanding historically specific revolutions, rebellions, and nonviolent forms of protest. [3]

SOC 8333. Survey Seminar on Cultural Sociology. [Formerly SOC 333] The creation of culture, including values, norms, beliefs, symbols, and lifestyles. The reproduction of society through culture; institutions that purposefully preserve, produce, and transmit aspects of culture. [3]

SOC 8335. Survey Seminar on Deviant Behavior and Social Control. [Formerly SOC 335] Major works on crime, juvenile delinquency, and forms of extralegal deviance. Social control in connection with counteraction of deviance, sociology of law, and manipulation of human behavior. [3]

SOC 8337. Survey Seminar on Race and Ethnic Relations. [Formerly SOC 337] Analyses of enduring topics in the study of race and ethnicity, including stratification, discrimination, immigration, assimilation, and politics. Other topics include racial and ethnic identity and the social construction of race and ethnic categories. [3]

SOC 8339. Survey Seminar on Political Sociology. [Formerly SOC 339] Classical and modern theories about the nature and distribution of power in society and in other human groups. Social bases and implications of major political institutions, the state in particular; and political order and change. [3]

SOC 8341. Survey Seminar on Population Studies and Human Ecology. [Formerly SOC 341] Population processes, elements of social organization, and their interaction. Major theories and research pertaining to fertility, mortality, migration, urbanization, urban structure, technology, and the division of labor. [3]

SOC 8343. Survey Seminar on Social Psychology. [Formerly SOC 343] The interaction of social structure and personality. Socialization, social perception, small groups, exchange theory, and symbolic interactionism. [3]

SOC 8345. Survey Seminar on Social Stratification. [Formerly SOC 345] Major theories and lines of research pertaining to the origin, nature, and functioning of systems of social inequality. [3]

SOC 8347. Survey Seminar on Sociology of Science and Knowledge. [Formerly SOC 347] How ideas and systems of thought are related to the social structure and culture of societies. Institutionalization of scientific and intellectual activity, scientific and intellectual communities or organizations, and social influences on the directions of research by scientists and academicians. [3]

SOC 8351. Survey Seminar on Medical Sociology. [Formerly SOC 351] Theoretical paradigms and methodologies for the study of social and cultural factors in the perception, diagnosis, treatment, and distribution of disease. Emphases on medicalization, mental health, medical technology, and roles of patients and medical professionals. [3]

SOC 8355. Survey Seminar on Sociology of Family. [Formerly SOC 355] Examinations of the family as a social institution. Principles of social organization applied to family relationships. Macro-level analyses of family structure, the effects of families on individuals, and interactions of family systems with other institutions. [3]

SOC 8357. Survey Seminar on Sociology of Education. [Formerly SOC 357] Comparative and functional analyses of education in society and education as society. Theories accounting for the form, role, and evolution of educational systems. Intersection of education and other institutions. [3]

SOC 8359. Survey Seminar on International Migration. [Formerly SOC 359] Key current theoretical debates about international migration and intersection with the empirical data and case studies. Emphases on interdisciplinarity and method, and comparative studies. [3]

SOC 8999. Non-candidate Research. [Formerly SOC 379] Research prior to entry into candidacy (completion of Qualifying Examination) and for special non-degree students. [Variable credit: 0-12]

SOC 9361. Special-Topic Seminars on Social Phenomena at the Macro Level. [Formerly SOC 361] Each focuses on some aspect of social structure, social organization, culture, international relations, global systems, spatial organization, or the social division of labor. Cities, communities, urban areas, metropolitan areas, regions, countries, or status categories are the principal units of comparison. May be repeated more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

SOC 9363. Special-Topic Seminars on Institutions and Organizations. [Formerly SOC 363] Each focuses on some type of institution-economic, educational, familial, medical, political, or religious-or some type of organization, including business firms and voluntary associations. May be repeated more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

SOC 9365. Special-Topic Seminars on Norms, Power, and Related Normative Phenomena. [Formerly SOC 367] Each focuses on a particular

type of deviance, the sociology of law, social control, or political sociology. May be repeated more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

SOC 9367. Special-Topic Seminars on Social Processes and Social Change. [Formerly SOC 368] Each focuses on collective behavior, social movements, innovation and diffusion, societal development, cultural evolution, revolutions, migration, mortality, fertility, or mobility. May be repeated more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

SOC 9369. Special-Topic Seminars on Methodology. [Formerly SOC 371] Each seminar focuses on a particular kind of research method or statistical technique. May be repeated more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

SOC 9371. Special-Topic Seminars on Theory. [Formerly SOC 372] Each seminar focuses on a particular theorist, a particular theoretical perspective, or the methodology of theory construction. May be repeated more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

SOC 9888. Directed Studies. [Formerly SOC 390A] Students work independently on topics of special interest not covered in depth in course offerings. Work in a tutorial relationship with an individual faculty member or in a student seminar, subject to faculty approval, should several students share a common interest. Prerequisite: consent of the instructor. May be repeated more than once if there is no duplication in topic, but students may earn only up to 3 credits per semester of enrollment. [1-3]

SOC 9889. Directed Studies. [Formerly SOC 390B] Students work independently on topics of special interest not covered in depth in course offerings. Work in a tutorial relationship with an individual faculty member or in a student seminar, subject to faculty approval, should several students share a common interest. Prerequisite: consent of the instructor. May be repeated more than once if there is no duplication in topic, but students may earn only up to 3 credits per semester of enrollment. [1-3]

SOC 9995. Half-time Ph.D. Dissertation Research. [Formerly SOC 3995] For students who have completed 72 hours and devote a half-time effort to dissertation research. [0]

SOC 9999. Ph.D. Dissertation Research. [Formerly SOC 399] [0-12]

Spanish

SPAN 5111. Spanish for Graduate Reading. [Formerly SPAN 101G] Survey of grammar and vocabulary, with extensive reading. Available only to graduate students for "No Credit". [0]

SPAN 5315. Contrastive Analysis of Spanish and English. (Also listed as SPAN 4315) A comparison of the phonological, morphological, and syntactical structures of Spanish and English to demonstrate the similarities and differences between the linguistic systems of these two languages. No credit for students who have earned credit for 4315. [3]

SPAN 5320. Phonology. (Also listed as SPAN 4320) Analysis of the production, nature, and systematic function of the sounds of the Spanish language, as well as of problems frequently experienced by non-native speakers. Both standard and dialect features of Spanish are examined. No credit for students who have earned credit for 4320. [3]

SPAN 5325. Dialectology. (Also listed as SPAN 4325) Formation, general characteristics, distinctive features, and geographical extension of the principal dialectal regions of Spain and Spanish America. Both historical and modern dialects are considered. Emphasis on non-standard dialectal varieties of Spanish. No credit for students who have earned credit for 4325. [3]

SPAN 5335. Morphology and Syntax. (Also listed as SPAN 4335) An introduction to the principles of modern Spanish morphology (word formation) and syntax (phrase structure and usage) through an analysis of the native speaker's organization of reality and use of language to reflect and to express that organization. No credit for students who have earned credit for 4335. [3]

SPAN 5340. History of Spanish Language. (Also listed as SPAN 4340) Origins and evolution of the Spanish (Castilian) language. Emphasis on the phonological and morphological development of Spanish within historical and cultural contexts of the Iberian Peninsula. No credit for students who have earned credit for 4340. [3]

SPAN 5345. The Languages of Spain. (Also listed as SPAN 4345) Origins, development, and the contemporary sociolinguistic situation of the principal languages and dialects of Spain, including Castilian, Catalan, Galician, and Basque. No credit for students who have earned credit for 4345. [3]

SPAN 5350. Communicating Across Cultures. (Also listed as SPAN 4350) Relationships among discourse, identity, and culture. Linguistic construction of ethnicity and gender. Latin American and U.S. Latino ways of speaking. Serves as repeat credit for student who completed 295 section 1 in spring 2005 or spring 2008. [3]

SPAN 5355. Spanish in Society. (Also listed as SPAN 4355) Language variation and linguistic change. Regional, socioeconomic, gendered, and ethnic differences in spoken Spanish. Language as it shapes the identities of speakers. Language use in social contexts with comparisons to English. Prerequisite: 3303. [3]

SPAN 5375. Film and Culture in Latin America. (Also listed as SPAN 3375) Latin American cinema from the perspective of cultural history; screenings and supplementary texts, including manifestos and critical readings. No credit for students who have earned credit for 3375. [3]

SPAN 5400. The Origins of Spanish Literature. (Also listed as SPAN 4400) From its beginnings to the Renaissance; the creation of a social order and a cultural tradition. Close study of three literary landmarks—*Poema del Cid*, *Libro de Buen Amor*, *La Celestina*—and other prose and poetry selections. No credit for students who have earned credit for 4400. [3]

SPAN 5405. Literature of the Spanish Golden Age. (Also listed as SPAN 4405) Representative works from early modern Spain, including poetry, prose, and drama of the Renaissance and Baroque periods. No credit for students who have earned credit for 4405. [3]

SPAN 5410. Spanish Literature from the Enlightenment to 1900. (Also listed as SPAN 4410) Essays and Neoclassic literature. Romanticism, Realism, and Naturalism. Representative works and authors from all genres. No credit for students who have earned credit for 4410. [3]

SPAN 5415. Spanish Literature from 1900 to the Present. (Also listed as SPAN 4415) Representative authors and works. No credit for students who have earned credit for 4415. [3]

SPAN 5420. Spanish American Literature from the Conquest to 1900. (Also listed as SPAN 4420) Development of all forms from colonial times to the end of the 19th century. Patterns of interaction of Amerindian, African, and European cultural traditions. Unity and diversity of Spanish American literature. No credit for students who have earned credit for 4420. [3]

SPAN 5425. Spanish American Literature from 1900 to the Present. (Also listed as SPAN 4425) The works of Neruda, Borges, Paz, García Márquez and others. No credit for students who have earned credit for 4425. [3]

SPAN 5440. Development of the Short Story. (Also listed as SPAN 4440) From early manifestations in Spain through its current forms in Spain and Spanish America. No credit for students who have earned credit for 4440. [3]

SPAN 5445. Development of the Novel. (Also listed as SPAN 4445) From the seventeenth century through Realism and Naturalism in Spain and Spanish America. No credit for students who have earned credit for 4445. [3]

SPAN 5450. The Contemporary Novel. (Also listed as SPAN 4450) New forms in the twentieth-century novel in Spain and Spanish America. No credit for students who have earned credit for 4450. [3]

SPAN 5455. Development of Drama. (Also listed as SPAN 4455) Spanish theatrical works from 1600 to 1900, including the Golden age comedia, neoclassicism, romanticism, and early realism in drama. No credit for students who have earned credit for 4455. [3]

SPAN 5465. The Theory and Practice of Drama. (Also listed as SPAN 4465) Critical works and plays from different periods. Introduction to the principles of dramaturgy. No credit for students who have earned credit for 4465. [3]

SPAN 5470. Development of Lyric Poetry. (Also listed as SPAN 4470) Popular and traditional forms; the sonnet and other Renaissance and Baroque classical forms. Romanticism. No credit for students who have earned credit for 4470. [3]

SPAN 5475. Contemporary Lyric Poetry. (Also listed as SPAN 4475) From Modernism to the present in Spain and Spanish America. No credit for students who have earned credit for 4475. [3]

SPAN 5550. The Theory and Practice of Literary Translation. (Also listed as SPAN 4550) Theoretical approaches and their consequences for the interpretation of translated texts. Practical application of these principles in the translation of both Spanish and Portuguese texts into English. Taught in Spanish. Written work in Spanish or Portuguese. No credit for students who have earned credit for 4550. [3]

SPAN 5620. Love and Honor in Medieval and Golden Age Literature. (Also listed as SPAN 4620) The evolution of the key themes of love and honor in works from various genres of medieval and Golden Age Spanish literature with special attention to sociohistorical context. No credit for students who have earned credit for 4620. [3]

SPAN 5640. Don Quixote. (Also listed as SPAN 4640) Directed reading and intensive study of the novel. No credit for students who have earned credit for 4640. [3]

SPAN 5720. Literary Genres and National Identities in Latin America. (Also listed as SPAN 4720) A comparative approach to the rise of the national literary traditions from independence to the latter half of the twentieth century. Indigenist novels, abolitionist narratives, and gaucho poetry by colonial figures, including African slaves, indigenous peoples, and Argentine Gauchos. No credit for students who have earned credit for 4720. [3]

SPAN 5730. Modern Latin American Poetry. (Also listed as SPAN 4730) Development of poetry in Spanish America and Brazil during the twentieth century. Major poets and movements, including both Spanish American Modernismo and Brazilian Modernismo. Poetry as a genre; composition and discussion of students' poetry. Taught in Spanish. No credit for students who have earned credit for 4730. [3]

SPAN 5740. Spanish-American Literature of the Boom Era. (Also listed as SPAN 4740) The Boom novel of the 1960s: Carlos Fuentes' *La muerte de Artemio Cruz*, Julio Cortázar's *Rayuela*, Mario Vargas Llosa's *La ciudad y los perros*, Guillermo Cabrera Infante's *Tres tristes tigres*, and Gabriel García Márquez's *Cien años de soledad*. No credit for students who have earned credit for 4740. [3]

SPAN 5741. Spanish-American Literature of the Post-Boom Era. (Also listed as SPAN 4741) The post-Boom novel from the 1970s to the present; analysis of related films. Manuel Muig's *Boquitas pintadas*, *Me llamo Rigoberta Menchú*, Laura Esquivel's *Coma agua para chocolate*, Reinaldo Arená's *Viaje a La Habana*, and Daisey Rubiera Castillo's *Reyita, sencillamente*. No credit for students who have earned credit for 4741. [3]

SPAN 5745. Love in the Latin American Novel. (Also listed as SPAN 4745) Conceptions of love in Latin American novels beginning in the nineteenth century. The effect of history, race, and morals on the shaping of affective response. No credit for students who have earned credit for 4745. [3]

SPAN 5750. Afro-Hispanic Literature. (Also listed as SPAN 4750) From nineteenth-century slave narrative to modern writers such as Miguel Barret, Alejo Carpentier, and Quince Duncan. No credit for students who have earned credit for 4750. [3]

SPAN 5755. Latina and Latin American Women Writers. (Also listed as SPAN 4755) Contemporary writing of women in Latin America and of Latinas in the United States. Representation of sexuality and the maternal body. No credit for students who have earned credit for 4755. [3]

SPAN 5850. Independent Study. (Also listed as SPAN 3850) Designed primarily for majors. Projects are arranged with individual professors and

must be approved by the director of undergraduate studies before the close of registration in the semester of the project. May be repeated for a total of 12 credits over a four semester period, but students may earn only up to 3 credits per semester of enrollment. No credit for students who have earned credit for 3850. [1-3; maximum of 12 credits total for four semesters of SPAN 3850]

SPAN 5891. Special Topics in Hispanic Culture. (Also listed as SPAN 3891) May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. No credit for students who have earned credit for 3891. [3]

SPAN 5892. Special Topics in Spanish Language and Linguistics. (Also listed as SPAN 3892) May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. No credit for students who have earned credit for 3892. [3]

SPAN 5893. Special Topics in Hispanic Literature. (Also listed as SPAN 3893) May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. No credit for students who have earned credit for 3893. [3]

SPAN 5995. Contemporary Latin American Prose Fiction in English Translation. (Also listed as SPAN 2995) Themes and techniques of the contemporary novel, novella, and short story written by both men and women in Spanish America and Brazil. No credit for graduate students in Spanish or Portuguese. No credit for students who have earned credit for 2995. [3]

SPAN 6010. Literary Analysis and Theory. [Formerly SPAN 301] (Also listed as Portuguese 6010) Methods of literary analysis for the teaching of literature. The systematic application of contemporary theories—structuralist and poststructuralist—in the analysis of poetry and narrative. [3]

SPAN 6020. Ibero-Romance Philology. [Formerly SPAN 302] (Also listed as Portuguese 6020) Study of the evolution of the languages and dialects of the Iberian Peninsula. Analysis of selected linguistic developments and readings from medieval texts. [3]

SPAN 6030. Foreign Language Learning and Teaching. [Formerly SPAN 310] (Also listed as Portuguese 6030) Principles and practices of teaching a second language with concentration on recent interactive and communicative models of foreign language instruction. Classroom observations, journal writing, development of materials, and a small action research project are expected. Required of all entering teaching assistants. [3]

SPAN 6040. Research and Grant Proposal Writing. [Formerly SPAN 303] Designed for Humanities students. Issues of professionalization, career choices, and the job search. Models, guidance, and practice in formulating research projects and writing dissertation and grant proposals. Peer evaluation. [3]

SPAN 6080. Comprehensive Exam Study. Individualized preparation for the exam. Does not count for degree requirements. May be taken only once. [3]

SPAN 7000. Survey of Medieval Spanish Literature. [Formerly SPAN 330] Introduction to major works of pre-modern Spanish literature through the fifteenth century. [3]

SPAN 7010. Seminar: The Baroque. [Formerly SPAN 344] Readings in Spanish baroque literature and culture, including works by Góngora, Quevedo, Cervantes, María de Zayas, Calderón, and Gracián. [3]

SPAN 7050. Introduction to Latin American Colonial Studies. [Formerly SPAN 314] (Also listed as Portuguese 314) Provides a panoramic introduction to the canonical works of the colonial period from “discovery” to “independence,” as well as an overview of the theoretical debates in colonial studies within the Latin American context. Topics include the construction and reshaping of identities and otherness through various stages of Latin American cultural history, the emergence of what has been called the American consciousness during the “New World Baroque,” and the discourses of “independence” and early nation building. [3]

SPAN 7060. Seminar: Modernismo. [Formerly SPAN 333] The major literary movement of the end of the nineteenth century and beginning of

the twentieth century in the Spanish-speaking world. Major authors, their context, and the fundamental ideological and literary shifts evident in their works. [3]

SPAN 7070. Spanish American and Brazilian Literature I. [Formerly SPAN 341] (Also listed as Portuguese 7070) Spanish-American and Brazilian literature from the conquests to the end of the nineteenth century. Authors may include: Sor Juana, Matos, Alencar, Assis, and Carrasquilla. [3]

SPAN 7071. Spanish American and Brazilian Literature II. [Formerly SPAN 342] (Also listed as Portuguese 7071) Spanish American and Brazilian literature from twentieth century and to the present. Texts may include: *Os sertões*, *La guerra del fin del mundo*, *Ficciones*, *Perto do coração selvagem*, and *Água viva*. [3]

SPAN 7999. Master's Thesis Research. [Formerly SPAN 369] [0-12]

SPAN 8100. Seminar: Studies in Medieval Literature. [Formerly SPAN 331] Topics vary. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

SPAN 8110. Seminar: Early Modern Spanish Narrative. [Formerly SPAN 345] Readings in Spanish prose fiction from 1550 to 1700, including the picaresque tradition and works by Cervantes, María de Zayas, and other writers. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

SPAN 8120. Seminar: Studies in Golden Age Drama. [Formerly SPAN 343] The *comedia nueva* in cultural and critical contexts. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

SPAN 8130. Seminar: Studies in Eighteenth- and Nineteenth-Century Spanish Literature. [Formerly SPAN 361] A broad survey of specific topics such as: textual civil wars; literary constructions of the nation; reconstruction of the narrative genre (1700-1900); eccentricities of Spanish Enlightenment and/or Spanish Romanticism; theatrical spectacles. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

SPAN 8140. Seminar: Modern Spanish Poetry and Poetics. [Formerly SPAN 363] Key moments of Spanish lyric poetry during the nineteenth and twentieth centuries. Theory and praxis, Romanticism, Avant-Garde, and Post-Modernism. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

SPAN 8150. Seminar: Studies in 20th- and 21st-Century Spanish Literature. [Formerly SPAN 372] Topics vary. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

SPAN 8200. Seminar: Studies in Colonial Literature. [Formerly SPAN 338] (Also listed as Portuguese 8200) May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

SPAN 8210. Seminar: Hispanic American Essay. [Formerly SPAN 340] (Also listed as Portuguese 8210) May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

SPAN 8220. Seminar: Studies in Spanish American Literature in a Global Context. [Formerly SPAN 373] May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

SPAN 8300. Seminar: Studies in Trans-Atlantic Literature and Culture. [Formerly SPAN 375] May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

SPAN 8400. Seminar: Studies in Inter-American Literature. [Formerly SPAN 374] (Also listed as Portuguese 8400) Comparative approaches to literary texts from such New World cultures as Brazil, Spanish America, the United States, the Caribbean, and Canada (both its French and English

traditions). Fluency in Spanish and/or Portuguese required; reading competency in English and French. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

SPAN 8500. Seminar: Issues in Hispanic Cinema. [Formerly SPAN 352] Possible topics include: feminine reflections in contemporary Spanish cinema; Hispanic variations on the cinematic Bildungsroman; traveling films; delivering the nation (Spain 1975-2005). [3]

SPAN 8600. Seminar: Issues in Latin American Cinema. Films from Brazil and Argentina in the early twenty-first century. Globalization, gender, sexuality, ethnicity, and race. Brazilian films will have English subtitles. [3]

SPAN 8999. Non-candidate Research. [Formerly SPAN 379] Research prior to entry into candidacy (completion of Qualifying Examination) and for special non-degree students. [Variable credit: 0-12]

SPAN 9110. Love in Late Medieval Spanish Literature. [Formerly SPAN 332] Examination of the different conceptions and discourses of love in Spain during the fourteenth and fifteenth centuries. [3]

SPAN 9140. Seminar: The Realist Novel of the Nineteenth-Century. [Formerly SPAN 362] A multifaceted approach to the Spanish Realist novel with attention to the sociopolitical context, contemporary cultural discourses and practices; European literary and artistic currents of the day, and theoretical formulations on the genre. [3]

SPAN 9240. Ordering and Disrupting Fictions in Latin America. [Formerly SPAN 334] Fictions of the mid nineteenth and early twentieth centuries. The racialized and sexualized nature of these imagined communities and their uncanny tendency to disassemble themselves. [3]

SPAN 9250. Self-Writing in Latin America. [Formerly SPAN 336] Theory and practice of self-writing; memoir, testimony, autobiography in Latin America. The connection between the body, language, and memory in a subject of both national and individual dimensions. [3]

SPAN 9260. The Spanish American Novel of the Boom Period. [Formerly SPAN 335] An examination of the Boom novel, from the 1960s: *La muerte de Artemio Cruz*, *Rayuela*, *La casa verde* or *Conversación en la Catedral*, *Tres tristes tigres*, and *Cien años de soledad*. [3]

SPAN 9265. The Melancholy Novel in Latin America. [Formerly SPAN 337] Construction of a melancholy subject built on the loss of a linguistic, sexual, and racial identity. The works of mourning and remembering of an absent maternal body. Texts by Latin American women writers and Latinas. [3]

SPAN 9270. The Politics of Identity in Latino U.S. Literature. [Formerly SPAN 354] The writings of Latinas/Latinos from the four largest groups: Chicanos, Cuban Americans, Puerto Rican Americans, and Dominican Americans. Redefinition of borders, cultures, and languages. [3]

SPAN 9300. Comparative Methodology. [Formerly SPAN 351] (Also listed as Portuguese 9300) Comparative literature as an academic discipline; scholarly and theoretical distinctions; methodologies, applications, relationship to national literature units and humanities programs. [3]

SPAN 9510. Special Topics in Spanish Literature. [Formerly SPAN 388] Topics vary. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

SPAN 9520. Special Topics in Spanish American Literature. [Formerly SPAN 389] Topics vary. For list of previous topics, please see departmental Web page. May be repeated for credit more than once if there is no duplication in topic. Students may enroll in more than one section of this course each semester. [3]

SPAN 9560. Special Studies in Spanish Linguistics. [Formerly SPAN 396] May be repeated for credit more than once if there is no duplication in topic, but students may earn only up to 6 credits per semester of enrollment. [1-6]

SPAN 9660. Special Studies in Spanish Literature. [Formerly SPAN 397] May be repeated for credit more than once if there is no duplication

in topic, but students may earn only up to 6 credits per semester of enrollment. [1-6]

SPAN 9670. Special Studies in Spanish American Literature. [Formerly SPAN 398] May be repeated for credit more than once if there is no duplication in topic, but students may earn only up to 6 credits per semester of enrollment. [1-6]

SPAN 9995. Half-time Ph.D. Dissertation Research. [Formerly SPAN 3995] For students who have completed 72 hours and devote a half-time effort to dissertation research. [0]

SPAN 9999. Ph.D. Dissertation Research. [Formerly SPAN 399] [0-12]

Special Education

SPED 7999. Master's Thesis Research. [Formerly SPED 3690] Open only to candidates for the Master of Science degree engaged in thesis research and writing. Consent of major professor required. [Variable credit 0-6]

SPED 8100. Proseminar I. [Formerly SPED 3010] Advanced review of research and scientific principles, methods, and the status of research and other professional developments in special education. Required for post-master's degree students in special education. [3]

SPED 8200. Proseminar II: Contrasting Research Methodologies in Special Education Research. [Formerly SPED 3011] The purpose of this course is to provide an overview of the frameworks and major designs within three alternative research methodologies within Special Education: single-subject research, group design, and qualitative methods. Prerequisite: 8100. [3]

SPED 8300. Research Design in Special Education. [Formerly SPED 3012] Provides in-depth analysis of group research methodology within Special Education. Design features and statistical methods are reviewed; research is critiqued; and sample studies are designed. Prerequisite: 8100, 8200. [3]

SPED 8400. Experimental Analysis of Behavior. [Formerly SPED 3017] Overview of basic behavioral processes. Presents information relating to human and nonhuman learning with a focus on the experimental analysis of behavior. Topics covered include environmental feedback mechanisms, schedules of reinforcement, establishing operations, multi-operant performances, discriminative stimulus control, stimulus equivalence, rule-governed behavior, behavioral pharmacology, and remembering/forgetting. The course also focuses on research methodologies and the critical analysis of research. Students apply their skills using computer based simulations of laboratory experiments. [3]

SPED 8600. Leadership in Special Education. [Formerly SPED 3019] This is a doctoral seminar focusing on areas where leadership is critical to the field. Leadership in special education, regardless of career choice, requires continuing development toward excellence in teaching, research and service. The major focus of this course is to develop knowledge, understandings, and skills that continue the trajectory toward excellence and leadership abilities in these areas. At this time, this course addresses the following areas: the role of theory in leading, informing, and organizing research; research, practice, and leadership in college teaching; current research, needs, and leadership in preservice teacher preparation; and an exploration of career choices after the Ph.D. [3]

SPED 8810. Introduction to Single Case Research Design. [Formerly SPED 3013] Initial course in the use of single case research methodology within special education. Overview of behavioral measurement, single case research designs, and methods of data analysis. Critical analysis of research articles. Development of a single case research proposal is required. [3]

SPED 8820. Advanced Procedures in Single-Subject Research Methodology. [Formerly SPED 3014] Use of research procedures to investigate problems in the education of persons with disabilities. Advanced procedures in single-subject research methodology, including design strategies and experimental control, are emphasized. Design and implementation of a research study is required. Prerequisite: 8810, 7400. [3]

SPED 8830. Hierarchical Linear Modeling in Educational Research. [Formerly SPED 3016] This course provides an introduction to hierarchical linear modeling (HLM). HLM is a methodology that can be used when a dataset possesses some form of nesting or hierarchical structure. This includes conditions where data are collected among clustered units, such as students within schools or employee within organizations. It also includes many longitudinal studies, as repeated measures can be viewed as nested with persons. (Not currently offered) [3]

SPED 8840. Observational Methods. [Formerly SPED 3018] This doctoral-level course addresses what is known about quantitative, systematic observation of behavior to measure behavior that may or may not be used to infer status on psychological constructs. The content emphasis is on providing students with the rationale for selecting among the many options at all stages of observational measurement. Among the topics covered are (a) classical measurement theory and Generalizability theory as they relate to observational measurement, (b) principles for selecting measurement procedures, selecting behavior sampling methods, designing coding systems, selecting appropriate metrics (including nonsequential and sequential variables), (c) sequential analysis of behavior, (d) the tension between ecological validity, representativeness, and construct validity, (e) interobserver reliability issues, and (f) other issues related to the direct observation of behavior. [3] Yoder.

SPED 8999. Non-Candidate Research. [Formerly SPED 3790] Research prior to entry into candidacy (completion of qualifying examination) and for special non-degree students. [Variable credit: 0-12]

SPED 9995. Half-time Ph.D. Dissertation Research. [Formerly SPED 3995] Ph.D. Dissertation Research. For students who have completed 72 hours and devote a half-time effort to dissertation research. [0]

SPED 9999. Ph.D. Dissertation Research. [Formerly SPED 3990] Ph.D. Dissertation Research. [0-12]

Teaching and Learning

EDUC 7999. Master's Thesis Research. [Formerly EDUC 3690]

EDUC 8010. Inquiry into Education. [Formerly EDUC 3070] An introduction to the function and means of various practices of educational research. Promotes understanding of the language of educational inquiry, aims and uses of research, various ways of framing research questions and designing studies, and procedures for obtaining, analyzing, and interpreting qualitative and quantitative data. Presents issues of procedure or design and related issues of validity: construct definition and data generation, instrumentation and data collection; and data quality, meaning, appropriateness, credibility, and inferences made based on data. For doctoral students or by permission of instructor. [3]

EDUC 8020. Teaching as a Social Practice. [Formerly EDUC 3040] This course provides an investigation into teaching as situated in the social context of the school and school district. Classroom observation in tandem with a series of readings are the basis of the course. Assignments are intended to provide students opportunities to coordinate important aspects of the readings with observations of practice. For doctoral students or by permission of instructor. [3]

EDUC 8030. Advanced Learning and Instruction. [Formerly EDUC 3120] Introduces theories of learning and explores their utility for the design of learning environments. Contrasts socio-cultural and cognitive approaches toward concepts and categories, problem solving, and model-based reasoning. For doctoral students or by permission of instructor. [3]

EDUC 8040. Diversity and Equity in Education. [Formerly EDUC 3080] Provides an introduction to the structural, systemic, and institutional dimensions and complexities of diversity that often emerge in education across multiple contexts. Central constructs of the course include race, culture, SES, gender, language, achievement, policy, epistemology, and learning. For doctoral students or by permission of instructor. [3]

EDUC 8100. Epistemological Foundations of Mathematics and Sciences. [Formerly EDUC 3710] Examines the social, cognitive and material

mechanisms that contribute to generating, sustaining and revising knowledge in mathematics and in sciences. [3]

EDUC 8200. Foundations in Learning and Development. [Formerly EDUC 3200] Provides a foundation in relevant developmental milestones related to children's academic behaviors from pre-kindergarten through high school. Children's development and learning is viewed in the context of school expectations with an emphasis on the diversity among learners. [3]

EDUC 8410. Sociocognitive Perspectives of Literacy Theory and Practice. [Formerly EDUC 3480] This seminar critically examines literacy research from a sociocognitive perspective. Critical reading of seminal and new works on theoretical models is complimented by research on effective literacy instruction an emerging promising practices in print and digital contexts. Particular attention is paid to reading comprehension, digital literacies and new media, design of scaffolded learning environments, and students who experience learning difficulties. [3]

EDUC 8420. Sociocultural Theories of Literacy. [Formerly EDUC 3490] A doctoral readings seminar on social and cultural theories in their relation to literacy and literacy learning. [3]

EDUC 8800. Scientific Writing. [Formerly EDUC 3160] Students who have completed substantial reading in an area of their research interest participate in a lecture/workshop setting to conceptualize, draft, and revise a scientific manuscript. Most students who take the course will be in the process of completing a major area paper for the Department of Teaching and Learning. These papers take the form of a literature review (typically 50-100 pages), but other writing projects are welcome, as well. [3]

EDUC 8810. Discourse Analysis in Education. [Formerly EDUC 3810] This course provides a rigorous introduction to the analysis of discourse in educational contexts. The course draws on critical discourse analysis, sociocultural approaches, and other traditions to consider relations of learning, identity, and power in educational texts and communicative activity. The course provides experience and instruction through processes of data collection, transcription, and analysis. [3]

EDUC 8820. Methods of Educational Research: Qualitative. [Formerly EDUC 3912] Covers issues and strategies involved in collection and analysis of qualitative data. Focuses on the assumptions and related research techniques of qualitative research, framed by the post-positivist paradigm (i.e., naturalistic inquiry, ethnography). [3] Recommended for advanced doctoral students)

EDUC 8830. Advanced Qualitative Methods: Learning and the Interaction. Graduate Level research methods course for students who will use video and/or audio recordings as data in studies of learning and teaching. Readings cover conversation analysis, ethnomethodology, gesture studies, and micro-ethnographies of life in classrooms and workplaces. Assignments focus on technologies and procedures for capturing and managing video and audio recordings of human interactions that can serve as data for these kinds of studies, as well as procedures for indexing, transcribing, and conducting comparative analysis. Prerequisite: Introductory Qualitative or interpretive research methods course. [3]

EDUC 8999. Non-Candidate Research. [Formerly EDUC 3790] Research prior to entry into candidacy (completion of qualifying examination) and for special non-degree students. [Variable credit: 0-12]

EDUC 9700. Research Groups. [Formerly EDUC 3700] Examination of a research issue of mutual interest in a year-long study. Multiple topics will be offered. May be repeated. [0-3]

EDUC 9995. Half-Time Dissertation Research. [Formerly EDUC 3995] [0-6]

EDUC 9999. Ph.D. Dissertation Research. [Formerly EDUC 3990]

Theatre

THTR 5201. Contemporary Drama and Performance Criticism. (Also listed as THTR 3201W) Dramatic literature and performance theory. Advanced techniques in writing performance criticism. No credit for students who have earned credit for 3201W. [3]

THTR 5202. Histories of Theatre and Drama II: The European Stage.

(Also listed as THTR 2202W) Including the Italian Renaissance, French neoclassicism, English Restoration, German and French romanticism, and the modernist movements of realism, symbolism, Dada and futurism, expressionism, epic theatre, and absurdism. No credit for students who have earned credit for 2202W. [3]

THTR 5204. Histories of Theatre and Drama III: The U.S. Stage.

(Also listed as THTR 2204) Including British colonial and revolutionary drama; frontier theatre; melodrama; minstrelsy, vaudeville, burlesque, and the musical stage; pageantry and community theatre; postwar realism; African-American, Chicana/o, feminist, and Asian-American theatre movements. No credit for students who have earned credit for 2204. [3]

THTR 5211. Shakespeare in the Theatre.

(Also listed as THTR 4201) Selected plays and scenes. Theoretical and practical exploration of script, theatre, and audience in terms of production past and present. Prerequisite: at least junior standing. No credit for students who have earned credit for 4201. [3]

THTR 5651. Intermediate Play Direction.

(Also listed as THTR 3651) Development of theoretical and practical approaches to directing dramatic texts. Emphasis on research, interpretation, and communication. No credit for students who have earned credit for 3651. [3]

Tibetan Language

TBTN 5101. Elementary Tibetan I (UVA).

(Also listed as TBTN 1101) Grammar and syntax of spoken and written Tibetan. Listening, speaking, reading and writing from Tibetan short stories, proverbs, and other sources. Tibetan culture. Offered on a graded basis only. No credit for students who have earned credit for 1101. [4]

TBTN 5102. Elementary Tibetan II (UVA).

Grammar and syntax of spoken and written Tibetan; listening, speaking, reading and writing. Examples from Tibetan short stories and proverbs, among other sources. Exposure to Tibetan culture to improve communication skills, using a dynamic, interactive format. Offered on a graded basis only. Prerequisite: 5101. [4]

TBTN 5201. Intermediate Tibetan I (UVA).

(Also listed as TBTN 2201) Grammar and syntax of spoken and written Tibetan. Listening, speaking, reading, and writing through the integrated use of spoken and literary forms. Enhanced knowledge of Tibetan culture. Offered on a graded basis only. No credit for students who have earned credit for 2201. [4]

TBTN 5202. Intermediate Tibetan II (UVA).

Grammar and syntax of spoken and written Tibetan; listening, speaking, reading and writing through spoken and literary forms. Further study of Tibetan culture to improve communication skills. Offered on a graded basis only. Prerequisite: 5201. [4]

University Courses

UNIV 5150. Justice, Mercy, and Mass Incarceration.

Mass incarceration is a central legal and moral challenge of our era, which draws upon the historically powerful synergies between law and religion. Mass incarceration is a legal creation, and law defines the experience of incarceration and re-entry. But theories of crime and punishment have long depended upon religious legitimation, and the impact of mass incarceration on our society ultimately presents deeply moral and theological questions. The issue cannot be effectively addressed from the perspective of a single discipline. By addressing mass incarceration through law and religion together, this course will equip students with a deeper understanding of the causes and consequences of our current system, and it will address the racial dimensions of incarceration as both legal and religious constructions. It will explore the legal structures and justifications that create mass incarceration as well as the moral and theological arguments mass incarceration provokes. This interdisciplinary study will enable students to become better advocates for change through policy, law, outreach, and activism. [3] Mr. Reside and Mr. Rubin

UNIV 5225. Social Entrepreneurship. This course will help nascent social entrepreneurs consider both opportunities and challenges presented by this emerging form of social action. Through a combination of lecture and

discussion, guest speakers and written case studies, we will engage the important questions of "what," "so what," and "what next" that drive the ideas and practice of social entrepreneurs. While the course will place particular emphasis on the areas of education and community development, time will be spent looking at social change in other arenas as well. [3]

UNIV 5278. Tackling Big Questions with Mobile Cloud Computing.

This course will address big questions motivated by the rapid growth of interest across disciplines in computing technologies that have occurred over the past decade, due in part to the pervasive and profound impact of mobile devices and powerful cloud computing services on many aspects of our daily lives. Examples of these big questions include how mobile cloud computing technologies are (1) being used to engage teens with chronic diseases, (2) changing political discourse in the US and around the world, and (3) helping economically disadvantaged individuals bridge the digital divide to obtain better guidance on nutrition and legal matters. This class will provide a multidisciplinary environment where undergraduate and graduate students from multiple Schools team with Computer Science students to address big questions in a project-based format. Each project will be sponsored and mentored by a subject matter expert in the field from other Schools on campus, with the goal of providing students a hands-on experience understanding and applying key mobile cloud computing techniques, tools, and principles needed to tackle these big questions. FALL, SPRING [3 each semester; maximum of 6 hours total for all semesters]

UNIV 5315. Planetary Health, Policy and Social Justice.

This is a three credit hour elective course designed for students interested in exploring the intersections between primary care, planetary health and climate change (according to WHO, currently the greatest threat to global health), social justice and policy. The causes of climate change and the resulting primary, secondary and tertiary impacts on people and communities will be examined through the lens of global health and policy. Students will develop evidence based and targeted adaptation and mitigation strategies as well as policy-based solutions, all incorporating science and engineering, political science and policy, law and economics as well as nursing and medicine to address healthspan disparities related to climate change and social vulnerability. [3]

UNIV 5320. The Causes and Consequences of LGBT Public Policies.

This new Multicultural University Course will introduce students to critical questions about public policies relevant to LGBTQIA populations, including: legal access to same-sex marriage; nondiscrimination policies in employment, housing, and public accommodation, including whether they are trans-inclusive; so-called 'bathroom bills'; religious freedom restoration laws (also called 'conscience' acts); and others. The course will investigate the causes, correlates, and consequences of these policies using the lenses of economics, law, sociology, political science, and public health and medicine. Students will critically analyze leading research articles and mainstream media discussions of LGBTQ-related public policies; hear from guest speaker experts; perform an immersive research project; and visit Tennessee policymakers to understand views on a range of LGBTQ-related issues. [3]

UNIV 5325. Health Policy Analysis and Advocacy.

Health is both wildly sought after and wildly controversial. We race for cures, rally for affordable and accessible health care, debate the ethics of various treatments and pass laws meant to keep our people healthy. This Multicultural University Course will prepare students to be more effective and skillful participants in debates over health policy by immersing them in the national and Tennessee health policy environment. This course promotes critical scholarship and leadership through engagement with national policy experts, media and locally elected officials. Students will learn how to leverage publicly available data to write policy reports that address important health policy problems; additional readings and skills-based exercises are required for graduate students. [3]

UNIV 5330. The History of Science and Brewing.

Historical and scientific perspectives on brewing beer and related beverages. History of brewing and beer production, religious dimensions of beer consumption in past societies, biochemical processes of fermentation and alcohol abuse, and neuroscience of reward and addiction. The course includes a laboratory component. [3]

UNIV 5350. Design Thinking, Design Doing. This course is an introduction to theories and practices of design. The design thinking elements of the course offer a critical understanding of methods for researching interactions between humans and the social and built environment, whereas the design doing elements teach how to develop purposeful interventions that result in more meaningful and effective interactions. Throughout, we will examine how (and what) people can learn while engaged in the design process. Working in teams, students in the course will spend significant time observing, listening, analyzing, storytelling, and otherwise engaging users as they work in teams to develop and implement meaningful and transformative designs to projects in the domains of education, health and business. [3]

UNIV 5360. Data Science Methods for Smart City Applications. Integrating technological and socio-economic approaches to challenges facing metropolitan areas experiencing unprecedented growth. Infrastructure and resources needed for sustainable development and maintaining quality of life. Adapting technology-driven internet-of-things framework to Smart Cities concept of urban development. Ethical and justice concerns, including privacy and equitable access to data. Algorithmic methods of machine learning and statistics, such as supervised and unsupervised learning, factor analysis, multi-dimensional regression analysis, and hierarchical linear modeling. Agent-based and equation-based simulation modeling. Linear and nonlinear optimization. Mixed methods approaches to gathering and analyzing qualitative and quantitative socio-economic data. Computational methods for data from large distributed infrastructure. The course will combine lectures on the fundamental material, and a semester-long multidisciplinary group project. [3]

UNIV 5370. Cultural Heritage in Context: The Future of the Past. Cultural heritage is under threat globally as a casualty of war, economic development, and environmental changes. This course is concerned with the preservation the tangible and intangible products of human societies from prehistory to the present. Given the complexities of cultural heritage management, this course is relevant to multiple disciplines in the humanities (anthropology, archaeology, art, history, history of art, philosophy), social sciences (communication studies, economics, sociology) and physical sciences (aerospace, computer science, materials sciences), as well as law and music. Students will learn about current issues in cultural heritage from Vanderbilt faculty and invited experts and will undertake independent research projects. [3]

UNIV 5655. Historic Black Nashville. This course will explore the underdeveloped history of black Nashville from settlement to the early twentieth century. Through instructor and guest lectures, digital humanities instruction, site visits, and independent research in local archives, students will recover and document the lives of the city's enslaved and free people of color as well as the community institutions and social and artistic movements that defined the black experience in Nashville. As students gain substantive expertise, they will also learn research methods and multiple media and technologies for telling historical narratives. No credit for students who have earned credit for HIST 2655. Offered on a graded basis only. FALL [3] Landers and Sharfstein.

UNIV 6215. From Academic Insight to Entrepreneurial Impact. This course provides a unique opportunity for graduate students in engineering, science, medicine, law, and business to gain real-world experience as part of an entrepreneurial team. Multidisciplinary teams will examine inventions from Vanderbilt labs from all angles--technical, business, legal, and regulatory--thinking about how these inventions can make an impact on markets and clinics. Students will learn about patents, legal and business strategies to optimize value, customer discovery, funding, and venture terms from a cross-disciplinary team of Vanderbilt faculty, industry and legal mentors, and members of the greater entrepreneurial community. [2]

WGS 5970. Sexing the Archive: Research Methods in Women's and Gender Studies. Conducting research through a feminist and queer lens. Archival research; examining oral histories using specialized Vanderbilt resources, as well as other local and online archives. Offered on a graded basis only. [3]

WGS 8301. Gender and Sexuality: Feminist Approaches. [Formerly WGS 301] Interdisciplinary introduction to the major debates, theoretical terms, and research methods in feminist, gender, sexuality, and queer studies. [3]

WGS 8302. Gender and Pedagogy. [Formerly WGS 302] Feminist theories of teaching and learning; gender and diversity in the classroom; critical pedagogy. Classroom practicum. [1-4]

WGS 8303. Queer Theory. [Formerly WGS 303] History and development of queer theory. Key intellectual antecedents, significant theorists, and current trends. How sexuality intersects with gender, race, class, nationality, ability, and religion. [3]

WGS 8304. Gender, Power, and Justice. Theoretical, historical, and cultural analysis of power structures and politics; analysis of activist and academic responses to contemporary political questions. [3]

WGS 8989. Independent Study. [Formerly WGS 389] Work in a tutorial relationship with an individual faculty member or in a student seminar, subject to faculty approval, should several students share a common interest. May be repeated for credit more than once if there is no duplication in topic, but students may earn only up to 3 credits per semester of enrollment. [1-3]

Women's and Gender Studies

WGS 5201. Women and Gender in Transnational Context. (Also listed as WGS 3201) Gender as a social construction. Feminist critiques of knowledge, family and work, sexuality, health and medicine, and the women's movement. The future of feminism in global context. No credit for students who have earned credit for 3201. [3]

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Graduate School

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University Honors Held by Members of the Vanderbilt Faculty

The Harvie Branscomb Distinguished Professor Award, begun in 1964 and awarded annually for a period of one year, recognizes the distinguished accomplishment of a faculty member in furthering the aims of the university. The award is made by the Chancellor on recommendation of the Consultative Committee of the Faculty Senate.

1964 AMOS CHRISTIE, Professor of Pediatrics
 1965 WILLARD B. JEWELL, Professor of Geology
 1966 AVERY LEISERSON, Professor of Political Science
 1967 NICHOLAS GEORGESCU-ROEGEN, Distinguished Professor of Economics
 1968 CHARLES RAWLINSON PARK, Professor of Physiology
 1969 JAMES PHILIP HYATT, Professor of Old Testament
 1970 CHARLES F. DELZELL, Professor of History
 1971 DEWEY W. GRANTHAM, Professor of History
 1972 ELLIOT V. NEWMAN, Joe and Morris Werthan Professor of Experimental Medicine
 1973 WILLIAM H. NICHOLLS, Professor of Economics
 1974 BJARNI JÓNSSON, Distinguished Professor of Mathematics
 1975 D. STANLEY TARBELL, Distinguished Professor of Chemistry

1976 JOHN W. WADE, Distinguished Professor of Law
 1977 WALTER HARRELSON, Distinguished Professor of Old Testament
 1978 SIDNEY P. COLOWICK, American Cancer Society–Charles Hayden Foundation Professor of Microbiology
 1979 GRANT W. LIDDLE, Professor of Medicine
 1980 RENDIGS T. FELS, Professor of Economics
 1981 DOUGLAS E. LEACH, Professor of History
 1982 OSCAR TOUSTER, Professor of Molecular Biology
 1983 JOSEPH H. HAMILTON, Landon C. Garland Distinguished Professor of Physics
 1984 MILDRED R. STAHLMAN, Professor of Pediatrics
 1985 HANS H. STRUPP, Distinguished Professor of Psychology
 1986 WILLIAM C. HAVARD, JR., Professor of Political Science
 1987 ALFRED A. BAUMEISTER, Professor of Psychology and Special Education
 1988 LEON W. CUNNINGHAM, Professor of Biochemistry
 1989 SALLIE MCFAGUE, E. Rhodes and Leona B. Carpenter Professor of Theology
 1990 DAVID T. KARZON, Professor of Pediatrics
 1991 LAURENCE D. LERNER, Edwin Mims Professor of English
 1992 CAROLYN M. EVERTSON, Professor of Education
 1993 FRANK CHYTI, Professor of Biochemistry; General Foods Distinguished Professor of Nutrition; Assistant Professor of Medicine
 1994 FRANK L. PARKER, Distinguished Professor of Environmental and Water Resources Engineering; Professor of Management of Technology
 1995 MELVIN D. JOESTEN, Professor of Chemistry; Professor of Education
 1996 ROBERT D. COLLINS, Professor of Pathology
 1997 PAUL K. CONKIN, Distinguished Professor of History
 1998 JOHN A. OATES, Thomas F. Frist Professor of Medicine
 1999 TRAVIS I. THOMPSON, Professor of Psychology, Peabody College; Professor of Psychology, College of Arts and Science; Professor of Special Education; Professor of Psychiatry
 2000 LAWRENCE J. MARNETT, Mary Geddes Stahlman Chair in Cancer Research; Professor of Biochemistry; Professor of Chemistry
 2001 ANN P. KAISER, Professor of Special Education; Professor of Psychology, Peabody College; Director, Research Program on Communication, Cognitive, and Emotional Development, John F. Kennedy Center
 2002 THOMAS R. HARRIS, Professor of Biomedical Engineering and Chair of the Department; Professor of Chemical Engineering; Professor of Medicine
 2003 JOHN A. PHILLIPS III, David T. Karzon Professor of Pediatrics; Professor of Biochemistry; Professor of Medicine; Investigator, John F. Kennedy Center for Research on Human Development
 2004 ROBERT S. DITTUS, Joe and Morris Werthan Professor of Investigative Medicine; Professor of Medicine; Director, Division of General Internal Medicine
 2005 HAROLD L. MOSES, Hortense B. Ingram Professor of Molecular Oncology; Professor of Cancer Biology; Professor of Pathology; Professor of Medicine; Director, Emeritus, Vanderbilt-Ingram Cancer Center
 2006 ELAINE SANDERS-BUSH, Professor of Pharmacology; Professor of Psychiatry; Investigator, Vanderbilt Kennedy Center for Research on Human Development; Director, Vanderbilt Brain Institute
 2007 CECILIA TICHI, William R. Kenan, Jr., Professor of English
 2008 DANIEL B. CORNFIELD, Professor of Sociology
 2009 RONALD D. SCHRIMPF, Orrin Henry Ingram Professor of Engineering; Professor of Electrical Engineering; Professor of Computer Engineering
 2010 WILLIAM SCHAFFNER, Professor of Preventive Medicine and Chair of the Department; Professor of Medicine

2011 DAVID JON FURBISH, Professor of Earth and Environmental Sciences; Professor of Civil and Environmental Engineering
 2012 SUZANNA SHERRY, Professor of Law
 2013 DONNA FORD, Professor of Special Education
 2014 JAY CLAYTON, William R. Kenan Jr. Professor of English; Director of the Curb Center for Art, Enterprise, and Public Policy
 2015 KEIVAN G. STASSUN, Professor of Astronomy
 2016 LORRAINE M. LOPEZ, Associate Professor of English
 2017 GEORGE M. HORNBERGER, University Distinguished Professor of Civil and Environmental Engineering and Earth and Environmental Sciences
 2018 KATE DANIELS, Professor of English
 2019 BENOIT DAWANT, Cornelius Vanderbilt Chair in Engineering

The Alexander Heard Distinguished Service Professor Award was established in 1982 to honor Chancellor Alexander Heard at the time of his retirement. The title is conferred annually, for a one-year period, upon a faculty member in recognition of distinctive contributions to the understanding of contemporary society.

1983 DAVID J. WILSON, Professor of Chemistry
 1984 DAVID RABIN, Professor of Medicine
 1985 ERWIN C. HARGROVE, Professor of Political Science; Professor of Education
 1986 ALFRED A. BAUMEISTER, Professor of Psychology, Peabody College
 1987 WALTER HARRELSON, Distinguished Professor of Old Testament
 1988 FRANK L. PARKER, Professor of Environmental and Water Resources Engineering; Professor of Management of Technology
 1989 W. ANDERSON SPICKARD, JR., Professor of Medicine
 1990 FRANK A. SLOAN, Centennial Professor of Economics
 1991 LISTON O. MILLS, Oberlin Alumni Professor of Pastoral Theology and Counseling
 1992 RICHARD A. PRIDE, Associate Professor of Political Science
 1993 H. CARL HAYWOOD, Professor of Psychology, Peabody College; Professor of Neurology
 1994 THOMAS A. MAHONEY, Frances Hampton Currey Professor of Organization Studies
 1995 KARL B. SCHNELLE, JR., Professor of Chemical Engineering; Professor of Environmental Engineering
 1996 SUSAN FORD WILTSHIRE, Professor of Classics
 1997 KENNETH A. DODGE, Professor of Psychology; Professor of Psychiatry
 1998 PAUL K. CONKIN, Distinguished Professor of History
 1999 JONATHAN I. CHARNEY, Professor of Law
 2000 HUGH DAVIS GRAHAM, Holland N. McTyeire Professor of History; Professor of Political Science
 2001 JOHN J. SIEGFRIED, Professor of Economics
 2002 DAVID J. ERNST, Professor of Physics
 2003 VIRGINIA L. SHEPHERD, Professor of Pathology; Professor of Biochemistry; Professor of Medicine
 2004 ELLEN B. GOLDRING, Professor of Educational Policy and Leadership
 2005 KATHRYN M. EDWARDS, Professor of Pediatrics; Director, Division of Pediatric Clinical Research
 2006 JAMES W. GUTHRIE, Professor of Public Policy and Education; Director, Peabody Center for Education Policy; Chair, Department of Leadership, Policy, and Organizations
 2007 STEVEN D. HOLLON, Professor of Psychology, College of Arts and Science; Professor of Psychology, Peabody College; Associate Professor of Psychiatry; Investigator, Vanderbilt Kennedy Center for Research on Human Development
 2008 DALE C. FARRAN, Professor of Education; Professor of Psychology, Peabody College; Member, Vanderbilt Kennedy Center for Research on Human Development
 2009 C. NEAL TATE, Professor of Political Science and Chair of the Department; Professor of Law
 2010 NANCY J. KING, Lee S. and Charles A. Speir Professor of Law

2011 ROBERT BARSKY, Professor of French and Comparative Literature
 2012 SOHEE PARK, Professor of Psychology
 2013 GREGORY F. BARZ, Associate Professor of Musicology (Ethnomusicology)
 2014 TERESA A. GODDU, Associate Professor of English; Associate Professor of American Studies
 2015 BONITA A. PILON, Professor of Nursing
 2016 MITCHELL SELIGSON, Centennial Professor of Political Science; Professor of Political Science
 2017 EUGENE LEBOEUF Professor of Civil and Environmental Engineering
 2018 KEVIN B. JOHNSON, Professor of Biomedical Informatics; Cornelius Vanderbilt Chair, Biomedical Informatics
 2019 LYNN S. FUCHS, Dunn Family Chair in Psychoeducational Assessment, Professor of Special Education
 DOUGLAS H. FUCHS, Nicholas Hobbs Chair in Special Education and Human Development, Professor of Special Education

The Earl Sutherland Prize for Achievement in Research was initiated in 1976. It is awarded annually to a member of the Vanderbilt faculty whose achievements in research, scholarship, or creative expression have had significant critical reception and are recognized nationally or internationally. The recipient is chosen by the Chancellor on recommendation of the University Research Council.

1976 NICHOLAS GEORGESCU-ROEGEN, Distinguished Professor of Economics
 1977 STANLEY COHEN, Distinguished Professor of Biochemistry; American Cancer Society Research Professor of Biochemistry
 1978 CLAUDE PICHOLS, Distinguished Professor of French
 1979 GRANT W. LIDDLE, Professor of Medicine
 1980 JOHN W. WADE, Distinguished Professor of Law
 1981 SIDNEY FLEISCHER, Professor of Molecular Biology
 1982 BJARNI JONSSON, Distinguished Professor of Mathematics
 1983 DONALD A. DAVIE, Andrew W. Mellon Professor of Humanities and Professor of English
 1984 CHARLES RAWLINSON PARK, Professor of Physiology
 1985 JON H. KAAS, Professor of Psychology
 1986 LUBOMIR HNILICA, Professor of Biochemistry
 1987 HANS H. STRUPP, Distinguished Professor of Psychology
 1988 JOSEPH H. HAMILTON, Landon C. Garland Distinguished Professor of Physics
 1989 PAUL K. CONKIN, Distinguished Professor of History
 1990 TADASHI INAGAMI, Professor of Biochemistry
 1991 EDWARD FARLEY, Drucilla Moore Buffington Professor of Theology
 1992 JAMES F. BLUMSTEIN, Professor of Law
 1993 THOMAS M. HARRIS, Centennial Professor of Chemistry
 1994 JOHN H. EXTON, Professor of Molecular Physiology and Biophysics
 1995 GISELA MOSIG, Professor of Molecular Biology
 1996 HANS R. STOLL, Anne Marie and Thomas B. Walker Jr. Professor of Finance
 1997 JOHN D. BRANSFORD, Centennial Professor of Psychology
 1998 ALICE C. HARRIS, Professor of Linguistics and Chair of the Department of Germanic and Slavic Languages; Professor of Anthropology
 1999 TRAVIS I. THOMPSON, Professor of Psychology, Peabody College; Professor of Psychology, College of Arts and Science; Professor of Special Education; Professor of Psychiatry
 2000 RANDOLPH BLAKE, Centennial Professor of Psychology, College of Arts and Science; Investigator and Senior Fellow, John F. Kennedy Center
 2001 F. PETER GUENGERICH, Professor of Biochemistry; Director, Center in Molecular Toxicology
 2002 DAVID M. HERCULES, Centennial Professor of Chemistry
 2003 LEONARD BICKMAN, Professor of Psychology, Peabody College; Associate Dean for Research, Peabody College; Professor of Psychiatry; Director, Mental Health Policy Center, Institute for Public Policy Studies; Member, John F. Kennedy Center for Research on Human Development

- 2004 HERBERT Y. MELTZER, Bixler/Johnson/Mays Professor of Psychiatry; Professor of Pharmacology; Director, Division of Psychopharmacology
- 2005 LYNN S. FUCHS, Professor of Special Education; Nicholas Hobbs Chair in Special Education and Human Development; Investigator, Vanderbilt Kennedy Center for Research on Human Development
- DOUGLAS FUCHS, Professor of Special Education; Nicholas Hobbs Chair in Special Education and Human Development; Investigator, Vanderbilt Kennedy Center for Research on Human Development
- 2006 L. JACKSON ROBERTS II, Professor of Pharmacology; Professor of Medicine; Investigator, Center for Molecular Neuroscience
- 2007 DAVID ROBERTSON, Elton Yates Professor of Autonomic Disorders; Professor of Medicine; Professor of Pharmacology; Professor of Neurology; Investigator, Center for Molecular Neuroscience
- 2008 LENN E. GOODMAN, Andrew W. Mellon Professor of Humanities; Professor of Philosophy
- 2009 HAROLD L. MOSES, Hortense B. Ingram Professor of Molecular Oncology; Professor of Cancer Biology; Professor of Pathology; Professor of Medicine; Director, Emeritus, Vanderbilt-Ingram Cancer Center
- 2010 JOHN A. OATES, Thomas F. Frist Sr. Professor of Medicine; Professor of Pharmacology
- 2011 MARK W. LIPSEY, Professor of Human and Organizational Development
- 2012 PETER I. BUERHAUS, Valere Potter Professor of Nursing
- 2013 JOHN C. GORE, University Professor of Radiology and Radiological Sciences; Hertha Ramsey Cress Chair in Medicine; Professor of Biomedical Engineering; Professor of Physics and Astronomy; Professor of Molecular Physiology and Biophysics; Director, Institute for Imaging Science
- 2014 JANE GILMER LANDERS, Gertrude Conaway Vanderbilt Professor of History
- 2015 BILLY G. HUDSON, Elliott V. Newman Professor of Medicine; Professor of Medicine; Professor of Pathology, Microbiology and Immunology; Professor of Cell and Developmental Biology; Professor of Biochemistry
- 2016 DAVID S. KOSSON, Cornelius Vanderbilt Professor of Engineering; Professor of Civil and Environmental Engineering; Professor of Chemical and Biomolecular Engineering; Director of Consortium for Risk Evaluation with Stakeholder Participation (CRESP)
- 2017 LARRY BARTELS, Professor of Political Science; May Werthan Shayne Chair in Public Policy and Social Science
- 2018 KATHLEEN L. GOULD, Louise B. McGavock Chair, Professor of Cell and Developmental Biology
- 2007 KENNETH A. WALLSTON, Professor of Psychology in Nursing; Professor of Psychology, Peabody College; Professor of Psychology, College of Arts and Science; Member, Vanderbilt Kennedy Center for Research on Human Development
- 2008 DAVID CHARLES WOOD, Centennial Professor of Philosophy; Professor of Philosophy
- 2009 DANA D. NELSON, Gertrude Conaway Vanderbilt Professor of English; Professor of English
- 2010 DAVID S. KOSSON, Professor of Civil and Environmental Engineering and Chair of the Department; Professor of Chemical Engineering; Professor of Earth and Environmental Sciences
- 2011 BRUCE COMPAS, Patricia and Rodes Hart Chair in Psychology and Human Development
- 2012 JANOS SZTIPANOVITS, Professor of Electrical and Computer Engineering
- 2013 TOM D. DILLEHAY, Rebecca Webb Wilson University Distinguished Chair In Anthropology and Religion and Culture
- 2014 OWEN D. JONES, New York Alumni Chancellor's Chair in Law; Professor of Law; Professor of Biological Sciences
- 2015 TED. S. HASSELBRING, Research Professor of Special Education
- 2016 VELMA MCBRIDE MURRY, Betts Chair of Education and Human Development; Professor of Human and Organizational Development; Professor of Health Policy
- 2017 LAURIE E. CUTTING, Patricia and Rodes Hart Chair; Professor of Special Education; Professor of Psychology; Professor of Pediatrics
- 2018 ALAN WISEMAN, Professor of Political Science; Cornelius Vanderbilt Chair, Political Science
- 2019 STEVEN A. WERNKE, Associate Professor of Anthropology

The Joseph A. Johnson, Jr., Distinguished Leadership Professor Award to Recognize Faculty Leadership in Equity, Diversity, and Inclusion is an annual award established in 2016 to recognize a faculty member whose contributions to the university have enhanced equity, diversity, and inclusion in the university's academic endeavors and in the university community. The award is named for the Rev. Joseph A. Johnson, Jr., who was the first African American to be admitted to and to receive a degree from Vanderbilt and the first to earn a Vanderbilt doctoral degree, as well as the second African American trustee of the university.

The Joe B. Wyatt Distinguished University Professor Award, created to honor Chancellor Wyatt upon his retirement in 2000, recognizes the development of significant new knowledge from research or exemplary innovation in teaching, particularly accomplishments that span multiple academic disciplines. The recipient of this annual award is chosen by the Chancellor from nominations by members of the faculty and carries the title for one year.

- 2001 DOUGLAS FUCHS, Professor of Special Education; Co-Director, Research Program on Learning Accommodations for Individuals with Special Needs, John F. Kennedy Center
- LYNN S. FUCHS, Professor of Special Education; Co-Director, Research Program on Learning Accommodations for Individuals with Special Needs, John F. Kennedy Center
- 2002 JUDY G. OZBOLT, Independence Chair in Nursing; Professor of Nursing; Professor of Biomedical Informatics
- 2003 PAUL A. COBB, Professor of Education
- 2004 MARSHALL C. EAKIN, Professor and Chair of History
- 2005 GARY F. JENSEN, Professor of Sociology and Chair of the Department; Professor of Religious Studies
- 2006 SANKARAN MAHADEVAN, Professor of Civil and Environmental Engineering; Professor of Mechanical Engineering

- 2016 LINDA J. SEALY, Associate Professor of Cell and Developmental Biology; Associate Professor of Cancer Biology; Associate Professor of Molecular Physiology and Biophysics
- 2017 JANA L. LAUDERDALE, Assistant Dean for Diversity and Inclusion; Associate Professor of Nursing
- 2018 JESSE EHRENFELD, Professor of Anesthesiology
- 2019 CHARLENE M. DEWEY, Professor of Medical Education and Administration

University Professorships, Named and Distinguished Professorships and Chairs

- DOUGLAS ADAMS, Distinguished Professor in Civil and Environmental Engineering, Daniel F. Flowers Chair in Civil and Environmental Engineering
- CHRISTOPHER AIKEN, Cornelius Vanderbilt Chair in Pathology, Microbiology, and Immunology
- VICTOR ANDERSON, Oberlin Theological School Chair
- CELIA STEWART APPEGATE, William R. Kenan, Jr., Chair in History
- ELLEN T. ARMOUR, E. Rhodes and Leona B. Carpenter Associate Professor of Feminist Theology
- DAVID ARONOFF, Addison B. Scoville, Jr., Chair in Medicine
- HOUSTON A. BAKER, JR., University Distinguished Professor in English
- H. SCOTT BALDWIN, Katrina Overall McDonald Chair of Pediatrics
- B. RUCE BARRY, Brownlee O. Currey, Jr., Professor of Management
- LARRY M. BARTELS, May Werthan Shayne Chair in Public Policy and Social Science

- R. DANIEL BEAUCHAMP, John Clinton Foshee Distinguished Chair of Surgery
LAUREN A. BENTON, Nelson O. Tyrone, Jr., Chair in History
FRED BESS, Vickie and Thomas Flood Chair in Hearing and Speech Sciences
MICHAEL D. BESS, Chancellor's Professor of History
ITALO BIAGGIONI, David Robertson, M.D., Professorship in Autonomic Disorders
GAUTAM BISWAS, Cornelius Vanderbilt Chair
DAVID BLACKBOURN, Cornelius Vanderbilt Distinguished Chair of History
RICHARD BLACKETT, Andrew Jackson Chair in American History
TIMOTHY BLACKWELL, Ralph and Lulu Owen Chair in Medicine
WILLIAM BLOT, Ingram Professor of Cancer Research
JAMES F. BLUMSTEIN, University Professor of Constitutional Law and Health Law and Policy
NICOLAS BOLLEN, Frank K. Houston Professor of Finance
ERIC W. BOND, Joe L. Roby Chair in Economics
JAMES BOOTH, Patricia and Rodes Hart Professor of Educational Neuroscience
RICHARD M. BREYER, Ruth King Scoville Chair in Medicine
KENDAL SCOT BROADIE, Stevenson Professor in Neurobiology
NANCY J. BROWN, Hugh J. Morgan Chair in Medicine
WILLIAM CAFERRO, Gertrude Conaway Vanderbilt Chair in the Humanities
DAVID CALKINS, Denis M. O'Day, M.B.B.S., Chair in Ophthalmology and Visual Sciences
MARIA CAMPOS-PONS, Cornelius Vanderbilt Chair in Art
RICHARD M. CAPRIOLI, Stanford Moore Chair in Biochemistry
J. JEFFREY CARR, Cornelius Vanderbilt Chair in Radiology and Radiological Sciences
ERIK CARTER, Cornelius Vanderbilt Chair in Special Education
KENNETH C. CATANIA, Stevenson Chair in Biological Sciences
PAUL CHANEY, E. Bronson Ingram Professor of Accounting
EDWARD CHAUM, Margy Ann and J. Donald M. Gass Chair in Ophthalmology
WALTER J. CHAZIN, Chancellor's Chair in Medicine
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 EMMANUELE DIBENEDETTO, Centennial Professor in Mathematics
 JOEL HARRINGTON, Centennial Professor in History
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 JOHN LACHS, Centennial Professor in Philosophy
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 MARK V. SAPIR, Centennial Professor in Mathematics
 MITCHELL A. SELIGSON, Centennial Professor in Political Science
 FRANK TONG, Centennial Professor in Psychology

Faculty

- DOUGLAS KILPATRICK ABBOT, Associate Professor of Biological Sciences
B.S. (Georgia 1989); M.S. (Simon Fraser [Canada] 1994); Ph.D. (Arizona 2001) [2004]
- MARK D. ABKOWITZ, Professor of Civil and Environmental Engineering; Professor of Engineering Management
B.S., M.S., Ph.D. (Massachusetts Institute of Technology 1974, 1976, 1980) [1987]
- BROOKE A. ACKERLY, Professor of Political Science; Associate Professor of Law
B.A. (Williams 1988); Ph.D. (Stanford 1997) [2001]
- PHILLIP I. ACKERMAN-LIEBERMAN, Associate Professor of Jewish Studies; Associate Professor of Classical and Mediterranean Studies; Associate Professor of Law
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- DOUGLAS E. ADAMS, Distinguished Professor of Civil and Environmental Engineering; Daniel F. Flowers Chair; Professor of Civil and Environmental Engineering; Professor of Mechanical Engineering; Chair of Civil and Environmental Engineering
B.S. (Cincinnati 1994); M.S. (Massachusetts Institute of Technology 1997); Ph.D. (Cincinnati 2000) [2013]
- NICHOLAS M. ADAMS, Research Assistant Professor of Biomedical Engineering
B.S. (Dixie State 2009); Ph.D. (Vanderbilt 2014) [2014]
- SUSAN M. ADAMS, Professor of Nursing; Professor of Psychiatry and Behavioral Sciences
B.S. (Valparaiso 1972); M.S.N. (California, San Francisco 1977); Ph.D. (Kentucky, Lexington 2007) [1995]
- JOHN F. AHNER, Professor of Mathematics
B.A., Ph.D. (Delaware 1967, 1972) [1974]
- CHRISTOPHER R. AIKEN, Cornelius Vanderbilt Chair in Pathology, Microbiology and Immunology; Professor of Pathology, Microbiology, and Immunology
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- SCOTT F. AIKIN, Assistant Professor of Philosophy; Assistant Professor of Classical and Mediterranean Studies
- A.B. (Washington University 1994); M.A. (Montana 1999); M.A., Ph.D. (Vanderbilt 2003, 2006) [2006]
- TERRAH L. AKARD, Associate Professor of Nursing; Associate Professor of Pediatrics
B.S. (Jacksonville State 1999); M.S.N., Ph.D. (Vanderbilt 2001, 2008) [2005]
- YASIN ALAN, Assistant Professor of Management
B.Sc. (Texas A&M 2006); M.Sc., Ph.D., M.Sc. (Cornell 2008, 2012, 2012) [2012]
- MELINDA C. ALDRICH, Assistant Professor of Thoracic Surgery; Assistant Professor of Biomedical Informatics; Assistant Professor of Medicine (Epidemiology)
B.A. (California, Santa Cruz 1992); M.P.H., Ph.D. (California, Berkeley 2003, 2007) [2010]
- AKRAM ALDROUBI, Professor of Mathematics
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- HOLLY M. ALGOOD, Associate Professor of Medicine; Associate Professor of Pathology, Microbiology and Immunology
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- MICHAEL L. ALLES, Associate Director of the Institute for Space and Defense Electronics (ISDE); Research Professor of Electrical Engineering
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- CANDICE AMICH, Assistant Professor of English
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- KATHRYN H. ANDERSON, Professor of Economics; Director, Graduate Program in Development Economics
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- VICTOR ANDERSON, Oberlin Theological School Chair; Professor of Ethics and Society; Professor of African American and Diaspora Studies
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- ALLISON P. ANOLL, Assistant Professor of Political Science
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- CELIA APPEGATE, William R. Kenan Jr. Chair of History; Professor of History; Professor of German Studies
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