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This is the Introduction, General Information, and Majors and Degrees Table from the 2001-2003 Graduate School Catalog for the University of Minnesota, Twin Cities campus.

Introduction

General Information Contents

Introduction

Graduate School Location

The Graduate School's main administrative offices are on the East Bank of the University of Minnesota's Twin Cities campus in Johnston Hall, 101 Pleasant Street S.E., Minneapolis, MN 55455. See Campus Maps at the end of this catalog. Johnston Hall is wheelchair accessible.

Publications

***Graduate School Catalog*—**Prospective and current graduate students are responsible for all the information contained in this catalog that is pertinent to graduate study and their specific field.

The first section, General Information, is the official source of information about Graduate School policies and procedures. The next section, Majors and Degrees, lists approximately 150 degree programs offered through the Graduate School.

The largest sections, Degree Programs and Faculty, and Courses, list contact names and addresses for the degree programs (Program Offices), faculty who teach in each discipline (Graduate Faculty) and present requirements and course descriptions for the various programs offering graduate degrees. The short section that follows is Duluth Degree Programs.

At the back is a complete set of Campus Maps and Course Designators. The inside back cover, Course Numbers and Symbols, explains the numbering system, punctuation, department designators, and symbols used throughout the course descriptions.

The catalog is available in the Graduate School (309 Johnston Hall) and on the Internet at <www.catalogs.umn.edu/grad/index.html>.

Updates to Catalog Information—Changes in Graduate School policies and procedures relating to admission, registration, financial assistance, and commencement are accessible on the Internet at <www.grad.umn.edu>.

Other Publications—The *Class Schedule* lists courses, class hours, locations, instructors, and basic costs and regulations. It is available in campus bookstores before registration each term. Separate catalogs are printed for the College of Continuing Education, the Duluth campus, and other University units.

Policies

Catalog Use—The information in this catalog and other University catalogs, publications, or announcements is subject to change without notice. University offices can provide current information about possible changes.

This publication is available in alternative formats on request. Contact the Office of Admissions, University of Minnesota, 240 Williamson Hall, 231 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-625-2008; e-mail admissions@umn.edu).

Equal Opportunity—The University of Minnesota is committed to the policy that all persons shall have equal access to its programs, facilities, and employment without regard to race, color, creed, religion, national origin, sex, age, marital status, disability, public assistance status, veteran status, or sexual orientation.

In adhering to this policy, the University abides by the Minnesota Human Rights Act, Minnesota Statute Ch. 363; by the Federal Civil Rights Act, 42 U.S.C. 2000e; by the requirements of Title IX of the Education Amendments of 1972; by Sections 503 and 504 of the Rehabilitation Act of 1973; by the Americans With Disabilities Act of 1990; by Executive Order 11246, as amended; by 38 U.S.C. 2012, the Vietnam Era Veterans Readjustment Assistance Act of 1972, as amended; and by other applicable statutes and regulations relating to equality of opportunity.

The Office of Equal Opportunity and Affirmative Action helps students and employees with concerns about possible discrimination, and provides consultations regarding nepotism and consensual relationships. Staff members can discuss issues, help resolve or investigate complaints, and provide training programs. Inquiries regarding compliance may be directed to Julie Sweitzer, Director, Office of Equal Opportunity and Affirmative Action, University of Minnesota, 419 Morrill Hall, 100 Church Street S.E., Minneapolis, MN 55455 (612-624-9547).

Disability Services—The University's mission is to provide optimal educational opportunities for all students. The University recognizes that students with disabilities sometimes have unique needs that must be met for them to have access to campus programs and facilities. In general, University policy calls for accommodations to be made on an individualized and flexible basis. It is the responsibility of students to seek assistance at the University and make their needs known.

The first place to seek assistance is Disability Services (DS). This office promotes program and physical access, which means ensuring the rights of students with disabilities and assisting the University in meeting its obligations under federal and state laws. DS provides direct assistance such as information, referral, support, and academic accommodations for enrolled and prospective students, as well as consultation to faculty and staff to ensure access to their programs and facilities. The office also assists students with disabilities in obtaining services from other University or community resources and serves as a liaison between the University and the Division of Rehabilitation Services. Campus accessibility maps also are available from DS; building accessibility information is printed in the *Student-Staff Directory* and *Class Schedule*. For more information, contact Disability Services, University of Minnesota, 180 McNamara Alumni Center/University Gateway, 200 Oak Street S.E., Minneapolis, MN 55455 (612-626-1333 voice or TTY).

Access to Student Educational Records—In accordance with regents' policy on access to student records, information about a student generally may not be released to a third party without the student's permission. (Exceptions under the law include state and federal educational and financial aid institutions.) The policy also permits students to review their educational records and to challenge the contents of those records.

Some student information—name, address, electronic (e-mail) address, telephone number, dates of enrollment and enrollment status (full time, part time, not enrolled, withdrawn and date of withdrawal), college and class, major, adviser, academic awards and honors received, and degrees earned—is considered public or

directory information. Students may prevent the release of public information. To do so, they must request suppression from the records office on their campus.

Students have the right to review their educational records. The regents' policy, including a directory of student records, is available for review at 200 Fraser Hall, Minneapolis and at records offices on other campuses of the University. Questions may be directed to the Office of the Registrar, 200 Fraser Hall (612-625-5333).

Immunization—Students born after 1956 who take more than one University course are required under Minnesota law to submit a Student Immunization Record form.

The form, which is sent along with the official Graduate School admission letter, should be filled out and returned to Boynton Health Service as soon as possible, but absolutely no later than 45 days after the beginning of the first term of enrollment, in order for students to continue registering for courses at the University. Complete instructions accompany the form.

Smoke-Free Campus Policy—Smoking is prohibited in all facilities of the University of Minnesota, Twin Cities campus except for designated private residence hall rooms.

The Campus and Community

On the Twin Cities campus, Graduate School students enjoy the vast academic and cultural opportunities of a major university and a unique metropolitan area.

Two Campuses in One—The Twin Cities campus, the largest and oldest in the University system, is technically two separate campuses: one just east of downtown Minneapolis on the Mississippi River, the other just west of the State Fairgrounds a couple of miles from downtown St. Paul.

The Mississippi River divides the Minneapolis campus into two banks connected by the double-decker Washington Avenue Bridge. The picturesque mall of the main East Bank is bordered by stately traditional buildings—including Johnston Hall, home of the Graduate School. Next door is Northrop Auditorium and its plaza. On the other end of the mall, Coffman Memorial Union offers a good place to relax between classes. Nearby are unique underground facilities and the health sciences complexes.

Just across the river is the West Bank. Newer and smaller, it boasts sleek brick buildings like the main library, the Humphrey Institute of Public Affairs, the Law Center, the Ted Mann Concert Hall, and the Carlson School of Management.

Three miles away is the St. Paul campus, whose animal barns, croplands, flowers, and wooded areas evoke a small college atmosphere.

Urban Diversity—The Dinkytown, Stadium Village, Seven Corners, and Cedar-Riverside areas near the Minneapolis campus, and the St. Anthony Park neighborhood alongside the St. Paul campus, all feature shops and restaurants tailored to students' interests and budgets.

Minneapolis (the largest city in Minnesota) and St. Paul (the state capital) are both flourishing centers of commerce and industry, where grandiose historic buildings complement bold new skyscrapers. Focal points of a progressive metropolitan area of 2.3 million people, the two downtowns offer many opportunities for entertainment, research, volunteer or part-time work, internships, and careers.

Arts and Entertainment—The Twin Cities are renowned for their innovative and varied cultural attractions, such as the Guthrie Theater, Ordway Music Theater, Orchestra Hall, Science Museum and Omnitheater, and Brave New Workshop. Northrop Auditorium, the campus centerpiece, hosts performances by popular musical and dance artists and outstanding University bands and ensembles. Students can see or star in plays at the Rarig Center. Or they can enjoy the Walker Art Center and the Minneapolis Institute of Arts, the Minnesota and Como Zoos, the Mall of America, the Renaissance Festival and Valleyfair, and the Minneapolis Aquatennial and St. Paul Winter Carnival. Overlooking the Mississippi River is the University's Frederick R. Weisman Art Museum, with award-winning design by Frank Gehry.

Recreation and Sports—The Recreational Sports program, one of the largest of its kind on any campus in the country, offers curling, cycling, racquetball, crew, ballroom dance, juggling, and 100 other teams, clubs, and fitness activities. Sports fans can view Golden Gophers or Vikings football and Twins baseball at the Metrodome, Timberwolves basketball at the Target Center and Wild hockey at the Xcel Energy Center. Many women's and men's intercollegiate athletic events also take place right on campus.

Outdoor enthusiasts can explore the Twin Cities' 150 parks and 200 lakes, ideal for picnicking, hiking, biking, swimming, canoeing, sailing, fishing, rollerblading or ice skating, cross-country or downhill skiing, or simply sitting and thinking. The Boundary Waters Canoe Area Wilderness, one of the most unsullied wilderness treasures in the entire nation, is only a few hours drive north.

The warmth of spring, greenery of summer, and bright colors of autumn are followed by at least three months of winter snow, but even then, daytime temperatures generally average an invigorating 10 to 30 degrees above zero.

University Counseling & Consulting Services

University Counseling & Consulting Services (UCCS), 109 Eddy Hall on the East Bank and 199 Coffey Hall on the St. Paul campus (612-624-3323 for both), offers counseling for academic, career, personal, or relationship concerns. Besides counseling, UCCS features a variety of services. The Career Development Center and the Learning and Academic Skills Center offer workshops, courses, and materials for career development or academic skills improvement. UCCS offers a series of workshops for graduate students as well as ongoing dissertation support groups. The Organizational Development Program offers consultation, assessment, team building, conflict mediation, training, and workshops. UCCS's Office of Measurement Services (OMS) scores exams, surveys, and research instruments and provides consultation to University faculty and staff. The Testing Center administers computerized national tests. For more information, see <www.ucs.umn.edu>.

Libraries and Research Opportunities

The University of Minnesota, Twin Cities Libraries, with a collection of more than 5.7 million catalogued volumes and over 45,000 serials, ranks 17th in size among American universities. Included in the system are the *Bio-Medical Library* (health sciences); *Magrath Library* (agriculture, biological sciences, human ecology); *Science and Engineering Library* (in Norris Gymnasium through 2001 and Walter Library beginning early 2002); and *Wilson Library* (social sciences, humanities, education, psychology, special collections). Other campus libraries include those for architecture, entomology, fisheries and wildlife, forestry, horticulture, journalism, law, mathematics, music, plant pathology, and veterinary medicine. Many specialized libraries and archives, such as the Children's Literature Research Collections and the Immigration History Research Center Archives, are located in the *Elmer L. Andersen Library*. In addition to strong comprehensive research collections, the system offers a full range of reference and information services, including specialized reference assistance, interlibrary loan service, database literature searching, and library user instruction. LUMINA, the library's online system, may be accessed from residence halls, offices, and other locations at <www.lib.umn.edu>.

Research support is provided by the Office of the Vice President for Research and Dean of the Graduate School as well as by the public and private sectors. The Graduate School distributes a total of $6 million annually in competitive fellowship awards to students. Another $6 million annually is awarded competitively to faculty for research support and endowed professorship support. The University also ranks among the top research universities receiving federal research money.

Use of Human or Animal Subjects in Research

All research on the Twin Cities, Duluth, Morris, and Crookston campuses that involves the use of human or animal subjects must be reviewed and approved before initiation by the Institutional Review Board: Human Subjects Committee (IRB) or the Institutional Animal Care and Use Committee (IACUC). This policy, approved by the University Senate and Board of Regents, applies to funded and nonfunded faculty, staff, and student research. All research, including Plan B projects, theses, and dissertations, that involves human or animal subjects must be approved by the appropriate committee to ensure that the rights and welfare of the subjects are protected. For more information, contact the Research Subjects Protection Office, University of Minnesota, MMC 820, 420 Delaware Street S.E., Minneapolis, MN 55455 (612-626-5654; fax 612-626-6061).

University Research Centers

Addiction Studies, Center for
Advanced Control in Plasma Processing, Center for
Aging, Center on
Agricultural Experiment Station
Alternative Plant and Animal Products, Center for
Applied Research and Educational Improvement, Center for (CAREI)
Archaeology Laboratory
Archaeometry Laboratory
Army High Performance Computing Research Center
Austrian Studies, Center for
Avian Research Center
Biological Process Technology, Institute for Advanced Studies in
Biomedical Engineering Center
Bioethics, Center for
Biometric Research, Coordinating Centers for (CCBR)
Cedar Creek Natural History Area
Cellular Injury Laboratory Center
Cereal Rust Laboratory
Chemical Toxicology Research Center
Child and Family Health Promotion and Research, Center for
Child Welfare, Center for Advanced Studies in
Clinical Outcomes Research Center (CORC)
Clinical Research Center
Cloquet Forestry Center
Cognitive Neuroscience and Brain Imaging Program
Cold Climate Housing Program
Community and Regional Research, Center for
Community Genetics, Center for
Community Integration, Institute on
Computational Science and Engineering, Laboratory for
Conflict and Change Center
Control Science and Dynamical Systems Center
Cooperative Learning Center
Corrections Education Research, Center on
Corrosion Center
CPCRA (Community Program for Clinical Research on AIDS) Statistical Center
Criminal Justice Institute
Dairy Foods Research Center
Daylighting Center, Regional
Death Education and Research, Center for
Dental Research Center for Biomaterials and Biomechanics, Minnesota
Dental Research Institute
Design Center for the American Urban Landscape
Development of Microsensor Technology, Center for the
Early Childhood Research Institute
Early Education and Development, Center for
Early Modern History, Center for
Economic Development Center (Twin Cities)
Economic Development (Duluth), Center for
Economic Education (Duluth), Center for
Economic Education (Twin Cities), Center for
Economic Research, Center for
Education in Agriculture and Extension, Center for
Educational Outcomes, National Center on
Entrepreneurial Studies, Carlson Center for
Epilepsy Clinical Research Program
European Studies, Center for
Experiential Education and Service Learning, Center for
Excellence in Critical Care, Center for
Feminist Studies, Center for Advanced
Food Animal Biotechnology Center
Gay, Bisexual, Transgender Studies, (Steven J.) Schochet Center for
Gene Therapy of Fibrotic Lung Disease, Center for
Geological Survey, Minnesota
Geometry Center, The
Girls and Women in Sport, Center for Research on
Hardwood Ecology, Center for
Herbarium
History of Information Processing, (Charles) Babbage Institute-Center for the
Holocaust and Genocide Studies, Center for
Home Monitoring of Patient Status, Center for
Hormel Institute
Horticultural Research Center
Human Factors Research Laboratory
Human Genetics, Institute of
Human Resource Development Research Center
Humanities Institute
Imaging Center
Immigration History Research Center
Immunology, Center for
Industrial Relations Center
Integrated Natural Resources and Agricultural Management, Center for

Additional information about the Graduate School, including links to individual degree program pages, is available online at <www.grad.umn.edu/grad.html>.

Distinguished McKnight University Professorship Winners for 2001

Once a year, the Graduate School selects four University professors to receive the Distinguished McKnight University Professorship. Winners are chosen on the merit of their scholarly achievements and the potential for greater attainment in the field; the extent to which their achievements have brought distinction to the University of Minnesota; the quality of their teaching and advising; and their contributions to the wider community.

The four recipients for 2001 are:

Lydia Artymiw
Music

R. Lawrence Edwards
Geology and Geophysics

Timothy P. Lodge
Chemistry

Lawrence P. Wackett
Biochemistry, Molecular Biology, and Biophysics

Interdisciplinary Applications in Magnetic Resonance, Center for
Interdisciplinary Studies of Writing, Center for
Interest Measurement Research, Center for
Interfacial Engineering, Center for
International Food and Agricultural Policy, Center for
International Studies, Royal D. Alworth Jr. Institute for
International Studies and Programs, Institute of
Interpersonal Relationships, Center for Research on
Jewish Studies Center
Journalism Center, Minnesota
Lake Itasca Forestry and Biological Station
Landscape Arboretum, Minnesota
Landscape Studies Center
Language Acquisition, Center for Advanced Research on (CARLA)
Large Lakes Observatory
Learning, Perception, and Cognition, Center for Research in
Life Course Center
Limnological Research Center
liMNology: A Virtual Center for Limnology
Long-Term Care Administration, Center for
Low-Vision Research, Minnesota Laboratory for
Lung Health Study Coordinating Center
Magnetic Resonance Research, Center for
Management Information Systems Research Center
Manufacturing, Design, & Control, Center for Advanced (CAMDAC)
Mathematics and Its Applications, Institute for
Medieval Studies, Center for
Metals in Biocatalysis, Center for
Microbial Genomics, Center for
Microbial Physiology and Metabolic Engineering, Center for
Micromagnetics and Information Technologies Center (MINT)
Microtechnology Laboratory (MTL)
Midwest Ecological Risk Assessment Center (MERAC)
Minnesota Population Research Institute
Molecular and Cellular Therapy, Center for
Muscle and Muscle Disorders, Center for
NanoStructure Laboratory
Natural Resource Policy and Management, Center for
Natural Resources Research Institute
Neurocommunication Research, Edwin Eddy Center for
Neuroscientific Databases, Center for
North Central Soil Conservation Research Laboratory
Nuclear Physics, Williams Laboratory for
Nursing Research on Elders, Center for
Occupational Health and Safety, Midwest Center for
Pain Research, Center for
Pharmaceutical Research in Management and Economics (PRIME) Institute
Philosophy of Science, Minnesota Center for
Plant Molecular Genetics Institute
Plants and Human Health, Center for
Political Economy, Center for
Polymerization and Polymer Process Engineering Center
Population Analysis and Policy, Center for
Psychiatry Research
Race and Poverty, Institute on
Raptor Center
Research on Developmental Education and Urban Literacy, Center for
Research on Girls and Women in Sport, Center for
Reflective Leadership Center
Refugee Studies Center
Residential Services and Community Living, Center for
Restorative Justice and Mediation, Center for
Retail Food Industry Center, The (TRFIC)
Rock Magnetism, Institute for
Rural Health Research Center
Rural Sociology and Community Analysis, Center for
St. Anthony Falls Laboratory
Sand Plain Research Farm
Sea Grant College Program, Minnesota
Silha Center
Social, Economic and Ecological Sustainability, Institute for (ISEES)
Space Grant Consortium, Minnesota
Speech, Equality, and Harm, Center for
Strategic Management Research Center
Study of Political Psychology, Center for the
Study of Neurobehavioral Development in the Context of Adversity, Center for the
Supercomputer Institute
Superconductivity, Center for Science and Application of
Survey Research, Minnesota Center for
Sustainable Agriculture, Minnesota Institute for (MISA)
Technological Leadership, Center for Development of
Theoretical Physics Institute
Transportation Studies, Center for
Twin and Adoption Research, Minnesota Center for
Underground Research Site, Soudan
Urban and Regional Affairs, Center for
Violence and Abuse, Higher Education Center Against (HECAVA)
Violence Prevention and Control, Center for
Vocational Education, Minnesota Research and Development Center for
Vocational Education, National Center for Research in
Water Resources Research Center
Women and Public Policy, Center on
Youth Development, Center for

Administration

University Regents

Maureen K. Reed, Stillwater, Chair
Robert S. Bergland, Roseau, Vice Chair
Anthony R. Baraga, Side Lake
Dallas Bohnsack, New Prague
William E. Hogan II, Minnetonka
Warren C. Larson, Bagley
David R. Metzen, Sunfish Lake
H. Bryan Neel III, Rochester
Michael O'Keefe, Minneapolis
Jessica J. Phillips, Minneapolis
Patricia B. Spence, Rice

University Administrators

Mark G. Yudof, President
Robert Bruininks, Executive Vice President and Provost
Frank B. Cerra, Senior Vice President, Health Sciences
Tonya Moten Brown, Vice President and Chief of Staff
Carol Carrier, Vice President for Human Resources
Sandra Gardebring, Vice President for University Relations
Robert J. Jones, Interim Vice President for Student Development
Eric Kruse, Vice President for University Services
Christine M. Maziar, Vice President for Research and Dean of the Graduate School
Charles Muscoplat, Vice President for Agricultural Policy
Mark B. Rotenberg, General Counsel

Graduate School Administrators

Christine M. Maziar, Ph.D., Vice President for Research and Dean of the Graduate School
Victor A. Bloomfield, Ph.D., Vice Provost for Research and Associate Dean of the Graduate School
Esam El-Fakahany, Ph.D., Assistant Vice President for Research and Associate Dean of the Graduate School
Shirley Nelson Garner, Ph.D., Associate Dean of the Graduate School
George D. Green, Ph.D., Associate Dean of the Graduate School
Stephen C. Hedman, Ph.D. Associate Dean of the Graduate School, Duluth
Samuel L. Moore, Ph.D., Assistant Dean of the Graduate School
Naomi B. Scheman, Ph.D., Associate Dean of the Graduate School

General Information Contents

General Information

The Graduate School provides advanced training in a variety of fields and promotes research in an atmosphere of freedom of inquiry.

The Graduate School administrative structure includes six policy and review councils, consisting of faculty and students, in the areas of biological sciences; education and psychology; health sciences; language, literature, and the arts; physical sciences; and social sciences. These councils, together with an Executive Committee, are responsible for making general policy for the Graduate School. The Executive Committee is composed of the Graduate School dean; chairpersons of the policy and review councils, the Graduate School Research Advisory Committee, and the Fellowship Committee; and representatives from the Duluth Graduate Faculty Committee, Graduate School administration and staff, and the Council of Graduate Students.

Tuition and Fees

Tuition for the various categories of Graduate School registration and fees are listed in the *Class Schedule*, published each term, and can be found on the Web at <http://onestop.umn.edu/Finances/tuition_and_fees.html>. Summer session tuition and fees are listed in the *Summer Session Catalog*.

Residence—Because the University is a state institution, Minnesota residents pay lower tuition than nonresidents. To qualify for resident status, students must reside in Minnesota for at least one calendar year before the first day of class attendance. For more information, contact the Resident Classification and Reciprocity Office, University of Minnesota, 240 Williamson Hall, 231 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-625-6330).

Reciprocity—For residents of North Dakota, South Dakota, Wisconsin, or Manitoba who qualify for reciprocity privileges, tuition rates are lower than for nonresidents and are, in some cases, comparable to resident rates. For more information, contact the Resident Classification and Reciprocity Office (see above).

Resident Tuition Benefit—For information on resident tuition for graduate assistants, fellows, and trainees, see Assistantships and Fellowships on page 10. For information on the benefit for underrepresented and educationally disadvantaged students, see Office of Graduate School Outreach on page 12.

Basic Admission Requirements

Any student with a U.S. bachelor's degree or a comparable foreign degree from a recognized college or university may apply to the Graduate School dean for admission. Applicants with the necessary background for their chosen major field, an excellent scholastic record from an approved college or university, and appropriate professional qualifications may be admitted for graduate work on recommendation of the graduate faculty in the proposed major field and approval of the Graduate School dean. The Graduate School operational standard for admission is an undergraduate grade point average (GPA) of 3.00. Many programs require a higher GPA. Applicants should consult the program to which they are applying for more specific information about admission standards.

For more information on admission requirements and application procedures, contact the proposed major field at the address or phone number listed with each program in the Degree Program and Faculty section of this catalog.

Application Procedure

Requests for application materials should be sent to the director of graduate studies in the individual program (see the contact information listed with each program in the Degree Programs and Faculty section). Requests should specify the applicant's proposed major field and emphasis, degree objective, and date of entry. Applicants may also apply online at <www.grad.umn.edu/application.html>.

Applicants are encouraged to apply for admission well in advance of the term in which they wish to enter the Graduate School (but no more than one year in advance of the proposed entry date). The Graduate School application, complete with all required materials, must be submitted by the following deadlines.

Fall semester—June 15

Spring semester—October 15

Summer session—March 15

Deadlines that fall on a holiday or weekend will be extended through the next regular workday.

Many major fields have established deadlines earlier than those listed above and also require additional application and supporting materials. It is the applicant's responsibility to obtain information about those deadlines and requirements from the director of graduate studies for the proposed major.

Note: More detailed and up-to-date information regarding the application fee, transcripts, and test data is included in the instructions accompanying the Graduate School Application for Admission.

Transcripts—Official transcripts of previous academic study must be submitted.

Experience at the University of Minnesota has been that often during the course of the program of study a student has need of a complete set of official credentials covering previous college and university training. Applicants are urged to request two sets of official credentials when preparing their admission application—one to be submitted for permanent filing in the Graduate School and the other for personal use.

International Applicants—All international applicants must submit complete credentials. Details on the types of transcripts required are given in the Graduate School Application for Admission instructions.

Test Data—One or more of the following tests may be required as part of the application process (in addition, consult the individual program requirements under Degree Programs and Faculty):

Graduate Record Examination (GRE)—Most major fields request the GRE. It would be wise, therefore, for applicants to complete this test either in the senior year of undergraduate work or before filing an admission application.

The Graduate School requires GRE General Test results from all applicants who submit undergraduate narrative transcripts or transcripts containing "pass-no credit (P-N)," "credit," or other ungraded notations for a

Information about the GRE and GMAT, including practice tests and online registration, can be found on the Educational Testing Services Web site at <www.ets.org/>.

substantial number of courses taken during the junior and senior years or whose transcripts do not show a substantial number of letter grades during those years.

For information about the test, contact the Educational Testing Service, CN 6000, Princeton, NJ 08541. Official scores must be sent to the Graduate School office from the testing service.

Graduate Management Admission Test (GMAT)—See the business administration program description under Degree Programs and Faculty. For information on registering for the GMAT, write to the Educational Testing Service, CN 6108, Princeton, NJ 08541.

Test of English as a Foreign Language (TOEFL) and *Michigan English Language Assessment Battery (MELAB)*—The operational standard for admission to the Graduate School is a TOEFL score of 550 (213 on the computer-based test) or MELAB score of 80; individual programs may require a higher score. One of these tests is required of all international applicants whose native language is not English, except those who will have completed 24 quarter or 16 semester credits (within the past 24 months) in residence as a full-time student at a recognized institution of higher learning in the United States before entering the University of Minnesota. These transfer students, however, may be asked to take locally administered English tests after arrival on campus.

Foreign Medical Graduate Examination in the Medical Sciences (FMGEMS)—Applicants seeking admission to graduate study in clinical medical fields whose medical degrees or qualifications were conferred by medical schools outside the United States, Puerto Rico, or Canada must submit certification by the Educational Commission for Foreign Medical Graduates or evidence of a full and unrestricted license to practice medicine issued by a state or other territory under U. S. jurisdiction that is authorized to license physicians. For more information on certification and the FMGEMS, write to the Educational Commission for Foreign Medical Graduates, 3624 Market Street, Philadelphia, PA 19104, USA or phone 215-386-5900.

Additional Information—The Graduate School and individual programs within it reserve the right to request additional information when they believe it is necessary.

Special Applicant Categories

University of Minnesota Undergraduates—University of Minnesota students who have no more than seven semester credits or two courses to complete for their bachelor's degree (including both distribution and total credit requirements), if they are admitted, may register in the Graduate School to begin a graduate program while simultaneously completing their baccalaureate work. A final bachelor's transcript must be submitted before the second term of registration.

Professional Development—Applicants who wish to enroll in a field in the Graduate School but are not interested in a graduate degree may apply for admission for "professional development coursework." Applicants for professional development courses must complete the usual application materials and meet existing deadlines and admission standards. Because some major fields restrict admission to those planning on pursuing an advanced degree, applicants are advised to consult with the director of graduate studies in their proposed major field before completing application materials.

Academic Staff—University of Minnesota staff holding academic appointments above the rank of instructor or research fellow are normally not permitted to complete a graduate degree at the University. Those who wish to register for courses and transfer them elsewhere may apply for admission for "professional development coursework."

Committee on Institutional Cooperation Traveling Scholar Program—The University of Minnesota participates in the Traveling Scholar Program for graduate students enrolled in Committee on Institutional Cooperation (CIC) institutions. The 14 participating universities are the members of the "Big Ten," the University of Chicago, the University of Illinois at Chicago, and the University of Wisconsin-Milwaukee.

The program enables doctoral students at any CIC university to take advantage of educational opportunities—specialized courses, unique library collections, unusual laboratories—at any other CIC university without change in registration or increase in fees. Students may take advantage of these educational opportunities for three quarters or two semesters.

Graduate students interested in graduate course offerings not available at the University of Minnesota should confer first with their major department and major adviser concerning which of the cooperating institutions to select for program enrichment and diversification. Information on procedures for participating in the Traveling Scholar Program is available in the Graduate School Admissions Office, 309 Johnston Hall (612-625-9364).

Assistantships and Fellowships

Resolution of the Council of Graduate Schools in the United States—Acceptance of an offer of financial aid (such as a graduate scholarship, fellowship, traineeship, or assistantship) for the next academic year by an enrolled or prospective graduate student completes an agreement that both student and graduate school expect to honor. When a student accepts an offer before April 15 and subsequently desires to withdraw, the student may submit a written resignation for the appointment at any time through April 15. However, an acceptance given or left in force after April 15 commits the student not to accept another offer without first obtaining a written release from the institution to which a commitment was made. Similarly, an offer made by an institution after April 15 is conditional on presentation by the student of a written release from any previously accepted offer. It is further agreed by the institutions and organizations subscribing to this resolution that a copy of the resolution should accompany every scholarship, fellowship, traineeship, and assistantship offer.

Graduate Assistantships—Graduate assistantships are academic appointments reserved for graduate and professional students. Appointments to teaching assistant, research assistant, or administrative fellow positions are offered through various departments. A teaching assistant helps teach students in a specified course or courses under the general supervision of the academic staff and may be assigned primary responsibility for an entire course. A research assistant carries out activities connected with research studies assigned by the supporting department or principal research investigator. An administrative fellow performs duties of a specialized nature connected with academic administration.

To be eligible to hold one of these appointments, a student must have been admitted to the Graduate School or a professional school and be registered in the Graduate School or professional school each term of the appointment; this applies to appointments of any percentage or any number of hours. For more specific information, refer to the Graduate Assistant Employment Area in the Office of Human Resources (612-624-7070) or its Web site <www1.umn.edu/ohr/gao>.

Benefits—All graduate assistants holding appointments as teaching assistants, research assistants, and administrative fellows may become eligible for the following benefits:

Tuition Benefits—Upon reaching minimum qualification for eligibility (refer to the graduate assistant office Web site above), students receive a tuition benefit equal to twice the percentage of time worked. For example, a 40 percent appointment for the full payroll semester period includes an 80 percent tuition benefit, which applies only to tuition costs. The maximum benefit is 100 percent and applies to a maximum of 14 credits each academic term. The tuition benefit does not cover course or student services fees.

Resident Rate Privilege—Upon reaching minimum qualification for eligibility (refer to the graduate assistant office Web site above), students receive a resident rate break, which is credited on the fee statement before the tuition benefit. This privilege applies concurrently to members of the immediate family (spouse or domestic partner, children, and parents).

Extended Resident Rate Privilege—When a graduate assistant has completed two qualifying terms of assistantship, the resident rate break continues for the number of terms the appointments were held, up to a maximum of six terms. This privilege applies also to the student's immediate family. *Note:* For the student and family, this privilege does not extend beyond three years from the termination of the last or most recent qualifying appointment.

Each department sets its own financial aid application deadline. Unless otherwise noted, students should apply by January 15 for appointments for the ensuing academic year; applications received after January 15 are considered for available vacancies.

Graduate assistants are compensated according to a pay range established each year by the University's central administration and approved by the Board of Regents. The current pay range for graduate assistants is available from the department or the University of Minnesota Job Center. Graduate students may not hold appointments for which there is no monetary compensation, nor are they allowed to hold appointments for which they receive only course credit or resident tuition rates.

More information may be obtained from either the head of the department offering the appointment or the Job Center, which maintains the graduate assistant office Web site and *Grapevine,* a newsletter for graduate assistants. More information about the assistantship program at the University may be obtained from the Job Center, University of Minnesota, 200 Donhowe Building (first floor for walk-in assistance), 319 15th Avenue S.E., Minneapolis, MN 55455 (612-624-7070; fax 612-625-9801; e-mail gaoinfo@umn.edu).

Graduate Assistant Health Care Plan—University-subsidized health insurance is available to most Graduate School or professional school students who hold an appointment as a teaching assistant, research assistant, or administrative fellow (some other fellows and trainees enrolled in the Graduate School are also eligible). For these students, the University pays 50 to 100 percent of the insurance premium during the academic year (fall through spring), the percentage depending on the level of appointment. To receive this coverage, eligible students must apply for it by the end of the second week of classes. To apply and for more information, contact the Graduate Assistant Insurance Office, N-323 Boynton Health Service, 410 Church Street S.E., Minneapolis, MN 55455 (612-625-6936; e-mail gradins@bhs.umn.edu; <www.bhs.umn.edu>).

General College Assistantships—Graduate students are eligible to apply for teaching assistantships in General College in mathematics, natural sciences, social sciences, writing, ESL, oral communication, and the humanities. The General College program consists of developmental and general education courses that enable underprepared students to later transfer to degree-granting colleges. Approximately 35 percent of the students in the college are from Asian/Pacific-American, African-American, Native American, and Hispanic ethnic groups.

All graduate teaching assistantships for General College are posted for at least five days in the Job Center, University of Minnesota, 319 15th Avenue S.E., Minneapolis, MN 55455. Notices of vacancies in General College are routinely sent to related academic departments in other University colleges.

Graduate Fellowships—Graduate fellowships, awards based on academic merit, are available to new and currently enrolled graduate students. The Graduate School Fellowship Office, 321 Johnston Hall, administers several fellowship programs; a number of individual academic departments also administer field-specific fellowships. Entering students should contact their prospective graduate program. Currently enrolled students should consult the Fellowship Office and their graduate program office for current information on fellowship opportunities. The Fellowship Office also processes applications for several international competitions, such as Fulbright Grants for graduate study abroad.

Resident Benefit for Graduate Fellows and Trainees—Graduate students who hold fellowships or traineeships are eligible for resident tuition rates, provided the award is administered by the University and the stipend is at least equal to a 25-percent-time graduate assistantship. This eligibility also extends to members of the immediate family (i.e., parent, spouse, child, or ward). Any changes to this policy will appear in the *Class Schedule*.

For New Graduate Students

GRADUATE SCHOOL FELLOWSHIPS—Intended for recruiting outstanding new students to the University's graduate programs, these fellowships provide approximately $13,500 for the academic year plus tuition for up to 14 credits per term and subsidized health insurance. Prospective students must be nominated by their chosen major field in early February through procedures announced by the Graduate School during fall semester. Applicants should contact the director of graduate studies in their major field in advance.

FELLOWSHIPS AND SCHOLARSHIPS ADMINISTERED THROUGH DEPARTMENTS—Many academic departments have fellowships and awards from private endowment income, gifts, and other sources. Complete information is available on award amounts and purposes, deadlines, and the application process from individual departments. Students should inquire directly.

FELLOWSHIPS AVAILABLE FOR UNDERREPRESENTED AND EDUCATIONALLY DISADVANTAGED STUDENTS—Because eligibility varies depending on the fellowship, students should contact the appropriate program office to see if they are eligible. Information can also be obtained from the Office of Graduate School Outreach, 333 Johnston Hall (612-625-6858; e-mail gsoeo@umn.edu).

Diversity of Views and Experiences Fellowship (DOVE)—Students planning to enter the Graduate School for the first time in the fall semester are eligible for these one-year fellowships, which provide a stipend of approximately $13,500 plus tuition and health insurance (fees not included) for the academic year. Departmental support following the fellowship year is included. All applicants must be nominated by the graduate program they plan to enter. About 10 fellowships are awarded by the Graduate School each year.

Other Available Fellowships—The availability of other fellowships for underrepresented and educationally disadvantaged students changes yearly. They include the Ford Foundation Predoctoral and Dissertation Fellowships for Minorities, the GEM Master's Fellowship, the GEM Ph.D. Engineering and Natural Science Fellowship, the MacArthur Scholars Fellowship, the National Physical Science Consortium Fellowships for Minorities and Women in the Physical Sciences, and others. Contact the Office of Graduate School Outreach, 333 Johnston Hall, for information. In addition, underrepresented and educationally disadvantaged students should check all regular sources of support described in this catalog.

Office of Graduate School Outreach

This office (333 Johnston Hall, 612-625-6858, e-mail gsoeo@umn.edu) promotes a diversity of views in the pursuit of research, scholarship, and artistry at the University. This diversity is promoted through recruiting and supporting academically excellent students with diverse economic, educational, racial, and ethnic backgrounds and experiences. The office provides students (U.S. citizens and permanent residents) with information on graduate programs and the graduate admissions process and assists in identifying financial aid sources. In addition, the office administers fellowships and initiatives that focus on academic excellence in graduate education.

Waiver of Nonresident Tuition—The University of Minnesota may waive, in whole or part, nonresident tuition for high-ability nonresident, nonreciprocity students that the University is seeking to attract. The waiver may be for either the full nonresident component of tuition or for half the nonresident component of tuition. Awards are made to new students who receive no departmental funding at the time they enter the University. The awards are renewable through graduation for students who attend full-time and maintain satisfactory academic progress.

Tuition waivers for high-ability nonresident, nonreciprocity graduate students are awarded on the basis of a review of an individual's application for the award, which is conducted by the Office of Graduate School Outreach. The criteria used in evaluating applicants for these awards include academic achievement, high academic potential, educational disadvantages, financial need, race and ethnicity, special talents, evidence of outstanding leadership, creativity, unique work or service experience, and community involvement.

Other Financial Assistance

Student Employment—The University's Job Center (part of the Office of Human Resources) offers graduate students a wide range of nonacademic employment opportunities both on campus and throughout the Twin Cities area. All jobs are posted at the Job Center, 200 Donhowe Building, 319 15th Avenue S.E., Minneapolis, MN 55455 (612-625-2000). Contact the Job Center for more information, including registration requirements for graduate student eligibility.

In addition to University (on-campus) employment, the Center offers programs for off-campus employment: the Job Location and Development (JLD) Program helps locate career-related opportunities with private and public employers in the Twin Cities; Community Service Programs helps arrange employment on and off campus with nonprofit organizations and agencies.

Students who prefer more flexibility may apply for short-term, on-campus temporary positions through the Student Temporary Service (STS). STS also offers free microcomputer training and temporary job placement through the Microcomputer Training Program. Training is provided on Macintosh and IBM microcomputers. Once qualified, students are placed in temporary, on-campus microcomputer-related jobs at competitive wages.

Office of Student Finance (OSF)—To apply for financial aid, graduate students must complete the Free Application for Federal Student Aid (FAFSA), available from the financial aid office each year. Graduate students are considered for the following programs, according to their degree program, student status, and other qualifying criteria: Ford Federal Direct Subsidized and Unsubsidized Loans; Federal Perkins Loans; Student Educational Loan Fund (SELF); University Trust Fund Loan (UTFL); University of Minnesota scholarships and fellowships; regular student employment and Work-Study; Health and Human Services Health Care Professions Grants; Minnesota Medical Foundation Scholarship; Minnesota Tuition Offset for Health Professions; Peters Pharmacy Scholarship; University of Minnesota Medical School Scholarships; Health Professions Student Loan (HPSL); Loans for Disadvantaged Students (LDS) for health professions; Nursing Student Loan (NSL); Primary Care Loan (PCL) for medical students; and private loans. International graduate students must contact International Student and Scholar Services for financial aid opportunities (see next page).

Most awards are based on financial need and full-time enrollment status. Aid from the UTFL, Perkins, and Work-Study programs is awarded as applications become complete and until all funds have been spent. Students who submit their FAFSAs early to the federal processor receive first priority consideration for limited funds. Prospective students may apply before admission to the University.

For detailed information, students should obtain the most recent edition of the *Scholarships and Financial Aid Handbook*, a comprehensive guide to the financial aid process at the University of Minnesota. The handbook is accompanied by the FAFSA, which must be completed for aid consideration. Students may write to the Office of Student Finance at either University of Minnesota, 210 Fraser Hall, 106 Pleasant Street S.E., Minneapolis, MN 55455, or University of Minnesota, 130 Coffey Hall, 1420 Eckles Avenue, St. Paul, MN 55108, or call 612-624-1665 or, July-September, 1-800-400-UofM(8636); the fax number is 612-624-9584 and

the e-mail address is osfa@umn.edu. To receive disability accommodations when in Fraser Hall or information in an alternative format, call the disability services liaison for financial aid at 612-625-9578; TTY telephone is 612-626-0701.

International Students and Scholars—International Students and Scholars Services (ISSS) provides counseling, advising, educational and career services to students and scholars from other countries. ISSS staff members offer counseling and advising services regarding visa requirements and other immigration issues; social, personal, and financial matters; international and intercultural educational opportunities; academic issues; and English language requirements.

International students new to the University of Minnesota must participate in ISSS's International Student Orientation Program, which introduces students to academic, social, and practical matters relevant to their study in the United States. In addition, ISSS coordinates many cross-cultural training programs and events for students, faculty, staff, and the Twin Cities communities. All admitted international students and scholars are mailed materials pertaining to pre-arrival, arrival, and transition to the University system. Prospective student inquiries may be addressed to International Student and Scholar Services, 190 Hubert H. Humphrey Center, 301 19th Ave. S., Minneapolis, MN 55455 (612-626-7100) or visit the Web site <www.isss.umn.edu>.

Army and Air Force ROTC—Graduate students may pursue a two-year Army or Air Force ROTC program. For information, see the University's *Undergraduate Catalog* for the Twin Cities campus or call the Army ROTC (612-624-7300) or Air Force ROTC (612-624-2884).

Student Grievance Procedures

Academic Grievances—An all-University Student Academic Grievance Policy exists to resolve "complaints brought by students regarding the University's provision of education and academic services affecting their role as students." Copies of the policy and information about its implementation are available from the Grievance Office, 658 Heller Hall, Twin Cities campus (612-624-1030).

Sexual Harassment—Policies pertaining to sexual harassment are contained in the Regent's policy adopted December 11, 1998. The policy defines sexual harassment in the following manner.

"Sexual harassment means unwelcome sexual advances, requests for sexual favors, and/or other verbal or physical conduct of a sexual nature when:
(1) submission to such conduct is made either explicitly or implicitly a term or condition of an individual's employment or academic advancement in any University activity or program; (2) submission to or rejection of such conduct by an individual is used as the basis of employment or academic decisions affecting this individual in any University activity or program; or (3) such conduct has the purpose or effect of unreasonably interfering with an individual's work or academic performance or creating an intimidating, hostile, or offensive working or academic environment in any University activity or program."

Individuals seeking information and guidance in matters involving sexual harassment should contact the Office of Equal Opportunity and Affirmative Action, 419 Morrill Hall (612-624-9547).

Crime Statistics—Crime statistics can be found on the University of Minnesota Police Web site at <www1.umn.edu/umpolice/crime.htm>.

Housing

At the current time, the University guarantees housing fall term to freshmen that apply before May 1. Graduate and professional students can be housed in residence halls/apartments usually during the spring term and will have an option of renewing for the following year. Students interested in living in a residence hall on campus or in off-campus housing in Minneapolis or St. Paul should contact Housing & Residential Life, Comstock Hall-East, 210 Delaware Street S.E., Minneapolis, MN 55455 (612-624-2994; fax 612-624-6987; e-mail housing@umn.edu). Listings of apartments, duplexes, houses, sleeping rooms, shared units, and sublets are maintained in the office as well as on the Web. Information on temporary housing, living costs, transportation, and day-care centers in the Twin Cities area is also available.

For more information, visit the Housing & Residential Life Web site at <www.umn.edu/housing>. For information on University family housing, contact Commonwealth Terrace Cooperative, 1250 Fifield Avenue, St. Paul, MN 55108 (651-646-7526), or Como Student Community, 1024 27th Avenue S.E., Minneapolis, MN 55414 (612-378-2434).

Orientation to the Twin Cities Campus

Designed for all incoming new graduate students in fall and spring semesters, Graduate Student Orientation (GSO) offers a wide variety of informational sessions and workshops to assist student transition into the University of Minnesota system. Sessions include "How to Navigate the U" and "The Nuts and Bolts of Graduate School" as well as basic resources such as "How to get your Student I.D." All incoming graduate students (except those with foreign addresses) are mailed a brochure outlining the GSO schedule for that semester; F1 and J1 visa students receive information from International Student and Scholar Services (612-626-7100). For more information, contact New Student Programs at 612-624-1979 or 800-234-1979 or visit their Web site at <www.nspo.umn.edu>.

For information about new student orientation plus writing and library research workshops, contact the Graduate Student Orientation program coordinator at 612-624-0666.

In addition to this University-wide orientation service, many graduate programs may offer orientation sessions specifically for their respective fields. For more information, students should contact the director of graduate studies in their major field.

Council of Graduate Students

The Council of Graduate Students (COGS) is the official governing body representing graduate students at the University. COGS provides opportunities for graduate students to participate actively in University and Graduate School administrative and policy decisions. Graduate students in each degree-granting and free-standing minor program are entitled to elect one representative to serve on COGS. COGS also recruits student representatives for the Graduate School Policy and Review Councils, the University Senate, and many College of Liberal Arts and University-wide committees. In addition, COGS assists in providing ombuds services for graduate students and disseminates information, primarily through the *Gradletter,* the EXTRA! (graduate student listserv), and through general meetings held throughout the academic year. Information on University governance and grievance procedures is available from the COGS office.

Students may contact COGS at University of Minnesota, 405 Johnston Hall, 101 Pleasant Street S.E., Minneapolis, MN 55455 (612-626-1612; e-mail cogs@umn.edu; <www.cogs.umn.edu>).

Preparing Future Faculty

Preparing Future Faculty (PFF) welcomes graduate and postdoctoral participants from all disciplines. PFF helps participants acquire information about the teaching and learning process and the faculty role at a variety of institutions of higher education; gain a realistic perspective on the skills required for success as a faculty member; examine their fit with a teaching career in higher education; work with a faculty mentor in a teaching opportunity at a local college or university; demonstrate, document, and reflect on their teaching skills; and market themselves for faculty or other professional positions.

To receive a letter of recognition and certificate of program participation from the Graduate School, participants must complete Grad 8101—Teaching in Higher Education and Grad 8102—Practicum for Future Faculty. Other credit courses on teaching and learning or the faculty role may be recognized by PFF as substitutes for Grad 8101 or Grad 8102.

PFF is a program of the Graduate School, administered through the Center for Teaching and Learning Services (CTLS) in the Office of Human Resources. For information on program enrollment, contact PFF at 612-625-3811 or pff@umn.edu, drop by CTLS in 120 Fraser Hall, or visit <www.umn.edu/ohr/pff/>.

Registration

Registration Deadlines—All graduate students must register before the term-specific, University-wide registration deadline. For University calendar and registration deadline information and the University-wide policy governing cancel/adds, refer to the *Class Schedule* or <www.onestop.umn.edu/schedule/html/tc.html>. For information about the summer term, including registration deadlines, refer to the *Summer Session Catalog* or the *Class Schedule* Web site above. Exceptions to University-wide registration deadlines will be considered only by written request to the Graduate School; such requests are not routinely granted.

All graduate students must register before the first day of the term to avoid a late registration fee.

Registration Requirements—Most graduate students are enrolled full time every semester. In addition, the following requirements apply as appropriate.

1. To maintain their active status, *graduate students must at minimum register once per year* (e.g., students registered for fall semester in any given year must register again for fall semester of the next year at the latest). Those who do not register in the Graduate School at least once per year are considered to have withdrawn; their Graduate School records are deactivated. Deactivated students may not register for courses, take examinations, submit degree program or thesis proposal forms, file for graduation, or otherwise participate in the University community as Graduate School students. Those who wish to resume graduate work must request readmission to the Graduate School *and, if readmitted, must register in the Graduate School for the term of readmission* to regain their active status. For further information about the Graduate School's registration requirement, including examples, refer to <www.grad.umn.edu/gsss/registration.html>.

Graduate students who *have* registered within the past year need not register for the sole purpose of taking final written or oral examinations for the master's degree or specialist certificate, or preliminary written, or final oral examinations for the doctorate.

2. Graduate students holding appointments as teaching assistants, research assistants, or administrative fellows must be registered each term of their appointment; this applies to appointments of any percentage or any number of hours. See Graduate Assistantships under Assistantships and Fellowships on page 10 for more information.

3. Students receiving other types of financial aid from the University or other agencies, international students with certain types of visas, and students who wish to use various University services and facilities may have specific registration requirements; these students are responsible for obtaining information about such requirements from the appropriate offices.

Special Registration Categories for Advanced Graduate Students

Advanced master's students and advanced doctoral candidates (i.e., students who have completed all their program coursework and required thesis credits, but still are working full-time on the research or writing of their thesis, papers, capstone project, or dissertation) may be eligible for special registration categories that enable them to be certified as "full-time" students when registered for one credit.

"Full-time with one credit registration" courses are available only to advanced master's (8333) and doctoral (8444) students. Eligibility criteria are specific to advanced master's and advanced doctoral applicants. Students must meet eligibility criteria and application deadlines to qualify.

For further information concerning eligibility requirements, deadlines, and application forms, contact the Graduate School, 316 Johnston Hall, the Graduate Assistantship Office, or <www.grad.umn.edu/gsss/>.

Readmission and Other Changes

Requests for readmission, change of major, track or degree objective, or change of campus within the Graduate School should be made on the Change of Status/Readmission application (G.S. Form 72), available from the Graduate School Admissions Office, 309 Johnston Hall. Payment of a $40 fee must accompany the form.

Readmission—To maintain their active status, *graduate students must at minimum register once every year.* Previously registered students who do not register in the Graduate School of the University of Minnesota at least once per year will be considered to have withdrawn and must apply for readmission in order to resume graduate work. More detailed information and specific examples are located at <www.grad.umn.edu/gsss/registration.html>.

Change of Major, Track, or Degree Objective— Students currently enrolled in the Graduate School who intend to change their major, track, or degree objective from that originally approved by the Graduate School should request a change of status. Students who have already been awarded a degree in the Graduate School must request a change of status if they wish to pursue another degree.

Change of Campus—Students currently enrolled in the Graduate School on one campus who wish to complete their studies on another campus should request a change of status. Graduate study is currently available on the Twin Cities campus and on the Duluth campus.

Grading System

The Graduate School uses two grading systems: A-B-C-D-F (with pluses and minuses) and S-N. Students have the option of choosing the system under which they will be graded, except in courses in which grading has been restricted to one system with approval of the Graduate School. Students choose their grading system at the time of initial registration. 5xxx and 8xxx courses with grades of A, B, C (including C-), and S may be applied to a Graduate School degree program. Under some circumstances and with approval of the student's major field, 4xxx, 6xxx, and 7xxx courses may also be applied to a Graduate School degree. At least two-thirds of the total number of course credits included on any degree program form must be taken A-F. Individual major fields have the option of specifying more stringent requirements regarding the application of S-N courses to a degree program. All A-F registrations in the Graduate School, regardless of course level, will be calculated in the cumulative GPA.

Incomplete Grades—The symbol "I" may be assigned by an instructor to indicate "incomplete," in accordance with provisions announced in class at the beginning of the semester, when in the instructor's opinion there is a reasonable expectation that the student can successfully complete the work of the course. An "I" remains on the transcript until the instructor replaces it with a final A-F or S-N grade. Course instructors may, at their discretion, establish a time limit for the removal of incomplete grades. The maximum number of credits of incompletes allowable at any given time is established by each major field for its graduate students. Students should refer to the Graduate School's Web site <www.grad.umn.edu> for further information.

Retaking Courses—The Graduate School discourages the retaking of courses to improve grades. If a course is retaken, all registrations and grades for the course remain on the student's transcript and are calculated into the cumulative GPA.

Grade Changes—To preserve the integrity of the graduate transcript as an accurate record of a student's academic progress, the Graduate School does not approve requests to change final grades assigned to students in prior semesters.

Satisfactory Progress Toward the Degree

In addition to fulfilling the Graduate School requirements, students should consult their major program's graduate studies handbook for program-specific criteria for satisfactory progress toward their degree.

Termination of Graduate Student Status

When performance is unsatisfactory in terms of grades or normal progress toward the student's degree objective, graduate student status may be terminated. All guidelines stated in this catalog are minimum requirements, and each program is free to set more specific terms by which progress is measured for purposes of continuation. Students are encouraged to check with the director of graduate studies in their major field for complete information about academic performance and degree progress standards and the procedures used to monitor these standards.

Students who do not register in the Graduate School at least once per year are considered to have withdrawn; their Graduate School records are deactivated (see Registration Requirements on page 14).

Postbaccalaureate Certificates

The Graduate School offers postbaccalaureate certificates that recognize graduate-level training beyond the award of the bachelor's degree. Certificates may be coupled with a master's or doctoral degree under special circumstances and with the approval of the graduate faculty in the degree-granting field. Postbaccalaureate certificates offered through the Graduate School require

a minimum of 15 credits. Regular Graduate School application procedures and admission requirements apply. Refer to the list of "Majors and Degrees" for the fields in which postbaccalaureate certificates are offered. For specific program requirements, see Degree Programs and Faculty in this catalog.

Master's Degree

The master's degree is awarded in recognition of academic accomplishment as demonstrated by a coherent program of coursework, passing of the required examinations, and preparation of a thesis or project(s).

Two Plans for the Master's Degree—The Graduate School offers the master's degree under two plans: Plan A, requiring a thesis, and Plan B, which substitutes additional coursework and special projects for the thesis. For plans offered in each major, see Degree Programs and Faculty in this catalog.

Registration Requirement for the Master's Degree—Master's degree students are required by the Graduate School to complete at least 60 percent of the coursework for their official degree programs (excluding thesis credits) as registered University of Minnesota Graduate School students; individual major fields may require a higher percentage. With approval of the adviser, director of graduate studies in the major (and director of graduate studies in the minor, if the courses are for a designated minor), and Graduate School, transfer coursework may make up the remaining 40 percent (maximum) of the degree coursework (see Transfer of Credits for the Master's Degree below).

Master's Plan A students must enroll for a minimum of 10 thesis credits (8777) before receiving the degree.

Double Counting—Students may have a maximum of 8 credits in common between two master's degrees.

Transfer of Credits for the Master's Degree—Unless otherwise specified under a student's major in Degree Programs and Faculty, the following rules apply to transfer of credits.

Master's degree students are required by the Graduate School to complete at least 60 percent of the coursework for their official degree programs (excluding thesis credits) as registered University of Minnesota Graduate School students. With approval of the adviser, director of graduate studies in the major (and director of graduate studies in the minor, if the courses are for a designated minor), and Graduate School, the transfer of up to 40 percent of the degree program coursework from any combination of the following is permitted.

1. Other recognized graduate schools;

2. Adult special, summer session, and College of Continuing Education registrations at the University of Minnesota before spring semester 2001 (such registrations taken spring semester 2001 or after will not be accepted for transfer);

3. 99PRD registrations at the University of Minnesota;

4. Registrations through other University of Minnesota units (e.g., College of Education, Law School) in pursuit of graduate-level degrees that were not awarded.

In all cases, official transcripts of the work must be attached to the degree program form, unless they have already been included in the student's Graduate School file.

Individual graduate programs have the option of specifying a lower percentage of coursework for transfer.

Work to be transferred must be graduate level (postbaccalaureate) and have been taught by faculty authorized to teach graduate courses. It is the student's responsibility to provide appropriate course documentation (e.g., course syllabi, faculty status information) supporting proposed transfer credits to the program.

In the case of a transfer from a non-U.S. institution, the credits must have been earned in a program judged by the Graduate School to be comparable to a graduate degree program in a graduate school of a regionally accredited institution in the United States.

Regarding the transfer of coursework from either a U.S. or non-U.S. institution, if conditions are placed on a student's admission to exclude certain coursework from transfer to a Graduate School degree program, that coursework may not be transferred regardless of the level of the coursework or the status of the school or college in which it was earned.

Credits are transferred by including the courses in the proposed degree program. Credits not accepted as part of a student's degree program cannot be transferred to the Graduate School transcript.

Courses taken before the awarding of a baccalaureate degree cannot be transferred.

Time Limit for Earning the Master's Degree—All requirements for the master's degree must be completed and the degree awarded within seven years. The seven-year period begins with the earliest coursework included on the official degree program form, including any transfer work. The graduate faculty in a specific program may set more stringent time requirements.

Students who are unable to complete the degree within the seven-year limit may petition the Graduate School for an extension of up to one additional year. *Extensions beyond one year are considered only in the most extraordinary circumstances.* Contact the Graduate School, 316 Johnston Hall, concerning information to be included in such a petition. To ensure timely consideration, petitions should be filed early in the term in which the time limit expires.

If a petition is approved, the student is notified of the expectations for progress and completion of the degree. If the petition is denied, the student is terminated from the graduate program.

Students who have been terminated under such circumstances may apply for readmission to the Graduate School; *readmission under these circumstances is not assured, however.* The faculty in the major field and the Graduate School set any readmission conditions on the student's resumption of work toward the degree, such as registering for additional coursework, retaking written examinations, completing the degree within a specified time period, or other appropriate terms.

Official Program for the Degree—By the time students have completed 10 credits, they must file with the Graduate School an official degree program. The degree program form is available from the Graduate School, 316 Johnston Hall or online at <www.grad.umn.edu/forms>. Students list all coursework, completed and proposed, that will be offered in fulfillment of degree requirements, including transfer work (see Transfer of Credits for the Master's Degree above). If a foreign language is required for the

degree, it also is specified on the degree program form. The members of a student's final examining committee (who are the thesis reviewers for Plan A) are appointed by the dean of the Graduate School on recommendation of the faculty in the major field at the time the student's official degree program is approved.

The minimum credit requirements for the program are specified under the Plan A and Plan B sections below.

A degree program approved by the Graduate School must be on file before reviewers report, examination, or graduation forms can be released to the student.

Changes in Approved Program—Once approved, the degree program must be fulfilled in every detail to meet graduation requirements. Program changes should be requested by completing a Graduate School petition form. The Graduate School petition form is available from the Graduate School, 316 Johnston Hall, or online at <www.grad.umn.edu/forms>.

Minimum Grade Requirements—The Graduate School requires a minimum GPA of 2.80 (on a 4.00 scale) for courses included on any official master's degree program form. Courses with grades of A, B, C (including C-), and S may be included in the official degree program, but grades of S are not calculated in the GPA. Students pursuing a Plan A master's degree are required to register for thesis credits (8777); these registrations are not graded and therefore cannot be used to meet course credit requirements. At least two-thirds of the course credits included on any degree program form must be taken A-F.

Individual major fields have the option of setting higher grade requirements and specifying more stringent requirements regarding the application of S-N courses to a degree program; students should be familiar with any special requirements in their major field.

Language Requirement—See Degree Programs and Faculty to determine the language requirement, if any, for a specific major field. The Graduate School monitors the fulfillment of language study when a major field requires a language. Information on how to demonstrate proficiency, and on conditions under which proficiency is recorded on the official transcript, is available from the Graduate School, 316 Johnston Hall, or online at <www.grad.umn.edu/forms>.

More Information—Students who have questions about the master's degree after reading this entire section (including the following on Plan A and Plan B) may review online information at <www.grad.umn.edu/gsss> or contact the Graduate School by e-mail (gsmast@umn.edu). *Note:* Some commonly used forms are available on the Graduate School Web site at <www.grad.umn.edu/forms>.

Plan A: Master's Degree With Thesis

Minimum Credit Requirements—Students must complete an approved program of coursework consisting of a minimum of 14 credits in the major field and a minimum of 6 credits in one or more related fields outside the major. All credits included on the official degree program form must be in graduate-level courses. A 2.80 minimum GPA must be maintained for all courses on the program form. Students must also register for a minimum of 10 master's thesis credits (8777); these registrations are not graded and therefore cannot be used to meet course credit requirements.

Students who wish to complete a designated minor (which is certified on the transcript—unlike the related fields option, which is not) must complete 6 or more credits in a single field. A designated minor must be approved by the director of graduate studies in the minor field.

For majors in clinical branches, the minor or related fields must be in nonclinical fields that will serve as a basis for the proposed clinical specialization. This fundamental work should be taken early in the program. Familiarity with those phases of the nonclinical disciplines essential to proficiency in the major specialty is required.

Thesis Credits—Students must enroll for a minimum of 10 master's thesis credits (8777) before receiving the degree. Students cannot include thesis credits in the total program credits when determining maximum transfer allowed (see Transfer of Credits for the Master's Degree on page 16). They also cannot transfer thesis credits from other graduate institutions, double-count thesis credits between two master's degrees, or use thesis credits to meet the minimum major and related field coursework requirements for the degree.

Master's Thesis

Students must demonstrate familiarity with the tools of research or scholarship in their major field, the ability to work independently, and the ability to present the results of their investigation effectively, by completing a master's thesis.

Language of the Thesis—Theses must normally be written in English or in the language of instruction. *If a thesis is to be written in a foreign language, including a language of instruction other than English, a letter should be attached to the degree program form when it is submitted to the Graduate School.* This letter should confirm that the recommended thesis reviewers (including the outside reviewer) are qualified to read, comprehend, and criticize a thesis in the foreign language.

Published Work Included in or in Lieu of the Thesis—The thesis may include materials that students have published while University of Minnesota graduate students, provided the research was carried out under the direction of the graduate faculty and approved by the adviser for incorporation into the thesis. Such publication is welcomed as the best demonstration of quality in a student's research, and the Graduate School encourages the practice. The adviser should notify the Graduate School in writing of the intention to publish part of the thesis material, but the Graduate School's approval is not required.

In cases where the thesis research is to be presented to the examining committee in the form of one or more articles that have been published, or are in a form suitable for publication, the student should contact the Graduate School, 316 Johnston Hall, for information on accommodating such a presentation to the required thesis format.

Thesis Reviewers—The thesis is read by the entire examining committee, which is appointed by the dean of the Graduate School on recommendation of the faculty in the major field at the time the student's official degree program is approved. This examining committee consists of at least three members: two representatives from the major field and one from the minor or a related field. Committee members cannot represent more than one field simultaneously.

Graduate students must file an official degree program. Forms are available from the Graduate School, 316 Johnston Hall.

To permit faculty to allocate sufficient time to read the thesis and decide whether it is ready for defense, students must notify their adviser and other members of the final oral committee at least two weeks in advance that the thesis will be delivered on a particular date. All members of the examining committee must then have at least two weeks to read the thesis after it has been delivered. These are minimum standards; individual programs may establish other standards for their students.

The entire committee must be unanimous in certifying that the thesis is ready for defense, as indicated by their signatures on the thesis reviewers report form. The thesis reviewers report form, part of the graduation packet, is requested online at <www.grad.umn.edu/forms>. This form will be released only if the student has a degree prog Graduate School and has maintained active status (see Registration Requirements under Registration on page 14). When the signed form is returned to the Graduate School, 316 Johnston Hall, the student is provided with the final examination report form.

Final Examinations—Candidates for the master's degree, Plan A, must pass a final oral examination; a final written examination may also be required at the discretion of the graduate faculty in the major field. If both a written and an oral examination are specified, the written examination must precede the oral examination. The final examinations cover the major field and the minor or related fields, and may include any work fundamental to these fields. The final oral for the master's degree is conducted as a closed examination, attended by only the student and the examining committee.

Final examinations are coordinated by the chair of the student's examining committee. All committee members must be present at the examination; *the absence of any member results in an invalid examination.* The results of the examinations are reported to the Graduate School on the final examination report form. *A majority vote of the committee, all members present and voting, is required to pass the examination.* A student who fails the examination may be terminated from the graduate program or may be allowed, on unanimous recommendation of the examining committee, to retake the examination, *providing the reexamination is conducted by the original examining committee.*

Changes in the Examining Committee—Substitutions on the examining committee may be necessitated by such circumstances as a faculty member's temporary absence on leave from the University. The adviser or the director of graduate studies must request the Graduate School's approval of such substitutions well in advance of the examination. *Substitutions for an oral examination that are necessitated by emergency situations must also be approved in advance. In such cases, the adviser should consult with the Graduate School staff by telephone before the start of the examination.*

Preparation and Submission of the Thesis—Two copies of the thesis must be submitted to the Graduate School. *The student's adviser(s) must sign both copies of the thesis to confirm that they are complete and satisfactory in all respects and that all revisions required by the final examining committee have been made.* Instructions for the preparation of the thesis, including format specifications and adviser's signature requirements, should be obtained from the Graduate School, 316 Johnston Hall, or online at <www.grad.umn.edu/forms>.

Plan B: Master's Degree Without Thesis

Minimum Credit Requirements—Students must complete an approved program of coursework consisting of a minimum of 14 credits in the major field and a minimum of 6 credits in one or more related fields outside the major. The balance of credits to be completed to meet the 30-credit minimum requirement for the degree is chosen by agreement between the adviser and the student, subject to whatever restrictions the graduate faculty in the major field may place on that choice. All credits included in the official degree program must be in graduate-level courses. A 2.80 minimum GPA must be maintained for all courses included in the program.

Students who wish to complete a designated minor (which is certified on the transcript—unlike the related fields option, which is not) must complete 6 or more credits in a single field. A designated minor must be approved by the director of graduate studies in the minor field.

Plan B Project(s)—Students must demonstrate familiarity with the tools of research or scholarship in their major field, the ability to work independently, and the ability to present the results of their investigation effectively, by completing at least one Plan B project. The graduate faculty in each major field may require as many as three such projects.

The Plan B project(s) should involve a combined total of approximately 120 hours (the equivalent of three full-time weeks) of work. The graduate faculty in each major field specifies both the nature and extent of the options available to satisfy this requirement, and whether the requirement is to be satisfied in conjunction with or independent of the courses in the student's program.

Final Examinations—The Graduate School requires a final examination for Plan B candidates; this may be written, oral, or both, at the discretion of the graduate faculty in the major field. The final examinations cover the major field and the minor or related fields, and may include any work fundamental to these fields. Students should make the Plan B project(s) available to the examining committee for its review well in advance of the final examination. If a final oral is held, it is conducted as a closed examination, attended by only the student and the examining committee. All committee members must be present at the oral examination; *the absence of any member results in an invalid examination.*

A committee of at least three examiners is appointed by the dean of the Graduate School upon recommendation of the faculty in the major field at the time the official degree program is approved. This committee consists of two representatives from the major field and one from the minor or a related field. Committee members cannot represent more than one filed simultaneously. The examination is coordinated by the chair of the student's examining committee. The results of the examination are reported on a form the student must obtain from the Graduate School, 316 Johnston Hall, or by requesting a graduation packet online at <www.grad.umn.edu/forms> before the examination is held. This form will be released only if the student has a degree program form approved by the Graduate School and has maintained active status (see Registration Requirements under Registration on page 14). *A majority vote of the committee,* all members present and voting, is required to pass the examination. A student who fails the examination may be terminated from the graduate program or may be allowed, on

unanimous recommendation of the examining committee, to retake the examination, *providing the reexamination is conducted by the original examining committee.*

Changes in the Examining Committee—Substitutions on the examining committee may be necessitated by such circumstances as a faculty member's temporary absence on leave from the University. The adviser or the director of graduate studies must request the Graduate School's approval of such substitutions well in advance of the examination. *Substitutions for an oral examination that are necessitated by emergency situations must also be approved in advance. In such cases, the adviser should consult with the Graduate School staff by telephone before the start of the examination.*

More Information—Students who have questions about the master's degree may review online information at <www.grad.umn.edu/gsss> or contact the Graduate School by e-mail (gsmast@umn.edu). *Note:* Some commonly used forms are available on the Graduate School Web site at <www.grad.umn.edu/forms>.

Professional Master's Degree in Engineering

A number of engineering departments offer programs, with emphasis on design methods, leading to a designated professional master's degree in engineering. The design emphasis of the program is on applications rather than development of engineering methods or material behavior, and on application of knowledge and methods of the physical and social sciences as well as of engineering. The programs are primarily for students who have already earned a bachelor's degree in a related engineering field. Students normally are expected to be recent graduates of bachelor of science in engineering programs accredited by the Engineers' Council for Professional Development (ECPD). Full-time students should be able to complete a program in one calendar year. The professional master's degree in engineering is considered a terminal degree. Students should also note that only under exceptional circumstances will the Graduate School and the participating programs permit students to transfer from this program to a M.S. program.

Fields in Which the Program is Offered—Refer to the appropriate engineering department sections under Degree Programs and Faculty for information about the fields in which the professional master of engineering program is offered.

Regular Graduate School application procedures should be followed. Applicants should designate the master of engineering as their degree objective, to distinguish it from the master of science degree also available in the engineering fields.

Two Options for the Professional Master's Degree in Engineering—The Graduate School offers the professional master's degree in engineering with two options depending on the major field: a design project option and a coursework only option.

Design Project Option—This track requires 14 credits in the major field, a minimum of 6 credits in one or more related fields outside the major, and a design project measured as a minimum of 10 credits. Students who wish to complete a designated minor must complete 6 or more credits in a single field. The design project emphasizes problem solving based on engineering design criteria extant in industry. Performance of professional caliber is expected which can be subjected to the scrutiny and critique of senior design engineers in industry as well as engineering faculty.

Coursework Only Option—This track requires a minimum of 30 semester credits distributed to include 14 credits in the major field, a minimum of 6 credits in one or more related fields outside the major, and the remaining credits to be determined by the student and adviser subject to whatever guidelines the graduate faculty in the major field may place on such elective choices. Students who wish to complete a designated minor must complete 6 or more semester credits in a single field. No projects or papers specific to this track are required.

For information regarding degree completion requirements, which includes the submission of a final examination report form for both the design project and coursework only options, the student may contact the Graduate School by e-mail at gsmast@umn.edu.

Master of Fine Arts

Admission to master of fine arts programs is limited to students with the bachelor's degree or its equivalent from an accredited university or college who demonstrate exceptional promise as creative artists in one or more of the subfields in their major area. For a list of the subfields and for specific program requirements, see Art; Creative Writing; Design, Housing, and Apparel; and Theatre Arts under Degree Programs and Faculty.

Specialist Certificate in Education

The Graduate School offers two-year specialist certificates in several education fields (see Educational Policy and Administration, Educational Psychology—Counseling/Personnel, Educational Psychology—School Psychology, and Educational Psychology—Special Education under Degree Programs and Faculty for descriptions). The specialist certificate requires a minimum of 60 credits.

Transfer of Credits—With approval of the adviser, director of graduate studies in the major, and Graduate School, transfer of up to 50 percent of the degree program coursework from any combination of the following is permitted.

1. Other recognized graduate schools;

2. Adult special, summer session, and College of Continuing Education registrations at the University of Minnesota before spring semester 2001;

3. 99PRD registrations at the University of Minnesota;

4. Registration through other University of Minnesota units (e.g., College of Education, Law School) in pursuit of graduate-level degrees.

Individual graduate programs have the option of specifying a lower percentage of coursework for transfer.

Work to be transferred must be graduate level (postbaccalaureate) and have been taught by faculty authorized to teach graduate courses. It is the student's responsibility to provide appropriate course documentation (e.g., course syllabi, faculty status information) supporting proposed transfer credits to the program.

In the case of a transfer from a non-U.S. institution, the credits must have been earned in a program judged by the Graduate School to be comparable to a graduate degree program in a graduate school of a regionally accredited institution in the United States.

Regarding the transfer of coursework from either a U.S. or non-U.S. institution, if conditions are placed on a student's admission to exclude certain coursework from transfer to a Graduate School degree program, that coursework may not be transferred regardless of the level of the coursework or the status of the school or college in which it was earned.

Credits are transferred by including the courses in the proposed degree program. Credits not accepted as part of a student's degree program cannot be transferred to the Graduate School transcript.

Courses taken before the awarding of a baccalaureate degree cannot be transferred.

Degree Requirements—Students pursuing the specialist certificate ordinarily complete the requirements for the master's degree with a major in the field of the specialty as the first year of the program. All first-year students must meet regular admission, candidacy, and examination requirements for the master of arts degree and should specify as their degree objective the master's degree on the application. A decision regarding continuation beyond the master's degree in a specialist program depends on an evaluation of performance in meeting the master's requirements.

Time Limit for Earning the Specialist Certificate—The specialist certificate can be completed in two years but must be completed and awarded in 12 years. The 12-year period begins with the earliest coursework included on the program form, including any transfer work. Graduate credits earned before the 12-year span are evaluated by the faculty in the area of specialization and may be recommended to the Graduate School for acceptance on a full or partial basis. Students who expect to exceed the 12-year limit may petition the Graduate School for an extension of time; contact the Graduate School, 316 Johnston for more information.

Final Examinations—The Graduate School requires a final examination for specialist certificate candidates; this may be written, oral, or both, at the discretion of the graduate faculty in the major field. A committee of at least four examiners is appointed by the dean of the Graduate School upon recommendation of the faculty in the major field at the time the official degree program is approved. This committee must include two members from the student's major field and two members from outside the major field. Committee members cannot represent more than one field simultaneously.

The examination is coordinated by the chair of the student's examining committee. The results of the examination are reported on the final examination form that the student must obtain from the Graduate School, 316 Johnston, or by requesting a graduation packet online at <www.grad.umn.edu/forms> before the examination is held. This form will be released only if the student has a degree program form approved by the Graduate School and has maintained active status (see Registration Requirements under Registration on page 14). *A majority vote of the committee,* all members present and voting, is required to pass the examination. A student who fails the examination may be terminated from the graduate program or may be allowed, on unanimous recommendation of the examining committee, to retake the examination *providing the reexamination is conducted by the original committee.*

Except as noted in this section, the requirements and procedures for completing the specialist certificate are comparable to those described under Plan B: Master's Degree Without Thesis on page 18.

A degree program approved by the Graduate School must be on file before the examination or graduation forms can be released to the student.

More Information—Students who have questions about the specialist certificate after reading this entire section may review online information at <www.grad.umn.edu/gsss> or by e-mail (gsmast@umn.edu). *Note:* some commonly used forms are available on the Graduate School Web site at <www.grad.umn.edu/forms>.

Doctor of Philosophy Degree

The doctor of philosophy degree is awarded chiefly in recognition of high attainment and ability in a special subject field as demonstrated by passing the required examinations covering both a candidate's general and special subject fields, and by preparing and successfully defending a thesis based on original research that makes a significant contribution to knowledge in the student's field.

Registration Requirement for the Doctoral Degree—Doctoral students are generally required to register for major field and minor or supporting program coursework. Students should consult their graduate program to determine whether coursework completed while pursuing a University of Minnesota master's degree may be used to meet their doctoral coursework requirement.

Doctoral students are required to enroll for a minimum of 24 thesis credits (8888) while writing the doctoral thesis. Students may not register for thesis credits until the semester *after* they have passed their preliminary oral examination.

Doctoral Pre-Thesis Credits (8666)—These credits are available for doctoral students who have not yet passed their preliminary oral examination but need to be registered in the Graduate School to meet requirements of agencies or departments outside the Graduate School (e.g., loan agencies). Doctoral pre-thesis credits are not graded. *Note:* Registration for doctoral pre-thesis credits cannot be used to meet any Graduate School degree requirements other than to maintain active status (refer to Registration Requirements).

Transfer of Credits for the Doctoral Degree—Students may request from the Graduate School the transfer of the following types of course credits by including the courses on the proposed degree program form. In all cases, official transcripts of the graded work must be attached to the degree program form, unless they have already been included in the student's Graduate School file. Transfer of graduate credit is not allowed for courses taken before the awarding of a baccalaureate degree.

From Other Graduate Institutions—Graduate credits earned at other recognized graduate institutions may be applied to doctoral degrees if the coursework is graduate level and was taught by faculty authorized to teach graduate courses.

In the case of a transfer from a non-U.S. institution, the credits must have been earned in a program judged by the Graduate School to be comparable to a graduate degree program of a regionally accredited institution in the United States.

In the case of a transfer from either a U.S. or non-U.S. institution, if conditions are placed on a student's admission to exclude certain coursework from transfer to a Graduate School degree program, that coursework may not be transferred regardless of the level of the coursework or the status of the school or college in which it was earned.

From Awarded University of Minnesota Graduate-level Degrees—Graduate credits earned while pursuing a University of Minnesota graduate-level degree (offered by a unit other than the Graduate School) may be applied to doctoral degrees. The number of graduate credits accepted for transfer is determined by the graduate program faculty.

Graduate credits taken while pursuing a University of Minnesota graduate-level degree (offered by a unit other than the Graduate School) that was *not* awarded may be applied to doctoral degrees; however, such credits will be included in the 12-credit transfer maximum described immediately below.

From Adult Special, Summer Session, College of Continuing Education (CCE), and 99PRD Registrations—A maximum of 12 semester credits of completed graduate-level coursework from any combination of adult special*, summer session*, CCE*, and 99PRD registrations may be transferred to the doctoral program.

** The Graduate School will accept **only** adult special, summer session, and CCE coursework taken at the University of Minnesota before spring semester 2001. Any registration in these categories taken spring semester 2001 or later will not be accepted towards any Graduate School degree requirements.*

Time Limit for Earning the Doctoral Degree—All requirements for the doctoral degree must be completed and the degree awarded within five calendar years after passing the preliminary oral examination (see Preliminary Written and Oral Examinations on page 22).

Students who are unable to complete the degree within the five-year limit may petition the Graduate School for an extension of up to one additional year. *Extensions beyond one year are considered only in the most extraordinary circumstances.* Contact the Graduate School, 316 Johnston, concerning information to be included in such a petition. To ensure timely consideration, petitions should be filed no later than early in the term in which the time limit expires.

If the petition is approved, the student is notified of the expectations for progress and completion of the degree. If the petition is denied, the student is terminated from doctoral candidacy and from the graduate program.

Students who have been terminated under such circumstances may apply for readmission to the Graduate School; *readmission under these circumstances is not assured, however.* The faculty in the major field and the Graduate School set any readmission conditions on the student's resumption of work toward the degree, such as registering for additional coursework, retaking written examinations, filing a revised thesis proposal, completing the degree within a specified time period, or other appropriate terms.

Official Program for the Degree—Students are expected to file an official program for the degree during their second year of study; the specific semester depends on individual major field requirements. Students should submit their completed degree program forms to the Graduate School at least two semesters before the term in which they plan to take the preliminary oral examination. The degree program form is available from the Graduate School, 316 Johnston Hall, or online at <www.grad.umn.edu/forms>. The form should list all coursework, completed and proposed, that will be offered in fulfillment of degree requirements in the major field and in the minor field or supporting program, including any transfer work (see Transfer of Credits for the Doctoral Degree on page 20). If the student's major field requires proficiency in one or more foreign languages, these should be specified as well. The members of a student's preliminary oral examining committee are appointed by the dean of the Graduate School on recommendation of the faculty in the major field at the time the student's official degree program is approved.

A degree program approved by the Graduate School must be on file before the student is permitted to schedule the preliminary oral examination.

Changes in Approved Program—Once approved, the program must be fulfilled in every detail to meet graduation requirements and before the final oral examination can be scheduled. Program changes should be requested by completing a Graduate School petition form. The petition form is available from the Graduate School or online at <www.grad.umn.edu/forms>.

Minimum Grade Requirements—The Graduate School does not define a minimum GPA for courses included on an official doctoral degree program form, although individual programs are free to do so as part of their effort to monitor their students' academic achievement and degree progress. Courses with grades of A, B, C (including C-), and S may be included in the official degree program, but grades of S are not calculated in the GPA. Students pursuing a doctoral degree must register for doctoral thesis credits (8888); these registrations are not graded and therefore cannot be used to meet course credit requirements. *At least two-thirds of the total number of course credits included in any degree program must be taken A-F.* Individual major fields have the option of specifying more stringent requirements concerning the application of S-N courses to a degree program.

Major Field Credits—The Graduate School does not specify a minimum number of credits in the major field for the doctoral degree. Depending on previous preparation and the nature of the research undertaken, the number of credits required for individual students, even within the same major field, may vary considerably.

Minor Field or Supporting Program Work—For the doctoral degree, a minimum of 12 credits must be completed in the minor field or supporting program. With a traditional minor, this work is in a single field related to the major; the minor field must be declared before the student passes the preliminary oral examination. If the student chooses a supporting program, it must be composed of a coherent pattern of courses, possibly embracing several disciplines. Both the minor and supporting program options may require students to take written preliminary examinations in the fields included, but students electing the supporting program option are not expected to have competency in each of the fields comparable to that of a person with a traditional minor.

Minors can be earned in a variety of programs. Freestanding minors—those not part of a master's or doctoral program—offer even more options. See Majors and Degrees on pages 26 and 27.

For majors in clinical branches, the minor field or supporting program must be in nonclinical fields that will serve as a basis for the proposed clinical specialization. This fundamental work should be concentrated early in the program. Familiarity with those phases of the nonclinical disciplines essential to proficiency in the major specialty is required.

Language Requirement—See Degree Programs and Faculty to determine the language requirement, if any, for a specific major field. The Graduate School monitors the fulfillment of language study when a major field requires a language. Information on how to demonstrate proficiency, and on conditions under which proficiency is recorded on the official transcript, is available from the Graduate School, 316 Johnston Hall, or online at <www.grad.umn.edu/forms>.

Official Doctoral Candidacy—Doctoral candidacy is established when a student passes the preliminary oral examination (including "pass with reservations").

More Information—Students who have questions about the doctoral degree, including information on examinations and the thesis, may review online information at <www.grad.umn.edu/gsss> or contact the Graduate School by e-mail (gsdoc@umn.edu). *Note:* Some commonly used forms are available on the Graduate School Web site at <www.grad.umn.edu /forms>.

Preliminary Written and Oral Examinations

Preliminary Written Examination—All doctoral students are required to pass a written examination in the major field. This examination covers all work completed in the major field and may include any work fundamental to this field. The results of the examination are reported on the preliminary written examination report form, signed by the student's adviser and the director of graduate studies in the major field. It is the student's responsibility to ensure that this form is received by the Graduate School, 316 Johnston Hall, before scheduling the preliminary oral examination.

Preliminary Oral Examination—Students take the preliminary oral examination after completing a substantial part of the coursework and passing the preliminary written examination, but before writing the dissertation.

Preliminary Oral Examining Committee—The examination is administered by the committee appointed by the dean of the Graduate School on recommendation of the faculty in the major field at the time the student's official doctoral degree program is approved. The examining committee includes a minimum of four members: three (including the student's adviser) from the major field and one from the minor field or supporting program. Committee members cannot represent more than one field simultaneously.

All assigned members must be present at the preliminary oral examination; *the absence of any member results in an invalid examination.*

Changes in the Preliminary Oral Examining Committee—Substitutions on the examining committee may be necessitated by such circumstances as a faculty member's temporary absence on leave from the University. The adviser or the director of graduate studies must request the Graduate School's approval of such substitutions well in advance of the examination. *Substitutions necessitated by emergency situations must also be approved in advance. In such cases, the adviser should consult with the Graduate School staff by telephone before the start of the examination.*

Scheduling the Preliminary Oral Examination—It is the responsibility of the student to schedule the preliminary oral with the examiners and with the Graduate School, 316 Johnston Hall, *at least one week in advance.* In certain of the health science fields, however, the faculty requires 30 days' notice of the date of the preliminary oral.

Preliminary oral examinations should not be scheduled during the summer unless the members of the assigned committee can be assembled without substitution.

Before the oral examination can be scheduled, a degree program form approved by the Graduate School must be on file, along with a written examination report form indicating that the student has passed the preliminary written examination. The Graduate School must also confirm that the student has maintained active status (see Registration Requirements under Registration on page 14).

If these documents are on file and the student has active status, the Graduate School issues the preliminary oral examination report form and instructions for conducting the preliminary oral examination to the chair of the examining committee. A copy of the student's degree program form is also sent to both the chair of the examining committee and the student; this may be useful to the committee in reviewing the student's preparation and in confirming the completion of degree requirements, including coursework and any language requirements. The preliminary oral examination may be authorized in spite of deficiencies in these requirements, unless more stringent standards have been established by the major field. All requirements must be completed before the final oral examination may be scheduled.

Preliminary Oral Examination Content and Outcome—All doctoral students are required to pass an oral examination in the major field. The preliminary oral examination covers the major field, the minor field or supporting program, and any work fundamental to these areas, including possible plans for thesis research. *Unlike the final oral examination, the preliminary oral is conducted as a closed examination, attended by only the student and the examining committee.*

Immediately before the preliminary oral examination, the committee chair stipulates the objectives of the examination and, in consultation with other members of the examining committee, determines how the examination is to be conducted. Immediately after the examination, the candidate is excused from the room and a written secret ballot is taken before discussing the examination. Following the discussion, a second and final vote is taken, and the participants sign in the appropriate place on the report form, which is to be returned to the Graduate School, 316 Johnston Hall, *no later than the first workday after the examination.*

The outcome of the examination, with all committee members present and voting, is recorded in one of three ways: pass, pass with reservations, or fail. The voting proportions necessary for these decisions are as follows: if the committee consists of four members, a favorable verdict for passing consists of either a unanimous vote or a vote of 3-1; if the committee consists of five members, a unanimous vote or a vote of 4-1 is needed; if the committee consists of six members, a unanimous vote or a vote of 5-1 or 4-2 is needed; and if there are seven members, a unanimous vote or a vote of 6-1 or 5-2 is needed. Candidates who do not earn committee votes in these proportions *fail* the examination. If, to achieve the *minimum* number of

votes to reach a verdict of pass, any vote of pass with reservations is included, then the outcome will be recorded as a *pass with reservations.* A vote to pass the student with reservations still constitutes a passing vote.

Pass With Reservations—If the student passes the examination with reservations, the student is informed immediately, but the committee is permitted one week in which to convey its reservations to the student in writing, informing the student of the steps that must be taken to remove them. *A copy of this letter must be sent to the Graduate School and should accompany the signed oral examination report form.* When the student has satisfied the committee's reservations, a second letter informing the student and the Graduate School that the reservations have been removed and that the student may proceed toward the degree is also required. Both letters should be written by the committee chair. *The final oral examination may not be scheduled until the Graduate School has received a copy of the letter indicating that the reservations have been removed.*

If the committee members disagree as to whether the reservations have been satisfactorily removed, the committee chair asks for another vote, the results of which are subject to the same voting proportions as the initial vote. If the student is unable to satisfy the committee's reservations, his or her doctoral candidacy and graduate student status may be terminated.

Failure of the Preliminary Oral Examination— Students who fail the examination may be excluded from candidacy for the degree or may be allowed, on unanimous recommendation of the examining committee, to retake the examination, *providing the reexamination is conducted by the original preliminary oral examining committee.*

In no case may the reexamination take place before 10 weeks have passed. No more than one reexamination is allowed.

Recess of a Preliminary Oral Examination—If the preliminary oral examining committee recesses without having determined whether a student has passed the examination, the chair of the committee must send a letter to the dean of the Graduate School explaining the reasons for the recess and noting the date on which the examining committee will reconvene. If the recess will be longer than one week, the examination report form must be returned to the Graduate School, 316 Johnston Hall, and the student must reschedule the examination with the Graduate School one week in advance. A new examination report form will be mailed to the chair of the committee one week before the date on which the committee will reconvene. *The reconvened committee must be composed of the same members as the original preliminary oral examining committee.*

Ph.D. Thesis

The thesis must demonstrate the student's originality and ability for independent investigation, and the results of the research must constitute a contribution to knowledge. The thesis must exhibit the student's mastery of the literature of the subject and familiarity with the sources. The subject matter must be presented with a satisfactory degree of literary skill.

Thesis Proposal—At the time of submission of the doctoral program, or not later than the first semester after passing the preliminary oral examination, students must file the thesis proposal form with the Graduate School, 316 Johnston Hall. The form must include the proposed thesis title and a thesis proposal, about 250 words in length, describing the research to be undertaken and the methods to be employed in carrying it out.

The thesis reviewers and other members of the final oral examining committee are appointed by the dean of the Graduate School upon recommendation of the faculty in the major field at the time the student's thesis proposal is approved.

A thesis proposal approved by the Graduate School must be on file before the reviewers report form can be issued to the student.

Changes in the Thesis Title or the Thesis Proposal— Changes in the *wording* of the thesis title may be made without special approval, but changes cannot be made after the final thesis copy is submitted to the Graduate School. If substantive changes are made in the nature of the thesis research itself, the student must submit a revised thesis proposal immediately.

Language of the Thesis—Theses must normally be written in English or in the language of instruction. *If a thesis is to be written in a foreign language, including a language of instruction other than English, a letter should be attached to the thesis proposal form when it is submitted to the Graduate School.* This letter should confirm that the recommended thesis reviewers (including the outside reviewer) are qualified to read, comprehend, and criticize a thesis in the foreign language.

Published Work Included in or in Lieu of the Thesis—The thesis may include materials that students have published while University of Minnesota graduate students, provided the research was carried out under the direction of the graduate faculty and approved by the adviser for incorporation into the thesis. Such publication is welcomed as the best demonstration of quality in a student's research, and the Graduate School encourages the practice. The adviser should notify the Graduate School in writing of the intention to publish part of the thesis material, but the Graduate School's approval is not required.

In cases where the thesis research is to be presented to the examining committee in the form of one or more articles that have been published, or are in a form suitable for publication, the student should contact the Graduate School, 316 Johnston Hall, for information on accommodating such a presentation to the required thesis format.

Thesis Reviewers—*All members of the final oral examining committee read the thesis, although only those designated as thesis reviewers sign the report form certifying that the thesis is ready for defense.*

The designated thesis reviewers consist of the adviser, representing the major field, and at least two other members of the final oral examining committee, including at least one representative from the major field and one representative from the minor or supporting program. Part of this group of reviewers should come from outside of the graduate program's thesis advisory committee, if the program uses such a committee. Reviewers cannot represent more than one field simultaneously.

Certification of the thesis as ready for defense is a necessary step toward the final oral examination, but in no way diminishes the significance of that examination.

The thesis reviewers report form is obtained by the student from the Graduate School, 316 Johnston, or by requesting a graduation packet online at <www.grad.umn.edu/forms>. This form will be released

only if the student has on file a thesis proposal form approved by the Graduate School and has maintained active status (see Registration Requirements under Registration on page 14).

Delivery of the Thesis to Thesis Reviewers—At the time the candidate submits a draft of the thesis to the thesis reviewers, copies must also be provided to all other members of the final oral examining committee. The thesis abstract must be included with the thesis when it is distributed to the committee. The abstract must be signed by the adviser and submitted, with the final thesis copy, to the Graduate School which forwards both to University Microfilms.

To permit faculty to allocate sufficient time to read the thesis and decide whether it is ready for defense, students must notify their adviser and other members of the final oral committee at least two weeks in advance that the thesis will be delivered on a particular date. All members of the examining committee must then have at least two weeks to read the thesis after it has been delivered.

When signing the thesis reviewers report form, the reviewers have three options: the thesis is acceptable for defense as presented; the thesis is acceptable for defense with minor revisions; or the thesis requires major revisions and is not acceptable for defense as presented.

The reviewers must be unanimous in certifying that the thesis is ready for defense, whether as presented or with minor revisions. If this is the case, and all other requirements have been met (see Final Oral Examination below), the Graduate School authorizes the final oral examination. In any instance where revisions are required, the committee must inform the student in writing of the revisions required, and all questions concerning such revisions must be resolved before the final copies of the thesis are submitted and the degree is conferred. *It is the adviser's responsibility to ensure that revisions required by the reviewers are satisfactorily made* (see Preparation and Submission of the Copies of the Thesis on the next page).

Final Oral Examination

All doctoral students are required to successfully defend their theses in a final oral examination and graduate within five calendar years after passing the preliminary oral examination. To be eligible for the final oral examination, a student must have completed all work on the official doctoral degree program form, including the language requirement, if any; must have passed both the written and oral preliminary examinations; must have an approved thesis proposal on file with the Graduate School; must have maintained active status; and must have satisfied the thesis credit requirement. In addition, the thesis must have been certified by the readers as ready for defense.

Scheduling the Final Oral With the Graduate School—*The student must schedule the examination at least one week in advance with both the committee and the Graduate School (see Clearance for Graduation on the next page). In certain of the health science fields, however, the faculty requires 30 days' notice of the date of the final oral.*

When the examination is scheduled, the student's Graduate School file is checked to determine if the student can be cleared to take the examination as stipulated above. If so, the report form for the final oral examination will be forwarded to the chair of the examining committee. If difficulties are apparent, the Graduate School staff will contact the student immediately.

A minimum of 10 weeks must intervene between the preliminary oral and the final oral examinations. Also, the final oral should not be scheduled during the summer unless the committee members can be assembled without substitution.

Final Oral Examining Committee—The committee must consist minimally of four members: three (including the student's adviser) from the major field and one from the minor field or supporting program. At least one committee member from the minor field or supporting program should represent a graduate program and budgetary unit other than that of the student's major. Committee members cannot represent more than one field simultaneously.

Although the student's adviser serves as a member of the final oral examining committee, another member of the committee is designated as the chair and functions in this capacity at the final oral examination. The chair must be a full member of the graduate faculty and may be from either the major field or the minor field or supporting program. *The chair and other members of the final oral examining committee are appointed by the dean of the Graduate School upon recommendation of the faculty in the major field at the time the student's thesis proposal is approved.*

All committee members must be present at the examination; *the absence of any member results in an invalid examination.*

Changes in the Final Oral Examining Committee—Substitutions on the examining committee may be necessitated by such circumstances as a faculty member's temporary absence on leave from the University. The adviser or the director of graduate studies must request the Graduate School's approval of such substitutions well in advance of the examination. *Substitutions necessitated by emergency situations must also be approved in advance. In such cases, the committee chair should consult with the Graduate School staff by telephone before the start of the examination.*

Form of the Final Oral Examination—The final oral examination consists of a seminar in which the candidate presents the thesis and to which the scholarly community is invited. The seminar may take place only after the thesis has been judged ready for defense. The examination is limited to the candidate's thesis subject and relevant areas. It will not exceed three hours. A closed meeting between the candidate and the appointed examining committee immediately follows the thesis presentation. The candidate is then excused and the vote taken on whether the candidate passed the examination.

Reporting the Results of the Final Oral Examination—Upon completion of the examination, a formal vote of the committee is taken. To be recommended for the award of the doctoral degree, candidates must receive a vote with no more than one dissenting member of the total examining committee. If the student has clearly *passed* or clearly *failed* the examination and all members have signed the final examination report form, the report form must be returned to the Graduate School *no later than the first workday following the examination.*

The adviser should be responsible for ensuring the inclusion of appropriate modifications and required revisions, if any, in the final thesis. The final oral examination report form should not be signed and submitted to the Graduate School until all revisions have been made. *If the form will be held for more than one week, a letter must be sent to the Graduate School stating that the form is being held pending required revisions.*

Once the final report form has been returned to the Graduate School indicating that the student has either passed or failed the final oral examination, a hold is placed on the student's records to prevent further registration in the Graduate School. If the adviser indicates that the student needs additional time to make minor revisions to the thesis before it is submitted to the Graduate School, the student is permitted to register for one additional semester. Once the thesis has been submitted, no further registration in the Graduate School is permitted unless the student has been admitted to professional development status or to another major field.

Recess of a Final Oral Examination—On rare occasions, the examining committee may conclude that the final oral examination should be recessed, to be reconvened at a later date. Guidelines for such circumstances are sent to the chair of each examining committee along with the final oral examination report form.

The Graduate School need not be notified until after the fact of informal recesses of up to a week. In the case of a longer recess, the committee must inform the student *in writing* of the reasons for recessing the examination, including any deficiencies noted in the student's thesis or defense, and must indicate when they expect to reconvene and resume the examination. A copy of this letter must be sent to the Graduate School, along with the unsigned final examination report form. When the student and the committee are ready to reconvene the examination, it should be scheduled in the normal way with the Graduate School. A new examination report form will be mailed to the chair of the committee one week before the date on which the committee will reconvene. *The reconvened committee must be composed of the same members as the original final oral examining committee.*

Preparation and Submission of the Copies of the Thesis

A copy of the thesis must be submitted to the Graduate School. *The student's adviser(s) must sign the thesis to confirm that it is complete and satisfactory in all respects and that all revisions required by the final examining committee have been made.* Instructions for the preparation of the thesis, including format specifications and adviser's signature requirements, can be obtained from the Graduate School, 316 Johnston Hall, or online at <www.grad.umn.edu/forms>.

Pursuit of a Second Ph.D. Degree

Students are not permitted to earn two Ph.D. degrees at the same time in two fields using the same program of study and thesis. Although students are generally discouraged from doing so, special circumstances may warrant taking a second Ph.D. degree at a later date, but only when a completely separate program and thesis are involved.

Doctor of Education

The University of Minnesota awards the doctor of education (Ed.D.), its highest professional degree in educational policy and administration and work, community, and family education, in recognition of satisfactory academic preparation and demonstrated competence for professional activity in those fields.

Standards and procedures for admission, and expectations for scholastic performance, are comparable to those for the Ph.D. A major part of the program must be conducted in full-time residence, including at least one continuous academic year at advanced stages of the program. Rules and procedures governing examinations, candidacy, time limits, appointment of committees, and the thesis for the Ph.D. apply in general to the Ed.D.

For requirements, see Doctor of Philosophy Degree on page 20, or contact the Graduate School by e-mail at gsdoc@umn.edu. *Note:* Some commonly used forms are available on the Graduate School Web site at <www.grad.umn.edu>.

Doctor of Musical Arts

The program for the professional doctor of musical arts (D.M.A.) degree has a performance-teaching orientation. Standards and procedures for admission, and expectations for scholastic performance, are comparable to those for the Ph.D. Emphases offered, and details concerning major and minor requirements for the D.M.A., are included in the Music section under Degree Programs and Faculty. Rules and procedures governing examinations, candidacy, time limits, and appointment of committees for the Ph.D. apply in general to the D.M.A.; in place of the thesis, a project document or paper is required. This document is submitted only to the music graduate program office.

For requirements, see Doctor of Philosophy Degree on page 20, or contact the Graduate School by e-mail at gsdoc@umn.edu. *Note:* Some commonly used forms are available on the Graduate School Web site at <www.grad.umn.edu>.

Joint Degrees

The University offers the opportunity for study towards two degrees in the following areas: M.D./Ph.D. program; master of social work (M.S.W.) and master of public policy (M.P.P); M.S.W. and master of public health (M.P.H.); M.P.P. and master of science (M.S.) in health services research, policy, and administration; J.D. and M.P.P.; M.P.P. and Ph.D. in political s nursing and M.P.H.; Doctor of Veterinary Medicine and M.S./Ph.D. in veterinary medicine; and a joint J.D./M.S./Ph.D. program in law, health, and life sciences. For further information, contact the program.

Clearance for Graduation

Degrees are awarded at the end of each month. To qualify for graduation for a particular month, a student must submit the Application for Degree form on or before the first workday of that month and must complete the examination and all other requirements (including necessary forms and fees) by the last workday of that month.

Commencement Ceremony

Two Graduate School commencement ceremonies are held each year—in *late spring* and in *late fall*. Graduates are encouraged, but not required, to attend. To make sure their names appear in the program distributed at the commencement ceremony, students must submit the commencement attendance form by the deadline specified in the Graduate School section of the *Class Schedule*. Commencement information, including deadlines and forms, can be found online at <www.grad.umn.edu/gsss>.

Majors and Degrees

Twin Cities Campus

Research Degrees (Ph.D., M.A., M.S.)

Majors	*Degrees Offered*
Aerospace Engineering	M.S.Aero.E., Ph.D.
Agricultural and Applied Economics	M.S., Ph.D.
American Studies	M.A., Ph.D.
Ancient and Medieval Art and Archaeology	M.A., Ph.D.
Animal Sciences	M.S., Ph.D.
Anthropology	M.A., Ph.D.
Applied Plant Sciences	M.S., Ph.D.
Art History	M.A., Ph.D.
Astrophysics	M.S., Ph.D.
Biochemistry, Molecular Biology, and Biophysics	M.S., Ph.D.
Biomedical Engineering	M.S., Ph.D.
Biomedical Science	Ph.D.
Biophysical Sciences and Medical Physics	M.S., Ph.D.
Biostatistics	M.S., Ph.D.
Biosystems and Agricultural Engineering	M.S.B.A.E., Ph.D.
Business Administration	Ph.D.
Cellular and Integrative Physiology	M.S., Ph.D.
Chemical Engineering	M.S.Ch.E., Ph.D.
Chemical Physics	M.S., Ph.D.
Chemistry	M.S., Ph.D.
Child Psychology	M.A., Ph.D.
Chinese	M.A., Ph.D.
Civil Engineering	M.S., Ph.D.
Classical and Near Eastern Studies	M.A., Ph.D.
Classics	M.A., Ph.D.
Communication Disorders	M.A., Ph.D.
Comparative Literature	M.A., Ph.D.
Comparative Studies in Discourse and Society	M.A., Ph.D.
Computer and Information Sciences	M.S., Ph.D.
Conservation Biology	M.S., Ph.D.
Control Science and Dynamical Systems	Ph.D.
Design, Housing, and Apparel	M.A., M.S., Ph.D.
Ecology, Evolution, and Behavior	M.S., Ph.D.
Economics	M.A., Ph.D.
Education	M.A., Ph.D.
Educational Policy and Administration	M.A., Ph.D.
Educational Psychology[1]	M.A., Ph.D.
Electrical Engineering	M.S.E.E., Ph.D.
English	M.A., Ph.D.
Entomology	M.S., Ph.D.
Environmental Health	M.S., Ph.D.
Epidemiology	M.S., Ph.D.
Family Social Science	M.A., Ph.D.
Feminist Studies	M.A., Ph.D.
Fisheries	M.S., Ph.D.
Food Science	M.S., Ph.D.
Forestry	M.S., Ph.D.
French	M.A., Ph.D.
Geography	M.A., Ph.D.
Geological Engineering	M.S., Ph.D.
Geology	M.S., Ph.D.
Geophysics	M.S., Ph.D.
Germanic Studies	M.A., Ph.D.
Health Informatics	Ph.D.
Health Services Research, Policy, and Administration	M.S., Ph.D.
Hispanic and Luso-Brazilian Literatures and Linguistics	Ph.D.
History	M.A., Ph.D.
History of Medicine and Biological Sciences	M.A., Ph.D.
History of Science and Technology	M.A., Ph.D.
Human Resources and Industrial Relations	Ph.D.
Industrial Engineering	M.S.I.E., Ph.D.
Interdisciplinary Archaeological Studies	M.A., M.S., Ph.D.
Japanese	M.A., Ph.D.
Kinesiology	M.A., Ph.D.
Linguistics	M.A., Ph.D.
Mass Communication	M.A., Ph.D.
Materials Science and Engineering	M.S.Mat.S.E., Ph.D.
Mathematics	M.S., Ph.D.
Mechanical Engineering	M.S.M.E., Ph.D.
Mechanics	M.S., Ph.D.
Medicinal Chemistry	M.S., Ph.D.
Microbiology, Immunology and Cancer Biology	M.S., Ph.D.
Molecular, Cellular, Developmental Biology and Genetics	Ph.D.
Molecular Veterinary Biosciences	M.S., Ph.D.
Music	M.A., Ph.D.
Neuroscience	M.S., Ph.D.
Nursing	M.S., Ph.D.
Nutrition	M.S., Ph.D.
Oral Biology	M.S., Ph.D.
Otolaryngology	M.S., M.S.Otol., Ph.D.Otol.
Pharmaceutics	M.S., Ph.D.
Pharmacology	M.S., Ph.D.
Philosophy	M.A., Ph.D.
Physics	M.S., Ph.D.
Plant Biological Sciences	M.S., Ph.D.
Plant Pathology	M.S., Ph.D.
Political Science	Ph.D.
Psychology	M.A., Ph.D.
Rehabilitation Science	M.S., Ph.D.
Rhetoric and Scientific and Technical Communication	M.A., Ph.D.
Scientific Computation	M.S., Ph.D.
Social, Administrative, and Clinical Pharmacy	M.S., Ph.D.
Social Work	Ph.D.
Sociology	M.A., Ph.D.
Soil Science	M.S., Ph.D.
South Asian Languages	M.A., Ph.D.
Speech-Communication	M.A., Ph.D.
Statistics	M.S., Ph.D.
Surgery	M.S.Surg., Ph.D.Surg.
Theatre Arts	M.A., Ph.D.
Toxicology	M.S., Ph.D.
Veterinary Medicine	M.S., Ph.D.
Water Resources Science	M.S., Ph.D.
Wildlife Conservation	M.S., Ph.D.

Research Degrees (Master's Only)

Majors	*Degrees Offered*
Arabic	M.A.
Art Education	M.A.
Clinical Laboratory Science	M.S.
Clinical Research	M.S.
Computer Engineering	M.S.
Dentistry	M.S.
East Asian Studies	M.A.
Elementary Education	M.A.
English as a Second Language	M.A.
Hispanic Linguistics	M.A.
Hispanic Literature	M.A.
Italian	M.A.
Landscape Architecture	M.S.
Luso-Brazilian Literature	M.A.
Mathematics Education	M.A.
Microbial Engineering	M.S.
Music Education	M.A.
Physical Therapy	M.S.
Recreation, Park, and Leisure Studies	M.A.
Russian Area Studies	M.A.

Professional Degrees

Majors	*Degrees Offered*
Aerospace Engineering	M.Aero.E.
Architecture	M.Arch.
Art	M.F.A.
Biological Science	M.B.S.
Biosystems and Agricultural Engineering	M.B.A.E.
Business Taxation	M.B.T.
Chemical Engineering	M.Ch.E.
Civil Engineering	M.C.E.
Computer and Information Sciences	M.C.I.S.
Computer Engineering	M.Comp.E.

[1] *Also see Certificate of Specialist in Education offerings near the end of this list.*

Creative Writing	M.F.A.
Dentistry	M.S.
Design, Housing, and Apparel	M.F.A.
Educational Policy and Administration	Ed.D.
Electrical Engineering	M.E.E.
English as a Second Language	M.A.
Experimental Surgery	M.S.Exp.Surg.
Forestry	M.F.
Geographic Information Science	M.G.I.S.
Geological Engineering	M.Geo.E.
Geology	M.S.
Health Informatics	M.S.
Human Resources and Industrial Relations	M.A.
Infrastructure Systems Engineering	M.S.I.S.E.
Landscape Architecture	M.L.A.
Liberal Studies	M.L.S.
Management of Technology	M.S.MOT.
Manufacturing Systems Engineering	M.S.M.S.E.
Materials Science and Engineering	M.Mat.S.E.
Molecular, Cellular, Developmental Biology and Genetics	M.S.
Music	M.M., D.M.A.
Occupational Therapy	M.S.
Physical Therapy	M.S.
Political Science	M.A.
Public Affairs	M.P.A.
Public Policy	M.P.P.
Science, Technology, and Environmental Policy	M.S.
Scientific and Technical Communication	M.S.
Social Work	M.S.W.
Software Engineering	M.S.S.E.
Theatre Arts	M.F.A.
Urban and Regional Planning	M.U.R.P.
Work, Community, and Family Education	Ed.D.

Certificate of Specialist in Education

Counseling
General Educational Administration
School Psychological Services
Special Education
Special Education Administration

Freestanding Minors

Bioethics
Cognitive Science
Complementary Therapies and Healing Practices
Composition, Literacy, and Rhetorical Studies
Conflict Management
Development Studies and Social Change
Gerontology
Human Factors/Ergonomics
International Education
Interpersonal Relationships Research
Law
Medieval Studies
Microbial Ecology
Museum Studies
Political Psychology
Program Evaluation
Public Health
Quaternary Paleoecology
Religious Studies
Social and Philosophic Studies of Education
Studies in Africa and the African Diaspora
Studies of Science and Technology
Sustainable Agriculture Systems

Postbaccalaureate Certificates

Applied Developmental Psychology
Policy Issues on Work and Pay
Transportation Studies

Duluth Campus

Research Degrees (Master's Only)

Majors	*Degrees Offered*
Applied and Computational Mathematics	M.S.
Biology	M.S.
Chemistry	M.S.
Computer Science	M.S.
Counseling Psychology	M.A.
English	M.A.
Geology	M.S.
Music	M.M.
Physics	M.S.

Professional Degrees

Majors	*Degrees Offered*
Art	M.F.A.
Business Administration	M.B.A.
Communication Sciences and Disorders	M.A.
Counseling Psychology	M.A.
Engineering Management	M.S.E.M.
Liberal Studies	M.L.S.
Music	M.M.
Social Work	M.S.W.

Freestanding Minor

Linguistics

McKnight Land-Grant Professorship Winners for 2001-03

The goal of this program is to advance the careers of the University's most promising junior faculty at a crucial period in their professional lives. Recipients are honored with the title McKnight Land-Grant Professor, an endowed chair which they will hold for two years. The award consists of a $25,000 research grant in each of two years, summer support, and a research leave in the second year.

The winners were chosen for their potential for important contribution to their field; the degree to which their past achievements and current ideas demonstrate originality, imagination, and innovation; the potential for attracting outstanding students; and the significance of the research and the clarity with which it is conveyed to the non-specialist. Profiles of the 14 recipients follow.

Mohamed-Slim Alouini, Electrical and Computer Engineering
Analysis of wireless communication transmission techniques

Bruce P. Braun, Geography
The theoretical relationship between nature, the state, and modernity

Patricia Crain, English
The history of literacy as a concept and symbol in American culture

Shaul Hanany, Physics and Astronomy
Understanding the origin and evolution of the universe through measurements of cosmic microwave background radiation

George E. Heimpel, Entomology
Integrating principles of insect ecology with biologically-based pest management

Richard P. Hsung, Chemistry
Synthesis of the naturally-occurring substance arisugacin

Victoria L. Interrante, Computer Science and Engineering
The science behind the art of communicating information through images

Canan Karatekin, Child Development
The nature and development of normal cognitive processes and how they go awry in mental disorders

Monica Luciana, Psychology
Human brain-behavior relationships

Gary J. Muehlbauer, Agronomy and Plant Genetics
Understanding the molecular mechanisms governing interactions between fungus and plants

Claudia Schmidt-Dannert, Biochemistry, Molecular Biology, and Biophysics
Combining metabolic engineering and molecular evolution techniques to create biosynthetic pathways

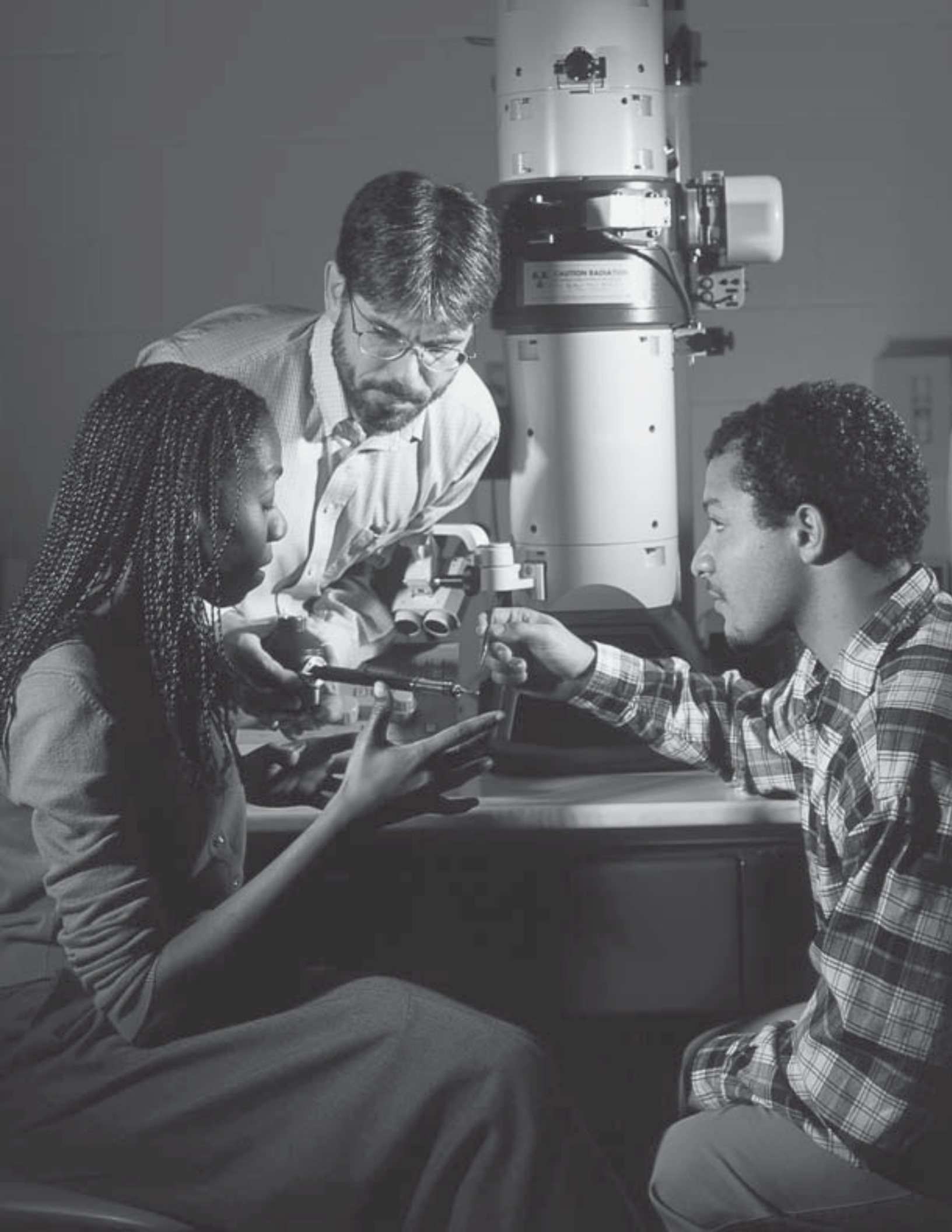
Yoav Segal, Medicine
Genetic diseases of the kidneys

Jiaping Wang, Mathematics
Geometric analysis and partial differential equations

Barbara Y. Welke, History
A consuming passion: product liability and the rights revolution in twentieth century America

This is the Degree Programs section of the 2001-2003 Graduate School Catalog for the University of Minnesota, Twin Cities campus.

Degree Programs


CAUTION RADIATION

Key to Abbreviations

Faculty
Graduate faculty are listed at the beginning of each degree program. After the faculty name, the home department will be listed (unless the department is the same as the program name), followed by the graduate faculty status in the program. Professors emeriti are identified by "(emeritus)."

Membership Categories
Full Membership (FM)—Authorization to advise students at all levels, including the doctorate; serve as a thesis reviewer and an examiner on student examining committees, including service as chair of doctoral committees; and teach courses for graduate credit. In fields that also offer a professional doctorate, some full-member appointments may be restricted to the supervision of students seeking the professional degree.

Associate Membership (AM)— Authorization to advise students at the master's and specialist certificate levels; serve as a thesis reviewer and an examinter on student examining committees at all levels, but not as chair of doctoral committees; co-advise doctoral students with a full member of the graduate faculty in the same field; and teach courses for graduate credit.

Examining Membership (E)— Authorization to serve as a thesis reviewer and an examiner on student examining committees at all levels, but not as chair; and teach courses for graduate credit.

Tests
The following test abbreviations appear throughout graduate program listings.

GMAT—Graduate Management Admission Test

GRE—Graduate Record Examination

MELAB—Michigan English Language Assessment Battery

TOEFL—Test of English as a Foreign Language

For more information about these individual tests, see page 9 in the General Information section.

Aerospace Engineering and Mechanics

Contact Information—Chair, Graduate Admissions Committee, Department of Aerospace Engineering and Mechanics, University of Minnesota, 107 Akerman Hall, 110 Union Street S.E., Minneapolis, MN 55455 (612-625-8000; fax 612-626-1558; e-mail dept@aem.umn.edu; <www.aem.umn.edu>).

Regents' Professor
Daniel D. Joseph, FM
James B. Serrin, Jr., (emeritus), Mathematics, FM

Professor
Roger E. A. Arndt, Civil Engineering, FM
Gary J. Balas, FM
Gordon S. Beavers, FM
Graham V. Candler, FM
Roger Fosdick, FM
William L. Garrard, FM
Richard D. James, FM
Perry H. Leo, FM
Thomas S. Lundgren (emeritus), FM
Mitchell B. Luskin, Mathematics, FM
Andrew Vano, AM
William H. Warner (emeritus), FM
Theodore A. Wilson, FM

Associate Professor
Ellen K. Longmire, FM
Thomas W. Shield, FM
Lev Truskinovsky, FM
Yiyuan Zhao, FM

Adjunct Associate Professor
Dale F. Enns, FM

Assistant Professor
Ashley James, FM
Yohannes Ketema, AM
Krishnan Mahesh, FM
Ivan Marusic, FM
Mehran Mesbahi, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The department offers graduate study in two major fields, mechanics and aerospace engineering. The graduate programs emphasize engineering sciences that are basic to these fields: fluid mechanics, aerospace systems, and continuum and solid mechanics. Theoretical, analytical, experimental, and computational aspects of these fields are covered by the courses and research opportunities offered by the department.

Prerequisites for Admission—A four-year B.S. degree in an engineering, basic science, or mathematics program is required. Admission depends primarily on the applicant's undergraduate record and letters of recommendation.

Special Application Requirements—GRE scores are not required but are strongly recommended for students applying for graduate fellowships. In all cases, these test scores are taken into account if provided.

Students are admitted fall semester only. Only under unusual circumstances are students allowed to begin their studies at another time during the academic year.

Use of 4xxx Courses—Programs can contain no more than 2 courses at 4xxx.

Courses—Please refer to Aerospace Engineering and Mechanics (AEM) in the course section of this catalog for courses pertaining to the program.

M.Aero.E. Coursework Only and Design Project Degree Requirements

The M.Aero.E. program emphasizes applications of fluid mechanics, aerospace systems, and continuum and solid mechanics in aerospace engineering. The program must include at least 12 credits of 5xxx or 8xxx courses. In addition to the minimum credit requirement, the student must demonstrate an understanding of aerodynamics and aerospace vehicle mechanics, either from previous study or from additional coursework in the graduate program.

Language Requirements—None.

Final Exam—The final exam is oral.

M.S.Aero.E. Degree Requirements

This program emphasizes coursework in engineering sciences that are basic to this field: fluid mechanics, aerospace systems, and continuum and solid mechanics. Plan A requires 30 graduate credits, a minimum of 20 course credits and 10 thesis credits. No seminar credits can be used to satisfy the 20-course credit requirement. Plan B requires 30 credits including the 3 credit plan B project course. Of the remaining 27 credits a minimum of 24 credits of coursework is required and no seminar credits can be used to satisfy this 24-credit requirement. If seminar credits are used to meet the 30 credit requirement, they must be in one-credit modules.

For both Plan A and Plan B, the program must include at least one sequence of 8xxx courses in aerospace engineering and no more than 8 credits of 4xxx courses. Also, the student must demonstrate an understanding of aerodynamics and aerospace vehicle mechanics, either from prior study or from additional coursework beyond the 30-credit minimum.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—At least one sequence of two 8xxx courses in aerospace engineering is required.

M.S. Degree Requirements—Mechanics

The M.S. program in mechanics emphasizes coursework in fluid mechanics, aerospace systems, and continuum and solid mechanics. Theoretical, analytical, experimental, and computational aspects of these subjects are covered by the courses and research opportunities offered by the department.

Plan A requires 30 credits; a minimum of 20 course credits and 10 thesis credits. No seminar credits can be used to satisfy the 20-course credit requirement.

Plan B requires 30 credits for the degree. This total includes the 3 credit Plan B project course. Of the remaining 27 credits, a minimum of 24 credits of coursework is required and no seminar credits can be used to satisfy this 24 credit requirement. If seminar credits are used to meet the 30 credit requirement for the degree, the seminar credits must be in one-credit modules.

For both the Plan A and Plan B, the program must include at least one sequence of 8xxx courses in mechanics and no more than 8 credits of 4xxx courses. The student must also demonstrate a breadth of knowledge in mechanics, either from previous study or from coursework in more than one M.S. subfield of mechanics.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—At least one sequence of two 8xxx courses in mechanics is required.

Ph.D. Degree Requirements—Aerospace Engineering

The Ph.D. program emphasizes coursework and research in engineering sciences that are basic to this field. Many of the courses offered by the department serve both major fields: aerospace engineering and mechanics. The difference between these major fields is most apparent in the thesis topics, which for aerospace engineering concern aerodynamics and aerospace systems.

The Ph.D. requires about two years of coursework, but the heart of the program is the thesis research. The program must contain a minimum of 42 credits of approved courses and four semesters of colloquium attendance. Of the 42 credits, a minimum of 36 credits must be in approved coursework, not including seminar credits. If seminar credits are used to meet the 42 minimum credit requirement they must be in one-credit modules. The program also must include at least four 8xxx courses in aerospace engineering (at least four 8xxx courses in mechanics for the Ph.D. in mechanics—see below) and can contain no more than two 4xxx courses. The first year of the Ph.D. program is similar to the master's program and most Ph.D. students receive the master's degree. The second year is devoted to more advanced courses and beginning research. Subsequent years include some coursework with increased focus on research. The time required to complete a research project varies, but most students finish the Ph.D. within five years after the bachelor's degree.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—At least 12 credits in aerospace engineering are required, including at least one sequence of two 8xxx courses.

Ph.D. Degree Requirements—Mechanics

The Ph.D. program in mechanics emphasizes coursework and research in the subfields of fluid mechanics, aerospace systems, and continuum and solid mechanics. Many courses offered by the department serve both major fields: aerospace engineering and mechanics. The thesis topics for mechanics concern fundamental aspects of dynamical systems, material properties, and fluid and solid behavior.

Ph.D. coursework and credit requirements are the same as those listed for aerospace engineering in the second paragraph above.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—At least 12 credits in mechanics is required, including at least one sequence of two 8xxx courses.

Agricultural and Applied Economics

Contact Information—Department of Applied Economics, University of Minnesota, 231 Classroom-Office Building, 1994 Buford Ave., St. Paul, MN 55108 (612-625-2758; e-mail dgs@apec.umn.edu; <www.apecon.agri.umn.edu/>).

Regents' Professor

Vernon W. Ruttan (emeritus), FM
G. Edward Schuh, FM

Professor

Jeffrey D. Apland, FM
Sandra O. Archibald, Public Affairs, FM
Dale C. Dahl (emeritus), FM
K. William Easter, FM
Vernon R. Eidman, FM
Earl I. Fuller (emeritus), FM
William C. Gartner, FM
Jerome W. Hammond (emeritus), FM
Robert P. King, FM
Jean D. Kinsey, FM
Richard A. Levins, FM
Wilbur R. Maki (emeritus), FM
George W. Morse, FM
Kent D. Olson, FM
Claudia A. Parliament, FM
Glenn D. Pederson, FM
Stephen Polasky, FM
Philip M. Raup (emeritus), FM
Terry L. Roe, FM
C. Ford Runge, FM
Benjamin H. Senauer, FM
Wesley B. Sundquist (emeritus), FM
Delane E. Welsch (emeritus), FM

Associate Professor

Brian L. Buhr, FM
Jay S. Coggins, FM
Buddy G. Crewdson, AM
Jeremiah E. Fruin, FM
Paul W. Glewwe, FM
Frances R. Homans, FM
William F. Lazarus, FM
Donald J. Liu, FM
Gerard McCullough, FM
Philip G. Pardey, AM
Pamela J. Smith, FM
Rodney B. Smith, FM
Stanley C. Stevens, FM
Thomas F. Stinson, FM
Steven J. Taff, FM
David D. Trechter, AM

Assistant Professor

Elizabeth E. Davis, FM
Terrance M. Hurley, FM
Laura TJ Kalambokidis, FM
Margaretha V. Rudstrom, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Graduate study requires an operational knowledge of economic theory and modern methods of quantitative analysis as well as practical application in specialized fields of inquiry, which include agricultural policy, consumption economics, development economics and trade, natural resource and environmental economics, prices and marketing, and production and managerial economics.

Prerequisites for Admission—A grade point average of 3.00 in an undergraduate program and in graduate level work is the minimum standard for admission. Applicants with a bachelor's degree are, except in a few special cases, considered only for admission to the M.S. program. The following coursework is considered the minimum preparation for admission to the M.S. program: intermediate-level microeconomic and macroeconomic theory, statistics, calculus, and linear algebra. Applicants to the Ph.D. program should also have completed courses in microeconomic and macroeconomic theory at the master's level. Students lacking background in economics or quantitative methods may be required to complete deficiencies before being accepted into the program.

Special Application Requirements—GRE scores are required for all students. A minimum TOEFL score of 550 (213 on computer-based exam) is required for applicants whose native language is not English, including those with other academic study in the United States. Applicants should provide evidence of superior scholarship, professional experience, and general aptitude for graduate study. Students are admitted any semester but should keep in mind that most assistantships are allocated by the end of February for the following fall semester. Applicants seeking fellowships should submit all application materials by December 15.

Use of 4xxx Courses—Use of 4xxx courses toward degree requirements is not permitted.

Courses—Please refer to Applied Economics (ApEc) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements

The M.S. prepares students for employment opportunities in the public and private sector and for further graduate study. M.S. students are required to complete graduate level courses in microeconomic theory, macroeconomic theory, and econometrics or statistics, or to have completed equivalent courses prior to entry into the program. Students are also required to participate in a 1 credit M.S. seminar. Both Plan A and B require at least 30 credits, of which at least 14 credits must be in the major field and at least 6 credits must be in a related field or minor. The major field must include a minimum of 7 credits in applied economics (excluding thesis and special topics, independent study, and the M.S. seminar). Plan A requires 10 thesis credits. Plan B requires a 4- to 6-credit project. A minimum GPA of 3.00 in program courses is required for graduation.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—M.S. students must complete at least 9 credits of 5xxx or 8xxx courses in applied economics. Courses for the minor are approved by the director of graduate studies in the Department of Applied Economics. All courses in the minor must be taken A-F and completed with a GPA of 3.00 or better.

Ph.D Degree Requirements

The Ph.D. degree program in agricultural and applied economics prepares students for research, teaching, and extension positions and for research and administrative posts in public and private sector organizations.

The only specific credit or course requirements for the Ph.D. in agricultural and applied economics are a l credit seminar and the Graduate School requirement of a supporting field or minor of 12 to 18 credits and registration for 24 doctoral thesis credits. Ph.D. students follow a study program that includes coursework in microeconomic theory, macroeconomic theory, econometrics, and two fields of specialization. One field may be replaced by an approved minor in another graduate program. Courses in economics may be counted in the major field or as part of the supporting field. A minimum GPA of 3.00 in program coursework is required for graduation. Preliminary written exams cover microeconomic theory and fields in agricultural and applied economics. Oral exams are required for approval of the dissertation proposal and for its defense.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—Ph.D. students must complete at least 15 credits of 5xxx or 8xxx courses in applied economics. Courses for the minor are approved by the director of graduate studies in the Department of Applied Economics. All courses in the minor must be taken A-F and completed with a GPA or 3.00 or better.

Agricultural Engineering

See Biosystems and Agricultural Engineering.

American Studies

Contact Information—Program in American Studies, University of Minnesota, 104 Scott Hall, 72 Pleasant Street S.E., Minneapolis, MN 55455 (612-624-4190; e-mail amstdy@umn.edu; <http://cla.umn.edu/american/american.html>).

Professor

Patricia C. Albers, American Indian Studies, FM
Ronald R. Aminzade, Sociology, FM
Ayers Bagley, Educational Policy and Administration, FM
Kent R. Bales, English, FM
Hyman Berman, History, FM
David O. Born, Preventive Sciences, FM
Hazel Dicken-Garcia, Journalism and Mass Communication, FM
Mary G. Dietz, Political Science, FM
Sara M. Evans, History, FM
James Farr, Political Science, AM
Philip J. Gersmehl, Geography, FM
Edward M. Griffin, English, FM
John R. Howe, Jr., History, FM
Karen N. Hoyle, Library Collection Development/ Management (Children's Literature Research Collection), AM
Mary Jo Kane, Kinesiology and Leisure Studies, FM
Sally J. Kenney, HHH Institute of Public Affairs, AM
Sally G. Kohlstedt, Geology and Geophysics, FM
Barbara Laslett, Sociology, FM
Richard D. Leppert, Cultural Studies and Comparative Literature, FM
Alex J. Lubet, Music, FM
Karal Ann R. Marling, Art History, FM
Judith A. Martin, Urban Regional Planning, FM
Elaine Tyler May, FM
Lary L. May, FM
Ronald C. McCurdy, Music, FM
Toni A.H. McNaron, English, FM
Russell R. Menard, History, FM
David W. Noble, FM
john a. powell, Law School, FM
Riv-Ellen Prell, FM
Paula Rabinowitz, English, FM
Nancy L Roberts, Journalism and Mass Communication, FM
David Roediger, History, FM
Martin Roth, English, FM
Steven Ruggles, History, FM
Harvey B. Sarles, Cultural Studies and Comparative Literature, FM
Dennis N. Valdes, Chicano Studies, FM
Rudolph J. Vecoli, History, FM
Gayle Graham Yates, FM
Jack D. Zipes, German, Scandinavian, and Dutch, FM

Associate Professor

Lisa Albrecht, General College, FM
W. John Archer, Cultural Studies and Comparative Literature, FM
Rose M. Brewer, Afro-American and African Studies, FM
Brenda J. Child, FM
Marie Damon, English, FM
Lisa J. Disch, Political Science, FM
John M. Dolan, Philosophy, AM
George D. Green, History, FM
March L. Krotee, Kinesiology and Leisure Studies, AM
Josephine D. Lee, English Language and Literature, AM
Ellen Messer-Davidow, English, FM
Carol A. Miller, FM
Roger P. Miller, Geography, FM
Gail K. Noble, General College, AM
Lisa A. Norling, History, FM
Jean M. Obrien-Kehoe, History, FM
Joanna O'Connell, Spanish and Portuguese, AM
Jennifer L. Pierce, FM
Guillermo Rojas, Chicano Studies, FM
Thomas M. Scanlan, Rhetoric, AM
Robert B. Silberman, Art History, FM
John S. Wright, English (Afro-American and African Studies), FM
Jacquelyn N. Zita, Women's Studies, FM

Assistant Professor

Thomas Augst, English, AM
Catherine C. Choy, AM
Greg P. Choy, General College, AM
Roderick Ferguson, AM
Kirsten Fischer, History, AM
Douglas Hartmann, Sociology, AM
Daniel J. Philippon, Rhetoric, AM
Eden Torres, Women's Studies, AM

Senior Fellow

Harry C. Boyte, HHH Institute of Public Affairs, AM

Other

William C. Beyer, AM
Colleen J Sheehy, Weisman Art Museum, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—American studies is an interdisciplinary, interdepartmental program. The American studies graduate faculty consists of American studies core faculty members and graduate faculty members drawn from a wide number of departments. Students create a field of concentration and also pursue broad training in analyzing the development of cultural and historical processes that shaped the nation and its diverse cultures, as well as analyzing contemporary practices.

Prerequisites for Admission—An undergraduate major in a field related to American studies or other preparation acceptable to the Admissions Committee for American studies is required.

Special Application Requirements—The following should be sent to the program office: a special application form available through the program office, a personal statement, three letters of recommendation, a writing sample, scores from the General (Aptitude) Test of the GRE, and transcripts of all college work. Applications must be submitted by December 15. Entry is only in fall semester.

Use of 4xxx Courses—One 4xxx course in American studies, English, history, or comparative studies in discourse and society may be included as one of the seminars to meet the one-semester specialty requirement in American studies.

Courses—Please refer to American Studies (AmSt) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements

The master's degree is not designed as a terminal degree and students are not admitted to it. A Ph.D. student may elect to pursue the M.A. All coursework is applicable to the Ph.D.

Plan A and Plan B require American studies core seminars—AmSt 8201, 8202 (6 credits); a two-semester research course in American studies or in another department with approval of the director of graduate studies (6 credits); and a comparative cultural course covering international or non-U.S. subjects (3 credits).

Plan A requires two adviser-approved courses in the field of concentration, including one focused on cultural pluralism within the U.S. experience (6 credits); 10 thesis credits for a total of 31 credits; and a written thesis.

Plan B requires five adviser-approved courses in the field of concentration, including one focused on cultural pluralism within the U.S. experience (15 credits) for a total of 30 credits. The student is required to write three Plan B papers, each approved by a member of the graduate faculty. The papers are usually expanded seminar papers.

Language Requirements—Reading knowledge of one foreign language is required.

Minor Requirements for Students Majoring in Other Fields—For a master's degree minor, students are expected to choose courses consistent with or complementary to their major. Students should complete either AmSt 8201 or 8202 and two more courses in American studies or in an ethnic studies program.

Ph.D. Degree Requirements

A minimum of 45 credits (15 courses) is required, distributed as follows: introductory seminars AmSt 8201 and 8202 (6 credits); practicum in American studies 8401; dissertation seminar 8801; three one-semester courses from the American studies specialty seminars or from other units approved by the director of graduate studies (9 credits); one comparative culture course (3 credits); and 7 adviser-approved field of concentration courses, including 6 credits of cultural pluralism courses. Twenty-four thesis credits are also required.

Language Requirements—Reading knowledge of one foreign language is required.

Minor Requirements for Students Majoring in Other Fields—For a doctoral degree minor, students must complete at least 12 credits of courses consistent with or complementary to their major, including four courses in American studies, one of which must be AmSt 8201 or 8202.

Anatomy

Contact the Graduate School for information about the status of this program.

Ancient and Medieval Art and Archaeology

See Classical and Near Eastern Studies.

Animal Sciences

Contact Information—Department of Animal Science, University of Minnesota, 305 Haecker Hall, 1364 Eckles Avenue, St. Paul, MN 55108 (612-624-3491; fax 612-625-5789; e-mail renox001@umn.edu; <www.ansci.umn.edu>).

Professor

David R. Brown, Veterinary Pathobiology, FM
Brian A. Crooker, FM
William R. Dayton, FM
Mohamed E. El-Halawani, FM
Douglas N. Foster, FM
Esther M. Gallant, Veterinary Pathobiology, FM
Leslie B. Hansen, FM
Marcia R. Hathaway, FM
Alan G. Hunter, FM
Dennis G. Johnson, E
Lee J. Johnston, FM
Benjamin S. Leung, Obstetrics and Gynecology, FM
James G. Linn, FM
George D. Marx, AM
Sally L. Noll, FM
Scott M. O'Grady, FM
John W. Osborn, FM
F. Abel Ponce de Leon, FM
Jeffrey K. Reneau, AM
Bradley E. II Seguin, Clinical and Population Sciences, FM
Anthony James Seykora, FM
Gerald C. Shurson, FM
Marshall D. Stern, FM
Roger D. Walker, E
Jonathan E. Wheaton, FM
Michael E. White, FM

Adjunct Professor

Hans-Joachim G. Jung, Agronomy and Plant Genetics, FM
Vijay M. Kumar, FM

Associate Professor

Mitchell S. Abrahamsen, Veterinary Pathobiology, FM
Hugh Chester-Jones, AM
Alfredo DiCostanzo, FM
Mathur S. Kannan, Veterinary Pathobiology, FM
William G. Olson, Clinical and Population Sciences, FM
Mats H. T. Troedsson, Clinical and Population Sciences, FM

Assistant Professor

Sam K. Baidoo, FM
Yang Da, Veterinary Pathobiology, FM
Oladele S.Gazal, FM
William A. Head, Jr., FM
Graham C. Lamb, AM
Laura J. Mauro, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Students concentrate on one of the animal sciences subdisciplines: genetics, growth biology, nutrition, physiology, or production systems. Students have the option of tailoring their program to include study in more than one subdiscipline and to emphasize basic or applied science.

Prerequisites for Admission—A bachelor's degree in agriculture or a biological field with training in biology, chemistry, physics, and mathematics is required.

Special Application Requirements—A complete set of transcripts in addition to that required by the Graduate School, three letters of recommendation evaluating the applicant's potential, and a statement of career goals are required. The minimum GPA generally required for admission is 3.00 for the M.S. and 3.20 for the Ph.D. GRE scores are required. Applicants are admitted every semester.

Use of 4xxx Courses—Certain 4xxx courses may be included on the program form with prior approval by the student adviser and the director of graduate studies.

Courses—Please refer to Animal Science (AnSc) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements

The Plan A requires a minimum of 14 semester credits in the major and 6 credits in a designated minor, or related fields outside the major. Selection of courses to fulfill this requirement and development of the thesis project are primarily the responsibility of the student and faculty adviser. Students also must register for a minimum of 10 thesis credits. An official program of study, listing coursework to be completed and a thesis title, is submitted to a Graduate Faculty Program Committee and the Director of the Animal Sciences Graduate Program for review and then forwarded to the Graduate School for approval.

The Plan B requires a minimum of 30 credits. These must include 14 or more credits in the major area and at least 6 credits in one or more related fields outside the major. The balance of credits is chosen by agreement between the adviser and student. In addition to coursework, a project(s) is to be conducted that requires approximately 120 hours to complete. The nature and extent of the project is agreed upon in advance by the student and faculty adviser.

Language Requirements—None.

Final Exam—The final exam consists of a public seminar followed by an oral examination.

Minor Requirements for Students Majoring in Other Fields—Requirements are designed to fit the student's needs. A master's minor requires 6 credits in areas not closely related to the major; no more than 2 of these credits may be in research or special problems.

Ph.D. Degree Requirements

The Ph.D. degree is granted chiefly in recognition of the candidate's achievements and knowledge in a specific field. Although there is no minimum number of credits required, students typically complete 40-50 credits to develop competency in their field of interest. Students must register for a

minimum of 24 thesis credits. Appropriate graduate level courses taken at another university may be approved for transfer. Coursework completed under an M.S. program can be counted towards the Ph.D. degree. The student is expected to maintain a B average or better in all coursework.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—Requirements are designed to fit the student's needs. A doctoral minor requires 12 credits in areas not closely related to the major; no more than 3 of these credits may be in research or special problems.

Anthropology

Contact Information—Department of Anthropology, University of Minnesota, 395 Hubert H. Humphrey Center, 301-19th Ave. S., Minneapolis, MN 55455 (612-625-3400; fax 612-625-3095; e-mail wells001@umn.edu; <http://cla.umn.edu/anthropology/>).

Professor

Patricia Albers, American Indian Studies, FM
Luther P. Gerlach (emeritus), FM
Guy E. Gibbon, FM
Stephen F. Gudeman, FM
John M. Ingham, FM
Frank C. Miller, FM
Eugene Ogan (emeritus), FM
Gloria G. Raheja, FM
William L. Rowe (emeritus), FM
Peter S. Wells, FM
Joseph J. Westermeyer, Psychiatry, FM

Associate Professor

Daphne Berdahl, AM
Timothy Dunnigan, FM
David M. Lipset, FM
Mischa Penn, FM
Riv-Ellen Prell, American Studies, FM
Janet D. Spector (emeritus), FM

Assistant Professor

Kathleen Barlow, FM
Pradeep Jeganathan, AM
Gregory Laden, AM
Jean Langford, AM
Sonia E. Patten, Family Practice and Community Health, E
Martha Tappen, AM
Thomas Wolfe, History, AM

Other

John M. Weeks, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The Department of Anthropology offers graduate education in sociocultural anthropology, anthropological archaeology, and biological anthropology. Major areas of faculty research and graduate student training in sociocultural anthropology include the politics and poetics of "tradition" and memory; gender and feminist anthropology; language and rhetorical practices; the cultural construction of economy; the politics of anthropological knowledge; colonialism and nationalism; transglobal processes; culture and consumption; and psychological anthropology. Regional specialization includes Melanesia, India, Europe, Latin America, and North America.

The program in biological anthropology offers training and research opportunities in paleoanthropology with a focus on faunal analysis and taphonomy, and behavioral biology with a focus on human foragers, evolutionary ecology, and evolutionary theory. Regional specializations include Africa and the Caucasus.

The program in anthropological archaeology offers perspectives on the nature of archaeological knowledge, paleoecology and evolutionary theory, and the use of sociocultural theories and interpretive strategies in the reconstruction of historic and prehistoric pasts. Regional specialization includes Africa, Europe, the Near East, and North America.

Prerequisites for Admission—None. Any necessary background work may be completed after admission.

Special Application Requirements—Three letters of recommendation on a form furnished by the department and scores from the General (Aptitude) Test of the GRE should be sent to the director of graduate studies. Admission is usually in fall semester; the deadline for all materials is January 15.

Use of 4xxx Courses—4xxx anthropology courses may be included on the degree program form as long as they are taught by members of the graduate faculty.

Courses—Please refer to Anthropology (Anth) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements

Graduate students pursuing the M.A. degree must take a sequence of three seminars (3 credits each) during their first year in residence: during fall and spring semesters, all students take the seminars Anth 8001 and 8002; during spring semester, students also take a specialized seminar—Anth 8003 for sociocultural students or 8004 for archaeology students.

Plan A students must take an additional 9 course credits in anthropology, 6 credits in a minor or related field, and 10 thesis credits (34 credits total). Plan B students must take an additional 9 course credits in anthropology, 6 credits in a minor or related field, and 10 credits in a combination of anthropology and non-anthropology courses (34 credits total) determined with the student's adviser and the director of graduate studies. All graduate students are also required to demonstrate proficiency in statistics.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—The minor program is individually designed by the student and the director of graduate studies. Minimally, students must take 6 credits in anthropology (5xxx courses or above).

Ph.D. Degree Requirements

All Ph.D. students must take the same sequence of three semimars outlined in the master's program above. Ph.D. students must also take Anth 8217 and have completed a minimum of 18 course credits in anthropology and 12 credits in a minor or supporting program. The distribution of these courses is determined with the adviser and the director of graduate studies. All graduate students are also required to demonstrate proficiency in statistics.

Language Requirements—Ph.D. students must demonstrate a basic reading knowledge of one language other than English for which there is an anthropological literature or a long-standing literate tradition (e.g., Chinese, Hindi). The adviser and other members of a student's advisory committee can require additional language training when circumstances warrant.

Minor Requirements for Students Majoring in Other Fields—The minor program in anthropology is individually designed by the student and the director of graduate studies. A minimum of 12 credits in anthropology (5xxx or 8xxx courses) must be completed for the minor.

Applied Developmental Psychology

Contact Information—Applied Developmental Psychology Certification Program, Institute of Child Development, 51 East River Rd, Minneapolis, MN 55455 (612-624-2576; fax 612-624-6373).

Professor

Herbert L. Pick, Jr., E
Richard Weinberg, E

Curriculum—The certificate in applied developmental psychology is a specialization for doctoral students in child psychology and related fields. The concentration allows graduate students to study and experience how basic developmental science applies to real life problems and issues concerning children and youth in our society.

Prerequisites for Admission—Applicants must be admitted to a doctoral program in child psychology or a related field.

Certificate Requirements

The core of the program consists of a proseminar, basic and elective developmental coursework, and a field experience in an applied setting.

Applied Plant Sciences

Contact Information—Director of Graduate Studies, University of Minnesota, 411 Borlaug Hall, 1991 Upper Buford Circle, St. Paul, MN 55108 (612-625-1791; fax 612-625-1268; e-mail apsc@umn.edu).

Regents' Professor
Ronald L. Phillips, FM

Professor
Peter D. Ascher (emeritus), FM
Roger L. Becker, FM
Robert H. Busch (emeritus), FM
Vernon B. Cardwell, AM
Jerry D. Cohen, FM
Beverly R. Durgan, FM
Nancy J. Ehlke, FM
Gary M. Gardner, FM
Burle G. Gengenbach, FM
Jeffrey L. Gunsolus, FM
Leland L. Hardman, AM
Dale R. Hicks, AM
Emily E. Hoover, FM
Robert J. Jones, FM
Pen Hsiang Li, FM
James J. Luby, FM
Albert H. Markhart III, FM
Ervin A. Oelke (emeritus), FM
James H. Orf, FM
Peter J. Olin, AM
Harold M. Pellett, FM
David G. Pitt, Landscape Architecture, AM
Donald C. Rasmusson (emeritus), FM
Carl J. Rosen, Soil, Water, and Climate, FM
Craig C. Sheaffer, FM
Steve R. Simmons, FM
David A. Somers, FM
Joseph R. Sowokinos, FM
Deon D. Stuthman, FM
Bert T. Swanson (emeritus), FM
Donald B. White, FM
David K. Wildung, FM
Donald L. Wyse, FM
Nevin D. Young, Plant Pathology, AM

Adjunct Professor
John W. Gronwald, FM
Hans-Joachim G. Jung, FM
Howard W. Rines, FM
Carroll P. Vance, FM

Associate Professor
James A. Anderson, FM
Rex N. Bernardo, FM
Gregory Cuomo, FM
John E. Erwin, FM
Vincent A. Fritz, FM
Susan M. Galatowitsch, FM
Gregg A. Johnson, FM
Nicholas R. Jordan, FM
Bradley W. Pedersen, AM
Paul M. Porter, FM
Alan G. Smith, FM
Cindy B. Tong, FM
John V. Wiersma, AM

Adjunct Associate Professor
Frank Forcella, FM

Assistant Professor
Neil O. Anderson, FM
Elizabeth A. Dyck, FM
Lori K. Falkner, FM
Jeffrey H. Gillman, FM
Mary H. Meyer, FM
Gary J. Muehlbauer, FM
Seth L. Naeve, FM
Paul Peterson, FM
Kevin P. Smith, FM
Christian A. Thill, FM
Jochum J. Wiersma, FM

Adjunct Assistant Professor
JoAnn F. Lamb, FM
Helene Murray, AM

Other
Deborah L. Brown, AM
Raymond Porter, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Applied plant sciences is an interdisciplinary program for educating students to become professional scientists well grounded in the applied disciplines of agronomy/agroecology, horticulture, and plant breeding. Graduates of the program are able to provide innovative leadership and contribute to problem solving in their discipline in the public or private sector and within society at large. The program develops the quantitative and qualitative research skills necessary to conduct high quality research and scholarship. Students gain a broad familiarity with all the disciplines within the program and gain in-depth knowledge within their area of expertise. The program's graduate faculty is drawn primarily from the Department of Agronomy and Plant Genetics and the Department of Horticultural Science, but also from the Departments of Plant Pathology; Soil, Water, and Climate; and Landscape Architecture and related departments. Students choose from among four specialization tracks—agronomy/agroecology, applied plant sciences, horticulture, or plant breeding/plant molecular genetics.

***Agroecology/Agronomy Specialization*—**In this track, students conduct research to increase their knowledge of cropping systems and weed science including alternative approaches and management strategies. Emphasis is on improving production efficiency and profitability in an environmentally sound approach that benefits society. Mechanisms of crop physiology and ecology underlying plant responses to the environment are a particular emphasis of this track.

***Applied Plant Sciences Specialization*—**Students create an integrated, individualized program combining a breadth of courses from several disciplines or areas including plant biology at the organismal level, genetics and plant breeding, cropping systems and communities, and courses relating to the production of agronomic and/or horticultural commodities.

***Horticulture Specialization*—**In this track, students conduct research to increase their knowledge of production practices, end use products, and the environmental impact of horticultural crop production systems. Students may focus on food, woody ornamental, floriculture, or turf crops with research opportunities ranging from cold hardiness of perennial plants to developing best management practices for horticultural systems using physiologic and/or genetic techniques.

***Plant Breeding/Plant Molecular Genetics Specialization*—**This track allows students to select from genetic research projects ranging from applied plant breeding projects emphasizing breeding procedures and methodologies to molecular genetic projects doing biotechnology and genetic engineering in agronomic and horticultural crops. These research projects give students the opportunity to integrate the latest developments in the laboratory with applied applications in the field to reach the overarching goal of developing new germplasm that will improve the sustainability of our food and fiber systems.

Prerequisites for Admission—Students entering the program should have a foundation in the physical and biological sciences, preferably with some emphasis in plant science. A minimum of 10 credits of math and physics, 12 credits of chemistry and biochemistry, and 15 credits of biological and/or agricultural sciences are recommended for admission. In addition, students should have completed a B.S. or B.A. degree in agriculture, biology, or other related life sciences. Students with a B.S. or B.A. degree outside these areas may be admitted with the requirement that they take the prerequisite courses noted above at the undergraduate level in addition to their graduate coursework.

Special Application Requirements—Three letters of recommendation, a statement by the applicant outlining career objectives and experience, and GRE scores are required. Students may apply at any time; however, submission of all application materials by January 1 is strongly encouraged to ensure priority consideration for fellowships and teaching and research assistantships awarded for the next academic year. Students can be admitted any term.

Use of 4xxx Courses—Inclusion of 4xxx courses on the degree program form is subject to adviser and director of graduate studies approval.

Courses—Please refer to Agronomy (Agro), Applied Plant Sciences (APSc) and Horticulture (Hort) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements

The M.S. is offered under Plan A (with thesis) and Plan B (with project). Plan A requires a minimum of 20 course credits and 10 thesis credits; Plan B requires a minimum of 30 course credits. Students are encouraged to complete the courses in the common curriculum and the requirements for their specialization, and to present one graduate seminar. Additional course requirements are flexible and are determined in consultation with the student's adviser(s) and advisory committee.

Language Requirements—None.

Final Exam—The final exam is oral.

Ph.D. Degree Requirements

Ph.D. students are required to complete the courses in the common curriculum, the requirements for their respective specialization, and present two graduate seminars; 24 thesis credits are also required. Additional course requirements are flexible and are determined in consultation with the student's adviser(s) and advisory committee.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A Ph.D. minor requires 12 credits from among 4xxx, 5xxx, and 8xxx courses in the areas of specialization, with only one 4xxx course allowed.

Arabic

No new students are being accepted for the Arabic major under present policy.

Contact Information—Arabic Program, Department of Afro-American and African Studies, University of Minnesota, 808 Social Sciences Building, 267 19th Avenue S., Minneapolis, MN 55455 (612-624-9847).

Professor

Caesar E. Farah, AM

Assistant Professor

Charles A. Pike, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—*Note: No new students are currently being accepted to this program. Contact the Graduate School for information on the status of the program.*

The program focuses on the Arabic language and the literature and culture of the Arabic-speaking world.

M.A. Plan B Degree Requirements

The M.A. is offered under Plan B only. The minimum requirement is 33 credits, including 27 course credits and 6 credits for the Plan B research paper. The coursework must include 15 credits in Arabic literature or culture, including Arab/Afro 5001 (3 credits) and one 8xxx seminar (3 credits). Students also take 6 credits (2 courses) in related fields outside Arabic, depending on the student's academic goals and subject to the approval of the director of graduate studies.

Language Requirements—Students must complete Arab/Afro 5102 (Advanced Arabic) or its equivalent, and must demonstrate reading knowledge of a classical or modern language appropriate to the field.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A minimum of 12 graduate credits for a master's minor is required. Students must possess an acceptable knowledge of Arabic, but may not apply language-specific courses toward the minor. A program of study must be arranged with the director of graduate studies of Arabic. No written exam is required for the minor.

Architecture

Contact information—Department of Architecture, University of Minnesota, 110 Architecture Building, 89 Church Street S.E., Minneapolis, MN 55455 (612-624-7866; fax 612-624-5743; e-mail calainfo@umn.edu).

Professor

Thomas Fisher, AM
Lance A. LaVine, AM
Julia Robinson, AM
Garth C. Rockcastle, AM
Leon G. Satkowski, AM

Adjunct Professor

Dale M. Mulfinger, AM
Duane Thorbeck, AM

Associate Professor

Lee B. Anderson, AM
Arthur H. Chen, AM
William F. Conway, AM
Gunter A. Dittmar, AM
Mary M. Guzowski, AM
Cynthia Jara, AM
Andrzej Piotrowski, AM
Katherine M. Solomonson, AM
J. Stephen Weeks, AM

Adjunct Associate Professor

Victor Caliandro, AM
Bruno M. Franck, AM
Vincent James, AM
Thomas Andrew Meyer, AM
Todd J. Rhoades, AM
Juliann V. Snow, AM
Lee E. Tollefson, AM
Gregory Watson, AM
Craig L. Wilkins, AM

Adjunct Assistant Professor

Robert Ferguson, E
Timothy J. Fuller, E
Ali Reza Heshmati, E
Douglas Lew, E
Robert C. Mack, E
Ralph Nelson, E
Bruce A. Parker, E
Timothy G. Quigley, E
Marcy Schulte, AM
Jennifer Yoos, E

Instructor

Kenneth D. Potts, E

Lecturer

William A. Blanski, E
Mike Christianson, E
David H. Dimond, E
Nina Ebbighausen, E
Dawn Gilpin, E
Todd P. Hansen, E
Harold Kiewel, E
Carolyn Krall, E
Martha McQuade, E
Nancy Miller, E
Joshua Weinstein, E
Mark S. Wentzell, E
Thomas Westbrook, E
Thomas G. Whitcomb, E

Senior Research Fellow

John C. Carmody, E

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Architecture encompasses the making and study of the buildings and environment that we inhabit. The concerns of architecture involve a wide variety of areas of study, including the art of representing built projects through drawings and computer graphics; the technology of building structure, building materials, and natural and mechanical systems; the history, theory, and art of making, using, and understanding buildings as cultural artifacts for human use; and the practice of architecture in the context of urban form and business economics.

The M.Arch. program introduces students to the practice and discipline of architecture as a speculative, analytic, and investigative endeavor. It prepares students to enter architecture as both a profession and a field of knowledge. The program is organized around the design studio, incorporating coursework in the diverse areas of architectural knowledge: representation, technology, history, theory, urban design, and architectural practice.

The professional M.Arch. degree program is for those who have an undergraduate degree with a major or concentration in architecture and seek to become licensed architects. Because the admitted student will already have a broad educational background and will have completed fundamental courses, the program focus is on professional and disciplinary coursework, including required and elective lecture, seminar, and design studio courses.

Prerequisites for Admission—Applicants to the M.Arch. program must hold a baccalaureate degree and must have completed the equivalent of at least a year of preparatory work, including coursework in calculus, physics, architectural history, drawing, and architectural design.

Students are expected to have basic computer skills before beginning the program, including familiarity with either Macintosh or Windows operating systems, word processing, basic drawing or painting programs, and use of e-mail. Intermediate classes in computer methods in architecture (Arch 5371, 5372, 5373) are part of degree requirements during the first year; advanced classes (Arch 5374, 5375) are required during the second year.

In exceptional circumstances, students who have a nonprofessional baccalaureate degree in architecture and have completed the equivalent of the first year of the M.Arch. program requirements may qualify for advanced placement in the program. Depending on their academic record, their previous coursework, and their portfolio review, these students could complete the M.Arch. degree in a minimum of two years.

A small number of students who hold a bachelor of architecture professional degree (B.Arch.) are admitted each year to pursue a second professional degree. Admission is based on the quality of the previous academic work and the quality of the portfolio. Depending on their background, these students could complete the M.Arch. degree in a minimum of three semesters.

For more complete information, please see the *College of Architecture and Landscape Architecture Bulletin* and contact the Department of Architecture.

Special Application Requirements— Admission to the M.Arch. program is highly competitive. In addition to meeting Graduate School application requirements, students applying to the program must demonstrate design talent in a portfolio and must submit all of the following: a one-page statement of interest, transcripts of all coursework, three faculty recommendations, a recent paper written in English, and GRE scores. The portfolio should be a notebook no larger than 10" x 12" (other portfolio formats will be rejected). International students must submit scores from the TOEFL or the MELAB.

Use of 4xxx Courses—4xxx courses cannot be included on degree program forms without the permission of the adviser and director of graduate studies.

Courses—Please refer to Architecture (Arch) in the course section of this catalog for courses pertaining to the program.

M.Arch. Plan A Degree Requirements

The professional M.Arch.I curriculum accredited by the National Architectural Accreditation Board (NAAB) consists of a minimum of 93 credits, including the thesis. The first-year integrated curriculum is followed by two years of less structured coursework culminating in the thesis. Students are required to take intermediate and advanced courses in computer methods in architecture.

Postprofessional M.Arch.II (advanced standing) is offered for students with previous architectural education, a professional degree such as the bachelor of architecture (B.Arch.), or a professional master of architecture. Students entering with advanced standing plan an individualized curriculum, with faculty consultation, that will meet professional objectives and include a minimum of 30 credits, requiring at least 3 semesters of study.

Language Requirements—None.

Final Exam—Oral and visual presentation of the thesis is required.

Art

Contact Information—Department of Art, University of Minnesota, 208 Art Building, 216 21st Avenue S., Minneapolis, MN 55455 (612-625-8096; fax 612-625-7881; e-mail artdept@umn.edu; <http://artdept.umn.edu>).

Professor
Karl E. Bethke, AM
Curtis C. Hoard, AM
M. Diane Katsiaficas, AM
Clarence E. Morgan, AM
Mark Pharis, AM
Wayne E. Potratz, AM
Thomas A. Rose, AM

Associate Professor
Guy A. Baldwin, AM
Thomas R. Cowette, AM
David Feinberg, AM
Lynn A. Gray, AM
Gary L. Hallman, AM
James V. Henkel, AM
Jerald A. Krepps, AM
Thomas J. Lane, AM
Susan M. Lucey, AM
Joyce Lyon, AM

Assistant Professor
Christine Baeumler, AM
Margaret Bohls, AM
Marjorie Franklin, AM
Alexis Kuhr, AM
Lynn T. Lukkas, AM
Ryuta Nakajima, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The master of fine arts program places major emphasis on creative studio work of high quality. It promotes not only the conceptual and technical education of the professional artist in the context of the studio environment, encouraging critical inquiry, excellence, and an understanding of the history of art, but also an experimental approach toward each media. The following areas of concentration are available: ceramics, drawing and painting, photography, printmaking, sculpture and, time and interactivity. The M.F.A. is considered the terminal degree in the field of fine arts and is typically the degree required to teach at the college or university level.

Prerequisites for Admission—A bachelor of fine arts or an undergraduate major in art is required.

Special Application Requirements— Admission is in fall semester only. Ceramics, painting, and sculpture applicants must submit from 10 to 20 color slides of work completed in their chosen medium. Printmaking applicants must submit a minimum of four original prints in addition to slides. Time and interactivity applicants must submit a portfolio in the medium appropriate to the work being submitted for review. Photography applicants may submit 10 to 20 slides or a minimum of ten finished prints. Three letters of recommendation must be sent directly to the director of graduate studies, as well as a brief statement of purpose that describes the applicant's reasons for pursuing an advanced degree. Completed Graduate School applications (including official transcripts) must reach the Graduate School by January 5. Slides or visual portfolio, letters of recommendation, and the statement of purpose must reach the director of graduate studies in the Department of Art also by January 5.

Use of 4xxx Courses—Inclusion of 4xxx courses in the related field (other than art history) on the degree program form is subject to the adviser and director of graduate studies approval.

Courses—Please refer to Art (ArtS) in the course section of this catalog for courses pertaining to the program.

M.F.A. Degree Requirements

The M.F.A. program requires a total of 60 credits. It is typically a three-year program and studio space is provided for a maximum of three years for the pursuit of appropriate visual research. The program requires that 42 credits of coursework be completed prior to the final year of thesis registration for 18 credits. Candidates must plan programs with their advisers to include two semesters of the graduate seminar ArtS 8400 (taken in the first year) and 27 credits of visual art coursework. The related field requirement of 9 credits includes three courses in the history of art (or two courses in the history of art and one related academic course). Candidates must be reviewed annually before thesis registration. At the end of the thesis year, candidates demonstrate their visual research accomplishments through a solo thesis exhibition on campus, a supporting paper, and a final oral exam.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A minor in art may be obtained by candidates in a master's program by completing 9 credits of graduate level coursework chosen in consultation with the director of graduate studies in art. Candidates in a Ph.D. program must complete 12 credits. The minor must include ArtS 8400—Theoretical Constructions in Contemporary Art.

Art Education

See Education: Curriculum and Instruction for M.A., Ph.D., and contact information.

Professor
Kerry J. Freedman-Norberg, AM

Associate Professor
Margaret K. DiBlasio, AM

Lecturer
Faith M. Clover, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—By focusing on the curricular and instructional processes central to all educational endeavors, graduate programs within the Department of Curriculum and Instruction prepare students for professional roles in pre K-12 education, in postsecondary and research settings, and in educational service agencies.

The M.A. (Plan B only) in art education focuses on the application of research to practice in art education. Professionals in K-12 art education and other art-related fields work with advisers to construct a program of studies directed toward a specific professional research interest. Elective coursework can focus on studio arts, art history, and aesthetics, as well as on issues related to curriculum and instruction.

Prerequisites for Admission—Prerequisites vary among areas of emphasis or concentration. Generally a bachelor's degree with licensure and/or teaching experience fulfills the requirement. For some areas, however, there is no equivalent undergraduate program. In that case, 15 to 20 credits of work at the undergraduate level determined acceptable by advisers and the director of graduate studies are adequate.

Special Application Requirements—Scores from the GRE are required. Master's applications are reviewed by department faculty on continual basis throughout the academic year.

Use of 4xxx Courses—Inclusion of 4xxx courses on the degree program form is subject to adviser and director of graduate studies approval. Students from other majors may include such courses subject to their own program's approval.

Courses—Please refer to Curriculum and Instruction (CI) and Education (Educ) in the course section of this catalog for courses pertaining to the program.

M.A. Plan B Degree Requirements

The M.A. program requires a minimum of 30 credits: 14 credits in the major, a minimum of 4 credits in research (including 3-6 credits applied to the Plan B research project), 6 credits from a related field chosen with the consent of the adviser, and 6 elective credits.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—Students choosing a minor in art education elect courses appropriate to their research interest in consultation with program faculty. The minor requires a minimum of 6 credits. Coursework is determined on the basis of prior experiences, research competencies, interests, and the professional focus of each student.

Art History

Contact Information—Department of Art History, University of Minnesota, 338 Heller Hall, 271 19th Avenue South, Minneapolis, MN 55455 (612-624-0847 or 612-624-4500; fax 612-626-8679; e-mail arthist@umn.edu; <www.arthist.umn.edu/>).

Professor

Frederick M. Asher, FM
Frederick A. Cooper, FM
Karal Ann R. Marling, FM
Sheila J. McNally, FM
Robert J. Poor, FM
Leon G. Satkowski, AM
Gabriel P. Weisberg, FM

Adjunct Professor

Evan M. Maurer, *AM*

Associate Professor

W. John Archer, AM
Catherine B. Asher, FM
Robert B. Silberman, FM
Katherine M. Solomonson, AM
John W. Steyeart, FM
Michael W. Stoughton, FM

Assistant Professor

Jane M. Blocker, FM
Patricia McDonnell, AM

Other

Lyndel I. King, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Areas of specialization are: American art, architecture, and popular culture; Baroque art; East Asian art and Bronze Age archaeology; Greek and Roman art and archaeology; Islamic art and architecture; Late Gothic and northern Renaissance art; modern art including film and photography studies as well as nineteenth through twenty-first century art; South Asian art and architecture.

Prerequisites for Admission—For the M.A. program, a bachelor's degree is required, preferably in art history or a closely related field. Ability and scholarly promise must be demonstrated by a past record of academic excellence. For the Ph.D. program, an M.A. degree in art history or in a field closely related to the chosen area of specialization is required, as well as coursework or other experience indicating substantial background in art historical methods and knowledge.

Special Application Requirements—For the M.A. program, results from the GRE General Test, at least one substantial research paper in art history, and three letters of recommendation from persons well acquainted with the applicant's research and writing skills is required. In addition, M.A. applicants must provide a detailed statement describing previous experience and academic training as related to the projected course of study and academic goals.

For the Ph.D. program, results from the GRE General Test, a M.A. thesis or a minimum of two substantial M.A. papers in art history, and three letters of recommendation from persons well acquainted with the applicant's research and writing skills is required. In addition, Ph.D. applicants must provide a statement describing previous experience and academic training as related to the projected course of study and academic goals. Ph.D. candidates are urged to contact the director of graduate studies before application.

Applications for the Ph.D. program (if not previously enrolled in the department) and M.A. program are reviewed in January for admission in the fall. For both of these, the application form, statement of purpose, official transcripts, and official GRE scores must reach the Graduate School by early January (contact the Department of Art History for the precise date). Duplicates of these materials, as well as three letters of recommendation and research paper(s), must reach the department by the same deadline. Internal Ph.D. applicants should contact the department for details and deadlines. All applications for financial aid are due on the same date as the applications for admission.

Use of 4xxx Courses—Inclusion of 4xxx art history courses on the degree program form is subject to adviser and director of graduate studies approval. Students from other majors may include such courses subject to their own program's approval.

Courses—Please refer to the Art History (ArtH) course section of this catalog for courses pertaining to the program.

M.A. Plan B Degree Requirements

A minimum of 36 course credits (about 12 courses) is required, including at least two 8xxx seminars in art history. A minimum of 21 credits must be art historical in content and drawn from courses in at least three of the following areas: American, ancient, medieval, Baroque, modern, East Asian, South Asian, Islamic. Of these, four courses must be in an area of primary concentration, two courses in an area of secondary concentration, and one course in a third area. Students focusing on Asian/Islamic art must take at least one course in western art. Students focusing on western art must take at least one course in Asian/Islamic art. In addition, students must take 6 credits in courses that are not art historical in content. The remaining 9 credits may be either in art history or outside the discipline; this is decided in consultation with the adviser and the director of graduate studies. Two Plan B papers are required, the first of which should be completed by the end of the first year of full-time study.

Language Requirements—Students must attain reading proficiency in a second language directly related to their course of study.

Final Exam—The final exam is written. See the department's *Graduate Student Handbook* for details.

Minor Requirements for Students Majoring in Other Fields—For an M.A. degree, a minimum of 11 graduate credits in art history is required for a minor.

Ph.D. Degree Requirements

A minimum of 54 course credits (about 18 courses) is required. At least 18 credits (about six courses) must be in an area of primary concentration within art history, while a minimum of 9 credits (about three courses) must be in an area of secondary concentration in art history. In addition, at least 6 credits (about two courses) must be outside the field of art history in the minor or supporting program beyond work done at the M.A. level; a minimum of 12 credits in a minor or supporting field is required.

Language Requirements—Students must attain reading proficiency in at least two foreign languages. Contact the director of graduate studies for details.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor requires a minimum of 12 credits in art history.

Asian Languages and Literatures

No new students are being admitted to the Chinese, Japanese, and South Asian Languages graduate programs. New graduate degree programs under the department of Asian Languages and Literatures (ALL) will be formalized and approved in the near future.

Graduate students currently enrolled in any of these degree programs are to work with the Graduate School to complete their course requirements. Questions regarding curriculum options can be directed to the director of graduate studies of Asian Languages and Literatures, or to a member of the ALL administrative staff.

Chinese

Professor

Joseph R. Allen, FM
Yu-Shih Chen (emeritus), FM
Chun-Jo Liu (emeritus), FM
Richard B. Mather (emeritus), FM
Ann B. Waltner, History, AM
Stephen S. Wang (emeritus), FM

Japanese

Professor

Joseph R. Allen, FM

Associate Professor

Polly E. Szatrowski, FM

South Asian Languages

Professor

Frederick M. Asher, Art History, FM
Iraj Bashiri, FM
Indira Y. Junghare, FM

Associate Professor

William W. Malandra, Classical and Near Eastern Studies, FM

Librarian

Donald C. Johnson, Ames Library of South Asia, AM

Astrophysics

Contact Information—Department of Astronomy, University of Minnesota, 356 Tate Laboratory of Physics, 116 Church Street S.E., Minneapolis, MN 55455 (612-624-0211; fax 612-626-2029; e-mail grad-req@astro.umn.edu; <http://astro.umn.edu>).

Professor

Cynthia A. Cattell, Physics, FM
Kris D. Davidson, FM
John M. Dickey, FM
Robert D. Gehrz, FM
Roberta M. Humphreys, FM
Terry J. Jones, FM
Thomas W. Jones, FM
Leonard V. Kuhi, FM
Robert L. Lysak, Physics, FM
Keith A. Olive, Physics, FM
Robert O. Pepin, Physics, FM
Lawrence Rudnick, FM
Evan D. Skillman, FM
Cecil J. Waddington (emeritus), Physics, FM
Paul R. Woodward, FM

Associate Professor

Charles E. Woodward, FM
John R. Wygant, Physics, FM

Assistant Professor

Shaul Hanany, Physics, FM
Yong-zhong Qian, Physics, FM
Liliya L.R. Williams, FM

Senior Research Associate

David H. Porter, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Astrophysics is the study of the universe and its constituent parts. The program offers emphases in observational, theoretical, and computational astrophysics and in instrument development. The main research areas include properties and dynamics of normal and active galaxies, quasars, stellar evolution, interaction of stars with their environments, the interstellar medium, astrophysical magnetohydro-dynamics, and galactic and cosmological structure. Observational research includes X-ray, ultraviolet, optical, infrared, and radio astronomy. Extensive research programs in space physics and the elementary particle-cosmology interface are also carried out in interdisciplinary connections with the graduate program in physics.

Prerequisites for Admission—For major work, an undergraduate degree in astronomy or physics or the equivalent is required. Contact the director of graduate studies for exceptions.

Special Application Requirements—A statement of career goals, scores from the GRE General (Aptitude) Test and Subject (Advanced) Test in physics, and three letters of recommendation are required. Applications for financial aid are due January 15. Applications are accepted for entry in fall semester only.

Facilities—The Department of Astronomy is purchasing a 5 percent share in the Large Binocular Telescope (LBT) on Mt. Graham in southeastern Arizona. The LBT is currently under construction through a consortium of universities and research institutes led by the University of Arizona and has an expected completion date of 2004. This purchase will allow the department to trade time on the LBT for time on several other telescopes—including the 6.5 meter upgraded Multiple Mirror Telescope, the two 6.5 meter Magellan telescopes in the southern hemisphere, and the 10 meter Heinrich Hertz millimeter radio telescope—that are part of the same research consortium, providing guaranteed access to multi-wavelength capabilities.

The University also operates a 60-inch telescope on Mt. Lemmon, near Tucson, Arizona, which is well equipped for both optical and infrared observations. A 30-inch telescope with a CCD camera and infrared instruments is maintained at the O'Brien Observatory about 40 miles from the Twin Cities campus. Both telescopes are fully computer controlled and can be operated remotely. Plans are under development for a major (3.5 meter) observatory. Excellent shop facilities support our instrument development for the telescopes at O'Brien and Mt. Lemmon, for the University of Wyoming's infrared telescope, and for major national observatories such as the NASA Infrared Telescope Facility (IRTF) in Hawaii.

The Automated Plate Scanner is based in the astronomy department and has been used to digitize the entire Palomar Sky Survey resulting in a massive catalog of star and galaxy positions, magnitudes, and colors. The associated computer reduction system can analyze 100,000 images per hour.

The astronomy department maintains a large network of linux-based computers used for the reduction and analysis of X-ray, ultraviolet, optical, and radio observations. The department is connected through an ethernet backbone to clusters of supercomputers and super-workstations at the University's Supercomputer Institute and the Laboratory for Computational Science and Engineering. These facilities are available to faculty and students for their research.

In addition, members of the department regularly use such national facilities as the Kitt Peak National Observatory; Cerro Tololo Inter-American Observatory in Chile; National Radio Astronomy Observatory's facilities in Green Bank and the VLA; Arecibo Radio Observatory; the NASA space based facilities such as the Hubble Space Telescope, the Far Ultraviolet Space Explorer, the Space Infrared Telescope Facility, the Chandra X-ray Space Telescope; and the IRTF in Hawaii.

Use of 4xxx Courses—A 4xxx astrophysics course may be counted toward the M.S. or Ph.D. degree programs.

Courses—Please refer to Astronomy (Ast) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements

The master's degree requires a minimum of 30 credits, including one semester of classical physics (Phys 5011) and one year of the two year-long sequences in introductory astrophysics (Ast 4011-4021 or Ast 5012-5022). Additional requirements depend on whether the student chooses the thesis (Plan A) or non-thesis (Plan B) option. Plan A requires 20 semester credits of coursework and 10 thesis credits. Plan B requires 30 semester credits of coursework. Completion of the degree normally takes two years.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—For the master's minor, 8 credits in astrophysics are required, either the Ast 4011-4021 or Ast 5012-5022 sequence.

Ph.D. Degree Requirements

The Ph.D. degree requires a minimum of 40 course credits, including a year of classical physics (Phys 5011-5012), the two year-long sequences in introductory astrophysics (Ast 4011-4021 and Ast 5012-5022), and 12 credits in a minor or supporting program; 24 thesis credits are also required. The graduate written examination, offered during the spring, must be passed on the second "real" attempt (first-year students are given a free trial). A second-year project must be defended by the end of the fall semester of the third year. The preliminary oral exam must be passed by the end of the third year.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—For the Ph.D. minor, 12 credits in astrophysics are required, including either the Ast 4011-4021 or the Ast 5012-5022 sequence.

Biochemistry, Molecular Biology, and Biophysics

Contact Information—Department of Biochemistry (Medical School), University of Minnesota, 6-155 Jackson Hall, 321 Church Street S.E., Minneapolis, MN 55455 (612-625-5179; fax 612-625-2163), or Department of Biochemistry (Biological Sciences), University of Minnesota, 140 Gortner Laboratory of Biochemistry, 1479 Gortner Avenue, St. Paul, MN 55108 (612-624-7755; fax 612-625-5780; e-mail bmbbgp@umn.edu <http://cbs.umn.edu/gpbmbb/gpbmbb.html>).

For information on the master's and doctoral degree programs offered in conjunction with the University of Minnesota Duluth, contact the associate director of graduate studies, Department of Biochemistry and Molecular Biology, 251 School of Medicine, University of Minnesota, 10 University Drive, Duluth, MN 55812 (218-726-7922).

Professor

John S. Anderson, FM
Paul M. Anderson, Biochemistry and Molecular Biology, Duluth, FM
Ian M. Armitage, FM
Leonard J. Banaszak, FM
George Barany, Chemistry, FM
Bridgette A. Barry, FM
David A. Bernlohr, FM
Victor A. Bloomfield, FM
Robert J. Brooker, Genetics, Cell Biology, and Development, FM
Bianca M. Conti-Fine, FM
Anath Das, FM
Mary E. Dempsey, FM
Lester R. Drewes, Biochemistry and Molecular Biology, Duluth, FM
Michael C. Flickinger, FM
James A. Fuchs, FM
Harry P. C. Hogenkamp, FM
Alan B. Hooper, FM
James F. Koerner, FM
David C. LaPorte, FM
John D. Lipscomb, FM
Dennis M. Livingston, FM
Rex E. Lovrien, FM
Kevin H. Mayo, FM
Matthew F. Mescher, Laboratory Medicine and Pathology, FM
Gary L. Nelsestuen, FM
Michael B. O'Connor, Genetics, Cell Biology, and Development, FM
Theodore R. Oegema, Jr., Orthopaedic Surgery, FM
Douglas H. Ohlendorf, FM
Harry T. Orr, Laboratory Medicine and Pathology, FM
Joseph R. Prohaska, Biochemistry and Molecular Biology, Duluth, FM
Lawrence Que, Chemistry, FM
Michael A. Raftery, FM
Michael J. Sadowsky, Soil, Water, and Climate, FM
Michel M. Sanders, FM
Janet L. Schottel, FM
David H. Sherman, Microbiology, FM
David D. Thomas, FM
Howard C. Towle, FM
Tian Y. Tsong, FM
Brian G. Van Ness, FM
Lawrence P. Wackett, FM
Kendall B. Wallace, Biochemistry and Molecular Biology, Duluth, FM

Associate Professor

Kenneth W. Adolph, FM
Vivian J. Bardwell, Genetics, Cell Biology, and Development, FM
Benjamin L. Clarke, Medical Microbiology and Immunology, Duluth, FM
Stephen C. Ekker, Genetics, Cell Biology, and Development, FM
Cecilia Giulivi, Chemistry, Duluth, FM
Thomas S. Hays, Genetics, Cell Biology, and Development, FM
Thomas E. Huntley, FM
Alex J. Lange, FM
Sharon E. Murphy, FM
Karin Musier-Forsyth, Chemistry, FM
Merry Jo Oursler, Biology, Duluth, FM
Robert J. Roon, FM
Ann E. Rougvie, Genetics, Cell Biology and Development, FM
Paul G. Siliciano, FM
Jeffrey A. Simon, Genetics, Cell Biology, and Development, FM
David A. Zarkower, Genetics, Cell Biology, and Development, FM

Assistant Professor

Annette L. Boman, Biochemistry and Molecular Biology, Duluth, FM
Antony M. Dean, Ecology, Evolution, and Behavior, FM
Deborah A. Ferrington, Ophthalmology, FM
Julio E. Herrera, FM
Laura J. Mauro, Animal Science, FM
Lincoln R. Potter, FM
Claudia Schmidt-Dannert, FM
Robert J. Sheaff, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The biochemistry, molecular biology, and biophysics program focuses on an explanation at the molecular level of the structures and processes that occur in living organisms. In the broadest sense, the program encompasses the chemistry, physics, and biology of living systems. Included is the study of the structure and function of biomolecules (proteins, nucleic acids, lipids, and carbohydrates), enzyme catalysis, metabolic pathways, bioenergetics, and the biochemical nature of genetic information storage and transmission, as well as the control, regulation, and integration of these processes. The program has four areas of emphasis: regulatory biochemistry, molecular biology, microbial biotechnology, and molecular biophysics. All students are expected to demonstrate a minimum level of competence in these areas but emphasize that area most related to their thesis project. The program involves faculty from the Department of Biochemistry, Molecular Biology, and Biophysics, as well as many faculty members from several other departments in the College of Biological Sciences, Medical School, Institute of Technology, and College of Veterinary Medicine.

Prerequisites for Admission—The program is flexible enough to accommodate students with a wide variety of educational backgrounds. Applications from students with undergraduate or master's degrees in the biological, chemical, or physical sciences are encouraged. Recommended academic preparation includes one year each of calculus, organic chemistry, and basic biology, including biochemistry and genetics. For students of demonstrated ability, background deficiencies can be made up during the first year of graduate study.

Special Application Requirements—Applicants must submit three letters of recommendation from persons familiar with their academic and research capabilities. A statement of interests and goals, a complete set of transcripts, and official scores from the General Test of the GRE are required. The GRE Subject Test in biochemistry, cell and molecular biology, biology, or cngly recommended, but not required. The recommended date for receipt of completed applications is January 15. Completed files are reviewed between January and March. Graduate studies typically begin fall term.

Information about an early start program involving participation in laboratory research beginning on July 1 may be obtained from the director of graduate studies.

Use of 4xxx Courses—Use of 4xxx courses toward degree requirements is permitted with written approval from a director of graduate studies.

Courses—Please refer to Biochemistry (BioC) in the course section of this catalog for courses pertaining to the program.

M.S. Plan A Degree Requirements

Requirements for the M.S. degree include core coursework and laboratory experiences taken by all students, followed by one or more courses in one of the areas of specialization. In addition all students are expected to participate in the seminar involving student reports on current literature and research. A thesis based on original laboratory research is required.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—Students electing a master's minor are required to complete 6 credits of general graduate level coursework which may be selected (with approval by the director of graduate studies) from the 5xxx and 8xxx courses offered by the program. BioC 4331 and 4332 may also be considered if approved by the directors of graduate studies of both the major and minor programs.

Ph.D. Degree Requirements

Requirements for the doctoral degree include core coursework and laboratory experiences taken by all students, followed by one or more courses in one of the areas of specialization. In addition all students are expected to participate in two continuing series of seminars: one involving student reports on current literature and research and the other involving prominent national and international scientists.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—Students electing a doctoral minor are required to complete BioC 8001 (5 credits), 8002 (5 credits), plus an additional course(s) (2-4 credits) to meet the minimum requirement of 12 total credits. In extenuating cases, students may petition the director of graduate studies for substitution of one or both of the required courses.

Bioethics

Contact Information—Graduate Minor in Bioethics, Center for Bioethics, University of Minnesota, N-504 Boynton, 410 Church St. SE, Minneapolis MN 55455-0346 (612-624-9440; fax 612-624-9108; e-mail bioethx@umn.edu; <www.bioethics.umn.edu>).

Professor

Muriel J. Bebeau, Preventive Sciences, E
Dan L. Burk, Law, E
Norman O. Dahl, Philosophy, E
John M. Eyler, History of Medicine, E
Jasper S. Hopkins, Philosophy, E
Jeffrey P. Kahn, Medicine, E
Rosalie A. Kane, Public Health, E
David J. Mayo, Philosophy, Duluth, E
Steven H. Miles, Medicine, E
Naomi B. Scheman, Philosophy, E
Susan M. Wolf, Law School, E

Associate Professor

John M. Dolan, Philosophy, E
Carl Elliott, Pediatrics, E
Gregory Plotnikoff, Medicine, E
Michael Root, Philosophy, E

Assistant Professor

John Song, Medicine, E
Beth Virnig, Health Services Research and Policy, E

Other

Ronald E. Cranford, Neurology, E

Curriculum—The Center for Bioethics, in close cooperation with the Department of Philosophy, offers a minor in bioethics for master's (M.A. and M.S.) and doctoral students with approval of the director of graduate studies in bioethics. The minor provides a structured program of study as well as formal recognition for academic accomplishments in the field.

While recognizing that philosophy is the focal discipline for the study of bioethics, the minor offers numerous opportunities for multidisciplinary study, including in history and philosophy of medicine, health law and public policy, health-care economics, professional ethics, clinical ethics, medical humanities, and moral development.

Prerequisites for Admission—Admission is contingent upon prior admission to a master's or doctoral degree-granting program within the Graduate School. Students are encouraged to have some previous exposure to philosophy or biomedicine or both. Graduate students in philosophy are expected to have successfully completed at least one graduate course in ethical theory.

Special Application Requirements—Contact the director of graduate studies in bioethics for an *Intent to Enroll* form, which should be submitted by the middle of the spring semester the year before initiating coursework in the minor. Enrollment is contingent upon approval by the director of graduate studies for bioethics.

Use of 4xxx Courses—Some 4xxx courses are allowed as indicated in the guidelines for the bioethics minor, available from the director of graduate studies.

Courses—Please contact the minor program office for information on relevant coursework.

Freestanding Minor Requirements

Students Majoring in Philosophy—Master's students (M.A. and M.S.) must complete a minimum of 8 graduate credits in bioethics: 6 credits of required courses and 2 credits of electives outside the Department of Philosophy.

Doctoral students must complete a minimum of 14 graduate credits in bioethics: 8 credits of required courses and 6 credits of electives outside the Department of Philosophy.

Students Majoring in a Field Other Than Philosophy—Master's students (M.A. and M.S.) must complete a minimum of 8 graduate credits in bioethics outside the student's major. Master's students are not required to take electives in bioethics and cognate areas, but are encouraged to do so.

Doctoral students must complete a minimum of 14 graduate credits in bioethics outside the student's major: 8 credits of required courses and 6 credits of electives.

Biological Science

Contact Information—Master of Biological Science, Professional Program, College of Biological Sciences, 123 Snyder Hall, 1475 Gortner Avenue, St. Paul, MN 55108 (612-625-3133; fax 612-624-2785; e-mail biolink@cbs.umn.edu; <www.cbs.umn.edu/biolink/mbs.html>).

Professor

Judith G. Berman, Molecular, Cellular, Developmental Biology and Genetics, AM
David A. Bernlohr, Biochemistry, Molecular Biology, and Biophysics, AM
Linda J. Brady, Food Science and Nutrition, AM
Robert M. Brambl, Plant Biology, AM
Paul P. Cleary, Microbiology, AM
Gary M. Dunny, Microbiology, AM
James A. Fuchs, Biochemistry, Molecular Biology, and Biophysics, AM
Ross G. Johnson, Molecular, Cellular, Developmental Biology, and Genetics, AM
Youngki Kim, Pediatrics, AM
Mindy S. Kurzer, Food Science and Nutrition, AM
Paul T. Magee, Microbiology, AM
Sheldon M. Mauer, Pediatrics, AM
Gary A. Reineccius, Food Science and Nutrition, AM
Patrick M. Schlievert, Microbiology, AM
Michael J. Simmons, Molecular, Cellular, Developmental Biology, and Genetics, AM
Donald B. Siniff, Ecology, Evolution, and Behavior, AM
Joanne L. Slavin, Food Science and Nutrition, AM
Lawrence P. Wackett, Biological Process Technology Institute, AM
Chester B. Whitley, Pediatrics, AM

Associate Professor

Wei Chen, Pediatrics, AM
Joellen Feirtag, Food Science and Nutrition, AM
Susan M. Galatowitsch, Horticultural Science, AM
Daniel D. Gallaher, Food Science and Nutrition, AM
Stephen Jameson, Laboratory Medicine and Pathology, AM
Christopher A. Pennell, Laboratory Medicine and Pathology, AM

Assistant Professor
Cheryl A. Gale, Pediatrics, AM

Research Associate
Nicole Kirchhof, Surgery, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—A professional master of biological science (M.B.S.) degree is offered with concentrations in areas such as biochemistry, basic biology (animal, plant, cell, applied, and general), biotechnology, biophysics, ecology, environment, evolution, food science and nutrition, genetics, microbiology, molecular biology, and neuroscience. It is a multicollege, cooperative degree program among the Colleges of Biological Sciences, Veterinary Medicine, and Agricultural, Food, and Environmental Sciences. The program is administered by the College of Biological Sciences and the degree is conferred by the Graduate School.

The M.B.S. is a highly flexible graduate-level practitioner-based program offered to meet the needs of a substantial portion of the working community who wish or need to increase their knowledge in areas related to modern biology. The program provides educational opportunities beyond those that aim at maintaining and improving productivity within the professions. It fills a gap in the present educational system for those who have neither the time nor the flexibility to earn a graduate degree through more traditional channels. It also provides this population with the most current information and advanced skills in their areas of professional interest, and gives them acknowledgment for their achievement. The degree enables recipients to learn new job skills, change professional emphasis, or provide added value to their present job.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please contact the program office for information on relevant coursework.

M.B.S. Coursework Only Degree Requirements

The program includes coursework, seminars, independent study, workshops, and a capstone project. With guidance from faculty advisers, students complete 30 credits. M.B.S. candidates may transfer up to 8 credits into the program. Core credits may be waived or substituted if the student can show proficiency in the subject area, pending advisory committee approval. If a core credit is waived, the credits must still be earned in an elective course. Coursework will be taken from the regular curriculum in the participating colleges, as well as from other approved credit-bearing courses (e.g., intensive short courses and Internet courses).

The overall GPA of a candidate must be a minimum of 3.00 for the degree to be awarded. A student with 8 or more credits of incomplete (I) coursework will not be allowed to register for additional courses until the I's are completed.

Language Requirements—None.

Final Exam—A capstone project is required.

Biomedical Engineering

Contact Information—Department of Biomedical Engineering, University of Minnesota, 7-105 BS&BE, 312 Church Street S.E., Minneapolis, MN 55455 (612-624-8396; fax 612-624-1120; e-mail bmengp@umn.edu; <www.bme.umn.edu/>). Program office is located in room 187 Shepherd Labs, 100 Union Street S.E., Minneapolis campus.

Professor
Robert J. Bache, Medicine, FM
David G. Benditt, Medicine, FM
Frank B. Cerra, Surgery, FM
Jay N. Cohn, Medicine, FM
Max Donath, Mechanical Engineering, FM
William K. Durfee, Mechanical Engineering, FM
Arthur G. Erdman, Mechanical Engineering, FM
Stanley M. Finkelstein, Laboratory Medicine and Pathology, FM
Martha Flanders, Neuroscience, FM
John E. Foker, Surgery, FM
Leo T. Furcht, Laboratory Medicine and Pathology, FM
James R. Gage, Orthopaedic Surgery, AM
Michael G. Garwood, Radiology, AM
Robert P. Hebbel, Medicine, FM
Wei-Shou Hu, Chemical Engineering and Materials Science, FM
Xiaoping Hu, Radiology, FM
Paul A. Iaizzo, Anesthesiology, FM
Kenneth Keller, HHH Institute of Public Affairs, FM
Seong-gi Kim, Radiology, FM
Tarald O. Kvalseth, Mechanical Engineering, FM
Paul C. Letourneau, Cell Biology and Neuroanatomy, FM
David G. Levitt, Physiology, FM
Jack L. Lewis, Orthopaedic Surgery, FM
Rex E. Lovrien, Biochemistry, FM
James B. McCarthy, Laboratory Medicine and Pathology, FM
Wilmer G. Miller, Chemistry, FM
David A. Nelson, Otolaryngology, FM
Robert P. Patterson, Physical Medicine and Rehabilitation, FM
Dennis L. Polla, FM
Richard E. Poppele, Neuroscience, FM
Gundu H. R. Rao, Laboratory Medicine and Pathology, FM
William P. Robbins, Electrical and Computer Engineering, AM
Ronald A. Siegel, Pharmaceutics, FM
Ephraim M. Sparrow, Mechanical Engineering, FM
Ahmed H. Tewfik, Electrical Engineering, FM
Robert T. Tranquillo, FM
Charles L. Truwit, Neurology, AM
Neal F. Viemeister, Psychology, FM
Robert F. Wilson, Medicine, AM

Associate Professor
Jerome H. Abrams, Surgery, FM
Alan J. Bank, Medicine, AM
John C. Bischof, Mechanical Engineering, FM
Wei Chen, Radiology, AM
William B. Gleason, Laboratory Medicine and Pathology, AM
Bruce E. Hammer, Radiology, FM
Ramesh Harjani, Electrical and Computer Engineering, AM
James E. Holte, Electrical Engineering, FM
Keith Lurie, Medicine, AM
Ronald C. McGlennen, Laboratory Medicine and Pathology, AM
David J. Odde, FM
A. David Redish, Neuroscience, AM
Clark M. Smith II, Pediatrics, FM
Stephen C. Strother, Radiology, AM
J. Thomas Vaughan, Radiology, FM
Jay Zhang, Medicine, FM
Cheryl L. Zimmerman, Pharmaceutics, AM

Assistant Professor
Victor H. Barocas, FM
Joan E. Bechtold, Orthopaedic Surgery, AM
Linda K. Hansen, Laboratory Medicine and Pathology, AM
Allison Hubel, Laboratory Medicine and Pathology, FM
Haiying Liu, Radiology, AM
David B. Masters, Pharmaceutics, AM
Michael H. Schwartz, Orthopedic Surgery, FM
Carl S. Smith, Urologic Surgery, AM
Joseph J. Tahlghader, Electrical and Computer Engineering, AM
Babak Ziaie, Electrical and Computer Engineering, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Biomedical engineering is the application of engineering principles and methods to problems in biology and medicine. The discipline includes the study of fundamental processes in biology and physiology, the study of the diagnosis and treatment of disease and injury, and the design and development of medical devices and techniques. Students take courses in mathematics, biology, biomedical engineering, and engineering emphasis areas. The engineering emphasis areas include biomaterials, biomechanics, cell/matrix science and tissue engineering, biomedical microdevices and instruments, biomedical instrumentation, medical information systems, medical devices, and biomedical heat and mass transfer.

Prerequisites for Admission—A baccalaureate degree in engineering or in a physical or biological science is required. Successful applicants without an engineering degree are required to complete appropriate coursework to provide preparation for graduate-level engineering courses before being admitted as a candidate for the degree. In most cases, this coursework is not considered part of the degree program.

Special Application Requirements—Three letters of recommendation and GRE scores are required of all applicants. For international students, the TOEFL with a minimum score of 575 is required.

Use of 4xxx Courses—No more than 3 credits of 4xxx courses may be included. These courses require approval of the adviser and director of graduate studies.

Courses—Please refer to Biomedical Engineering (BMEn) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements

The M.S. is offered under two plans: Plan A (with a thesis) and Plan B (with a project). Each program requires courses in mathematics, biology, biomedical engineering, an engineering emphasis area, and a minor or related field. Plan A requires completion of 25 course credits. Plan B requires completion of 35 course credits, including the research project. Coursework in a minor or supporting field must include a minimum of 6 credits for both Plan A and Plan B.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—The master's minor requires 6 to 8 course credits, including two BMEn core courses.

Ph.D. Degree Requirements

The Ph.D. program requires coursework in mathematics, biology, biomedical engineering, and engineering emphasis areas (typically 40 credits, including those satisfying a required minor field), a written preliminary exam, an oral preliminary exam, a dissertation, and a final oral exam.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—The doctoral minor requires 12 credits, including two BMEn core courses and courses from an engineering emphasis area.

Biomedical Science

Contact Information—Program Administrator, Combined M.D./Ph.D. Training Program, University of Minnesota, MMC 293, 420 Delaware St. S.E., Minneapolis, MN 55455 (612-625-3680; <http://mdphd.med.umn.edu>).

Regents' Professor

Ashley T. Haase, Microbiology, FM
Alfred F. Michael, Pediatrics, FM
James G. White, Laboratory Medicine and Pathology, FM

Professor

Dwight L.Anderson, Oral Sciences, FM
Robert J.Bache, Medicine, FM.
Leonard J. Banazak, Biochemistry, FM
Bruce R. Blazar, Pediatrics, FM
Frank B. Cerra, Surgery, FM
Paul P. Cleary, Microbiology, FM
Bianca M. Conti-Fine, Biochemistry, FM
David L. Dunn, Surgery, FM
Timothy J. Ebner, Neuroscience, FM
Robert P. Elde, Biological Sciences, FM
Esam E. El-Fakahany, Psychiatry, FM
Stanley L. Erlandsen, Genetics, Cell Biology, and Development, FM
David P. Fan, Genetics, Cell Biology, and Development, FM
Anthony J. Faras, Microbiology, FM
Stanley M Finkelstein, Laboratory Medicine and Pathology, FM
Leo T. Furcht, Laboratory Medicine and Pathology, FM
Apostolos P. Georgopoulos, Neuroscience, FM
Glenn J. Giesler, Jr., Neuroscience, FM
Gary Gray, Chemistry, FM
Perry B. Hackett, Genetics, Cell Biology, and Development, FM
David W. Hamilton, Genetics, Cell Biology, and Development, FM.
Stephen S. Hecht, Cancer Center, FM
Robert Herman, Genetics, Cell Biology, and Development, FM
Jordan L. Holtzman, Medicine, FM
Thomas H. Hostetter, Medicine, FM
Costintino Iadecola, Neurology, FM
David H. Ingbar, Medicine, FM
Harry S. Jacob, Medicine, FM
Ross G. Johnson, Genetics, Cell Biology, and Development, FM
Russell Johnson, Microbiology, FM
Marc Jenkins, Microbiology, FM
James F. Koerner, Biochemistry, FM
Ryoko Kuriyama, Genetics, Cell Biology, and Development, FM
David C. LaPorte, Biochemistry, FM
Alice A. Larson, Veterinary Pathobiology, FM
Tucker W. LeBien, Laboratory Medicine and Pathology, FM
Hon Cheung Lee, Pharmacology, FM
Paul C. Letourneau, Neuroscience, FM
Jack L. Lewis, Orthopaedic Surgery, FM
Richard W. Linck, Genetics, Cell Biology, and Development, FM
John D. Lipscomb, Biochemistry, FM
Horace H. Loh, Pharmacology, FM
Walter C. Low, Neurosurgery, FM
James B. McCarthy, Laboratory Medicine and Pathology, FM
R. Scott McIvor, Genetics, Cell Biology, and Development, FM
Steven C. McLoon, Neuroscience, FM
Matthew F. Mescher, Laboratory Medicine and Pathology, FM
Jeffrey S. Miller, Medicine, FM
Eric Newman, Neuroscience, FM
Theodore, Jr. Oegema, Orthopaedic Surgery, FM
Harry T. Orr, Laboratory Medicine and Pathology, FM
Peter G. W. Plagemann, Microbiology, FM
Richard Poppele, Neuroscience, FM
Sundaram Ramakrishnan, Pharmacology, FM
M. Elizabeth Ross, Neurology, FM
Michel M. Sanders, Biochemistry, FM
Patrick Schlievert, Microbiology, FM
Virgina S. Seybold, Neuroscience, FM
Norman E. Sladek, Pharmacology, FM
John F. Soechting, Neuroscience, FM
Chang W. Song, Therapeutic Radiology, FM
Robert Sorenson, Genetics, Cell Biology, and Development, FM
Sheldon B. Sparber, Pharmacology, FM
David D. Thomas, Biochemistry, FM
Howard C. Towle, Biochemistry, FM
Kamil Ugurbil, Radiology, FM
Daniel A. Vallera, Therapeutic Radiology, FM
Brian G. Van Ness, Genetics, Cell Biology, and Development, FM
Carol L. Wells, Laboratory Medicine and Pathology, FM
Susan M. Wick, Plant Biology, FM
Douglas Yee, Medicine, FM
Ben G. Zimmerman, Pharmacology, FM

Associate Professor

James Ashe, Neuroscience, FM
Vivian J. Bardwell, Genetics, Cell Biology, and Development, FM
John C. Bischof, Mechanical Engineering, FM
Kathleen F. Conklin, Microbiology, FM
Christopher M. Gomez, Neurology, FM
Kristin A. Hogquist, Laboratory Medicine and Pathology, FM
Victoria Iwanji, Genetics, Cell Biology, and Development, FM
Stephen C. Jameson, Laboratory Medicine and Pathology, FM
Ronald R. Jemmerson, Microbiology, FM
Jose V. Pardo, Psychiatry, FM
Lisa A. Peterson, Cancer Center, FM
Mary E. Porter, Genetics, Cell Biology, and Development, FM
Stephen J. Riederer, AM
Paul G. Siliciano, Biochemistry, FM
Amy P. N. Skubitz, Laboratory Medicine and Pathology, FM
Peter J. Southern, Microbiology, FM
Stanley A. Thayer, Pharmacology, FM
R. Carston Wagner, College of Pharmacy, FM

Assistant Professor

Linda M. Boland, Neuroscience, FM
Carol A. Lange, Medicine, FM
David A. Largaespada, Genetics, Cell Biology, and Development, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—In consultation with their faculty advisers and the Committee on Graduate Studies, students custom design interdisciplinary programs at the interfaces of biology, medicine, engineering, and physical sciences.

Prerequisites for Admission—Admission is limited to students who have been accepted by the Medical School's Combined M.D./Ph.D. Training Program.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Ph.D. Degree Requirements

This interdisciplinary program enables M.D./Ph.D. students to custom design their Ph.D. program. The goal is to train scientists who will be at the interface of research in several disciplines and to provide an alternative when a traditional graduate program will not satisfy the student's needs or intentions. Despite the interdisciplinary quality of biomedical science, each student's program will contain a coherent and cohesive core of individualized course material.

Language Requirements—None.

Biophysical Sciences and Medical Physics

Contact Information—Biophysical Sciences and Medical Physics Program, Department of Radiology, University of Minnesota, MMC 292, Room B230 Mayo Building, 420 Delaware Street S.E., Minneapolis, MN 55455 (612-626-6638; e-mail hanse032@umn.edu).

Professor

Dwight L. Anderson, Oral Sciences, FM
Victor A. Bloomfield, Biochemistry, FM
Bianca M. Conti-Fine, Biochemistry, FM
Ralph DeLong, Oral Sciences, AM
William H. Douglas, Oral Sciences, FM
Stanley M. Finkelstein, Laboratory Medicine and Pathology, FM
John E. Foker, Surgery, FM

Michael G. Garwood, Radiology, FM
Russell K. Hobbie, (emeritus), Physics and Astronomy, FM
Xiaoping Hu, Radiology, FM
Faiz M. Khan, Therapeutic Radiology, FM
Seong-gi Kim, Radiology, FM
Merle K. Loken, (emeritus), Radiology, FM
Rex E. Lovrien, Biochemistry, FM
Robert H. Margolis, Otolaryngology, FM
Scott M. O'Grady, Animal Science, FM
Robert P. Patterson, Physical Medicine and Rehabilitation, FM
Richard E. Poppele, Physiology, FM
E. Russell Ritenour, Radiology, FM
Chang W. Song, Therapeutic Radiology, FM
David D. Thomas, Biochemistry, FM
Kamil Ugurbil, Radiology, FM
Warren J. Warwick, Pediatrics, FM

Associate Professor

Alan J. Bank, Medicine, AM
Richard A. Geise, Radiology, FM
Bruce J. Gerbi, Therapeutic Radiology, FM
Rolf Gruetter, Radiology, FM
Bruce E. Hammer, Radiology, FM
Patrick Higgins, Therapeutic Radiology, AM
James E. Holte, Electrical Engineering, FM
Michael Jerosch-Herold, Radiology, AM
Arthur E. Stillman, Radiology, AM
Stephen C. Strother, Radiology, AM

Assistant Professor

Vincent A. Barnett, Physiology, AM
Mark J. Conroy, Radiology, AM
Bruce E. Hasselquist, Radiology, AM
Jeih-San Liow, Radiology, AM
Haiying Liu, Radiology, AM
Kelly Rehm, Radiology, AM

Senior Research Associate

David H. Live, Biochemistry, Molecular Biology, and Biophysics, AM
Ching-Change Ko, Oral Science, AM

Other

Firmin C. Deibel, AM
Christopher C. Kuni, AM
Kevin G. Waddick, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—This interdisciplinary program includes faculty members who have primary appointments in fields such as radiobiology, physics, engineering, computer science, physiology, dentistry, genetics, and biochemistry. Students concentrate in research areas such as molecular biophysics, medical imaging, magnetic resonance imaging and spectroscopy, radiobiology, radiation therapy physics, and mathematical biophysics and computation. A limited number of students prepare for employment as hospital-based medical physicists through a program that includes opportunities for coursework, laboratory work, and directed study to provide experience in areas such as purchase specification, acceptance testing, quality assurance, and radiation safety.

Prerequisites for Admission—All students should have some familiarity with physical chemistry, intermediate physics, intermediate mathematics, biostatistics, computer programming, biology, physiology, and biochemistry. This may be demonstrated by coursework completed at the undergraduate level or as part of the graduate program; by reading or practical experience; or by informal competency examinations.

Special Application Requirements—Three letters of recommendation and scores from the General Test of the GRE are required. Applicants are considered for admission in both semesters.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please refer to Biophysical Sciences (BPhy) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements

The M.S. is offered under two plans: Plan A, which includes a thesis, and Plan B, which includes a project. Plan A is considered suitable for students with full-time employment whose thesis can be related to their work assignments. Plan B is more suitable for students planning to work in government or hospital settings where technical knowledge is more germane than research experience. Plan B students complete a project under the direction of a faculty member and present the work to their faculty committee in an oral exam. A total of 30 credits is required, including 14 in the major and 6 in a related field or minor.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—Programs are arranged on an individual basis and must consist of courses that represent a subfield of the discipline, e.g., radiobiology or medical physics. At least 6 credits of BPhy courses are required.

Ph.D. Degree Requirements

Ph.D. students take preliminary written exams at the end of the first year of study or as soon as possible after completing the core course sequence in topics in physics for medicine and biology. An oral preliminary exam focuses on the plan for thesis research and the student's grasp of related information and is taken by the fall of the third year of full-time registration or its equivalent. At least 12 credits are required in a minor or supporting program. Additionally, 24 thesis credits are required.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—Programs are arranged on an individual basis and must consist of courses that represent a subfield of the discipline, e.g., radiobiology or medical physics.

Biostatistics

Contact Information—Student Services Center, School of Public Health, University of Minnesota, Mayo Mail Code 819, 420 Delaware Street S.E., Minneapolis, MN 55455 (612-626-3500 or 1-800-774-8636; fax 612-626-6931; e-mail sph-ssc@umn.edu; <www.sph.umn.edu>).

Professor

Bradley P. Carlin, FM
Kathryn M. Chaloner, Statistics, FM
John E. Connett, FM
William T.M. Dunsmuir, FM
Anne I. Goldman, FM
Chap T. Le, FM
Thomas A. Louis, FM
James D. Neaton, FM
Richard Lewis Tweedie, FM

Associate Professor

Patricia M. Grambsch, FM
William Thomas, AM

Assistant Professor

Sudipto Banerjee, AM
Hegang Chen, AM
Lynn E. Eberly, AM
Wei Pan, AM
Cavan Reilly, AM
Melanie Wall, AM

Senior Research Associate

James S. Hodges, FM

Research Associate

Judith Bebchuk, AM
Li Chen, AM
Katherine Huppler Hullsiek, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Biostatistics combines statistics, biomedical science, and computing to advance health research. Biostatisticians design, direct, and analyze clinical trials; develop new statistical methods; and analyze data from observational studies, laboratory experiments, and health surveys. This is an ideal field for students who have strong mathematical backgrounds and who enjoy working with computers, collaborating with investigators, and want to participate in health research. Students take courses in biostatistical methods, theory of statistics, clinical trials, statistical computing, categorical data, survival analysis, and health sciences.

Prerequisites for Admission—For the M.S., multivariable calculus and linear algebra, an introductory course in applied statistics, and programming in C or Fortran are required. For the Ph.D., an M.S. in statistics, biostatistics, or mathematics, with coursework in applied and theoretical statistics, and graduate level real analysis is required.

Three letters of recommendation and the GRE are required. Applicants should have a GPA of at least 3.10 on a 4.00 scale. Applicants to the M.S. program should have a GPA of 3.40 in quantitative courses, 450 on

the verbal GRE, and 550 on the quantitative and analytical GRE. Applicants to the Ph.D. program should have a GPA of 3.70 in quantitative courses, 550 on the verbal GRE, and 650 on the quantitative and analytical GRE. Non-native speakers of English applying to either program should have a TOEFL score of at least 600 (paper version) or 250 (computer version).

Special Application Requirements— Students should apply for admission during fall semester only. New students generally are not admitted in spring semester.

Use of 4xxx Courses—No 4xxx courses may be included on degree program forms in biostatistics.

Courses—Please refer to Public Health (PubH), where most biostatistics courses are numbered 54xx or 84xx.

M.S. Degree Requirements

For the M.S. Plan B degree, students must complete at least 36 credits with a GPA of 3.00, pass a written exam, complete the Plan B project and a final oral exam. Most students need two years of full time study to finish the degree. The required credits are divided among three areas: 1) nine required courses in statistical theory, biostatistics methods, and computing; 2) 3 credits in health science; 3) 3 credits in biostatistics. Details of the program are in the *Student Handbook* at <www.biostat.umn.edu>. The M.S. Plan A thesis degree is for those who have completed advanced work, such as a Ph.D. in a mathematical science and who want to begin dissertation research in biostatistics methodology after only one year of coursework. Students complete at least 20 credits, 14 in biostatistics and 6 in related fields.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—The minor for M.S. students majoring in statistics consists of at least 6 credits selected from the following: PubH 5421—Statistical Computing II (2 cr), PubH 5462—Clinical Trials (3 cr), PubH 5467—Analysis of Categorical Data (3 cr), PubH 8420—Survival Analysis (3 cr).

The master's minor for nonstatistics majors consists of PubH 5450—Biostatistics I (4 cr), PubH 5452—Biostatistics II (4 cr), and PubH 5462—Clinical Trials (3 cr).

Ph.D. Degree Requirements

The Ph.D. program requires at least 24 credits of coursework, a comprehensive written examination on the material from some of the required courses, a preliminary oral examination, writing the dissertation, and defending the dissertation in a final oral examination. This usually requires three years of full time study after the M.S. degree. The required courses include mathematical statistics, linear models, longitudinal data analysis, probability models, and Bayesian methodology.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A minor for Ph.D. students majoring in statistics consists of at least 12 credits selected from the following: PubH 5462—Clinical Trials (3 cr), PubH 5467—Analysis of Categorical Data (3 cr), PubH 8420—Survival Analysis (3 cr), PubH 8430—Sequential Analysis (2 cr), PubH 8431—Bayesian Decision Theory (4 cr), PubH 8433—Analysis of Longitudinal Data (3 cr), PubH 8434—Advanced Survival Analysis (2 cr), PubH 8436—Spatial Biostatistics (2 cr).

A minor for Ph.D. students in programs other than statistics consists of PubH 5465—Biostatistical Inference I (4 cr) and PubH 5466—Biostatistical Inference II (4 cr), plus 6 credits selected from the following: PubH 5421—Statistical Computing II (2 cr), PubH 5462—Clinical Trials (3 cr), PubH 5467—Analysis of Categorical Data (3 cr), PubH 8420—Survival Analysis (3 cr). Prerequisites for these courses include multivariate calculus, linear algebra, and statistical theory (Stat 5101-5102).

Biosystems and Agricultural Engineering

Contact Information—Director of Graduate Studies, Department of Biosystems and Agricultural Engineering, University of Minnesota, 1390 Eckles Avenue, St. Paul, MN 55108-6005 (612-625-7733; fax 612-624-3005; e-mail bae@gaia.bae.umn.edu; <www.bae.umn.edu>).

Professor

Mrinal Bhattacharya, FM
Charles J. Clanton, FM
Larry D. Jacobson, FM
Kevin A. Janni, FM
Theodore P. Labuza, Food Science and Nutrition, FM
R. Vance Morey, FM
John L. Nieber, FM
Rongsheng R. Ruan, FM
William F. Wilcke, FM

Associate Professor

James J. Boedicker, AM
Jonathan Chaplin, FM
Philip R. Goodrich, FM
John M. Shutske, AM
Bruce N. Wilson, FM

Assistant Professor

Gary R. Sands, AM
Jun Zhu, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Areas of emphasis include bioprocessing; food engineering; livestock environment; water quality, surface and subsurface flow, contaminant transport; waste management and resource utilization; terramechanics; safety; and grain quality.

With approval from the department faculty, supporting courses in other fields of engineering and the physical, biological, or agricultural sciences may be included in the major.

The M.B.A.E. is primarily a design-oriented professional degree intended for students who are already employed in engineering design positions, but the degree is also open to students who are not currently employed and students may select a coursework only option. The M.B.A.E. is normally considered to be a terminal degree; students who think they might pursue a Ph.D. would usually take the M.S., Plan A.

Graduate education in biosystems and agricultural engineering develops a strong foundation in engineering principles that are applied to important problems involving biological and agricultural systems. The master of science in biosystems and agricultural engineering (M.S.B.A.E.) degree is for students with a bachelor's degree in a biological, biosystems, agricultural, or related engineering field. Emphases are outlined above. Programs usually include study in at least one other engineering discipline as well as study or research in a biological or agricultural discipline.

The Ph.D. degree is for students with exceptional research and problem-solving capabilities. It should build upon a strong undergraduate program in engineering, biology, and agricultural systems, and progress in rigor to prepare the student to research advanced biosystems and agricultural engineering problems. Emphases are outlined above. Programs usually include study in at least one other engineering discipline as well as study or research in a biological or agricultural discipline.

Prerequisites for Admission—A B.S. degree in biological, agricultural, or related field of engineering, or equivalent coursework in mathematics, physics, engineering science, and engineering design is required. A strong academic record is also required.

Special Application Requirements—The GRE is not required, but GRE scores are highly recommended for students who do not have engineering degrees, have degrees from institutions outside the U.S., or have a low grade point average. Students are admitted each semester.

Use of 4xxx Courses—Degree programs are expected to include mostly 5xxx and 8xxx courses. If the program contains more than three 4xxx courses in the M.S. program, or more than two 4xxx courses beyond the courses taken for the master's degree in the doctoral program, students and their advisers are asked to include a letter of explanation when the degree program is submitted for approval.

Courses—Please refer to Biosystems and Agricultural Engineering (BAE) and Agricultural Engineering Technology (AgET) in the course section of this catalog for courses pertaining to the program.

M.B.A.E Degree Requirements

Students are required to complete a minimum of 14 course credits in the major field, 6 course credits in a related field or a minor, and a design project of a minimum of 10 credits. The design project is expected to be of professional caliber. Alternately, students may opt for a coursework (30 credits) only program. The coursework program must be approved by the biosystems and agricultural engineering director of graduate studies and the chair of the graduate program committee.

Language Requirements—None.

Final Exam—Students must present a seminar and pass a final oral exam. Students must also meet all Graduate School requirements regarding the final exam.

Minor Requirements for Students Majoring in Other Fields—A minor consists of at least 6 credits of BAE courses numbered 4xxx or higher.

M.S.B.A.E. Degree Requirements

The M.S.B.A.E. may be completed as either a Plan A (thesis) or Plan B (project). Plan A students must complete a minimum of 14 course credits in the major field, 6 course credits in a related field or a minor, and 10 thesis credits. Plan B students must complete a minimum of 14 course credits in the major field, 6 course credits in a related field or a minor, 10 other credits, and at least one Plan B project. All coursework programs must be approved by the biosystems and agricultural engineering director of graduate studies and the chair of the graduate program committee.

Language Requirements—None.

Final Exam—Students must present a seminar and pass a final oral exam. Students must also meet all Graduate School requirements regarding the final exam.

Minor Requirements for Students Majoring in Other Fields—A minor consists of at least 6 credits of BAE courses numbered 4xxx or higher.

Ph.D. Degree Requirements

This degree is intended to move students to the cutting edge of research in their subject matter area. Students develop skills that enable them to define problems or research questions, plan research, conduct research and/or lead research efforts, analyze data, and communicate research results to a variety of audiences. All Ph.D. degree programs must include a minimum of 45 graduate course credits beyond the B.S. and a minimum of 24 doctoral thesis credits (BAE 8888). A minimum of 12 course credits must be in a minor field or in a supporting program. Ph.D. degree programs should contain a minimum of 9 course credits in a concentrated area of scientific or mathematical theoretical development that is related to the student's research.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A minor consists of at least 12 credits of BAE courses numbered 4xxx or higher.

Business Administration

Contact Information—Ph.D. Program in Business Administration, Carlson School of Management, University of Minnesota, Room 4-201, 321 19th Avenue S., Minneapolis, MN 55455 (612-624-0875 or 612-624-5065; fax 612-624-8221; e-mail ebronson@csom.umn.edu; <http://CarlsonSchool.umn.edu/Csom/Phdprog/Index.html>).

Master of Business Administration—Graduate School students who wish to take M.B.A. courses must contact the Carlson School of Management MBA Office, 2-210 Carlson School of Management, Minneapolis, MN 55455 (612-625-5555; fax 612-626-7785).

Regents' Professor

Edward C. Prescott, Economics and Finance, FM

Professor

Carl R. Adams, Information and Decision Sciences, FM
Dennis A. Ahlburg, Human Resources and Industrial Relations, AM
Gordon J. Alexander, Finance, FM
Amin H. Amershi, Accounting, FM
John C. Anderson, Operations and Management Science, FM
Richard D. Arvey, Human Resources and Industrial Relations, FM
Frederick J. Beier, Marketing and Logistics Management, FM
Lawrence M. Benveniste, Finance, FM
Glen Berryman, Accounting, FM
Mario F. Bognanno, Human Resources and Industrial Relations, FM
Norman E. Bowie, Strategic Management and Organization, FM
John H. Boyd, Finance, FM
Philip Bromiley, Strategic Management and Organization, FM
John M. Bryson, Public Affairs and Strategic Management and Organization, AM
Richard N. Cardozo, Marketing and Logistics Management, FM
Balaji S. Chakravarthy, Strategic Management and Organization, FM
Chun Chang, Finance, FM
Norman L. Chervany, Information and Decision Sciences, FM
Terry L. Childers, Marketing and Logistics Management, FM
Shawn P. Curley, Information and Decision Sciences, FM
Gordon B. Davis, Information and Decision Sciences, FM
John W. Dickhaut, Accounting, FM
W. Bruce Erickson, Strategic Management and Organization, FM
John A. Fossum, Human Resources and Industrial Relations, FM
Joseph Galaskiewicz, Sociology and Strategic Management and Organization, FM
Arthur V. Hill, Operations and Management Science, FM
Thomas R. Hoffman, Information and Decision Sciences, FM
Michael J. Houston, Marketing and Logistics Management, FM
Deborah R. John, Marketing and Logistics Management, FM
George John, Marketing and Logistics Management, FM
Paul E. Johnson, Information and Decision Sciences, FM
Edward J. Joyce, Accounting, FM
Chandra S. Kanodia, Accounting, FM
Robert J. Kauffman, Information and Decision Sciences, FM
Stefanie A. Lenway, Strategic Management and Organization, FM
Ross Levine, Finance, FM
Barbara J. Loken, Marketing and Logistics Management, FM
Ian H. Maitland, Strategic Management and Organization, FM
Salvatore T. March, Information and Decision Sciences, FM
Alfred A. Marcus, Strategic Management and Organization, FM
Joan Meyers-Levy, Marketing and Logistics Management, FM
Christopher J. Nachtsheim, Operations and Management Science, FM
Timothy J. Nantell, Finance, FM
Mary L. Nichols, Strategic Management and Organization, FM
Margaret A. Peteraf, Strategic Management and Organization, FM
Judy D. Rayburn, Accounting, FM
Kenneth J. Roering, Marketing and Logistics Management, FM
Robert W. Ruekert, Marketing and Logistics Management, FM
David E. Runkle, Finance, AM
Roger G. Schroeder, Operations and Management Science, FM
James G. Scoville, Human Resources and Industrial Relations, FM
Shaker B. Srinivasan, Strategic Management and Organization, FM
Andrew H. Van de Ven, Strategic Management and Organization, FM
Orville C. Walker, Marketing and Logistics Management, FM
Jan Werner, Economics and Finance, FM
Andrew F. Whitman, Human Resources and Industrial Relations, FM
Mahmood A. Zaidi, Human Resources and Industrial Relations, FM

Associate Professor

Stuart Albert, Strategic Management and Organization, FM
Ross E. Azevedo, Human Resources and Industrial Relations, FM
Mark E. Bergen, Marketing and Logistics Management, FM
Gordon L. Duke, Accounting, FM
Gordon C. Everest, Information and Decision Sciences, FM
Robert A. Hansen, Marketing and Logistics Management, FM
John J. Mauriel, Strategic Management and Organization, FM
Thomas P. Murtha, Strategic Management and Organization, FM
J. David Naumann, Information and Decision Sciences, FM
Akshay R. Rao, Marketing and Logistics Management, FM
Peter Rosko, Finance, AM
Paul J. Seguin, Finance, FM
Priti P. Shah, Strategic Management and Organization, AM
Kingshuk K. Sinha, Operations and Management Science, FM
Michael R. Taaffe, Operations and Management Science, FM
Andrew Winton, Finance, FM
Akbar Zaheer, Strategic Management and Organization, FM
Srilata Zaheer, Strategic Management and Organization, FM

Assistant Professor

Regina M. Anctil, Accounting, AM
Rajesh Chandy, Marketing and Logistics Management, AM
Alvaro Cuervo-Cazurra, Strategic Management and Organization, AM
Yan Dong, Marketing and Logistics Management, AM

Karen L. Donohue, Operations and Management Science, AM
Daniel Forbes, Strategic Management and Organization, AM
G. Scott Gibson IV, Finance, AM
Ioulia Ioffe, Finance, AM
William W. Li, Operations and Management Science, AM
Kevin Linderman, Operations and Management Science, AM
Debasish Mallick, Operations and Management Science, AM
Susan M. Meyer, Operations and Management Science, AM
Jinsoo Park, Information and Decision Sciences, AM
Valery Polkovnichenko, Finance, AM
Paul Povel, Finance, AM
Baba Prasad, Information and Decision Sciences, AM
Balkrishna Radhakrishna, Accounting, AM
Karen A. Schnatterly, Strategic Management and Organization, AM
Brian P. Shapiro, Accounting, AM
Raj Singh, Finance, AM
Pervin Shroff, Accounting, AM
Andrew Spero, Accounting, AM
Mani R. Subramani, Information and Decision Sciences, AM
Weidong Xia, Information and Decision Sciences, AM
Mary E. Zellmer-Bruhn, Strategic Management and Organization, AM

Coordinator
Frederick R. Jacobs, AM

Lecturer
Gary W. Carter, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—This program offers full-time advanced graduate education for students seeking academic placement at leading universities or research-oriented positions in business or government. The program is for individuals who have the intellectual capacity for advanced study, enjoy independent research and analytical thinking, and who wish to master a discipline within business administration.

Students choose to concentrate in one of six areas of specialization: accounting; finance; information and decision sciences (including the management information systems and decision science subfields); marketing and logistics management; operations and management science; and strategic management and organization (covering the subfields of strategy, organization behavior, entrepreneurship and business-government-society, all of which includes an international focus).

Prerequisites for Admission—Applicants must have completed an undergraduate degree, in any field, and have successfully completed college courses in microeconomics and finite mathematics or calculus. Scores from the GMAT or GRE test taken no more than five years prior to admission must be submitted.

Special Application Requirements—Applicants must submit the Graduate School application, GMAT or GRE scores, TOEFL scores (international applicants), three letters of recommendation, complete official transcripts from each college or university attended, and a clearly written statement of purpose. These materials are to be sent directly to the program office to ensure proper processing. Graduate study begins in fall semester only.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to the approval of the adviser and director of graduate studies.

Courses—Please refer to Accounting (Acct); Business Administration (BA); Business, Government, and Society (BGS); Business Law (BLaw); Entrepreneurship (Entr), Finance (Fina); Information and Decision Sciences (IDSc); Insurance (Ins); Logistics Management (LM); Management (Mgmt); Marketing (Mktg); and Operations and Management Science (OMS) in the course section of this catalog for courses pertaining to the program.

Ph.D. Degree Requirements

Degree requirements vary by area of concentration. Each student's degree coursework is determined in consultation with an adviser, but in general it includes courses in the field of specialization, in research methodology, and in a minor or supporting program.

Accounting—Requires a minimum of 12 credits from accounting Ph.D. seminars. In addition, students take a minimum of 16 credits in a minor area outside the Carlson School of Management, or at least 16 credits in supporting programs taken across relevant fields (minimum of two courses from any one area). Students are expected to supplement these required credits with coursework in fields related to their research interests, e.g., finance, economics, statistics, or psychology, but there is no minimum requirement.

Finance—Students must take all three finance classes (Fina 8801, 8811, 8821), for 12 credits, plus the microeconomics sequence (Econ 8101, 8102, 8103, 8104) for 8 credits. The 8-credit macroeconomics and applied econometrics sequences are also highly recommended. Students should take a minimum of 8 additional elective credits in economics, statistics, accounting, etc.

Information and Decision Sciences—Students are required to take 12 courses over a two-year period (a minimum of 40 credits total). Courses must include IDSc 8511 and 8521, and two experimental design and regression analysis courses (OMS 8651 and 8652 recommended). An additional eight courses can be taken as electives and supporting program courses, with at least two of these being methodology courses.

Marketing and Logistics Management—The department requires students to take its five seminars (total 20 credits) plus a minimum of 12 credits of research methodology courses outside the department. Minor or supporting program coursework is determined by the student and adviser, and must total at least 16 credits.

Operations and Management Science—Students are required to take a minimum of ten courses (approximately 40 credits), including eight OMS Ph.D. courses, Mgmt 8101, and one graduate level course in linear programming (either OMS 8661 or Math 5711). Students should supplement this with at least 16 credits from outside the department for a minor or supporting program.

Strategic Management and Organization—Students are required to take at least five of seven core Ph.D. courses (20 credits), which must include one course from each of three areas (strategy, organization behavior, business-government-society), plus two in the student's area of specialization. The student should take at least five additional classes outside the department (approximately 20 credits) in supporting fields.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—For a doctoral minor, students must complete a cohesive program of at least 16 credits (at least four courses) of graduate work in one of the six areas of concentration. This program of study is developed in consultation with an adviser who is a full member of the graduate faculty in business administration.

Business Taxation

Contact Information—Master of Business Taxation Degree Program, Department of Accounting, University of Minnesota, 3-108 Carlson School of Management, Minneapolis, MN 55455 (612-624-7511; fax 612-626-7795; e-mail mbt@umn.edu; <www.cce.umn.edu/mbt>).

Professor
R. Glen Berryman (emeritus), Accounting and Business Law, AM
W. Bruce Erickson, Strategic Management, AM

Lecturer
Charles Caliendo, AM
Gary W. Carter, AM
Paul G. Gutterman, AM
Frederick R. Jacobs, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—This program helps students acquire a conceptual understanding of taxation and develop technical competence in the practical application of the rules of taxation in business and personal decision making.

Offered only in the evenings, the program accommodates both part-time and full-time students. Historically, more than 80 percent of students are employed in the business community and take courses on a part-time basis. Graduates of the program possess a common body of knowledge in traditional

business areas such as accounting, finance, and marketing. In addition, courses in business, government, and economic tax policy provide breadth to complement the technical tax courses that make up the majority of credits. Students enrolled part time can expect to complete the program in approximately two to three years. Students enrolled full-time can complete the program in a shorter period.

Special Application Requirements— Results of the GMAT or the Law School Admission Test (LSAT) are required. Applicants are considered for admission for fall, spring, and summer terms.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please refer to Accounting (Acct); Business, Government, and Society (BGS); Business Law (BLaw); Finance (Fina); Information and Decision Sciences (IDSc); Insurance (Ins); Logistics Management (LM); Management (Mgmt); Marketing (Mktg); Master of Business Taxation (MBT); and Operations and Management Science (OMS) in the course section of this catalog for courses pertaining to the program.

M.B.T. Plan B Degree Requirements

The M.B.T. requires 30 credits, including 6 credits in specified courses dealing with business and economic tax policy, 10 credits in specified tax courses, and 14 credits of elective tax courses. All students must have completed coursework in finance, marketing, accounting, economics, statistics, management, business law, operations management, information and decision sciences, and strategic management. It is expected that students with business degrees will have few, if any, deficiencies in these areas. Students with deficiencies must make them up before being awarded the degree and may do so while enrolled in program courses.

Final Exam—None.

Language Requirements—None.

Cell and Developmental Biology

See Molecular, Cellular, Developmental Biology and Genetics.

Cellular and Integrative Physiology

Contact Information—Department of Physiology, University of Minnesota, 6-125 Jackson Hall, 321 Church Street S.E., Minneapolis, MN 55455 (612-625-9178; fax 612-625-5149; e-mail katzx001@umn.edu; <http://physiology.med.umn.edu/grad/gc_iidx.htm>).

Additional information concerning the Duluth campus (master's program) is available by contacting the Associate Director of Graduate Studies, Department of Medical and Molecular Physiology, School of Medicine, University of Minnesota, 10 University Drive, Duluth, MN 55812 (218-726-7969; e-mail ehaller@d.umn.edu; <www.d.umn.edu/medweb/phsl/physiology/>).

Professor

Peter B. Bitterman, Medicine, FM
Dwight A. Burkhardt, Psychology, FM
Frank B. Cerra, Surgery, FM
Joseph DiSalvo, Physiology, FM
Timothy J. Ebner, Neuroscience, FM
William C. Engeland, Surgery, FM
John E. Foker, Surgery, FM
Esther M. Gallant, Veterinary Pathobiology, FM
Robert P. Hebbel, Medicine, FM
Lois J. Heller, School of Medicine, Duluth, FM
Paul A. Iaizzo, Anesthesiology, FM
David H. Ingbar, Medicine, FM
Hon Cheung Lee, Pharmacology, FM
Arthur S. Leon, Kinesiology and Leisure Studies, FM
David G. Levitt, Physiology, FM
Walter C. Low, Neurosurgery, FM
Robert F. Miller, Neuroscience, FM
Eric A. Newman, Neuroscience, FM
Scott M. O'Grady, Animal Science, FM
John W. Osborn, Animal Science, FM
Richard E. Poppele, Neuroscience, FM
O. Douglas Wangensteen, Physiology, FM

Associate Professor

W. Dale Branton, Neuroscience, FM
Jurgen F. Fohlmeister, Physiology, FM
Edwin W. Haller, School of Medicine, Duluth, AM
Stephen A. Katz, Physiology, FM
David E. Mohrman, School of Medicine, Duluth, AM
Edward K. Stauffer, School of Medicine, Duluth, AM
LaDora V. Thompson, Physical Medicine and Rehabilitation, FM
Lorentz E. Wittmers, Jr., School of Medicine, Duluth, FM

Assistant Professor

Mustafa N. Al'Absi, School of Medicine, Duluth, AM
Vincent A. Barnett, Physiology, FM
Janet L. Fitzakerley, School of Medicine, Duluth, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Physiology may be defined as the application of mathematics, physics, and chemistry to the study of structure and function in living systems. As such, physiology is a "hybrid" field in which expertise from many other disciplines is ordinarily required and combined.

The program emphasizes a quantitative approach to understanding the functions of cells, organs, and systems in living animals. Ph.D. students take a core concentration that provides a broad background in the physiology of membranes, cells, transport, and organ systems. Individualized programs are structured to build on the student's strengths and to fill in gaps that would otherwise be an impediment to specific problem solving. Teaching experience is also available to all students.

Areas of specialization include cardiovascular, respiratory, membrane and transport processes, cell physiology, and to a limited extent, exercise and gastrointestinal physiology, and endocrinology.

Entering students are expected to take a series of laboratory rotations to familiarize themselves with areas of research active within the degree program. The program offers faculty and corresponding research laboratories from the Department of Physiology and from other departments (or divisions), including medicine, psychology, surgery, neuroscience, neurosurgery, veterinary biology, neurology, anesthesiology, kinesiology, and animal science.

Students enter the Ph.D. program only from the Twin Cities campus, although a Ph.D. may be pursued on the Duluth campus in some circumstances. The Twin Cities Ph.D. program focuses on educating people with previous medical training who are already at the University of Minnesota or are considering the University of Minnesota Medical School for residency or fellowship training. For instance, a surgical resident, a renal or cardiology fellow, or other comparable student may be interested in bundling their required or optional research into a Ph.D. program. Also, people already affiliated with our graduate faculty are encouraged to apply for admission. For instance, appropriate undergraduate students, lab techs, or other people already working in a graduate faculty laboratory may be good candidates for the Ph.D. program. An additional route of admission is application with the aid of a graduate faculty sponsor.

Students enter the M.S. program from one of two sites. On the *Duluth campus*, students can enroll in coursework and participate in research in several basic areas. Students may pursue studies in muscle, cardiovascular, respiratory, and endocrine physiology, as well as in membrane transport, temperature regulation, and several areas of neuroscience.

In addition, the *Twin Cities campus* has started a special masters program that focuses on training people in local private industries who are engaged in relevant physiological projects. For instance, there are persons working in various biotechnology, biomedical and bioengineering companies in the Twin Cities area that are already doing work in physiology, and who may benefit from formal training. The curriculum can be blended into a part-time graduate program,

allowing continued employment in the Twin Cities area while working for the M.S. degree.

Prerequisites for Admission—For the major, an undergraduate degree with at least one year (three quarters or two semesters) of calculus, one year of physics, one year of biology, and two years of chemistry. For the minor, a background in mathematics, physics, chemistry, and biology acceptable to the graduate faculty.

Special Application Requirements—For the Ph.D., applicants must take either the General Test of the GRE or the Medical College Admission Test. For all applicants, three letters of recommendation must be submitted. Admission can be at the start of either fall or spring semester.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to both adviser and director of graduate studies approval. Students from other majors may include such courses subject to their own program's approval.

Courses—Please refer to Physiology (Phsl) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements

Duluth campus: All course requirements for the M.S. degree can be completed on the Duluth campus. Students are expected to fulfill all degree requirements over a period of two to three calendar years. The program includes at least 20 credits in physiology and 6 credits in a minor or related field of study. Incoming students are required to undertake at least two laboratory rotations in faculty research laboratories of their choice. Fulfillment of degree requirements also includes the presentation and defense of a thesis (Plan A). The final written examination and oral defense of the thesis takes place with participation of appropriate faculty from either campus.

Twin Cities campus: A special Plan A degree for individuals involved in research and employed at local companies requires 14 credits in physiology and 6 credits outside of physiology. The degree is based on laboratory research off or on campus, and requires a written thesis and an oral presentation of the work for the final exam. Plan B is primarily for Ph.D. students who, after about two years in the Ph.D. program, cannot or do not wish to complete the Ph.D. program. For Plan B, the final exam is oral.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A minimum of 6 graduate credits in cellular and integrative physiology is required.

Ph.D. Degree Requirements

The Ph.D. program requires courses in medical physiology and human neuroscience. No other specific courses are required, although some graduate level courses in cellular or molecular biology must be completed. The coursework is tailored to the student's interests with input from the director of graduate studies or the adviser. During the first year, students rotate through three laboratories, pick an adviser, and begin a research project. A preliminary written exam in physiology and neuroscience is taken before the preliminary oral exam. The preliminary oral exam is given to test the student's ability to apply principles of both physiology and the minor or supporting program to a proposed research based thesis. A minimum of 12 credits must be completed in the minor field or supporting program.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—Ph.D. students are expected to take Phsl 6101 or the equivalent.

Chemical Engineering and Materials Science and Engineering

Contact Information—Department of Chemical Engineering and Materials Science, University of Minnesota, 151Amundson Hall, 421 Washington Avenue S.E., Minneapolis, MN 55455
(612-625-0382; fax 612-626-7246;
e-mail cemsgrad@umn.edu;
<www.cems.umn.edu/>).

Regents' Professor

Rutherford Aris, (emeritus), FM
H. Ted Davis, Chemistry, FM
L. E. Scriven, FM

Professor

Frank S. Bates, FM
Raul Caretta, FM
Robert W. Carr, Jr., FM
C. Barry Carter, FM
James R. Chelikowsky, FM
Philip I. Cohen, Electrical and Computer Engineering, FM
Edward L. Cussler, FM
John S. Dahler, FM
Jeffrey J. Derby, FM
D. Fennell Evans, FM
Michael C. Flickinger, Biological Process Technology Institute, FM
Arnold G. Fredrickson, FM
Christie J. Geankoplis, FM
William W. Gerberich, FM
Wayne L. Gladfelter, Chemistry, FM
Allen M. Goldman, Physics and Astronomy, FM
J. Woods Halley, Physics and Astronomy, FM
Wei-Shou Hu, FM
Kenneth H. Keller, FM
David L. Kohlstedt, Geology and Geophysics, FM
Timothy P. Lodge, FM
John S. Lowengrub, Mathematics, FM
Christopher W. Macosko, FM
Alon V. McCormick, FM
Wilmer G. Miller, Chemistry, FM
Christopher J. Palmstrom, FM
Dennis L. Polla, Biomedical Engineering, FM
Lanny D. Schmidt, FM
David A. Shores, FM
Ronald A. Siegel, Pharmacy, FM
William H. Smyrl, FM
Friedrich Srienc, FM
Robert T. Tranquillo, FM
Michael D. Ward, FM

Associate Professor

Robert F. Cook, FM
Prodromos Daoutidis, FM
Alfonso Franciosi, FM
Lorraine F. Francis, FM
C. Daniel Frisbie, FM
David J. Odde, Biomedical Engineering, FM
J. Ilja Siepmann, Chemistry FM
Renata M. Wentzcovitch, FM
Kewen Yin, Wood and Paper Science, FM

Assistant Professor

Victor H. Barocas, Biomedical Engineering, FM
Marc A. Hillmyer, Chemistry, FM
Satish Kumar, FM
Christopher Leighton, FM
Richard B. McClurg, FM
David C. Morse, FM

Research Associate

Daniel M. Kroll, Medicinal Chemistry, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Research activities are broadly organized in the areas of: theory and computation; reaction engineering and chemical process synthesis; biotechnology and bioengineering; polymers; ceramics and metals; electronic and magnetic materials; and coating processes and interfacial engineering.

The graduate courses offered cover core areas of chemical engineering (fluid mechanics, applied mathematics: linear and non-linear analysis, transport, chemical thermodynamics, statistical thermodynamics and kinetics, and analysis of chemical reactors) and core areas of materials science (structure and symmetry of materials, thermodynamics and kinetics, electronic properties of materials, and mechanical properties of materials). In addition, several specialized topics are offered including biochemical engineering, biological transport processes, food processing technology, colloids, principles of mass transfer in engineering and biological engineering, rheology, coating process fundamentals, process control, finite elements methods of computer-aided analysis, ceramics, polymers, materials design and performance, materials processing, corrosion, introduction to polymer chemistry, polymer laboratory, contact and fracture properties of materials, electron microscopy, thin films and interfaces, composites, electrochemical engineering, physical chemistry of polymers, solid state reaction kinetics, electronic structure of materials, electronic properties and applications of organic materials, electronic ceramics, dislocations and interfaces, epitaxial thin film growth, and science of porous media.

Prerequisites for Admission—A bachelor's degree in chemical engineering, materials science, metallurgy, ceramics, polymer engineering, chemistry, physics, mechanical engineering, or electrical engineering is required. Applicants may be accepted without this prerequisite, but may be required to complete additional preparatory studies

prescribed by their adviser or the director of graduate studies after admission.

Special Application Requirements— Applicants must submit scores from the General Test of the GRE, three letters of recommendation from persons familiar with their scholarship and research potential, a complete set of official transcripts, and a clearly written statement of career interests, goals, and objectives. International students are required to provide scores of at least 560 on the paper-based or 220 on the computer-based TOEFL. Students may apply at any time; submission of all application materials by January 1 is strongly encouraged to ensure priority consideration for fellowships and assistantships; late applications are considered if space is available.

Research Centers and Facilities, Professional Courses, and Major Collaborating Programs—A number of outstanding interdisciplinary centers supplement the department, including the National Science Foundation Materials Research Science and Engineering Center, the Corrosion Research Center, the Industrial Partnership for Research in Interfacial and Materials Engineering, the Army High Performance Computing Research Center, the Biological Process Technology Institute, the Institute for Theoretical Physics, the Minnesota Supercomputer Institute, the Institute for Mathematics and its Applications, and the Regional Instrumentation Facility for Surface Analysis. Department faculty and students participate in all of these centers, creating powerful facilities and many opportunities to explore interdisciplinary research interests.

Use of 4xxx Courses—Chemical engineering will allow MatS 4214 to be taken for graduate credit. Materials science will allow MatS 4212—Ceramics, 4214—Polymer Physical Properties, MatS 4221—Materials Design and Performance, MatS 4301—Materials Processing, and MatS 4511—Corrosion to be taken for graduate credit. All other ChEn or MatS 4xxx courses must have adviser and director of graduate studies approval.

Courses—Please refer to Chemical Engineering (ChEn) and Materials Science (MatS) in the course section of this catalog for courses pertaining to these programs.

M.Ch.E or M.Mat.S.E. Design Project Degree Requirements

This professional master's in engineering degree is designed for employees of local industries who wish to pursue their studies on a part-time basis. It is intended to provide a fifth year of professional work and is offered under the design project track. No financial support is available from the program. The M.Ch.E. and M.Mat.S.E. are terminal degrees. Only under exceptional circumstances is a student allowed to transfer to an M.S. program.

Both degrees require a minimum of 14 course credits in the major field and a minimum of 6 credits in the minor or related fields. The work-related design project consists of an in-depth study of an engineering design. It need not represent a publishable research project. While the amount of work should be the same as for an M.S. thesis, the project can contain elements that the thesis would not, such as economic considerations, design consultation, and social relevance.

Language Requirements—None.

Final Exam—A final oral exam focused on the design project is required.

Minor Requirements for Students Majoring in Other Fields—Approval of the chemical engineering or materials science director of graduate studies is required for a master's minor.

M.S.Ch.E. and M.S.Mat.S.E. Plan A Degree Requirements

The M.S.Ch.E. and M.S.Mat.S.E. are offered only under Plan A (with thesis). The degrees require a minimum of 14 course credits in the major and a minimum of 6 credits in a minor or in one or more related fields. The program normally is completed in about 18 months.Students interested in a degree without a thesis should consider the professional master's in chemical engineering or materials science degree outlined above.

Many students entering these programs change to the Ph.D. program before or after completing the M.S. degree. Application for a change of status is done in consultation with the adviser and the director of graduate studies.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—Approval of the chemical engineering or materials science director of graduate studies is required for a master's minor.

Ph.D. Degree Requirements

The Ph.D. is primarily a research degree and performance that leads to a research thesis is emphasized. Supporting coursework is planned in consultation with the adviser. The Ph.D. requires a minimum of 21 course credits within the major, and 12 course credits in a minor or supporting program.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—For a minor in chemical engineering or materials science, students must successfully complete at least four of the core graduate courses in the minor program and obtain approval by the director of graduate studies.

Chemical Physics

Contact Information—Chemical Physics Program, Department of Chemistry, University of Minnesota, 137 Smith Hall, 207 Pleasant Street S.E., Minneapolis, MN 55455 (612-626-7444; fax 612-626-7541; e-mail inquiry@chem.umn.edu; <www.chem.umn.edu>).

Regents' Professor

H. Ted Davis, Chemical Engineering and Materials Science, FM

Professor

Victor A. Bloomfield, Biochemistry, FM
Charles E. Campbell, Physics, FM
Barry C. Carter, Chemical Engineering and Materials Science, FM
James R. Chelikowsky, Chemical Engineering and Materials Science, FM
Christopher J. Cramer, Chemistry, FM
John S. Dahler, Chemical Engineering and Materials Science, FM
Jiali Gao, Chemistry, FM
William R. Gentry, Chemistry, FM
Clayton F. Giese, Physics, FM
Allen M. Goldman, Physics, FM
J. Woods Halley, Physics, FM
Cheng-Cher Huang, Physics, FM
Kenneth R. Leopold, Chemistry, FM
Sanford Lipsky, Chemistry, FM
Wilmer G. Miller, Chemistry, FM
Lanny D. Schmidt, Chemical Engineering and Materials Science, FM
David D. Thomas, Biochemistry, FM
Donald G. Truhlar, Chemistry, FM

Associate Professor

David M. Ferguson, Medicinal Chemistry and Pharmacognosy, FM
Doreen G. Leopold, Chemistry, FM
Karin Musier-Forsyth, Chemistry, FM
Jeffrey T. Roberts, Chemistry, FM
J. Ilja Siepmann, Chemistry, FM
Renata M. Wentzcovitch, Chemical Engineering and Materials Science, FM
Xiaoyang Zhu, Chemistry, FM

Assistant Professor

David A. Blank, Chemistry, FM
Richard M. McClurg, Chemical Engineering and Materials Science, FM
David C. Morse, Chemical Engineering and Materials Science, FM
Darrin M. York, Chemistry, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Chemical physics focuses on areas where the techniques of chemistry and physics are brought together for the study of atoms and molecules; their interactions in gases, liquids, and solids; and the detailed structure and dynamics of material changes. Areas of research and specialization include spectroscopy, optical properties, laser applications, molecular collisions, chemical dynamics, quantum mechanics, computational chemistry, statistical mechanics, thermodynamics, low-temperature behavior, polymers and macromolecules, surface science, biochemistry, and biochemical and heterogeneous catalysis.

Prerequisites for Admission—Applicants should have adequate preparation in mathematics, physics, and chemistry. For financial support, applicants should apply either to the Department of Chemistry or the Department of Physics. Applicants not requiring financial support have their academic qualifications reviewed by the director of graduate studies in chemical physics.

Special Application Requirements—Three letters of recommendation are required.

Use of 4xxx Courses—Inclusion of any 4xxx courses on degree program forms is subject to approval by the director of graduate studies.

Courses—Please refer to Chemistry (Chem), Physics (Phys), Chemical Engineering (ChEn), Materials Science (MatS), Mathematics (Math), Chemical Physics (ChPh) and Scientific Computation (SciC) in the course section of this catalog for courses pertaining to the program.

M.S. Plan A Degree Requirements

The M.S. degree is offered Plan A (with thesis) and requires at least 20 course credits and 10 or more thesis credits. The course credits must include at least 6 credits each in chemistry, physics, and quantum mechanics, and at least 3 credits in thermodynamics, statistical mechanics, or statistical physics. There is no minor or related field requirement.

Language Requirements—None.

Final Exam—The final exam is oral.

Ph.D. Degree Requirements

A proficiency exam in physical chemistry is required. The Ph.D. program ordinarily consists of at least 24 course credits that include coursework in chemistry and/or physics with options for coursework in quantum mechanics, thermodynamics, statistical physics, and chemical dynamics. There is no minor or supporting program requirement. Students must also complete 24 thesis credits.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—Ph.D. minor requirements are determined by the director of graduate studies, the student, and the adviser.

Chemistry

Contact Information—Assistant to the Director of Graduate Studies, Department of Chemistry, University of Minnesota, 137 Smith Hall, 207 Pleasant Street S.E., Minneapolis, MN 55455 (612-626-7444 or 1-800-777-2431; fax 612-626-7541; e-mail inquiry@chem.umn.edu; <www.chem.umn.edu>).

Regents' Professor

H. Ted Davis, FM

Professor

George Barany, FM
Bridgette A. Barry, Biochemistry, FM
Frank S. Bates, Chemical Engineering and Materials Science, FM
Victor A. Bloomfield, Biochemistry, FM
Peter W. Carr, FM
Christopher J. Cramer, FM
John E. Ellis, FM
Jiali Gao, FM
Ronald W. Gentry, FM
Wayne L. Gladfelter, FM
Gary R. Gray, FM
Thomas R. Hoye, FM
Steven R. Kass, FM
Kenneth R. Leopold, FM
John D. Lipscomb, Biochemistry, FM
Sanford Lipsky, FM
Timothy P. Lodge, FM
Kent R. Mann, FM
Larry L. Miller, FM
Wayland E. Noland, FM
Louis H. Pignolet, FM
Lawrence Que, Jr., FM
Michael A. Raftery, FM
Marian Stankovich, FM
William B. Tolman, FM
Donald G. Truhlar, FM
Michael D. Ward, Chemical Engineering and Materials Science, FM

Associate Professor

Mark D. Distefano, FM
Craig J. Forsyth, FM
William B. Gleason, Laboratory Medicine and Pathology, FM
Doreen G. Leopold, FM
Karin Musier-Forsyth, FM
Jeffrey T. Roberts, FM
J. Ilja Siepmann, FM
Andreas Stein, FM
Michael R. Zachariah, Mechanical Engineering, FM
Xiaoyang Zhu, FM

Assistant Professor

Edgar A. Arriaga, FM
David A. Blank, FM
Michael T. Bowser, FM
Philippe Bühlmann, FM
Marc A. Hillmyer, FM
Richard Hsung, FM
Kristopher McNeill, FM
George A. O'Doherty, FM
R. Lee Penn, FM
Gianluigi Veglia, FM
Darrin M. York, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Graduate work in the Department of Chemistry is organized into six specialty areas: analytical chemistry, biological chemistry, inorganic chemistry, materials chemistry, organic chemistry, and physical chemistry. Interdisciplinary work is also an option.

Prerequisites for Admission—Applicants must offer the substantial equivalent of the courses in analytical, inorganic, organic, and physical chemistry required of undergraduate majors in the Minnesota chemistry curriculum. They must also have at least one year of college physics plus college mathematics through calculus.

Special Application Requirements—Three letters of recommendation are required for all applications. Scores from General (Aptitude) and Subject (Advanced) Tests of the GRE are required for fellowship consideration and are strongly recommended for all other applicants. International applicants are expected to provide scores of at least 580 on the TOEFL, as well as GRE scores.

Proficiency Examination—Students working toward the M.S. or Ph.D. in chemistry are required to take a set of four proficiency examinations, one each in analytical, inorganic, organic, and physical chemistry. These examinations are taken on entrance; the results are used for guidance. Ph.D. students are expected to satisfy the proficiency requirements in all four fields during their first academic year in residence. M.S. students are expected to pass the proficiency examination in their specialty area during their first academic year in residence.

Use of 4xxx Courses—One of the following courses may be allowed: Chem 4150 or Chem 4701.

Courses—Please refer to Chemistry (Chem) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements

M.S. students are expected to pass the proficiency exam (see above) in their specialty area in their first academic year in residence. Plan A requires 20 course credits and 10 thesis credits; Plan B requires 30 course credits (and one or two Plan B papers).

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—Six course credits from graduate-level chemistry courses are required for a master's minor.

Ph.D. Degree Requirements

The Ph.D. program requires 24 course credits and 24 thesis credits. Students are also required to take four proficiency exams (see above) by the end of their first academic year in residence.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—Ph.D. minor requirements are determined by the director of graduate studies, the student, and the adviser. Chem 4701 may be used.

Child Psychology

Contact Information—Child Psychology Program, University of Minnesota, 156 Child Development Building, 51 East River Road, Minneapolis, MN 55455 (612-624-0526; fax 612-624-6373; <http://icd.coled.umn.edu/>).

See the *College of Education and Human Development Professional Studies Catalog* for information on the master of education (M.Ed.) program in early childhood education.

Regents' Professor
Willard W. Hartup (emeritus), FM

Professor
Dale A. Blyth, 4H Youth Development Center, AM
Patricia J. Bauer, FM
Sandra L. Christenson, Educational Psychology, AM
W. Andrew Collins, FM
Nicki R. Crick, FM
Byron Egeland, FM
Norman Garmezy (emeritus), FM
Michael K. Georgieff, Pediatrics, FM
Harold D. Grotevant, Family Social Science, FM
Megan R. Gunnar, FM
Susan C. Hupp, Educational Psychology, FM
William G. Iacono, Psychology, FM
Gloria R. Leon, Psychology, FM
Michael P. Maratsos, FM
Ann S. Masten, FM
Scott R. McConnell, Educational Psychology, FM
Charles A. Nelson, FM
Anne D. Pick, FM
Herbert L. Pick, Jr., FM
Elsa G. Shapiro, Pediatrics, AM
L. Alan Sroufe, FM
Auke Tellegen, Psychology, FM
Paulus W. van den Broek, Educational Psychology, FM
Richard A. Weinberg, FM
Carolyn L. Williams, Epidemiology, AM
Albert Yonas, FM
Steven R. Yussen, FM

Associate Professor
Carrie M. Borchardt, Psychiatry, AM
Martha Erickson, AM
Maria D. Sera, FM

Assistant Professor
Canan Karatekin, FM
Monica Luciana, Psychology, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The Ph.D. in child psychology focuses primarily on training for research in normal human development, and most students take positions in academic or research settings. The goal of the program is to train all students for careers in research and college teaching in child psychology, and to prepare students in the joint program options for careers in applied areas of child psychology. General program students may choose to specialize in an area such as cognitive neuroscience, language, learning, personality, memory, perception, psychobiology, or social development. Students interested in applied areas may specialize in developmental psychopathology and clinical science or school psychology.

The developmental psychopathology and clinical science program is a cooperative effort between the Institute of Child Development and the Department of Psychology to train leaders in research and teaching. Training draws on the unique strengths of each program. Students are admitted to the Ph.D. program in child psychology through the Institute of Child Development and to this joint training program by the agreement of program faculty in both departments.

The APA-approved school psychology program is a cooperative program of the Institute of Child Development, the Department of Psychology, and the Department of Educational Psychology. Students are admitted jointly to one of the cooperating departments and to the school psychology program. Students must meet the standards and requirements of both the admitting department and the school psychology program.

Prerequisites for Admission—At least 8 semester credits in psychology and one course in statistics are required.

Special Application Requirements—New students are normally admitted in fall semester. Application deadline is in December of the preceding year. Applicants must submit scores from the General Test of the GRE that are less than five years old, three letters of recommendation from persons familiar with their scholarship and research potential, a complete set of official transcripts, a clearly written statement of career interests, goals, and objectives. The three letters of recommendation also must be received by the deadline.

Use of 4xxx Courses—Inclusion of 4xxx child psychology courses on degree program forms is approved with the following stipulations: child psychology Ph.D. students may include 4xxx courses as part of a supporting program with director of graduate studies' approval and if the course is taught by a member of the graduate faculty in the supporting program. Students from other majors may include 4xxx CPsy courses subject to their own program's approval.

Courses—Please refer to Child Psychology (CPsy) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements
The Institute of Child Development does not offer *admission* for a master's degree. On occasion, students complete a master's degree (typically Plan B) during their progress toward the Ph.D. Requirements for the M.A. are met through either Plan A or Plan B. Both require a full academic year of coursework.

Plan A requires a minimum of 20 course credits (a minimum of 14 in the major and 6 in the minor/related field) and 10 thesis credits.

Plan B requires 30 course credits, of which 14 credits must be in child psychology and 6 credits in one or more related fields. A project equivalent to 120 hours of work (may be satisfied by completing a first-year project) is also required.

Language Requirements—None.

Final Exam—The final exam for Plan A is oral; the final exam for Plan B is written.

Ph.D. Degree Requirements
The Ph.D. degree usually requires four years of graduate work. Major program components include coursework, research activities, and teaching experience. Coursework requirements are specialization specific, but all students are required to take 44 credits in the major, 14 credits in a supporting program, and 24 thesis credits. Each student specializes in an area such as social and personality development, learning, cognitive development, cognitive neuroscience, language development, psychobiology or perceptual development. Required courses include CPsy 8301, 8302, 8304, 8311, 8321, 8360, 8888, 8994, and statistics through EPsy 8263 or equivalent.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A Ph.D. minor requires 12 credits in child psychology, to include CPsy 8301 (4 credits), CPsy 8302 (4 credits), and CPsy 8996 (1-6 credits). Remaining credits can be taken from 4xxx (subject to their own program's approval) or 8xxx courses.

Chinese

See Asian Languages and Literatures.

Civil Engineering

Contact Information—Department of Civil Engineering, University of Minnesota, 122 Civil Engineering Building, 500 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-625-5522; fax 612-626-7750; e-mail gradsec@ce.umn.edu; <www.ce.umn.edu>).

Professor
Roger E. A. Arndt, FM
Patrick L. Brezonik, FM
Steven L. Crouch, FM
Emmanuel M. Detournay, FM
Andrew Drescher, FM
Efi Foufoula-Georgiou, FM
Catherine E. French, FM
Theodore V. Galambos, FM
John S. Gulliver, FM
Panos Michalopoulos, FM
John L. Nieber, Biosystems and Agricultural Engineering, FM
Gary Parker, FM
Michael J. Semmens, FM
Charles C. S. Song, FM
Heinz G. Stefan, FM
Henryk K. Stolarski, FM
Otto D. L. Strack, FM
Vaughan R. Voller, FM

Adjunct Professor
Peter A. Cundall, FM

Associate Professor
Randal J. Barnes, FM
Gary A. Davis, FM
Robert J. Dexter, FM
Jerome F. Hajjar, FM
Miki Hondzo, FM
Gerald W. Johnson, AM
Joseph F. Labuz, FM
Arturo E. Schultz, FM
Carol K. Shield, FM
Karl A. Smith, FM

Associate Adjunct Professor
Paul D. Capel, AM

Assistant Professor
William A. Arnold, FM
Bojan B. Guzina, FM
Raymond M. Hozalski, FM
Timothy M. LaPara, FM
David M. Levinson, FM
Mihai O. Marasteanu, FM
Paige J. Novak, FM
Fernando Porté-Agel, FM

Assistant Adjunct Professor
Eil Kwon, AM

Senior Research Associate
Sofia G. Mogilevskaya, AM
Eugene L. Skok Jr., AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Emphases are available in environmental engineering (e.g. pollutant fate and transport, process modeling, soil and groundwater remediation, water and wastewater treatment), geomechanics engineering (e.g. fracture and localization, groundwater flow, stability and liquefaction, wave and shock propagation), structural engineering (e.g. computational and structural mechanics, earthquake engineering, infrastructure performance and durability, new systems and materials), transportation engineering (e.g. intelligent transportation systems, pavement design and materials, transportation economics), and water resources engineering (e.g. earthscape processes, environmental and biological systems, hydrologic and climate dynamics, hydrodynamics, and turbulence.)

Prerequisites for Admission—A bachelor's degree in an engineering, basic science, or mathematics program is preferred. Admission depends primarily on the applicant's academic record and letters of recommendation. Applicants who lack civil engineering training are often required to complete one or more appropriate courses from the undergraduate civil engineering program. Graduate credit is not awarded for such preparatory work. For the M.C.E. program, an ABET-accredited bachelor's degree in civil engineering is required.

Special Application Requirements—Applicants are required to submit results of the GRE in support of their applications. The TOEFL is required of foreign applicants from non-English-speaking countries. A minimum TOEFL score of 550 is required for admission. Applicants who take the computer-based TOEFL are required to have a score of 213. Admission requirements also include three letters of recommendation and a statement of purpose that outlines the prospective student's research interests, reasons for pursuing graduate studies, and career plans after graduation. Students are admitted each semester, but applicants are strongly encouraged to submit their applications by December 31 in order to begin the following fall semester.

Use of 4xxx Courses—Inclusion of 4xxx departmental courses is subject to adviser and director of graduate studies approval. Students from other majors may include such courses subject to their own program's approval.

Course—Please refer to Civil Engineering (CE) in the course section of this catalog for courses pertaining to the program.

M.C.E. Coursework Only and Design Project Degree Requirements

The master of civil engineering (M.C.E.) degree is designed for the practicing engineer who would like to obtain an advanced degree on a part-time or full-time basis. Students who intend to proceed to the Ph.D. program or think they may later wish to be admitted to the Ph.D. program should apply for the master of science program.

Students are expected to follow a coherent program of coursework in one of the following subareas of civil engineering: environmental, geomechanics , structural, transportation, or water resources engineering. The program is selected with the help of a faculty adviser and approved by the director of graduate studies. In addition to completing graduate level courses, students must demonstrate professional competence either by carrying out and defending a design project or by taking a coursework-related final oral exam (without a project). The degree typically takes 12 to 18 months to complete on a full-time basis.

The M.C.E. degree requires 30 credits and is offered under two plans. One requires a minimum of 20 course credits and preparation of a design project (10 credits); the design project must be carried out by the student in consultation with a faculty adviser. The other plan is a coursework-only degree program and requires 30 course credits. At least 6 of the course credits must be taken outside the department for either plan.

Language Requirements—None.

Final Exam—A final oral exam is required of all M.C.E. candidates.

Minor Requirements for Students Majoring in Other Fields—For a master's minor, two or more 5xxx or 8xxx courses from the same subarea of civil engineering is required, for a total of 6 or more credits.

M.S. Degree Requirements

The master of science (M.S.) degree balances education in engineering fundamentals and design with research and development. The M.S. degree provides preparation for students wishing to pursue a career in industry or to continue studies toward a Ph.D. degree. Students are expected to follow a coherent program of coursework and research in one of the following subareas: environmental, geomechanics, structural, transportation, or water resources engineering. The program is selected with the help of a faculty adviser and approved by the director of graduate studies and typically takes 18 to 24 months to complete.

The M.S. degree requires 30 credits and is offered under two plans. Plan A emphasizes research and preparation of a thesis and Plan B emphasizes coursework. The thesis must be written on a research project carried out in consultation with a faculty adviser and should result in a scientific or technical contribution to the field. Under Plan B, the student must demonstrate the ability to work independently and present the results of such work effectively by completing one to three Plan B papers as determined by the faculty adviser. A wide variety of studies have been submitted as Plan B papers, including computer programs, annotated bibliographies, field or laboratory investigations, and the analysis/design of special engineering problems. Plan A requires 20 course credits and 10 thesis credits. Plan B requires 30 course credits. At least 6 of the course credits must be taken outside the department for either Plan A or Plan B.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—For a master's minor, two or more 5xxx or 8xxx courses from the same subarea of civil engineering are required, for a total of 6 or more credits.

Ph.D. Degree Requirements

The Ph.D. degree couples independent research with coursework in a comprehensive program for those wishing to attain mastery of their field. The Ph.D. degree demands the ability and desire to pursue independent and original studies and can be earned with emphasis in environmental, geomechanics, structural, transportation, or water resources engineering. Research performance, as judged by preparation of a dissertation on an independently pursued research topic, is the primary requirement for the Ph.D. degree. Students enter the Ph.D. program normally after completing the M.S. degree. The Ph.D. program is typically completed in five to six years following the bachelor's degree.

Each program of study is designed in consultation with a faculty adviser to meet the special needs of the student, although programs must be approved by the director of graduate studies. A typical program consists of 45 credits of coursework beyond the

bachelor's degree, plus 24 thesis credits. A supporting program or minor consisting of at least 12 credits taken outside the department must be included. Credits earned in an M.S. program may be presented in partial fulfillment of the Ph.D. requirements. Rigid requirements for the number of 8xxx courses appropriate for Ph.D. programs have not been set, nonetheless, the Ph.D. represents the highest level of scholarly achievement and coursework should be selected accordingly.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—For a Ph.D. minor, four or more 5xxx to 8xxx courses from one or two subareas of civil engineering are required for a total of 12 or more credits.

Classical and Near Eastern Studies

Contact Information—Department of Classical and Near Eastern Studies, University of Minnesota, 305 Folwell Hall, 9 pleasant St. S.E., Minneapolis, MN 55455 (612-625-5353; fax 612-624-4894; e-mail cnes@umn.edu; <http://cnes.cla.umn.edu/>).

Professor

Elizabeth Belfiore, Ancient and Medieval Art and Archaeology, Classics, Classical and Near Eastern Studies, FM
Frederick Cooper, Ancient and Medieval Art and Archaeology, FM
Sheila McNally, Ancient and Medieval Art and Archaeology, FM
S. Douglas Olson, Classics, Classical and Near Eastern Studies, FM

Associate Professor

Andrea Berlin, Ancient and Medieval Art and Archaeology, Classical and Near Eastern Studies, AM
Nita Krevans, Ancient and Medieval Art and Archaeology, Classics, Classical and Near Eastern Studies, AM
Bernard Levinson, Classics, Classical and Near Eastern Studies, FM
William Malandra, Classics, Classical and Near Eastern Studies, FM
Oliver Nicholson, Ancient and Medieval Art and Archaeology, Classics, Classical and Near Eastern Studies, FM
Jonathan Paradise, Ancient and Medieval Art and Archaeology, Classical and Near Eastern Studies, FM
Philip Sellew, Ancient and Medieval Art and Archaeology, Classical and Near Eastern Studies, FM
George Sheets, Ancient and Medieval Art and Archaeology, Classics, Classical and Near Eastern Studies, FM

Assistant Professor

Andre Lardinois, Classics, Classical and Near Eastern Studies, AM
Christopher Nappa, Classics, Classical and Near Eastern Studies, AM
Eva Von Dassow, Ancient and Medieval Art and Archaeology, Classics, Classical and Near Eastern Studies, AM
Azzan Yadin, Ancient and Medieval Art and Archaeology, Classics, Classical and Near Eastern Studies, AM

Adjunct Professor

Thomas Clayton, English, Ancient and Medieval Art and Archaeology, FM
Sandra Peterson, Philosophy, Ancient and Medieval Art and Archaeology, FM
Theofanis G. Stavrou, History, Ancient and Medieval Art and Archaeology, FM
Peter Wells, Anthropology, Ancient and Medieval Art and Archaeology, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—In addition to classical Greek and Latin literary studies, flexible degree programs permit minors or supporting programs in other disciplinary areas such as archaeology, linguistics, modern Greek and Hellenic studies, Medieval and Renaissance Latin, philosophy, and religious studies. The art and archaeology degree includes a variety of programs ranging broadly over ancient and medieval periods, with flexible emphases on languages and textual studies. While full faculty participation from a wide variety of fields provides differing coursework, all students take a common core of courses to promote optimum collegiality and intellectual exchange. Related special facilities include the Center for Medieval Studies and the Center for Modern Greek Studies.

Prerequisites for Admission—Prerequisites for admission without restrictions to majors in classics or classical and Near Eastern studies include sufficient knowledge to begin graduate reading courses in either Greek or Latin and at least intermediate ability in the other language. For a major in ancient and medieval art and archaeology, a background in archaeology, art history, and history sufficient for beginning graduate level studies, and evidence of language acquisition ability are required for admission without restrictions. Some course prerequisites can be made up on provisional admission.

Applications from students with undergraduate majors are welcomed in such fields as English, history, Greek and Latin, Near Eastern languages, philosophy, comparative literature, anthropology, theatre, religious studies, art history, political science, the modern languages, and linguistics.

Special Application Requirements—Applicants must send the following directly to the Department of Classical and Near Eastern Studies: copy of transcripts; copy of the GRE; three letters of recommendation from persons well acquainted with their academic work and professional experience; and a two-page statement describing previous experience and academic training as related to the intended course of study and professional goals; and for non-native speakers of English a copy of TOEFL. Students may be admitted in any academic term, but financial assistance is normally available only to applicants admitted in fall semester (deadline: January 15).

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to prior approval by the adviser and director of graduate studies.

Courses—Please refer to Akkadian (Akka), Ancient Near Eastern (ANE), Aramaic (Arm), Classics (Clas), Greek (Grk), Hebrew (Hebr), Latin (Lat), Religions in Antiquity (RelA), and Sumerian (Sum) in the course section of this catalog for courses pertaining to the program.

Ancient and Medieval Art and Archaeology

M.A. Degree Requirements

The art and archaeology degree includes a variety of programs ranging broadly over ancient and medieval periods. While these programs concentrate on both art historical and archaeological approaches, they have flexible emphases in languages and textual studies. Students take a common core of courses.

This program includes not only core courses and seminars in the Department of Classical and Near Eastern Studies, but also work in related fields in this and other departments. It is offered in cooperation with the Department of Art History, and the Center for Medieval Studies. The minimum requirement for Plan A is 38 credits (including 10 thesis credits), and for Plan B, 32 credits (including directed study registrations for the Plan B papers).

Language Requirements—For the M.A. degree, reading knowledge of one modern foreign language appropriate to the student's program is required (normally German or French).

Final Exam—The final exams are written and oral.

Minor Requirements for Students Majoring in Other Fields—Students must complete Clas 5794, as well as 9 credits in graduate art/archaeology courses with a Clas designator.

Ph.D. Degree Requirements

The art and archaeology degree includes a variety of programs ranging broadly over ancient and medieval periods, with flexible emphases in languages and textual studies. Students take a common core of courses. At the Ph.D. level, the four foci are art and archaeology, an ancient textual component, a complementary area (e.g., history, geology, anthropology), and a special (elective) topic.

This program includes not only core courses and seminars in the Department of Classical and Near Eastern Studies, but also work in related fields in this or other departments. It is offered in cooperation with the Department of Art History, and the Center for Medieval Studies. An extensive supporting program in *either* art history *or* classical studies is required. Students who continue from the M.A. program may apply those credits toward the degree, and students entering with an M.A. can usually receive credit for some

earlier coursework, subject to director of graduate studies approval and graduate school requirements. A typical Ph.D. program is 71 credits, including at least 21 credits in the major, 12 in the supporting program, and 24 thesis credits.

Language Requirements—Reading proficiency in German and in a second modern research language as appropriate (usually French), and research knowledge of an ancient language as demonstrated by satisfactory performance in a graduate-level reading course is required.

Minor Requirements for Students Majoring in Other Fields—Students must complete Clas 5794, as well as 12 credits in graduate art/archaeology courses with a Clas designator.

Classics

M.A. Degree Requirements

This program provides students with a broad background in the literature of ancient Greece and Rome in its cultural context. Extensive work in both Greek and Latin is supplemented with courses in history, archaeology, or religion.

The program requires nearly equal emphasis on courses and seminars in Greek and in Latin, as well as supporting work in related fields. The minimum requirement for Plan A is 47 credits (including 10 thesis credits), and for Plan B, 41 credits (including directed study registrations for the Plan B papers).

Language Requirements—One modern research language as appropriate (normally French or German) and proficiency in reading Greek and Latin as certified by a department exam on previously unseen passages is required.

Final Exam—The final exams are written and oral.

Minor Requirements for Students Majoring in Other Fields—Students must complete Clas 5794, as well as 6 credits in graduate Latin courses, excluding Lat 8120, and 6 credits in graduate Greek courses, excluding Grk 8120.

Ph.D. Degree Requirements

This program requires extensive advanced work in both Latin and Greek, together with interdisciplinary studies in fields such as archaeology, history, and religion, to provide a comprehensive understanding of the ancient world.

The program requires nearly equal emphasis on courses and seminars in Greek and in Latin, as well as supporting work in related fields. Students must take at least three seminars in the major and a two-semester sequence in ancient history, in addition to fulfilling all course requirements specified for the M.A. Students who continue from the M.A. program may apply those credits toward the degree, and students entering with an M.A. can usually receive credit for some earlier coursework, subject to director of graduate studies approval and graduate school requirements. A typical Ph.D. program is 77 credits, including at least 35 credits in the major, 12 in the supporting program, and 24 thesis credits.

Language Requirements—German, plus another modern language, preferably French, and proficiency in reading Greek and Latin as demonstrated by a department exam on previously unseen passages is required.

Minor Requirements for Students Majoring in Other Fields—Students must complete Clas 5794, as well as 9 graduate credits of Greek (excluding Grk 8120) and 9 graduate credits of Latin (excluding Lat 8120).

Classical and Near Eastern Studies

Greek Track

M.A. Degree Requirements

A core of advanced work in Greek is supplemented by a minor or a supporting program in another field such as archaeology, linguistics, modern Greek studies, philosophy, and religious studies. The minimum requirement for Plan A is 47 credits (including 10 thesis credits), and for Plan B, 41 credits (including directed study registration for Plan B papers).

Language Requirements—One modern research language as appropriate, preferably French or German, is required.

Final Exam—The final exams are written (Greek reading proficiency) and oral (general).

Minor Requirements for Students Majoring in Other Fields—Students must complete Clas 5794, as well as 9 graduate credits of Greek (excluding Grk 8120).

Ph.D. Degree Requirements

Extensive advanced coursework in Greek is combined with a minor or a rigorous supporting program in another field such as archaeology, linguistics, modern Greek studies, philosophy, or religion. Students must take at least three seminars in the major and a two-semester sequence of ancient history in addition to completing all M.A. course requirements. Students who continue from the M.A. program may apply those credits toward the degree, and students entering with an M.A. can usually receive credit for some earlier coursework, subject to director of graduate studies approval and graduate school requirements. A typical Ph.D. program is 77 credits, including at least 15 credits in Greek, 15 credits in the supporting program, and 24 thesis credits.

Language Requirements—German and a second modern language, preferably French, and reading proficiency in ancient Greek as demonstrated by a department exam on previously unseen passages is required.

Minor Requirements for Students Majoring in Other Fields—Students must complete Clas 5794, as well as 15 graduate credits in Greek (excluding Grk 8120).

Latin Track

M.A. Degree Requirements

A core of advanced work in Latin is supplemented by a minor or a supporting program in another field such as archaeology, linguistics, medieval studies, and religious studies. The minimum requirement for Plan A is 47 credits (including 10 thesis credits), and for Plan B, 41 credits (including directed study registration for Plan B papers).

Language Requirements—One modern research language as appropriate, preferably German or French, and reading proficiency in Latin as demonstrated by a department exam on previously unseen passages is required.

Final Exam—The final exams are written (language) and oral (general).

Minor Requirements for Students Majoring in Other Fields—Students must complete Clas 5794, as well as 9 graduate credits of Latin (excluding Lat 8120).

Ph.D. Degree Requirements

A series of advanced courses in Latin are combined with a minor or a rigorous supporting program in another field such as archaeology, linguistics, medieval studies, oral performance, or religious studies. Students must take at least three seminars in the major and a two-semester sequence in ancient history, in addition to completing all M.A. course requirements. Students who continue from the M.A. program may apply those credits towards the degree, and students entering with an M.A. can usually receive credit for some earlier coursework, subject to director of graduate studies approval and Graduate School requirements. A typical Ph.D. program is 77 credits, including at least 15 credits in Latin, 15 credits in the supporting program, and 24 thesis credits.

Language Requirements—German and a second modern research language, preferably French, and reading proficiency in Latin as demonstrated by a department exam on previously unseen passages is required.

Minor Requirements for Students Majoring in Other Fields—Students must complete Clas 5794 and 15 graduate credits of Latin (excluding Lat 8120).

Religions in Antiquity Track

M.A. Degree Requirements

The religions in antiquity track is fundamentally comparative in both method and content. Although students may focus on a particular religious tradition, they will nonetheless study several ancient religions. The Plan B requires 26 credits in the major plus 9 credits in related field. The Plan A requires 22 credits in the major, 9 credits in related field, plus 10 thesis credits.

Language Requirements—Proficiency in one modern language (normally German) and M.A.-level proficiency in at least one ancient language is required.

Final Exam—The final exam is oral.

Minor for Students Majoring in Other Fields—Not offered.

Classics

See Classical and Near Eastern Studies.

Clinical Laboratory Science

Contact Information—Clinical Laboratory Science Program, Department of Laboratory Medicine and Pathology, University of Minnesota Medical School, MMC 609, 420 Delaware Street S.E., Minneapolis, MN 55455 (612-625-8952; fax 612-625-5901; e-mail cls@umn.edu; <http://pathology.umn.edu/simplehome.htm>).

Professor

Fred S. Apple, Laboratory Medicine and Pathology, AM
Henry H. Balfour, Jr., Laboratory Medicine and Pathology, AM
Paul P. Cleary, Microbiology, AM
Agustin P. Dalmasso, Laboratory Medicine and Pathology, AM
Gary M. Dunny, Microbiology, AM
John H. Eckfeldt, Laboratory Medicine and Pathology, AM
Stanley L. Erlandsen, Cell Biology and Neuroanatomy, AM
Patricia Ferrieri, Laboratory Medicine and Pathology, AM
Robert P. Hebbel, Medicine, AM
Stephen S. Hecht, Laboratory Medicine and Pathology, AM
Marc K. Jenkins, Microbiology, AM
Russell C. Johnson, Microbiology, AM
John H. Kersey, Laboratory Medicine and Pathology, AM
Tucker W. LeBien, Laboratory Medicine and Pathology, AM
J. Jeffrey McCullough, Laboratory Medicine and Pathology, AM
R. Scott McIvor, Laboratory Medicine and Pathology, AM
Gary L. Nelsestuen, Biochemistry, AM
Harry T. Orr, Laboratory Medicine and Pathology, AM
Peter G. W. Plagemann, Microbiology, AM
Gundu H. R. Rao, Laboratory Medicine and Pathology, AM
Michael Y. Tsai, Laboratory Medicine and Pathology, AM
Daniel A. Vallera, Therapeutic Radiology, AM
Catherine M. Verfaillie, Medicine, AM
Carol L. Wells, Laboratory Medicine and Pathology, AM

Associate Professor

Ronald R. W. Jemmerson, Microbiology, AM
Vivek Kapur, Veterinary Pathobiology, AM
Ronald C. McGlennen, Laboratory Medicine and Pathology, AM
Phuong L. Nguyen, Laboratory Medicine and Pathology, AM
Miriam Segall, Laboratory Medicine and Pathology, AM
Amy P. Skubitz, Laboratory Medicine and Pathology, AM
William R. Swaim, Laboratory Medicine and Pathology, AM
Michael J. Wilson, Laboratory Medicine and Pathology, AM

Assistant Professor

Scott R. Burger, Laboratory Medicine and Pathology, AM
Charles P. Cartwright, Laboratory Medicine and Pathology, AM
Angela Panoskaltsis-Mortari, Pediatrics, AM

Instructor

Elizabeth G. Ingulli, Pediatrics, AM

Research Associate

Connie J. Gebhart, Research Animal Resources, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—This program offers students with basic science or medical technology backgrounds the opportunity to gain competence in a specialized area of laboratory medicine. It provides training in the research, supervisory, and teaching aspects of the field. Students pursue investigative work in one of five specialty areas: chemistry, genetics, hematology, immunology, and microbiology.

Prerequisites for Admission—A bachelor's degree in a basic science or in medical technology, including standard college courses in organic/inorganic chemistry, biochemistry, quantitative analysis, physics, and mathematics, is required. Previous laboratory experience is desirable.

Special Application Requirements—Applicants must forward to the Department of Laboratory Medicine and Pathology three letters of recommendation, an autobiographical outline that includes a statement of career goals, and scores from the General Test of the GRE. A minimum score of 550 on the TOEFL is required for applicants whose native language is not English.

Use of 4xxx Courses—The program accepts MedT 4xxx courses when cross-listed with CLS 5xxx courses and approved by the adviser and/or director of graduate studies, (e.g. CLS 5102—Principles of Diagnostic Microbiology, CLS 5251—Hematology I: Basic Techniques, CLS 5310 and 5311—Clinical Chemistry I and II: Lecture and Lab). However, credit will not be granted if the MedT equivalent of these CLS courses was taken as part of an undergraduate degree.

Courses—Please see Clinical Laboratory Science (CLS) for courses pertaining to the program.

M.S. Plan A Degree Requirements

The M.S. is a multidisciplinary program that prepares the medical technologist or basic science undergraduate for a career in research, teaching, or industry within a specialized area of laboratory medicine. Students pursue investigative work in one of five specialty areas: clinical chemistry, genetics/molecular genetics, hematology, immunology, or microbiology. Each area has required courses, but flexibility is maintained to allow students to choose some coursework that meets individual requirements and research interests.

Requirements include at least 17 credits in the specialty area, at least 6 credits in a minor or in related fields outside the specialty area, 10 thesis credits, and 2 student seminar credits.

Language Requirements—None.

Final Exam—The final exam is oral.

Clinical Research

Contact Information—Student Services Center, School of Public Health, University of Minnesota, MMC 819, 420 Delaware Street S.E., Minneapolis, MN 55455 (612-626-3500; fax 612-626-6931; e-mail sph-ssc@umn.edu; <www.epi.umn.edu/epi_pages/academic/ms_cr.html>).

Professor

Linda H. Bearinger, Nursing, AM
David M. Brown, Laboratory Medicine and Pathology, AM
James C. Cloyd III, Pharmacy Practice, AM
John H. Eckfeldt, Laboratory Medicine and Pathology, AM
G. Scott Giebink, Pediatrics, AM
Stephen P. Glasser, Epidemiology, AM
Richard H. Grimm, Medicine, AM
Joseph T. Hanlon, Health Services Research and Policy, AM
Dorothy Hatsukami, Psychiatry, AM
Robert P. Hebbel, Medicine, AM
Marshall I. Hertz, Medicine, AM
Thomas H. Hostetter, Medicine, AM
Jeffrey P. Kahn, Health Services Research and Policy, AM
Richard A. King, Pediatrics, AM
Russell V. Luepker, Epidemiology, AM
Nicole Lurie, Medicine, AM
Jeffrey McCullough, Laboratory Medicine and Pathology, AM
James H. Moller, Pediatrics, AM
Jim D. Neaton, Biostatistics, AM
Mark S. Paller, Medicine, AM
Bruce A. Peterson, Medicine, AM
Bruce L. Pihlstrom, Preventive Sciences, AM
Norma K. Ramsay, Pediatrics, AM
Leslie L. Robison, Pediatrics, AM
Hanna B. Rubins, Medicine, AM
Charles Schachtele, Oral Sciences, AM
Harvey L. Sharp, Pediatrics, AM
John E. Wagner, Pediatrics, AM
Daniel J. Weisdorf, Medicine, AM

Associate Professor

Gregory J. Beilman, Surgery, AM
Donna Z. Bliss, Nursing, AM
Stella M. Davies, Pediatrics, AM
Kristine E. Ensrud, Medicine, AM
Martin L. Freeman, Medicine, AM
Timothy D. Henry, Medicine, AM
James E. Hinrichs, Preventive Sciences, AM
Nigel S. Key, Medicine, AM
Tom W. Korioth, Oral Sciences, AM
Bryan S. Michalowicz, Preventive Sciences, AM
Antoinette Moran, Pediatrics, AM
Eric L. Schiffman, Diagnostic/Surgical Sciences, AM
Elizabeth R. Seaquist, Medicine, AM
John William Thomas, Biostatistics, AM

Assistant Professor

Edward W. Greeno, Medicine, AM
Gary H. Hildebrandt, Continuing Dental Education, AM
Karen L. Margolis, Medicine, AM
Timothy W. Schacker, Medicine, AM

Senior Research Associate

James S. Hodges, Biostatistics, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—This interdisciplinary program trains health professionals to design, implement, and manage research in clinical populations. Because the field is fast becoming more complex, sophisticated, and regulated, there is an emerging recognition of, and demand for, formalized training. This program focuses primarily on patient-oriented health research including mechanisms of human disease, therapeutic interventions, clinical trials, and development of new techniques. It focuses less on epidemiologic and behavioral studies, or on outcomes research and health services research; students interested in these areas might better be served by seeking a master of public health (M.P.H.) degree.

Prerequisites for Admission—The program is designed for individuals interested in a research career in academia, industry, research institutes, health agencies, or regulatory agencies. Applicants must have an advanced health professional degree such as M.D., D.D.S., D.V.M., Pharm.D., Ph.D., or advanced doctoral degree in a clinical biomedical field; or advanced nursing degree (e.g., M.S. in nursing, M.S.N., or nurse practitioner). Students must have completed or be at an advanced stage of their clinical practice training. The admissions committee will consider exceptions.

Special Application Requirements—In addition to the School of Public Health requirements listed in their catalog, the M.S. has specific application requirements including a health science professional degree, and training sufficient to be eligible for a license to practice as supported in the form of an official transcript. An official TOEFL score of at least 600 (written) or 250 (computer) is required of international students who have earned all of their degrees from non-native English speaking countries. There are three exceptions: 1) if you have taken and successfully passed the ECFMG or USMLE exams, you do not need to submit a TOEFL score; 2) University of Minnesota Medical Fellows or Medical Fellow Specialists who have taken at least 24 credits as part of their University fellowship will be exempt from providing an official TOEFL score if they provide a transcript of these credits; 3) The MELAB is an alternative exam to the TOEFL. The GRE is not required. One of the three required recommendation letters (and completed School of Public Health Recommendation Form) should be from the clinical director of training supporting the applicant's potential as a clinical researcher. Note: if you are a faculty member at the University of Minnesota above the rank of instructor, there are additional administrative procedures required by the Graduate School. Contact the Graduate School Admissions Office early in the process.

Use of 4xxx Courses—Inclusion of any 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please refer to the Clinical Research curriculum sheet available on the School of Public Health Web site at <www.sph.umn.edu/ssc/App_Info/CR.pdf> for courses pertaining to the program.

M.S. Plan A Requirements

The M.S. requires 38 credits, including 2 elective credits and 10 thesis credits. Coursework in biostatistics, epidemiology, clinical trials, data collection, grant writing, and ethics is provided. Elective courses are chosen in consultation with an adviser. The thesis may take the form of any approved clinical research project in which the student is involved in the design, implementation, and analysis.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—Requirements for a minor are under development. Contact the director of graduate studies for information on the status of the minor program.

Cognitive Science

Contact Information—Center for Cognitive Sciences, University of Minnesota, 205 Elliott Hall, 75 East River Road, Minneapolis, MN 55455 (612-625-9367; fax 612-626-7253; e-mail ccs@cogsci.umn.edu; <http://cogsci.umn.edu/>).

Professor

Patricia J. Bauer, Child Development, E
Paul W. Fox, Psychology, E
Maria Gini, Computer Science, E
Jeanette K. Gundel, Linguistics and Asian and Slavic Languages and Literatures, E
Keith Gunderson, Philosophy, E
Paul E. Johnson, Information and Decision Sciences, E
Michael B. Kac, Philosophy, E
Daniel J. Kersten, Psychology, E
Gordon E. Legge, Psychology, E
Charles A. Nelson, Child Development, E
J. Bruce Overmier, Psychology, E
Herbert L. Pick, Jr., Child Development, E
C. Wade Savage, Philosophy, E
James R. Slagle, Computer Science, E
Joseph P. Stemberger, Communication Disorders, E
Paulus W. van den Broek, E
Albert Yonas, Child Development, E

Associate Professor

Charles R. Fletcher, Psychology, E
Maria D. Sera, Child Development, E

Clinical Associate Professor

Mary Jo Nissen, Psychology, E

Curriculum—Cognitive science is a field of inquiry at the interface of cognitive psychology, computer science, linguistics, neuroscience, and philosophy. Cognitive science is concerned with the acquisition, representation, and use of knowledge by humans and machines. The curriculum provides students with a broad foundation in psychological, philosophical, and computational approaches to the study of cognition.

Prerequisites for Admissions—Admission is contingent upon prior admission to a master's or doctoral degree-granting program within the Graduate School. Admission is limited and only by permission of the director of graduate studies in cognitive science.

Special Application Requirements—Contact the director of graduate studies in cognitive science for an *Intent to Enroll* form that students are encouraged to submit by the end of fall semester the year before initiating coursework. Later submissions are considered as space permits.

Use of 4xxx Courses—4xxx courses may not be included on degree program forms for the cognitive science minor.

Courses—Please refer to the minor program office for coursework pertaining to the program.

Freestanding Minor Requirements

The minor in cognitive science is available to master's (M.A. and M.S.) and doctoral students. Both a master's and doctoral minor require the following core courses outside the student's major department: CgSc 8000—Philosophy of Cognitive Science, CSci 5511—Artificial Intelligence I, and Psy 5015—Cognition, Computation, and Brain. Substitutions for these courses are permitted only with prior permission from the director of graduate studies for cognitive science. In addition, CgSc 8001—Proseminar in Cognitive Science is required for the doctoral minor. The master's minor requires a minimum of 8 graduate credits; the doctoral minor requires 14 graduate credits. Additional courses beyond those required must be taught by faculty in the minor program or approved in advance by the cognitive science director of graduate studies. Courses in the student's major department do not count toward the minor.

Communication Disorders

Contact Information—Department of Communication Disorders, University of Minnesota, 115 Shevlin Hall, 164 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-624-3322; fax 612-624-7586).

Professor

Arlene E. Carney, FM
Robert H. Margolis, FM
Karlind T. Moller, AM
David A. Nelson, FM
Joe E. Reichle, FM
Charles E. Speaks, FM
Joseph P. Stemberger, FM
Jennifer A. Windsor, FM

Adjunct Professor

Robert Brookshire, FM
Timothy N. Doyle, AM
Dianne Van Tasel, FM

Associate Professor
Robert S. Schlauch, AM

Adjunct Associate Professor
David A. Fabry, AM
David A. Preves, AM

Assistant Professor
Mary R. T. Kennedy, AM
Kathryn Kohnert, AM
Benjamin Munson, AM
Peggy B. Nelson, AM
Nancy Pearl Solomon, AM

Adjunct Assistant Professor
Timothy D. Trine, AM

Associate Clinical Specialist
Leslie E. Glaze, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Emphases in the master's program are speech-language pathology and audiology. Emphases in the doctoral program are speech-language pathology, speech science, audiology, and hearing science.

Prerequisites for Admission—Prospective students must have completed an undergraduate degree. Individuals from both communication disorders and other academic areas are welcome. Students entering the M.A. program with minimal background in communication disorders should expect their program to extend beyond the usual two years.

Special Application Requirements—Three letters of recommendation evaluating the applicant's scholarship (two from professorial-rank faculty are recommended), a complete set of transcripts (in addition to that required by the Graduate School), and GRE scores are required. Deadline for application to the master's program is January 15; late applications are considered only if space is available. Master's students ordinarily begin graduate study during fall or summer terms.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please refer to Communications Disorders (CDis) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements

Emphases in the master's program are speech-language pathology and audiology, which are accredited by the American Speech-Language-Hearing Association's Council on Academic Accreditation. Students who complete the M.A. are eligible for clinical certification by the Association.

Students may select between two M.A. options. Plan A requires coursework and a thesis that is experimental in nature. Plan B requires coursework and one or more written projects that need not be experimental in nature but that should reflect rigorous scholarship.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A minimum of 6 credits, approved by the director of graduate studies, is required for a master's minor.

Ph.D. Degree Requirements

Emphases in the doctoral program are speech-language pathology, audiology, speech science, language science, or hearing science. The program prepares students for careers in research, teaching, and advanced clinical applications. Most students entering the program have a master's degree in speech-language pathology, audiology, or a related area. The Ph.D. degree usually requires three years of work beyond the master's degree. In general, a student's program is designed by the student in consultation with the adviser to satisfy the particular objectives of the student, but there are also some department and Graduate School requirements that must be satisfied. These include coursework, research activities, teaching experience, and preliminary and final exams.

A minimum of 12 course credits in a minor or supporting program and registration for 24 thesis credits are required. Also required is a statistics sequence, for which students typically register during their first two years. The written and oral preliminary exams are taken at the end of the second year.

Each student completes a seminar (CDis 8420) and a minimum of 4 credits of teaching experience that provide an opportunity for the student to develop and teach sections of department courses. Students also complete a seminar (CDis 8410) and a minimum of 4 credits of research under the direction of one or more faculty members in the department other than the adviser.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A minimum of 12 credits, approved by the director of graduate studies, is required for a doctoral minor.

Comparative Literature

Contact Information—Department of Cultural Studies and Comparative Literature, University of Minnesota, 350 Folwell Hall, 9 Pleasant Street S.E., Minneapolis, MN 55455 (612-625-5358; fax 612-626-0228; e-mail complit@umn.edu; <http://complit.cla.umn.edu>).

Professor
Timothy A. Brennan, FM
Maria M. Brewer, French and Italian, FM
John W. Mowitt, FM
Harvey B. Sarles, FM
Jochen Schulte-Sasse, German, Scandinavian, and Dutch, FM
Nicholas Spadaccini, Spanish and Portuguese, AM
Hernan Vidal, Spanish and Portuguese, FM
Anthony N. Zahareas, Spanish and Portuguese, FM
Jack D. Zipes, German, Scandinavian, and Dutch, FM

Associate Professor
Cesare Casarino, AM
Keya Ganguly, FM
Catherine Liu, FM
Thomas A. Pepper, FM

Assistant Professor
Haidee Wasson, Cultural Studies and Comparative Literature, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Comparative literature is the oldest field of literary criticism, dating back to the eighteenth century. Among the wide range of studies currently conducted under the rubric of comparative literature nationwide and internationally, the University focuses on theories of literary criticism and its explanatory bases; indeed the program is seen as one of the principal initiators of such fields of study. This program is likewise engaged in pushing the bounds of critical inquiry in related domains of literary inquiry, directing much of its energies toward women's writing and emergent literatures, within both First- and Third-World cultures, as well as toward related problems ranging from narrative to postcolonial studies.

A major portion of coursework for degrees in comparative literature is cross-listed with the literature and language departments. Approval may also be given to take graduate courses in such areas as anthropology, art, architecture, history, music, philosophy, and sociology. In all cases, students should consult with an adviser concerning course selections.

Prerequisites for Admission—Although most students in the program have undergraduate majors in language or literature, applicants with other undergraduate backgrounds are considered.

Special Application Requirements—Applicants must submit scores from the GRE. The deadline for applying for admission and for financial aid is January 15. Admission is only for fall semester.

Use of 4xxx Courses—Use of 4xxx courses may be permitted in majors or minors for the M.A. or Ph.D. degree with the approval of the adviser and director of graduate studies.

Courses—Please refer to Comparative Literature (CLit) in the course section of this catalog, the current *Class Schedule*, and flyers available in the department office for courses pertaining to the program.

M.A. Plan B Degree Requirements

Students normally are not admitted to work toward the M.A. degree, but in certain circumstances where earning the M.A. degree is desirable, students already in the Ph.D. program may apply through the

director of graduate studies to pursue this degree. Thirty credits including 8 credits of research seminar (8001-2), 12 additional CLit credits, 6 credits in courses in related fields outside comparative literature or in a formal minor in another program, and 4 credits either in CLit courses or in the related minor field are required. One substantial Plan B paper is required.

Language Requirements—In addition to English, high competence in one language and reading knowledge of another language are required. The choice of languages is made with respect to the student's area of specialization and in consultation with, and approval of, the adviser.

Final Exam—The final exams are written and oral.

Minor Requirements for Students Majoring in Other Fields—A minimum of 12 credits are required for a master's minor, which must include CLit 8001 and 8002.

Ph.D. Degree Requirements

The Ph.D. requires 51 semester credits, as follows: 8 credits of basic seminar (CLit 8001-8002), 3 credits in Pedagogy of Cultural Studies and Comparative Literature (CLit 8901), 28 credits in CLit courses (with approval of the adviser and the director of graduate studies up to 4 credits of the 28-credit requirement may be taken in the field of the minor or supporting program), and 12 credits in coursework that constitutes a supporting program. A supporting program may be a formal Graduate School minor, or it may be a program designed by you in consultation with your adviser. Overall, the degree should include 16 credits of 8xxx courses (exclusive of CLit 8001-8002 and 8901). 24 thesis credits are also required. A paper of publishable quality must be submitted to, and approved by, the student's doctoral committee before proceeding with the preliminary examinations.

Language Requirements—In addition to English, high proficiency in one language, proficiency in a second language, and a good reading knowledge of a third language are required. The choice of languages is made with respect to the student's area of specialization and in consultation with, and with the approval of, the adviser. For example, a student specializing in theory could have a high proficiency in French and proficiency in German (or vice versa) and reading knowledge of a classical language such as Latin; a student specializing in emergent literatures could have a high proficiency in a language related to the field, and proficiency in French and reading knowledge of German (or vice versa).

Minor Requirements for Students Majoring in Other Fields—A minimum of 16 credits is required for the doctoral minor and must include CLit 8001 and 8002.

Comparative Studies in Discourse and Society

Contact Information—Comparative Studies in Discourse and Society Program, University of Minnesota, 350 Folwell Hall, 9 Pleasant Street S.E., Minneapolis, MN 55455 (612-625-5358; fax 612-626-0228; e-mail csds@umn.edu; <http://csds.cla.umn.edu>).

Professor

Timothy Brennan, Cultural Studies and Comparative Literature, FM
Richard D. Leppert, Cultural Studies and Comparative Literature, FM
John W. Mowitt, Cultural Studies and Comparative Literature, FM
Paula Rabinowitz, English, FM
Harvey Sarles, Cultural Studies and Comparative Literature, FM
Jochen Schulte-Sasse, German, Scandinavian, and Dutch, FM
Hernan Vidal, Spanish and Portuguese, FM
Jack D. Zipes, German, Scandinavian, and Dutch, FM

Associate Professor

W. John Archer, Cultural Studies and Comparative Literature, FM
Robert L. Brown, Jr., Cultural Studies and Comparative Literature, FM
Cesare Casarino, Cultural Studies and Comparative Literature, AM
Maria Damon, English, FM
Keya Ganguly, Cultural Studies and Comparative Literature, FM
Catherine Liu, Cultural Studies and Comparative Literature, FM
Ellen Messer-Davidow, English, FM
Roger P. Miller, Geography, FM
Thomas Pepper, Cultural Studies and Comparative Literature, FM
Katherine M. Solomonson, Architecture, AM
Gary C. Thomas, Cultural Studies and Comparative Literature, FM
Jacquelyn N. Zita, Women's Studies, FM

Assistant Professor

Elizabeth Kotz, Cultural Studies and Comparative Literature, AM
Haidee Wasson, Cultural Studies and Comparative Literature, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—While most traditional humanistic disciplines tend to focus either on a given mode of discourse, e.g., art history, musicology or a specific cultural context, e.g., American studies, European languages and literatures, this program engages a broader problematic—how discourse and cultural production both shape and are shaped by life in time, space, matter, and society. Drawing on a variety of theoretical positions, close attention is paid to various types of discourse, such as music, film, myth, ritual, architecture, landscape and urban design, painting, sculpture, and literature in elite, popular, folk, and mass culture, understanding these as both a site and an instrument of contestation and negotiation among social forces. More generally, the program seeks to reassociate intellectual and cultural history with social and political history, to set discourse of various sorts within a social context, and to consider specific social formations within the ongoing historical process. In all this, the program encourages work that is interdisciplinary (at times, even anti-disciplinary) as well as cross-cultural.

The curriculum emphasizes small seminars and directed research. The core requirement is a two-semester research seminar, a practicum that develops critical and analytic skills and introduces current theoretical perspectives with the study of historic problems. The majority of courses are nonrecurring and closely relate to current faculty research. In all cases, students should consult their advisers and the director of graduate studies concerning course selections. Each entering graduate student also enrolls in CSDS 8901—Pedagogy, which focuses on developing skills and experience in teaching, fellowship application, placement, and other professional concerns.

Prerequisites for Admission—Applicants are required to have a B.A. in a humanities or social science discipline or other relevant field with clear evidence of comparative work. Because the program involves broad, often interdisciplinary, courses of study and a variety of emphases, the graduate admissions committee carefully reviews each applicant's background in terms of analytical skills, knowledge of subject matter, experience, language preparation, and especially, congruity with faculty interests and expertise.

Special Application Requirements—Scores from the General (Aptitude) Test of the GRE are required. The deadline for financial aid application is January 15 before the academic year for which aid is sought. Applications for admission are considered only at the January 15 deadline, except in certain cases for students already enrolled in a graduate degree program at the University of Minnesota. Consult the director of graduate studies for application requirements.

Use of 4xxx Courses—4xxx courses may be included in majors or minors for the M.A. or Ph.D. degree with the approval of the adviser and director of graduate studies.

Courses—Please refer to Comparative Studies in Discourse and Society (CSDS) in the course section of this catalog, the current *Class Schedule*, and fliers available in the department office for courses pertaining to the program.

M.A. Plan B Degree Requirements

Students normally are not admitted to work toward the M.A. degree, but in certain circumstances where earning the M.A. degree is desirable, students already in the Ph.D. program may apply through the director of graduate studies to pursue this degree. Thirty credits including 8 credits of research seminar (8001-2), 12 additional

CSDS credits, 6 credits in courses in related fields outside comparative literature or in a formal minor in another program, and 4 credits either in CSDS courses or in the related minor field are required. One substantial Plan B paper is required.

Language Requirements—Reading knowledge of one foreign language appropriate to the student's program is required.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A minimum of 12 credits is required for a master's minor, which must include CSDS 8001 and 8002.

Ph.D. Degree Requirements

The Ph.D. requires 51 graduatecredits, as follows: 8 credits of basic seminar (CSDS 8001-8002), 3 credits in CSDS 8901—Pedagogy of Cultural Studies and Comparative Literature, 28 credits in CSDS courses (with approval of the adviser and the director of graduate studies up to 4 credits of the 28-credit requirement may be taken in the field of the minor or supporting program), and 12 credits (or more, as necessary) to complete a formal minor in another Graduate School program, excluding comparative literature. If a formal minor is not pursued in another program, the student must complete 15 credits in coursework outside of CSDS, CSCL, or CLit courses, in a coherent and complementary program to be approved by the adviser and the director of graduate studies. Overall, the degree should include 16 credits of 8xxx courses (exclusive of CSDS 8001-8002 and 8901). 24 thesis credits are also required. A paper of publishable quality must be submitted to, and approved by, the student's doctoral committee before proceeding with the preliminary examinations.

Language Requirements—Reading knowledge of two foreign languages appropriate to the program is required. Students must attain reading knowledge of at least one foreign language before taking the preliminary examination.

Minor Requirements for Students Majoring in Other Fields—A minimum of 16 credits is required for a Ph.D. minor and must include CSDS 8001 and 8002.

Complementary Therapies and Healing Practices

Contact Information—Center for Spirituality and Healing, Mayo Mail Code 505, 420 Delaware St. S.E., Minneapolis, MN 55455 (612-624-9459; fax 612-626-5280; <www.csh.umn.edu>).

Professor

Linda J.Brady, E
Francis F. Busta (emeritus), E
Barbara Leonard, E
Robert P. Patterson, E
Mariah Snyder, E
Marilyn Speedie, E
Mark S. Umbreit, E

Associate Professor

V. Lois Erickson, E
Craig A. Hassel, E
Ruth D. Lindquist, E
Gregory Plotnikoff, E
Janice Post-White, E

Assistant Professor

Linda L. Chlan, E
Linda Halcon, E
Kate M. Hathaway, E
Donald R. Houge (emeritus), E
Mary Jo Kreitzer, E

Lecturer

Pat Culliton, E
Sue M. Towey, E

Research Associate

Ava J. Walker, E

Other

Lynne Mason, E

Curriculum—The graduate minor in complementary therapies and healing practices is an interdisciplinary program designed to expose students to the global range of complementary, cross-cultural, and spiritual healing practices. It will enhance the preparation of graduate students in health sciences and other disciplines by developing knowledge and skills in the emerging field of complementary and alternative healthcare. Specifically, the minor will provide students with a theoretical basis for applying complementary therapies and healing practices; prepare students to research complementary therapies and healing practices; prepare students to work collaboratively with other health professionals and patients in a multicultural, pluralistic healthcare system. The minor includes a set of core courses that provide the theoretical foundation for the program. Students may elect to take additional courses offered by the Center for Spirituality and Healing in clinical applications, spirituality, or cross-cultural health and healing. A number of other University courses also satisfy the course requirements of the minor. To apply other courses to the minor, contact the director of graduate studies.

Prerequisites for Admission—This graduate minor is available to master's and doctoral students. To have the minor formally designated on a transcript students must be enrolled in a major in the Graduate School and have completed—or concurrently be enrolled in—a graduate research course upon beginning the first course in the minor. Note that the research course is in addition to the specified credits required for the minor. Students should work out their program of study with the director of graduate studies for the minor early in their graduate study.

Use of 4xxx Courses—Use of 4xxx courses in the degree program is permitted based on approval of the graduate faculty and the director of graduate studies.

Courses—Please contact the minor program office for information on relevant coursework pertaining to the program.

Freestanding Minor Requirements

Master's and doctoral students will take CSpH 5100 and 1 credit in a 8xxx research critique course. Master's students must take an additional 4 credits for a total of 8 credits: doctoral students must take one additional credit at 8xxx and an additional 7 credits for a total of 12 credits. Note that students cannot use course credits to satisfy requirements for both a major and the minor.

Composition, Literacy, and Rhetorical Studies

Contact Information—Center for Interdisciplinary Studies of Writing, University of Minnesota, 227 Lind Hall, 207 Church Street S.E., Minneapolis, MN 55455 (612-626-7579; fax 612-626-7580; e-mail cisw@umn.edu; <http://cisw.cla.umn.edu/minorinfo.html>).

Professor

Josef L. Altholz, History, E
Ayers Bagley, Educational Policy and Administration, E
Richard W. Beach, Curriculum and Instruction, E
Lillian S. Bridwell-Bowles, English, E
Karlyn K. Campbell, Speech-Communication, E
Andrew D. Cohen, Linguistics and Asian and Slavic Languages and Literatures, E
Terence G. Collins, General College, E
Hazel Dicken-Garcia, Journalism and Mass Communication, E
Edward M. Griffin, English, E
Alan G. Gross, Rhetoric, E
Michael Hancher, English, E
Ruth-Ellen B. Joeres, German, Scandinavian, and Dutch, E
Mary M. Lay, Rhetoric, E
Earl E. McDowell, Rhetoric, E
Toni A. H. McNaron, English, E
Nancy L. Roberts, Journalism and Mass Communication, E
Donald J. Ross, Jr., English, E
Edward Schiappa, Speech-Communication, E
Amy L. Sheldon, Speech-Communication, E
Elaine E. Tarone, Linguistics and Asian and Slavic Languages and Literatures, E
Barbara M. Taylor, Curriculum and Instruction, E
Paulus W. van den Broek, Educational Psychology, E
Billie J. Wahlstrom, Rhetoric, E

Associate Professor

Lisa Albrecht, General College, E
Daniel Brewer, French and Italian, E
Robert L. Brown, Jr., Cultural Studies and Comparative Literature, E
Laura J. Gurak, Rhetoric, E
Amy M. Lee, General College, E
Carol A. Miller, American Studies, E
Rosemarie J. Park, Work, Community, and Family Education, E
Geoffrey Sirc, General College, E
Diane J. Tedick, Curriculum and Instruction, E
Constance L. Walker, Curriculum and Instruction, E
Arthur E. Walzer, Rhetoric, E
Susan M. Watts-Taffe, Curriculum and Instruction, E

Assistant Professor

Thomas E. Augst, English, E
Lee-Ann Kastman Breuch, Rhetoric, E
Patrick Bruch, General College, E

Patricia L. Crain, English, E
Richard J. Graff, Rhetoric, E
Julie Kalnin, Curriculum and Instruction, E
Rebecca L. Krug, English, E
John Logie, Rhetoric, E
Rita Raley, English, E
Thomas J. Reynolds, General College, E
Kirt H. Wilson, E
Thomas Wolfe, E

Curriculum—The minor in composition, literacy, and rhetorical studies (CLRS) was created to provide a forum for students and faculty interested in various facets of writing and communication. By crafting an individualized program of study including theory, pedagogy, and research, often in a historical context, students can complement their disciplinary degree and thereby open up new perspectives for their teaching and research. Students develop an interdisciplinary program of study in consultation with their major adviser (preferably one of the faculty above), the director of graduate studies in their major, and the director of graduate studies in composition, literacy, and rhetorical studies.

Prerequisites for Admission—Admission is contingent upon enrollment in good standing in a relevant doctoral or master's program within the Graduate School of the University. Prior teaching experience (at any level) is desirable but not required.

Special Application Requirements—Admission is competitive and restricted to a number that will allow for a quality experience. Entrance to the minor is granted only by permission of the director of graduate studies in CLRS and the faculty selection committee. Application materials include a completed application form, statement of purpose, curriculum vitae, relevant post-secondary transcripts, and two letters of recommendation. Deadlines for application materials are October 15 and March 15, although applications will be reviewed on a rolling basis.

Use of 4xxx Courses—Use of 4xxx courses toward degree requirements is permitted by director of graduate studies approval.

Courses—Please contact the minor program office for information on relevant coursework pertaining to the program.

Freestanding Minor Requirements

A master's minor (e.g., M.A. M.F.A.) requires three graduate courses or seminars (9 credits minimum), one from each of the following categories: literacy theory or practice, including pedagogy; research methods and practices in one of the areas of the minor; and a historical topic, e.g., history of the book, or rhetoric, or literacy. Students must also write a substantial paper that emerges from one of the three courses.

A doctoral minor requires four graduate courses or seminars (12 credits minimum). Three courses must be in each of the categories enumerated above for the master's minor. In addition, after those three courses have been completed, students must take either a capstone writing seminar specifically offered for the minor, or a seminar that involves a substantial term paper or a completed dissertation chapter on a topic related to the minor.

In order to make the minor interdisciplinary, no more than one of the three courses at the master's level, or two of the four courses at the doctoral level may be from the student's home department.

Language Requirements—None specific to the minor program.

Computer and Information Sciences

Contact Information—Department of Computer Science and Engineering, University of Minnesota, 4-192 Electrical Engineering/Computer Science, 200 Union Street S.E., Minneapolis, MN 55455 (612-625-4002; fax 612-625-0572; e-mail dgs@cs.umn.edu; <www.cs.umn.edu>).

Professor

Daniel L. Boley, FM
Gordon B. Davis, Information and Decision Sciences, FM
David H. Du, FM
Ding-Zhu Du, FM
David W. Fox, (emeritus), FM
Laël C. Gatewood, Laboratory Medicine and Pathology, AM
Maria Gini, FM
Ravi Janardan, FM
Paul E. Johnson, Information and Decision Sciences, AM
Michael B. Kac, Philosophy, AM
Daniel J. Kersten, Psychology, AM
Larry L. Kinney, Electrical Engineering, FM
K. S. P. Kumar, Electrical Engineering, FM
Vipin Kumar, FM
E. Bruce Lee, Electrical Engineering, FM
David J. Lilja, Electrical Engineering, FM
Arthur L. Norberg, AM
Nikolaos P. Papanikolopoulos, FM
Haesun Park, FM
Marian B. Pour-El, Mathematics, FM
J. Ben Rosen (emeritus), FM
Yousef Saad, FM
Shashi Shekhar, FM
Eugene B. Shragowitz, FM
James R. Slagle (emeritus), FM
Jaideep Srivastava, FM
Anand R. Tripathi, FM
Paul R. Woodward, Astronomy, AM
Pen-Chung Yew, FM

Associate Professor

John V. Carlis, FM
Vladimir Cherkassky, Electrical Engineering, AM
Mats P. E. Heimdahl, AM
Wei-Chung Hsu, FM
Joseph A. Konstan, FM
Gopalan Nadathur, FM
J. David Naumann, Information and Decision Sciences, AM
Matthew T. O'Keefe, Electrical Engineering, AM
John T. Riedl, FM
Gerald E. Sobelman, Electrical Engineering, AM
Bapiraju Vinnakota, Electrical Engineering, AM

Assistant Professor

Baoquan Chen, AM
Victoria Interrante, AM
George Karypis, AM
Richard M. Voyles, AM
Jon Weissman, AM
Zhi-Li Zhang, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The faculty of the Department of Computer Science and Engineering conducts research in a broad spectrum of the computer sciences and interdisciplinary fields. Graduate students may pursue research and study with faculty on topics such as theory of computation and algorithms, numerical algorithms, parallel and distributed computing, languages and compilers, operating systems, databases, graphics, human-computer interaction, data mining, artificial intelligence and robotics, computer architecture and networks, computer-aided design, software engineering, and history of computing. In addition, students may choose a course of study that combines a portion of one of these major areas with an entirely different field.

The computer and information sciences degrees include a Ph.D., an M.S. (either Plan A with thesis or Plan B with project), and an M.C.I.S. The M.C.I.S. is a coursework-only degree and is intended to be a terminal degree.

The Department of Computer Science and Engineering also supports a master of science in software engineering (M.S.S.E.) degree. This department and the Department of Electrical and Computer Engineering jointly offer a computer engineering program, and many faculty from the computer science department participate in the scientific computation program.

Prerequisites for Admission—A degree in any major with a substantial background in computer science is required; a computer science major is preferred. Applicants with an inadequate background must resolve any deficiencies before applying to the program.

Special Application Requirements—Three letters of recommendation are required. Scores from the General (Aptitude) Test of the GRE are required for M.S. and Ph.D. program applicants. The Subject Test is optional, although highly recommended, especially for those seeking financial assistance. If taken, it should be in the undergraduate major field or, if it is not offered in that field, in computer science, mathematics, or engineering. Masters and Ph.D. students are accepted for fall admission only. The application deadline is May 1. Students seeking financial aid must apply by December 15. Before applying, M.C.I.S. students must have the equivalent of six months full-time computer-related industrial experience in the United States and should contact the department before applying.

Research Facilities—Graduate students have access to today's most powerful supercomputers through the Minnesota Supercomputer Center and Army High Performance Computing Research Center.

The Department of Computer Science and Engineering also provides computing facilities through its various laboratories, such as the Graduate Research Laboratory, the Software Engineering Laboratory, the Artificial Intelligence/Robotics/Vision Laboratory, High Performance Computing Laboratory, Distributed Systems Laboratory, Collaborative Systems Laboratory, Database Laboratory, Scientific Computing Laboratory and Distributed Multimedia Laboratory.

Use of 4xxx Courses—Use of CSci 4xxx courses on degree program forms is not permitted. Credits from 4xxx courses from an outside department may be used for related field course requirements if the course grants graduate credit.

Courses—Please refer to Computer Science (CSci) in the course section of this catalog for courses pertaining to the program.

M.C.I.S. Coursework Only Degree Requirements

The M.C.I.S. is a coursework-only degree. It requires 31 credits of graduate work, with the following conditions: 1) at least 18 of the credits must be from CSci classes; 2) students must fulfill a breadth requirement of four courses in four of the five designated areas (computer engineering, artificial intelligence, numerical computing, theory, and systems); 3) at least 6 credits must be from outside the department; 4) at least 6 credits must be from 8xxx courses; and 5) students must take 1 credit of CSci colloquium, which cannot be counted toward any of the other requirements. Students must maintain a GPA above 3.00 after completing 8 credits.

Language Requirements—None.

Final Exam—There is no final exam.

Minor Requirements for Students Majoring in Other Fields—A minor consists of at least 6 credits in 4xxx CSci courses or higher.

M.S. Degree Requirements

The M.S. requires a minimum of 31 credits, with at least 14 of these from CSci courses (at least 3 of which must be 8xxx courses) and 6 from outside the department. There is a breadth requirement of four courses in four of the five areas (systems, computer engineering, artificial intelligence, numerical computing, and theory). For Plan A, at least 10 thesis credits are required; for Plan B, three Plan B project credits and 6 additional course credits are required. Students must also take 1 credit of CSci colloquium, which cannot be counted toward the other requirements. Students are expected to maintain a GPA of at least 3.25 for all courses listed on their degree program.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master's minor consists of at least 6 credits of 4xxx CSci courses or higher.

Ph.D. Degree Requirements

The Ph.D. requires at least 43 course credits of which 13 must be in CSci courses and at least 12 in a minor or supporting program. Additionally, at least 24 thesis credits are required. Students are expected to complete all courses in their degree program with a GPA of at least 3.45.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—At least 12 credits are required for a doctoral minor.

Computer Engineering

Contact Information—Graduate Program in Computer Engineering, University of Minnesota, 4-178 Electrical Engineering/ Computer Science, 200 Union Street S.E., Minneapolis, MN 55455 (612-625-3300; fax 612-625-4583; e-mail gradinfo@compengr.umn.edu; <www.compengr.umn.edu/>).

Professor

David H. Du, AM
Larry L. Kinney, Electrical Engineering, AM
Vipin Kumar, AM
David J. Lilja, Electrical Engineering, AM
Nikolaos Papanikolopoulos, AM
Shashi Shekhar, AM
Eugene B. Shragowitz, AM
Anand Tripathi, AM
Pen-Chung Yew, AM

Associate Professor

Vladimir Cherkassky, Electrical Engineering, AM
Mats P. E. Heimdahl, AM
Matthew T. O'Keefe, Electrical Engineering, AM
John Riedl, AM
Sachin Sapatnekar, Electrical Engineering, AM
Gerald E. Sobelman, Electrical Engineering, AM
Jaideep Srivastava, AM
Bapiraju Vinnakota, Electrical Engineering, AM

Assistant Professor

Kiarash Bazargan, AM
Richard M. Voyles, AM
Zhi-Li Zhang, AM

Other

Farnaz Mounes-Toussi, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Computer engineering is an interdisciplinary graduate program offered jointly by the Department of Electrical and Computer Engineering and the Department of Computer Science and Engineering. Students in this program develop a broad understanding of both hardware and software design issues. The M.S. is a traditional research-oriented degree that prepares graduates to work in industry or to continue with their graduate studies in either electrical engineering or computer science. The M.Comp.E. is a coursework-only professional engineering degree tailored primarily for working professionals. Students have access to a wide variety of computational and laboratory equipment. Students can focus their studies in several different areas, including computer architecture and system design, compilers, computer-aided design, databases, networks, operating systems, parallel computing, software engineering, and VLSI design and testing.

Prerequisites for Admission—Graduate study in computer engineering is open to students with an undergraduate degree in computer engineering, electrical engineering, computer science, or a closely related field, such as mathematics or physics. In some instances, additional preparatory work may be required.

Special Application Requirements—All applicants are required to submit three letters of recommendation. Scores from the GRE General Test are required of all students seeking financial aid. Applicants whose native language is not English must also submit TOEFL scores.

Use of 4xxx Courses—Use of 4xxx courses is not allowed on any computer engineering degree program form.

Courses—Please refer to Computer Engineering (CmpE), Computer Science (CSci), and Electrical Engineering (EE) in the course section of this catalog for courses pertaining to the program.

M.Comp.E. Coursework Only Degree Requirements

The M.Comp.E. degree requires 30 credits of graduate work distributed as follows: 1) at least 15 credits must be from the approved list of major field courses (of which at least 6 credits must be taken in electrical engineering and at least 6 credits in computer and information sciences); 2) at least 3 of the major field credits must be in 8xxx courses; 3) at least 6 credits must be from a minor or related field; 4) students take a breadth requirement of three courses in three of the four designated areas (system software; computer architecture and networking; VLSI and digital design; and data structures, algorithms, and software engineering); and 5) a maximum of 60 precent of coursework credit may be taken from a single department. Also, students must maintain a GPA of at least 3.00 to continue registration in any master's program in computer engineering (this standard must also be met at the time of graduation). All coursework in the degree program must be taken A-F.

Language Requirements—None.

Final Exam—None.

M.S. Degree Requirements

The M.S. degree requires 31 credits for Plan A or 30 credits for Plan B. Coursework distribution is the same as that of the M.Comp.E. degree above. In addition, Plan A, students must complete 10 thesis credits and Plan B students must complete 3 credits of a Plan B project. Students must maintain a GPA of at least 3.00 to continue registration

in any computer engineering master's program (this standard must also be met at the time of graduation). All coursework listed on the degree program must be taken A-F.

Language Requirements—None.

Final Exam—The final exam is oral.

Conflict Management

Contact Information—Director of Graduate Studies, Graduate Minor in Conflict Management, Conflict and Change Center, University of Minnesota, Hubert H. Humphrey Center, 301 19th Avenue S., Minneapolis, MN 55455 (612-625-0362; fax 612-625-3513; e-mail conflmin@umn.edu).

Professor

Mario F. Bognanno, Industrial Relations, E
Eugene Borgida, Psychology, E
Paul V. Ellefson, Forest Resources, E

Associate Professor

Mark S. Umbreit, Social Work, E

Lecturer

Thomas R. Fiutak, Independent Study, E

Curriculum—The conflict management minor, which is available to master's (M.A. and M.S.) and doctoral students, promotes inquiry into the origins, processes, dynamics, and consequences of social conflict and its management through various forms of dispute resolution procedures. The origins of this multidisciplinary field include but are not contained by the disciplines of sociology, psychology, socio-psychology, anthropology, management, organizational behavior, and communication.

Prerequisites for Admission—Admission is contingent upon prior admission to a master's or doctoral degree-granting program within the Graduate School.

Special Application Requirements—None.

Use of 4xxx Courses—Use of 4xxx courses toward degree requirements is permitted with the approval of the instructor, the adviser, and the conflict management minor director of graduate studies.

Courses—Please contact the minor program office for information on relevant coursework.

Freestanding Minor Requirements

A master's minor requires 9 credits, including 1 credit of the Proseminar in Conflict Management. A doctoral minor requires 15 credits, including 2 credits of the Proseminar in Conflict Management. It is recommended that courses be selected according to the need to develop theory, practical applications, and skills in conflict management.

Conservation Biology

Contact Information—Director of Graduate Studies, Conservation Biology Graduate Program, 199 McNeal Hall, University of Minnesota, 1985 Buford Avenue, St. Paul, MN 55108 (612-624-7751; e-mail cb-program@fw.umn.edu; <www.consbio.umn.edu>).

Professor

Ira Adelman, Fisheries and Wildlife, FM
Donald N. Alstad, Ecology, Evolution, and Behavior, FM
Dorothy H. Anderson, Forest Resources, FM
David A. Andow, Entomology, FM
Sandra O. Archibald, HHH Institute of Public Affairs, FM
Franklin H. Barnwell, Ecology, Evolution, and Behavior, FM
Marvin E. Bauer, Forest Resources, FM
John H. Beatty, Ecology, Evolution and Behavior, FM
Charles R. Blinn, Forest Resources, FM
James L. Bowyer, Wood and Paper Science, FM
Kenneth N. Brooks, Forest Resources, FM
Dwight A. Brown, Geography, FM
Thomas E. Burk, Forest Resources, FM
Vernon B. Cardwell, Agronomy and Plant Genetics, FM
Yosef Cohen, Fisheries and Wildlife, FM
Kendall W. Corbin, Ecology, Evolution, and Behavior, FM
William P. Cunningham, Genetics and Cell Biology, FM
James W. Curtsinger, Ecology, Evolution, and Behavior, FM
Edward J. Cushing, Ecology, Evolution, and Behavior, FM
Francesca J. Cuthbert, Fisheries and Wildlife, FM
Gary E. Duke, Veterinary Pathobiology, FM
K. William Easter, Applied Economics, FM
Mohamed E. El-Halawani, Animal Science, FM
Paul V. Ellefson, Forest Resources, FM
Robert T. Holt, Political Science, FM
Ralph W. Holzenthal, Entomology, AM
Anne R. D. Kapuscinski, Fisheries and Wildlife, FM
Scott M. Lanyon, Bell Museum of Natural History, FM
Patrice A. Morrow, Ecology, Evolution, and Behavior, FM
Claudia Neuhauser, Ecology, Evolution, and Behavior, FM
Gerald J. Niemi, Biology, Duluth, FM
James A. Perry, Forest Resources, FM
Stephen Polasky, Applied Economics, FM
Anne E. Pusey, Ecology, Evolution, and Behavior, FM
Patrick T. Redig, Small Animal Clinical Sciences, AM
Philip J. Regal, Ecology, Evolution, and Behavior, FM
Peter B. Reich, Forest Resources, FM
Carlisle F. Runge, Applied Economics, FM
Abdi I. Samatar, Geography, FM
Ruth G. Shaw, Ecology, Evolution, and Behavior, FM
Steve R. Simmons, Applied Plant Sciences, FM
Donald B. Siniff, Ecology, Evolution, and Behavior, FM
J.L. David Smith, Fisheries and Wildlife, FM
Peter W. Sorensen, Fisheries and Wildlife, FM
George R. Spangler, Fisheries and Wildlife, FM
Anthony M. Starfield, Ecology, Evolution, and Behavior, FM
Robert W. Sterner, Ecology, Evolution, and Behavior, FM
G. David Tilman, Ecology, Evolution and Behavior, FM
Robert M. Zink, Ecology, Evolution, and Behavior, FM

Adjunct Professor

David E. Andersen, Fisheries and Wildlife, AM
L. David Mech, Fisheries and Wildlife, FM

Associate Professor

James C. Bell, Soil, Water, and Climate, AM
Paul V. Bolstad, Forest Resources, FM
Jay S. Coggins, Applied Economics, FM
Susan M. Galatowitsch, Horticultural Science, FM
Frances R. Homans, Applied Economics, FM
Peter A. Jordan, Fisheries and Wildlife, FM
Raymond M. Newman, Fisheries and Wildlife, FM
Roderick H. Squires, Geography, FM

Adjunct Associate Professor

David L. Garshelis, Fisheries and Wildlife, FM
Frederick J. Jannett, Jr., Fisheries and Wildlife, FM
Ronald L. Tilson, Fisheries and Wildlife, E
Bruce C. Vondracek, Fisheries and Wildlife, FM

Assistant Professor

David C. Fulton, Fisheries and Wildlife, FM
Kristen C. Nelson, Forest Resources, FM
Daniel J. Philippon, Rhetoric, FM
Andrew M. Simons, Fisheries and Wildlife, FM

Adjunct Assistant Professor

David N. Bengston, Forest Resources, FM
Diane L. Larson, Ecology, Evolution, and Behavior, AM
Karen S. Oberhauser, Ecology, Evolution, and Behavior, AM

Lecturer

Thomas R. Fiutak, Independent Study, FM

Research Associate

Lee E. Frelich, Forest Resources, FM
Catherine C. Reed, Entomology, E

Other

Robert G. Haight, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The conservation biology program has two complementary objectives leading to a unique multidisciplinary program. The first is to provide students with sound graduate training in the biological sciences relevant to the global conservation of plants, animals, and ecosystems. The second objective promotes the study of social, political, and economic sciences that relate to recognition and solution of conservation problems. The overall goal of the program is to prepare students to develop solutions or approaches to address problems that are scientifically and environmentally sound and likely to be acted upon or implemented within their social and political context.

Prerequisites for Admission—A B.S. degree in biology or a closely related field is preferred. Applicants with a baccalaureate degree in another field are accepted, but these individuals may be required to take selected courses in biology. In general, Ph.D. applicants holding a baccalaureate degree are expected first to complete a master's degree.

Special Application Requirements—A statement of career goals and three letters of recommendation evaluating the applicant's potential for graduate study are required. Letters of recommendation should be sent directly to the Conservation Biology Program Office. Scores less than five years old from the General Test of the GRE are required. TOEFL is required for applicants who speak

English as a second language. Deadline for application is January 1; earlier application is encouraged for individuals seeking financial aid. Typically students are admitted to begin only in fall semester.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Conservation biology students take courses offered by a variety of colleges and departments across the University, including but not limited to fisheries and wildlife; ecology, evolution, and behavior; soil, water, and climate; forest resources; geography; sociology; and the Hubert Humphrey Institute of Public Affairs. Acceptable courses for the degree are chosen in consultation with the adviser.

M.S. Degree Requirements

Students must complete a minimum of 30 credits in the biological and social aspects of conservation biology. For Plan A students, 10 of these credits are thesis credits; for Plan B students, 10 of these credits are for Plan B papers.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A minor in conservation biology may be earned by completing the two required courses for a major, plus participating in one semester of the conservation biology seminar.

Ph.D. Degree Requirements

Ph.D. students complete 46 credits, including 10 credits courses required as part of the major, 12 credits in a minor or supporting program, and 24 thesis credits. Students take core courses and are expected to show competency in both the biological and social sciences. With their advisory committee, students develop a program that emphasizes the ecological and social aspects of conservation biology. Dissertation research may require proficiency in supporting areas (e.g., statistics, computing, communications).

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A minor in conservation biology may be earned by completing the two required courses for a major, participating in one semester of the conservation biology seminar, and completing six elective credits. Electives are determined in consultation with the director of graduate studies and the student's advisory committee.

Control Science and Dynamical Systems

Contact Information—Control Science and Dynamical Systems Center, University of Minnesota, 107 Akerman Hall, 110 Union Street S.E., Minneapolis, MN 55455 (612-625-3364; e-mail csdy@aem.umn.edu; <www.aem.umn.edu/csdy/>).

Regents' Professor

Daniel D. Joseph, Aerospace Engineering and Mechanics, FM

Professor

Donald G. Aronson, Mathematics, FM
Gary J. Balas, Aerospace Engineering and Mechanics, FM
Daniel L. Boley, Computer Science, FM
Max Donath, Mechanical Engineering, FM
David P. Fan, Genetics and Cell Biology, FM
William L. Garrard, Aerospace Engineering and Mechanics, FM
Tryphon T. Georgiou, Electrical Engineering, FM
Maria Gini, Computer Science, FM
Mostafa Kaveh, Electrical Engineering, FM
John C. Kieffer, Electrical Engineering, FM
Larry L. Kinney, Electrical Engineering, FM
K. S. P. Kumar, Electrical Engineering, FM
E. Bruce Lee, Electrical Engineering, FM
Walter Littman, Mathematics, FM
Richard P. McGehee, Mathematics, FM
Katsuhiko Ogata, Mechanical Engineering, FM
Nikolaos P. Papanikolopoulos, Computer Science, AM
George R. Sell, Mathematics, FM
Yasutaka Sibuya, Mathematics, FM
Kim A. Stelson, Mechanical Engineering, FM
Allen R. Tannenbaum, Electrical Engineering, FM
Ahmed H. Tewfik, Electrical Engineering, FM

Associate Professor

Prodromos Daoutidis, Chemical Engineering and Materials Science, AM
Yiyuan Zhao, Aerospace Engineering and Mechanics, AM

Adjunct Associate Professor

Dale F. Enns, Aerospace Engineering and Mechanics, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Student programs must emphasize modeling (mathematical and physical analyses of control or dynamical systems, with some computational or numerical expertise) and two areas selected from the following three: control theory for deterministic processes; stability theory and general analysis of dynamical systems; stochastic processes and information theory.

Prerequisites for Admission—Applicants must have completed a master's degree in one of the related fields of engineering, computer science, mathematics, statistics, or physics. Master's degrees with an emphasis in control science and/or dynamical systems can be earned in any of these fields at the University of Minnesota. An applicant with a master's degree in another area whose scientific, mathematical, and/or engineering background is adequate to pursue the program also is considered. A high level of proficiency in mathematics is necessary to successfully complete the Ph.D. program. Applicants are strongly encouraged to obtain a faculty adviser before formally applying to the program.

Special Application Requirements—Three letters of recommendation evaluating the applicant's scholarship and a complete set of transcripts are required. At least one letter of recommendation must be from a faculty member familiar with the applicant's previous graduate work. Because the faculty is drawn from a number of disciplines and students' programs can reflect a variety of emphases, it is important for applicants to clearly specify career goals and program emphasis desired in their application materials. Submission of GRE scores is strongly encouraged.

Use of 4xxx Courses—No 4xxx courses may be used for this program.

Ph.D. Degree Requirements

Programs are designed by the student and the adviser. Coursework is usually selected from those science, mathematics, engineering, and related fields that are relevant to control science and dynamical systems. Students can prepare for the written preliminary exam by completing three 8xxx or suitably advanced courses in three of the four areas of emphasis. In addition, students typically take substantial coursework in advanced mathematics.

Language Requirements—None.

Counseling and Student Personnel

See Educational Psychology.

Creative Writing

Contact Information—See English.

Regents' Professor

Patricia M. Hampl, AM

Professor

Michael Dennis Browne, AM
Valerie Miner, AM
Madelon M. Sprengnether, AM

Associate Professor

Maria J. Fitzgerald, AM
Julie Schumacher, AM
Ray Gonzalez, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The Department of English offers the master of fine arts degree for students committed to pursuing the writing life. This three-year degree provides advanced, graduate level coursework in writing, language, and literature, as well as study in a related field. The third year of the

program focuses on the final development of a book-length manuscript suitable for publication. At the heart of the program are writing workshops in poetry, fiction, and literary nonfiction, and courses in the Reading as Writers and Topics in Advanced Writing series, which enable writers to explore a variety of issues relating to contemporary themes in American and world literature. The program encourages experimentation across genres, fostering the discovery of new and varied forms for a developing voice.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please refer to English Composition (EngC), English: Creative and Professional Writing (EngW), and English Language and Literature (EngL) in the course section of this catalog for courses pertaining to the program.

M.F.A. Degree Requirements

The M.F.A. requires 45 credits distributed over a three-year period, culminating in a book-length manuscript and a public reading from the work. An M.F.A. essay is also required, generally completed in the spring of the second year.

Required coursework includes EngW 8101 (4 credits); four writing workshops (16 credits), three of which must be in the student's genre of choice and include one 8xxx course, and one of which must be outside the student's primary genre; language and literature courses (9 credits); related field (6 credits); and a creative project, a book-length manuscript suitable for publication (12 credits, 4 of which are for manuscript preparation and 8 for creative project registration).

Language Requirements—None.

Final Exam—The M.F.A. essay is a week-long, take-home exam based on 20 texts designated by program faculty.

Dentistry

Contact Information—School of Dentistry, University of Minnesota, 15-136 Malcolm Moos Health Sciences Tower, 515 Delaware Street S.E., Minneapolis, MN 55455 (612-624-7934; fax 612-626-6096; e-mail wegne009@umn.edu; <www1.umn.edu/dental/>).

Professor

Dwight L. Anderson, Oral Sciences, AM
M. Bashar Bakdash, Preventive Sciences, AM
Muriel J. Bebeau, Preventive Sciences, AM
Soraya M. Beiraghi, Preventive Sciences, AM
Richard R. Bevis, Preventive Sciences, AM
David O. Born, Preventive Sciences, AM
Edward C. Combe, Oral Sciences, AM
Ralph DeLong, Oral Sciences, AM
Anthony J. DiAngelis, Preventive Sciences, AM
William H. Douglas, Oral Sciences, AM
James R. Fricton, Diagnostic/Surgical Sciences, AM
Mark C. Herzberg, Preventive Sciences, AM
William F. Liljemark, Oral Sciences, AM
Leslie V. Martens, Preventive Sciences, AM
Karlind T. Moller, Preventive Sciences, AM
Bruce L. Pihlstrom, Preventive Sciences, AM
Peter J. Polverini, Oral Sciences, AM
Charles F. Schachtele, Oral Sciences, AM
Burton L. Shapiro, Oral Sciences, AM
T. Michael Speidel, Diagnostic/Surgical Sciences, AM
Michael J. Till, Preventive Sciences, AM
Larry F. Wolff, Preventive Sciences, AM
Frank W. Worms, Diagnostic/Surgical Sciences, AM

Clinical Professor

Gerald D. Cavanaugh, Diagnostic/Surgical Sciences, E

Associate Professor

Gary C. Anderson, Restorative Sciences, AM
James L. Baker, Restorative Sciences, E
Mahmoud E. ElDeeb, Restorative Sciences, AM
Pamela R. Erickson, Preventive Sciences, AM
James E. Hinrichs, Preventive Sciences, AM
James R. Holtan, Restorative Sciences, AM
Tom W. Korioth, Oral Sciences, AM
Ramesh K. Kuba, Diagnostic/Surgical Sciences, E
Thomas D. Larson, Restorative Sciences, E
Bryan S. Michalowicz, Preventive Sciences, AM
Kathleen J. Newell, Preventive Sciences, AM
Paul Olin, Restorative Sciences, AM
Joy B. Osborn, Preventive Sciences, AM
Jorge M. Perdigão, Restorative Sciences, AM
Igor J. Pesun, Restorative Sciences, AM
Maria R. Pintado, Oral Sciences, AM
Nelson L. Rhodus, Diagnostic/Surgical Sciences, AM
Eric L. Schiffman, Diagnostic/Surgical Sciences, AM
John K. Schulte, Diagnostic/Surgical Sciences, AM
Stephen K. Shuman, Preventive Sciences, AM
Jill L. Stoltenberg, Preventive Sciences, AM
James Q. Swift, Diagnostic/Surgical Sciences, AM
Omar A. Zidan, Restorative Sciences, AM

Assistant Professor

John P. Beyer, Diagnostic/Surgical Sciences, AM
Walter R. Bowles, Restorative Sciences, AM
Kate M. Hathaway, Diagnostic/Surgical Sciences, E

Research Associate

John O. C. Look, Diagnostic/Surgical Sciences, AM

Clinical Specialist

Chester J. Schultz, Jr., Restorative Sciences, E

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The M.S. program in dentistry prepares dentists and dental hygienists with clinical expertise for positions of leadership in education, research, and program administration in the oral health field. A multidisciplinary faculty of dental and dental hygiene educators, researchers, and clinicians teach the program, which is housed in the School of Dentistry. All students complete core coursework in teaching and evaluation in dentistry, research methods, and health-care administration. Additional advanced coursework is offered in these same focus areas as well as in selected clinical and oral science topics with interdisciplinary impact, including conscious sedation, craniofacial pain, geriatrics, oral biology, oral medicine and radiology, oral pathology, practice administration, and psychology. Students have flexibility in planning individualized programs to accommodate their specific areas of interest, and courses from other disciplines may be included for credit in the major area.

Students enrolled in an advanced clinical dental training program may be admitted to the dentistry graduate program for concurrent study, but must carefully plan their curriculum with their faculty adviser and the director of graduate studies so that their residency and M.S. programs are appropriately integrated and satisfy Graduate School registration requirements. American Dental Association-accredited programs in the School of Dentistry enrolling students for the M.S. degree include endodontics, orthodontics, pediatric dentistry, periodontics, prosthodontics, dental hygiene (with baccalaureate degree), and residencies in general practice dentistry (AEGD and GPR). Other dental school clinical and postdoctoral programs enrolling students for the M.S. degree include those in TMJ disorders/craniofacial pain, geriatric dentistry, and the Dentist Scientist Award.

The Dentist Scientist Award (DSA) training program provides for Ph.D. training in basic sciences and advanced education in a clinical specialty of dentistry. Other advanced research training options are possible. Admission is competitive and financial support will be dependent on the strength of the applicant and the availability of funds from several possible sources. Information about the DSA may be obtained from the director, Dr. Mark Herzberg, or the director of graduate studies.

Clinical Instruments—The School of Dentistry dental clinics maintain a centralized instrument usage and sterilization system that provides clinical instrumentation and related services for graduate students enrolled in advanced clinical training programs. Usage fees, where applicable, are listed in the *Class Schedule*.

Prerequisites for Admission—Applicants must have received a D.D.S. or D.M.D. degree from an accredited U.S. institution or completed a dental hygiene program along with a baccalaureate degree from an accredited U.S. institution. Students with comparable foreign degrees from recognized colleges or universities may also apply. Applications from individuals who have already completed or are enrolled in an advanced clinical training program (e.g., general dentistry or specialty residency program) are encouraged. A GPA of 3.00 or academic standing in the top one quarter of graduating class is required for admission. Applicants for whom English is a second language must also take the TOEFL.

Special Application Requirements—Applicants must submit three letters of recommendation directly to the department from persons familiar with their academic capabilities, along with a complete set of official transcripts and a clearly written, brief statement (under 500 words) which relates the applicant's career goals to the goals of the program. Applicants who are planning concurrent studies in an advanced clinical training program (i.e., dental specialty

residency) must contact that program for specific application deadlines and additional application requirements.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please refer to Dentistry (Dent) in the course section of this catalog for courses that pertain to this program.

M.S. Degree Requirements

The M.S. degree, which usually requires at least 18 months to complete, is offered under Plan A (with thesis) and Plan B (without thesis). Students in both plans must complete 14 credits in the major, including four core courses: 1) teaching and evaluation in dentistry, 2) basic research methodology, 3) introductory biostatistics, and 4) fundamentals of health-care administration. Courses from other disciplines may also be taken for credit in the major with the approval of the student's adviser and the director of graduate studies. All students must complete a minor or related field consisting of at least 6 credits as well as program requirements for training in the responsible conduct of research. Additionally, Plan A students must complete 10 thesis credits; Plan B students must instead complete 10 additional credits of coursework and submit three Plan B papers, one of which must involve the analysis and reporting of research data. Students must maintain a cumulative GPA of at least 3.00 in the program.

Language Requirements—None.

Final Exam—The final exam is oral.

Design, Housing, and Apparel

Contact Information—Director of Graduate Studies, Design, Housing, and Apparel, University of Minnesota, 240 McNeal Hall, 1985 Buford Avenue, St. Paul, MN 55108 (612-626-1219; fax 612-624-2750; e-mail dhagradinfo@che.umn.edu; <www.che.umn.edu/dha/>).

Regents' Professor
Joanne B. Eicher, FM

Professor
William J. Angell, AM
Marilyn R. DeLong, FM
Denise A. Guerin, FM
Kim K. P. Johnson, FM

Associate Professor
Jeffrey R. Crump, AM
Sherri A. Gahring, AM
Delores A. Ginthner, AM
Karen L. LaBat, FM
Barbara E. Martinson, FM
Steven McCarthy, AM
Gloria M. Williams, FM
Becky L. Yust, FM
Ann Ziebarth, FM

Adjunct Associate Professor
Margaret K. DiBlasio, FM
Edward G. Goetz, FM
David T. Grimsrud, AM

Assistant Professor
Marilyn Bruin, AM
Sauman Chu, AM
Stephanie A. Watson, AM

Lecturer
James Boyd-Brent, AM
Elizabeth Bye, AM

Other
Brad Hokanson, AM
Fiona L. Shen, AM
Carol C. Waldron, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The design, housing, and apparel graduate program focuses on the study of relationships between humans and their designed environments. This focus is based on the assumption that design and analysis of environments contributes to the improvement of the human condition. The program addresses theory, research, and application, using a shared disciplinary base from the social and behavioral sciences. The goal of the program is for students to analyze, evaluate, and integrate theoretical frameworks related to humans and their designed environments.

The M.A., M.S., and Ph.D. degrees are available with four areas of emphasis: apparel, design communication, housing, and interior design. The M.F.A. and M.A. degrees are available with an emphasis in multimedia. The emphasis in *apparel* advances both theoretical and practical knowledge of textile and apparel products related to human behavior. Students may focus on design, aesthetics, historic costume, or social science aspects of apparel, retailing, or apparel product analysis. The emphasis in *design communication* focuses on design theory, design process and methodology, visual communication (design and analysis), and color systems and perception. The emphasis in *housing studies* advances both theoretical and applied knowledge in the housing field. Through research, students are prepared to assist people and communities in addressing their housing-related problems. Courses emphasize human needs and behavior, analysis of designed environments and technology, policy and community development, and housing for special populations such as the elderly or low-income households. The emphasis in *interior design* includes study of the theory, research, and specialized practice components of design as applied to the interior environment. The emphasis in *multimedia* provides students with experience in designing for the electronic environment. The program integrates theory with practice in the application of emerging technologies and software to digital design solutions. Students complete a creative thesis.

Prerequisites for Admission—Individuals must have adequate undergraduate education in the area of emphasis and background in the basic disciplines of art, social science, physical science, and biological science appropriate to the area of emphasis. To pursue a degree with interior design as the emphasis area, a first professional degree in interior design is required. Students interested in pursuing a Ph.D. must first complete a master's degree. Specific requirements may be obtained by contacting the director of graduate studies.

Special Application Requirements—Consult the director of graduate studies; scores from the GRE are required. Students pursuing a degree in an emphasis related to design are required to submit a portfolio consisting of 15-20 slides. Students are admitted fall and spring semesters.

Use of 4xxx Courses—No more than 30 precent of a student's official degree program may be comprised of 4xxx courses. Not all of the department's 4xxx courses are available for graduate credit. Appropriate courses are selected in consultation with the student's advisers.

Courses—Please refer to Design, Housing, and Apparel (DHA) in the course section of this catalog for courses that pertain to this program.

M.A. Degree Requirements

Minimum requirements for the M.A. include 4 credits in courses that focus on theory building and the theoretical and philosophical bases of inquiry in the discipline; 6 credits in courses on qualitative or quantitative methods of research and evaluation; 8 credits for Plan A students, and 18 credits for Plan B students in the area of emphasis; 10 thesis credits for Plan A students; and 6 credits in a related field. Students may be required to complete additional credits upon recommendation of their committee.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—For a master's minor, a minimum of 9 credits in design, housing, and apparel is required, including DHA 8101. Courses are selected in consultation with the director of graduate studies.

M.F.A. Degree Requirements

Minimum requirements for the M.F.A. include 6 credits in courses that focus on theory building and the theoretical and philosophical bases of inquiry in the discipline; 6 credits in evaluation and analysis, including DHA 5388—Design Planning and Analysis and a 3-credit course in graduate level statistics; 28 credits in the area of emphasis; 12 credits of M.F.A. creative thesis; and 8 credits in a related field. Students may be required to complete additional credits upon recommendation of their committee.

Language Requirements—None.

Final Exam—The final exam is oral.

M.S. Degree Requirements

Minimum requirements for the M.S. include 4 credits in courses that focus on theory building and the theoretical and philosophical bases of inquiry in the discipline; 6 credits in courses on qualitative and quantitative methods of research and evaluation; 8 credits for Plan A students, and 18 credits for Plan B students in the area of emphasis; 10 thesis credits for Plan A students; and 6 credits in a related field. Students may be required to complete additional credits upon recommendation of their committee.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—For a master's minor, a minimum of 9 credits in design, housing, and apparel is required, including DHA 8101. Courses are selected in consultation with the director of graduate studies.

Ph.D. Degree Requirements

Minimum requirements for the Ph.D. include 6 credits in courses that focus on theory building and the theoretical and philosophical bases of inquiry in the discipline; 9 credits in courses on qualitative and quantitative methods of research and evaluation; 12 credits in the area of emphasis; 24 thesis credits; and 12 credits in a supporting program. Students may be required to complete additional credits upon recommendation of their committee.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—For a doctoral minor, a minimum of 12 credits in design, housing, and apparel is required, including DHA 8101—Philosophical Foundations of Design, Housing, and Apparel. Courses are selected in consultation with the director of graduate studies.

Development Studies and Social Change

Contact Information—MacArthur Interdisciplinary Program on Global Change, Sustainability and Justice, University of Minnesota, 260 Social Sciences Building, 267 19th Avenue S., Minneapolis, MN 55455 (612-624-0832; fax 612-626-2242; e-mail macarth@umn.edu; <www.icgc.umn.edu>)

Regents' Professor

Allen F. Isaacman, History, E
G. Edward Schuh, Public Affairs, E
John Sullivan, Political Science, E

Professor

Dennis A. Ahlburg, Industrial Relations, E
Ronald R. Aminzade, Sociology, E
Vernon B. Cardwell, Agronomy and Plant Genetics, E
William P. Cunningham, Genetics and Cell Biology, E
Raymond D. Duvall, Political Science, E
Lawrence Jacobs, Political Science, E
Amy K. Kaminsky, Women's Studies, E
Anne R. D. Kapuscinski, Fisheries and Wildlife, E
Sally Kenney, Public Affairs, E
Helga Leitner, Geography, E
John W. Mowitt, Cultural Studies and Comparative Literature, E
August H. Nimtz, Jr., Political Science, E
James A. Perry, Forest Resources, E
Philip J. Regal, Ecology, Evolution, and Behavior, E
Terry L. Roe, Applied Economics, E
David Roediger, History, E
Abdi I. Samatar, Geography, E
Eric S. Sheppard, Geography, E
Kathryn A. Sikkink, Political Science, E
George R. Spangler, Fisheries and Wildlife, E
Dennis N. Valdes, Chicano Studies, E
Ann B. Waltner, History, E
Donald Wyse, Agronomy and Plant Genetics, E

Associate Professor

Jean M. Allman, History, E
Fernando E. Arenas, Spanish and Portuguese, E
Ragui A. Assaad, Public Affairs, E
Keletso E. Atkins, Afro-American and African Studies, E
Daphne J. Berdahl, Anthropology, E
Jeffrey P. Broadbent, Sociology, E
Sarah C. Chambers, History, E
Jay S. Coggins, Applied Economics, E
Lisa J. Disch, Political Science, E
Daniel Kelliher, Political Science, E
Deborah Levison, Public Affairs, E
Carol A Miller, American Studies, E
Richa Nagar, Women's Studies, E
Jean M. O'Brien-Kehoe, History, E
Joanna O'Connell, Spanish and Portuguese, E
Jennifer L. Pierce, Sociology, E
Richard Price, Political Science, E
Angelita D. Reyes, Afro-American and African Studies, E
Ajay Skaria, History, E
Charles J. Sugnet, English, E
John S. Wright, African American and African Studies, E

Assistant Professor

Elizabeth H. Boyle, Sociology, E
Bruce P. Braun, Geography, E
Catherine C. Choy, American Studies
Vinay Gidwani, Geography, E
Douglas R. Hartmann, Sociology, E
Qadri Ismail, English, E

Adjunct Assistant Professor

Helene Murray, Agronomy and Plant Genetics, E

Curriculum—This structured interdisciplinary doctoral minor is offered in conjunction with the MacArthur Interdisciplinary Program on Global Change, Sustainability, and Justice. By focusing on the social bases of change in the developing world, the program engages a wide range of academic disciplines including the social sciences, humanities, and biological sciences. The minor focuses on three areas: 1) the relationships between macroscopic processes of political, economic, and social change, and the microscopic conditions of lived experience in the developing world; 2) specifically interdisciplinary perspectives (encompassing the social sciences, the biological sciences, and the humanities) on this general thematic concern; and 3) preparation of doctoral students for research on the developing world.

Prerequisites for Admission—Admission is contingent upon prior admission to a doctoral degree-granting program within the Graduate School and upon affiliation with the MacArthur Program.

Special Application Requirements—Students enrolled in a doctoral degree-granting program may apply for the minor at any time during the academic year; acceptance will take effect the following term.

Use of 4xxx Courses—Courses used to fulfill minor requirements must be 5xxx or above.

Courses—Please contact the minor program office for information on relevant coursework pertaining to the program.

Freestanding Minor Requirements

The doctoral minor requires a sequence of three core seminars (DSSC 8111, 8211-12, 8310) for 9 credits total (8310 is taken twice). Students also take one or two courses (minimum 3 credits total) chosen from an approved list of courses from across the Graduate School curriculum that are relevant to the field of development studies and social change.

East Asian Studies

Contact Information—East Asian Studies, Area Studies Programs, University of Minnesota, 214 Social Sciences Building, 267 19th Avenue S., Minneapolis, MN 55455 (612-624-8543).

Professor

Edward L. Farmer, AM
Chin-Chuan Lee, Journalism and Mass Communication, AM
Robert J. Poor, Art History, AM
Ann B. Waltner, History, AM

Associate Professor

Yanjie Bian, Sociology, AM
Jeffrey P. Broadbent, AM
Tsan-Kuo Chang, Journalism and Mass Communication, AM
Daniel Kelliher, AM
Tahirih V. Lee, Law School, AM

Assistant Professor

Christopher M. Isett, History, AM
Liping Wang, History, AM

Associate Librarian

Yuan Zhou, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The program offers an entry point for interdisciplinary study of East Asia, particularly China and Japan. It serves both as a stepping stone to advanced academic work and as a terminal degree for those with non-academic career goals related to East Asia.

Prerequisites for Admission—Ideally, an applicant's background should include undergraduate study in fields related to East Asia or East Asian languages. Students from other academic areas may be admitted, however, with the provision that prerequisite coursework be made up after admission.

Special Application Requirements—Three letters of recommendation and statement of purpose should be submitted to the department. GRE test scores are required. Students are admitted each semester.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please refer to East Asian Studies (EAS) and Global Studies (GloS) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements

The program uses an interdisciplinary approach that emphasizes the humanities and social sciences and requires proficiency in a foreign language, a theoretical framework, broad knowledge of the area in question, and a concise understanding of a topical theme to be developed in the Plan A thesis or Plan B papers.

Plan A requires 31 credits: a minimum of 21 course credits (7 courses), including 15 credits (5 courses) in the major and 6 credits (2 courses) in one or more fields outside the major, and 10 thesis credits. Coursework must include the 3-credit introductory scope and methods course (Area 8061) and three proseminars/seminars. A Plan A thesis must be written.

Plan B requires 30 course credits in order to provide a broader knowledge of the chosen field and allied subjects. It requires at least 15 credits (5 courses) in the major field and 12 credits (4 courses) in one or more related fields outside of the major, which must include three proseminars/seminars. Students must also take the 3-credit introductory scope and methods course (Area 8061). Three Plan B papers must be written, at least one of them outside of the major.

Language Requirements—The language requirement may be fulfilled by successful completion of either three years (six semesters) of a Chinese or Japanese language sequence, or at least four semesters of Chinese or Japanese language study and an approved study abroad experience in East Asia. For a Korean focus, it is possible to have a comparable level of Korean language in lieu of the Chinese or Japanese requirement. (Note: Proficiency exams and evaluations are provided by relevant language departments.)

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master's minor requires two years of language study or equivalent proficiency, plus at least three courses (minimum of 9 credits) in the field that include at least two semesters of seminars/proseminars.

Ecology, Evolution, and Behavior

Contact Information—Department of Ecology, Evolution, and Behavior, University of Minnesota, 100 Ecology Building, 1987 Upper Buford Circle, St. Paul, MN 55108-6097 (612-625-5700; fax 612-624-6777; e-mail EEBGrad@biosci.cbs.umn.edu; <http://biosci.cbs.umn.edu/eeb/graduate.html>).

Professor

Donald N. Alstad, FM
David A. Andow, Entomology, FM
Franklin H. Barnwell, FM
John H. Beatty, FM
Patrick L. Brezonik, Civil Engineering, FM
Kendall W. Corbin, FM
James W. Curtsinger, FM
Edward J. Cushing, FM
Stuart F. Goldstein, FM
Ralph W. Holzenthal, FM
Linda L. Kinkel, Plant Pathology, AM
Scott M. Lanyon, FM
D. Frank McKinney (emeritus), FM
Robert O. Megard, FM
Patrice A. Morrow, FM
Claudia Neuhauser, FM
Craig Packer, FM
John Pastor, University of Minnesota, Duluth, FM
Stephen Polasky, FM
Anne E. Pusey, FM
Philip J. Regal, FM
Peter B. Reich, Forest Resources, FM
Michael J. Sadowsky, Soil, Water, and Climate, FM
Ruth G. Shaw, FM
Michael J. Simmons, Genetics and Cell Biology, FM
Akhouri Sinha, Genetics and Cell Biology, FM
Donald B. Siniff, FM
Peter W. Sorensen, Fisheries and Wildlife, FM
Anthony M. Starfield, FM
Robert W. Sterner, FM
Bert E. Stromberg, Jr. FM
G. David Tilman, FM
Robert M. Zink, FM

Adjunct Professor

Lee E. Frelich, FM
L. David Mech, Fisheries and Wildlife, FM
Diane L. Larson, AM
Karen S. Oberhauser, FM

Associate Professor

James B. Cotner, FM
Susan M. Galatowitsch, Horticultural Science, FM
Georgiana May, FM
Raymond M. Newman, FM
Andrew M. Simons, FM
David W. Stephens, FM
Susan J. Weller, AM

Assistant Professor

Antony M. Dean, FM
Sarah E. Hobbie, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The graduate program in ecology, evolution, and behavior links faculty and students interested in the biology of organisms and their environments; how organisms interact in social groups, populations, communities and ecosystems; and how those interactions influence their distribution, abundance and evolution in space and time. The program provides broad training in the general areas of ecology, evolution, and animal behavior, and specialized courses and research in vertebrate and invertebrate zoology; behavior and ethology; evolution; population genetics; population, community and ecosystem ecology; limnology and paleoecology. Opportunities for field research are available in Africa, Antarctica, Central America and worldwide, as well as in local ecosystems. Seminars and individually designed tutorials are an important part of student programs.

Prerequisites for Admission—Incoming graduate students are ordinarily expected to have completed coursework in inorganic chemistry, organic chemistry, and general physics; one year of college calculus; and at least one course each in animal biology, biochemistry, genetics, physiology, and plant biology. Proficiency in a foreign language is recommended. Deficiencies must be made up early in the graduate program.

Special Application Requirements—Students are admitted only in fall semester. Deadline for application is January 7; earlier application is encouraged for individuals seeking financial aid. Three letters of recommendation evaluating the applicant's scholarship are required, plus GRE scores (including the Subject Test). Successful applicants are encouraged to participate in the Lake Itasca Biology Session during the summer before their first semester in residence.

Use of 4xxx Courses—As preparation for their preliminary examinations, Ph.D. students are expected to acquire basic knowledge in ecology, evolution, behavior, and organismal biology, typically by taking graduate courses. One of these courses can be an advanced undergraduate or 4xxx course.

Courses—Please refer to Ecology, Evolution, and Behavior (EEB) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements

The M.S. is offered under both Plan A (with thesis) and Plan B (without thesis). Both plans require a minimum of 14 course credits in the major and a minimum of 6 course credits in one or more related fields outside the major; Plan A also requires 10 thesis credits, and Plan B requires 10 additional course credits and one to three research papers, which may be written in conjunction with graduate courses. Significant field experience and competence in statistics, to include hypothesis testing, regression, and correlation are required. Degree programs are planned by the student and an advisory committee of three faculty members to meet the student's interests and needs.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A minimum of 7 credits of EEB 4xxx, 5xxx, and 8xxx courses is required for a master's minor in ecology.

Ph.D. Degree Requirements

A minimum of 3 course credits and 24 thesis credits are required in the major, and at least 12 course credits are required for either a minor in another field or a supporting program from several relevant fields. Significant field experience, proficiency in using computers in research, and competence in statistics, including experimental design, are required. Degree programs are planned by the student and an advisory committee of three to five faculty members.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A minimum of 12 credits of EEB 4xxx, 5xxx, and 8xxx courses is required for a doctoral minor in ecology.

Economics

Contact Information—Director of Graduate Studies, Department of Economics, University of Minnesota, 1035 Heller Hall, 271 19th Avenue S., Minneapolis, MN 55455 (612-625-6833; fax 612-624-0209; e-mail econdgs@econ.umn.edu; <www.econ.umn.edu>).

Regents' Professor

John S. Chipman, FM
Edward C. Prescott, FM
G. Edward Schuh, Public Affairs, FM

Professor

Beth E. Allen, FM
Michele Boldrin, FM
Varadarajan V. Chari, FM
Roger D. Feldman, Public Health, FM
Edward M. Foster, FM
Thomas J. Holmes, FM
Larry E. Jones, FM
Timothy Kehoe, FM
Narayana Kocherlakota, FM
Gerard McCullough, Agricultural and Applied Economics, AM
Andrew McLennan, FM
Marcel K. Richter, FM
Aldo Rustichini, FM
Craig E. Swan, FM
Jan Werner, FM

Adjunct Professor

Patrick J. Kehoe, AM
Ellen McGrattan, AM
Christopher Phelan, AM
David E. Runkle, Finance, AM
James A. Schmitz, AM
Warren E. Weber, AM

Associate Professor

George D. Green, History, AM
Erzo G.J. Luttmer, FM

Adjunct Associate Professor

Melvin L. Burstein, Law School, AM

Assistant Professor

Marco Bassetto, AM
Mariacristina DeNardi, AM
Gautam Gowrisankaran, AM
Matthew F. Mitchell, AM
Andrea Moro, AM
Julia K. Thomas, AM

Other

Simran Sahi, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The economics graduate program offers degree work in both theoretical and applied fields of economics. It is possible to pursue thesis research in microeconomic or macroeconomic theory. In addition, the following fields of specialization are offered: econometrics, economic growth and development, financial economics, game theory, industrial organization, international economics, labor economics, mathematical economics, monetary economics, and public economics. Students are admitted only for the Ph.D.; the M.A. is an optional part of the Ph.D. program.

Prerequisites for Admission—The general requirement is the capability to pursue Ph.D.-level work. Normally a student should have an undergraduate record from a recognized college that includes coursework in economic theory and mathematics (multivariate calculus and linear algebra).

Special Application Requirements—Students should submit their applications, including a record of GRE scores and three letters of recommendation, to the director of graduate studies. Applicants who would like financial aid should submit their materials no later than December 15. Students are admitted in fall semester only.

Use of 4xxx Courses—4xxx or 5xxx economics courses may not be included on degree program form for the economics Ph.D. program. Students may include 4xxx, 5xxx, and 8xxx courses outside economics in the economics Ph.D. program. Approval of the student's adviser and the director of graduate studies are needed to use 4xxx and 5xxx courses.

Courses—Please refer to Economics (Econ) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements

The M.A. is offered under Plan A (with thesis) or Plan B (without thesis). Coursework for the M.A. is drawn from the Ph.D. program and must include at least 10 credits of economic theory from the first-year Ph.D. sequences in theory (for majors) or microeconomic analysis (for minors) and macroeconomics, plus at least 3 credits in quantitative economics or econometrics. Beyond these restrictions, the general Graduate School requirements govern. For the Plan B degree, a Ph.D. student will have completed requirements for the M.A. when the written preliminary exams have been completed. Two Plan B projects consisting of research papers or literature reviews are required; the Ph.D. written preliminary exams required in two fields outside of economic theory ("field exams") may be used to satisfy either or both of the Plan B projects. Because the standards used to judge whether a preliminary exam has satisfied the requirement for the M.A. are less rigorous than those for the Ph.D., students may qualify for the master's Plan B without having satisfied all requirements for the Ph.D. written preliminary exams.

Language Requirements—None.

Final Exam—The final exam is oral for Plan A, written for Plan B.

Minor Requirements for Students Majoring in Other Fields—A master's minor consists of 6 credits in 4xxx, 5xxx, or 8xxx economics courses, all taken A-F and completed with grades of B or better (one 8xxx course may carry a grade of C). The 6 credits include Econ 5151 and Econ 5152 or more advanced courses in economic theory.

The economic theory requirement may be waived if, in the judgment of the director of graduate studies, the student's previous work in economics has included courses equivalent to Econ 5151 and 5152, though the requirement to complete 6 credits would still stand.

Ph.D. Degree Requirements

Emphasis in all aspects of the program is on careful development of the theoretical basis for the work, whether the work is theoretical or applied, and whether the relevant theory is drawn from economics, econometrics, mathematics, statistics, or other related disciplines.

Before undertaking research for a doctoral thesis, the student must pass written preliminary exams in micro- and macroeconomic theory, plus in two of the fields listed under the curriculum section above. A research paper may be substituted for one of the field examinations; see the *Economics Graduate Student Handbook.* The program does not specify a minimum number of courses for the major; rather, the courses taken to help prepare for the preliminary exams constitute the major program. In addition, students must complete 12 credits outside the major for a supporting program, which may include economics courses not included in the major.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—Requirements for a doctoral minor include five or more from among the following courses: Econ 8001-2-3-4 or 8101-2-3-4, and 8105-6-7-8; plus completion of at least two 8xxx courses in economics other than those listed above. All courses must be taken A-F, with no grade lower than C and no more than two course grades of C.

In addition, students must pass the microeconomics preliminary exam for minors or majors and either the macroeconomics preliminary exam for minors or majors, or a preliminary exam for majors in one of the fields listed under the program description above.

Education

Advanced work leading to the professional degree of master of education (M.Ed.) is offered in several areas of study. For more information, see the *College of Education and Human Development Professional Studies Catalog.* This catalog can be found online at <www.education.umn.edu/catalogs/catalog_intro.html>.

Education Emphases (Twin Cities campus)— At the Ph.D. level, the education major is divided into three emphases. Faculty associated with these doctoral programs are identified using the following abbreviations:

Curriculum and Instruction, C&I

Recreation, Park, and Leisure Studies, RPLS

Work, Community, and Family Education, WCFE

At the M.A. level, the education major is divided into two emphases. Faculty associated with these master's programs are identified using the following abbreviations:

Curriculum and Instruction, C&I

Work, Community, and Family Education, WCFE

Professor

Dorothy H. Anderson, RPLS, Forest Resources, FM
Patricia G. Avery, C&I, FM
Richard W. Beach, C&I, FM
James M. Brown, WCFE, FM
Carol A. Carrier, C&I, FM
John J. Cogan, C&I, FM
Kerry J. Freedman, C&I, FM
Lee Galda, C&I, FM
Michael F. Graves, C&I, FM
Ilene B. Harris, C&I, FM
Roger T. Johnson, C&I, FM
Mary Jo Kane, RPLS, FM
Judith J. Lambrecht, C&I, WCFE, FM
Frances P. Lawrenz, C&I, Educational Psychology, FM
Darrell R. Lewis, C&I, Educational Policy and Administration, FM
Theodore Lewis, WCFE, FM
John C. Manning, C&I, FM
Leo H. McAvoy, Jr., RPLS, FM
Gary N. McLean, WCFE, FM
Roland L. Peterson, WCFE, FM
Thomas R. Post, C&I, FM
David J. Pucel, WCFE, FM
S. Jay Samuels, C&I, Educational Psychology, FM
Richard A. Swanson, WCFE, FM
Barbara M. Taylor, C&I, FM
Ruth G. Thomas, C&I, AM; WCFE, FM
Michael G. Wade, RPLS, FM

Adjunct Professor

Richard A. Krueger, WCFE, FM

Associate Professor

Bruce D. Anderson. RPLS, FM
Kathleen Cramer, C&I, AM
Margaret K. DiBlasio, C&I, FM
Fred N. Finley, C&I, FM
Patricia A. Heller, C&I, FM
Simon R. Hooper. C&I, FM
Jean A. King, C&I, Educational Policy and Administration, AM
Gary W. Leske, WCFE, FM
Jerry McClelland, WCFE, FM
R. Michael Paige, C&I, Educational Policy and Administration, FM
Rosemarie J. Park, C&I, WCFE, FM
Jane E. Plihal, WCFE, FM
Marilyn A. M. Rossmann, WCFE, FM
James R. Stone III, WCFE, FM
Carla E.S. Tabourne, RPLS, FM
Diane J. Tedick, C&I, FM
Constance L. Walker, C&I, FM
Susan M. Watts-Taffe, C&I, FM
Diane M. Wiese-Bjornstal, RPLS, FM

Assistant Professor

Kenneth R. Bartlett, WCFE, AM
Martha H. Bigelow, C&I, AM
Deborah Ceglowski, C&I, AM
Douglas W. Huffman, C&I, AM
Joan E. Hughes, C&I, AM
Patricia A. James, C&I, General College, E
Richard M. Joerger, WCFE, AM
Jeremy Kahan, C&I, AM
Julie Kalnin, C&I, AM
W. Corliss Outley, RPLS, AM
Shari L. Peterson, WCFE, FM
Shelia K. Ruhland, WCFE, AM

Lecturer

Mary Bents, C&I, AM
L. Joanne Buggey, C&I, AM
Faith M. Clover, AM
Maurice K. Fahnestock, RPLS, AM
H. Michael Hartoonian, C&I, AM
Robert D. Shumer, WCFE, College of Continuing Education, AM
John R. Vreyens, WCFE, AM

Other

Jeanette R. Daines, WCFE, AM
Sara Dexter, C&I, AM
Marie J. Maher, WCFE, AM
Richard D. Nunneley, C&I, AM
Thomas D. Peacock, Education, Duluth, WCFE, AM
Jerome A. Stein, WCFE, AM
Joyce Walker, WCFE, AM
Barbara A. Warren, WCFE, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Education—Curriculum and Instruction

Contact Information—Department of Curriculum and Instruction, University of Minnesota, 125 Peik Hall, 159 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-625-2545; e-mail cigs@umn.edu).

Curriculum—By focusing on the curricular and instructional processes central to all educational endeavors, graduate programs within the Department of Curriculum and Instruction prepare students for professional roles in pre K-12 education, in postsecondary and research settings, and in educational service agencies.

The M.A.(Plan B only) includes concentrations in early childhood education; instructional systems and technology; literacy education (including children's literature, English education, language arts education, reading education, and writing education); science education; second languages and cultures education; and social studies education.

For additional M.A. programs, see art education, elementary education and mathematics education in this catalog.

The Ph.D. includes concentrations in art education; early childhood education; elementary education; instructional systems and technology; literacy education (including children's literature, English education, language arts education, reading education, and writing education); mathematics education; science education; second languages and cultures education; and social studies education.

Students must have an interest in educational research; students plan a program of coursework that prepares them to conduct scholarly research in an area of expertise related to curriculum and instruction.

Prerequisites for Admission—Prerequisites vary among areas of emphasis or concentration. Generally a bachelor's degree with licensure and/or teaching experience fulfills the requirement. For some areas, however, there is no equivalent undergraduate program. In that case, 15 to 20 credits of work at the undergraduate level determined acceptable by advisers and the director of graduate studies are adequate.

Special Application Requirements—Scores from the GRE are required. Master's and doctoral applications are reviewed by department faculty on continual basis throughout the academic year.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval. Students from other majors may include such courses subject to their own program's approval.

Courses—Please refer to Curriculum and Instruction (CI), Education (Educ), and Mathematics Education (MthE) in the course section of this catalog for courses pertaining to the program.

M.A. Plan B Degree Requirements

The M.A. degree requires a minimum of 30 credits, which includes 14 credits in the major, at least 4 credits in research (with at least 3 credits applied to the Plan B research paper), and 6 credits in a related area chosen in consultation with the adviser. Core and research course requirements are specified in accord with each area of concentration.

Language Requirements—Although language requirements for second languages and cultures (SLC) students are not specified in terms of degrees or coursework, each SLC student must give evidence of proficiency in communicating within the second language of choice.

Language Requirement—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master's minor requires a minimum of 6 credits, selected according to the student's needs and research interests.

Ph.D. Degree Requirements

A total of 78 credits is required for the Ph.D. Requirements include three core courses (9 credits) and at least 15 other credits in an area of concentration. Students must also complete 12 credits in research methodology; 6 credits in educational foundations; 12 credits in a minor or supporting program; and 24 thesis credits. Specific courses and additional work vary depending upon the area of concentration and are planned with the adviser.

Language Requirements—Although language requirements for second languages and cultures (SLC) students are not specified in terms of degrees or coursework, each SLC student must give evidence of proficiency in communicating within the second language of choice.

Minor Requirements for Students Majoring in Other Fields—A minimum of 12 credits is required for a minor. A demonstrated understanding of foundational knowledge related to curriculum and instruction is required.

Education—Recreation, Park, and Leisure Studies

Contact Information—Linda Estrem, Office of the Director of Graduate Studies, School of Kinesiology and Leisure Studies, University of Minnesota, 220 Cooke Hall, 1900 University Avenue S.E., Minneapolis, MN 55455 (612-624-5017; 612-625-5300; fax 612-626-7700; e-mail rpls@umn.edu; <www.kls.coled.umn.edu/>).

Curriculum—Ph.D. students in education with an emphasis in recreation, park, and leisure studies (RPLS) pursue an individualized program specializing in leisure services management, outdoor education/recreation, sport management, or therapeutic recreation.

Prerequisites for Admission—Although prospective students generally have completed undergraduate and masters' degrees in recreation, park, and leisure studies, others with a baccalaureate degree may be admitted who have related preparation and a significant background and interest in the subject. Admitted students may be required by their adviser to complete background preparation in undergraduate and graduate recreation and related coursework.

Special Application Requirements—Applicants must submit a completed application form including a clearly written statement of academic interests, goals, and objectives, scores from the General Test of the GRE (verbal and quantitative) or Miller Analogies Test that are less than five years old, three letters of recommendation from persons familiar with their scholarship and research potential, a scholarly paper, and copies of official transcripts. Students may apply at any time; however, submission of all application materials by January 15 is strongly encouraged to ensure priority consideration for admission as well as teaching and research assistantships awarded for the next academic year. Students can be admitted any term.

Research Facilities—Research facilities include the Institute on Community Integration and the Tucker Center for Research on Girls and Women in Sport.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please refer to Recreation, Park, and Leisure Studies (Rec) and Education (Educ) in the course section of this catalog for courses pertaining to the program.

Ph.D. Degree Requirements

The Ph.D. requires at least 86 credits, which must include 12 credits in an RPLS common core [including one course from Educational Policy and Administration (EdPA) or the Preparing Future Faculty Program (GRAD)], 21 credits in an RPLS emphasis area, 17 credits in research development, 12 credits in a supporting program or minor, and 24 thesis credits (Educ 8888). A minimum GPA of 3.00 is required to maintain good standing and to graduate.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor requires at least 12 credits of graduate level courses in RPLS, including Rec 5101 (3 cr) and Rec 8980 (2 cr).

Education—Work, Community, and Family Education

Contact Information—Gary Leske, Director of Graduate Studies, Department of Work, Community, and Family Education, University of Minnesota, R-350 Vocational and Technical Education Building, 1954 Buford Avenue, St. Paul, MN 55108 (612-624-1221; fax 612-625-8041; e-mail wcfe@umn.edu; <www.wcfe.coled.umn.edu>).

Curriculum—The program offers specializations in adult education, agricultural education and extension, business and industry education, family education, human resource development, and comprehensive work, community, and family education. Students combine study and related experiences to develop, apply, analyze, synthesize, and evaluate knowledge of the purposes, practices, issues, and problems of work, community, and family education; social, economic, historical, political, cultural, educational, technological, and psychological contexts within which work, community, and family education exist; and types of research that contribute to or apply that knowledge to the specialization.

See also Work, Community, and Family Education for information about the Ed.D. degree.

Prerequisites for Admission—Prospective students generally have completed an undergraduate degree or extensive coursework in the specialization area. Prospective doctoral degree students should have academic background and experience in at least one specialization area.

Special Application Requirements—Scores from the GRE General Test are required for applicants with a bachelor's degree from a U.S. institution. Applicants should designate the specific specialization to which they seek admission in their goal statement. A current resume is required. Students are admitted each term.

Use of 4xxx Courses—A maximum of 15 credits of 4xxx courses may be used in the related field or supporting program. Students who plan to use any 4xxx courses in their program are responsible for determining that the course is available for graduate credit. Degree programs must include rationale for the use of 4xxx course credits.

Courses—Please refer to Adult Education (AdEd), Agricultural, Food, and Environmental Education (AFEE), Business and Industry Education (BIE), Education (Educ), Family Education (FE), Human Resource Development (HRD), and Work, Community, and Family Education (WCFE) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements

The M.A. is offered under Plan A and Plan B. Students in either plan complete a minimum of 30 credits of 5xxx courses, including 14 credits in the major and 6 credits in the related field. Plan A students also take 10 thesis credits; Plan B students complete a 3- to 6-credit project or paper, with remaining credits taken in either the major or related field.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—The master's minor requires a minimum of 6 credits in one of the specializations, approved by the director of graduate studies.

Ph.D. Degree Requirements

The Ph.D. requires 60 course credits and 24 thesis credits. Course credits include a minimum of 16 credits in general aspects, a minimum of 16 credits in research, and a minimum of 16 credits in the specialization. Course credits must also include 12 elective credits and 12 credits from outside the department, which may overlap with those in general aspects, research, and the specialization.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—The doctoral minor requires a minimum of 12 credits in one of the specializations, approved by the director of graduate studies.

Educational Administration

Certificate of Specialist

Applications are not accepted for the Certificate of Specialist in this program. Students in the program are drawn from currently enrolled doctoral students who apply by submitting a Change of Status Application.

Educational Policy and Administration

Contact Information—Department of Educational Policy and Administration, University of Minnesota, 330 Wulling Hall, 86 Pleasant Street S.E., Minneapolis, MN 55455 (612-624-1006; fax 612-624-3377; e-mail edpagrad@umn.edu).

Professor

William M. Ammentorp, FM
Ayers Bagley, FM
Robert H. Bruininks, Educational Psychology, FM
David W. Chapman, FM
John J. Cogan, Curriculum and Instruction, FM
Philip T. K. Daniel, FM
Gerald W. Fry, FM
James C. Hearn, Jr., FM
Stephen A. Hoenack, Public Affairs, AM
Darrell R. Lewis, FM
Theodore Lewis, Work, Community, and Family Education, FM
Karen S. Louis, FM
Tim L. Mazzoni (emeritus), FM
Josef A. Mestenhauser (emeritus), FM
Van Dyck Mueller (emeritus), FM
Neal C. Nickerson (emeritus), FM
Robert D. Tennyson, Educational Psychology, FM
Caroline S. V. Turner, FM
James E. Ysseldyke, Educational Psychology, FM

Associate Professor

Melissa S. Anderson, FM
C. Cryss Brunner, FM
Arthur M. Harkins, FM
Darwin D. Hendel, FM
David R. Johnson, FM
Jean A. King, FM
R. Michael Paige, FM
Thomas D. Peacock, Education, Duluth, FM
Barbara B. Pillinger, AM
Byron J. Schneider, AM
James R. Stone III, Work, Community, and Family Education, AM
Jennifer York-Barr, FM

Assistant Professor

Nicola A. Alexander, AM

Lecturer

Jessica L. Bailey, E
Laura L. Bloomberg, E
Michael Courtney, E
Deanne L. Magnusson, AM
Joseph H. Nathan, AM
Richard Nunneley, E
Lynn R. Scearcy, AM
Patricia S. Seppanen, AM
Alice M. Thomas, AM
Kyla L. Wahlstrom, AM
Ann Z. Werner, E

Other

Carol M. Boyer, AM
Neil E. Christenson, AM
Timothy J. Delmont, AM
Gerald G. Mansergh, AM
Thomas F. Morgan, AM
Joyce Ann Walker, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The Department of Educational Policy and Administration prepares administrators, scholars, and analysts for leadership roles in education. The department is committed to the preparation of leaders who can act effectively and ethically within the structures, processes, and cultural contexts of organized education. Students in the M.A. and Ph.D. programs choose from one of four complementary but distinct program tracks: educational administration, evaluation studies, higher education, and comparative and international development education. In addition, the department offers a variety of Ed.D. programs for practicing professionals.

The department also cooperates with other departments within the College of Education and Human Development and the University to offer various certificate programs, an individualized concentration in youth leadership development, and freestanding minors in international education and program evaluation (see separate sections in this catalog for each minor).

These graduate programs incorporate relevant knowledge from the behavioral and social sciences and the humanities, with primary reliance on sociology, management science, political science, psychology, public affairs, economics, philosophy, history, and anthropology.

Prerequisites for Admission—Applicants must have completed appropriate undergraduate and graduate study. In some cases, where previous coursework or degrees are marginally related, otherwise qualified applicants will be asked to complete additional background courses after admission. Applications are encouraged from individuals who may have completed undergraduate and/or master's programs in related areas such as curriculum studies, public affairs, sociology, psychology, economics, political science, international relations, management science, measurement and statistics, and educational psychology. The department has study opportunities for professionals who are employed full time as well as for those who wish to pursue graduate studies full time.

Special Application Requirements—Applicants must submit scores from the General Test of the GRE, two letters of recommendation from persons familiar with their scholarship and research potential, a complete set of official transcripts, and three brief essays (personal statement, educational issue of interest, career goals). International students must also submit a TOEFL score, but international applicants to the M.A. program are exempt from the GRE. Applications are reviewed throughout the year; however, submission of all application materials by February 15 is strongly encouraged to ensure priority consideration for teaching and research assistantships awarded for the next academic year. All new students begin in fall semester unless permission to start earlier is granted by the program coordinator. The department application, letters of recommendation, and essays are sent directly to the department. The Graduate School application, GRE scores, transcripts, and TOEFL score are sent to the Graduate School.

Centers—College centers directed by department faculty include the Center for Applied Research and Educational Improvement (CAREI) and the Institute on Community Integration (ICI). These college centers and the department center, Postsecondary Education Policy Studies Center (PEPSC), provide research and graduate assistantship opportunities for department graduate students.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please refer to Educational Policy and Administration (EdPA) and Education (Educ) in the course section of this catalog for courses pertaining to the M.A. degree. Refer to EdPA and Education and Human Development (EdHD) for courses pertaining to the Ph.D. and Ed.D. degrees.

M.A. Plan B Degree Requirements

The master's is available under four program tracks: educational administration, evaluation studies, higher education, and comparative and international development education. All M.A. programs require 12 or more credits in program core courses, 6 or more credits in a related field, 6 or more credits of research methodology courses, 2-6 credits for the Plan B paper, and an oral exam. Within the general framework for M.A. requirements, the degree program is developed by the student and his or her adviser and is subject to approval by the department's director of graduate studies and the Graduate School.

Language Requirements—None

Final Exam—The final exam is oral.

Ph.D. Degree Requirements

The Ph.D. is available in four program tracks: educational administration, evaluation studies, higher education, or comparative and international development education. All Ph.D. programs include 10 credits in department core courses, 12 or more credits in program core courses, 6 or more credits in other program courses, 12 or more credits of research methodology courses, 12 or more course credits in a supporting program or minor, and 24 thesis credits. Preliminary written and oral exams are required and students must complete a dissertation and a

final oral examination. Within the general framework for Ph.D. requirements, the degree program is developed by the student and his or her adviser and is subject to approval by the department's director of graduate studies and the Graduate School.

Language Requirements—None.

Ed.D. Degree Requirements

The doctor of education (Ed.D.) is a professionally oriented degree program for those who will provide leadership in educational institutions. The program emphasizes breadth of preparation in educational policy and administration and in related fields. Through courses, seminars, and independent study, students learn to apply the products of disciplined inquiry to educational policy issues and practical situations in educational environments.

The Ed.D. is offered in two areas in educational policy and administration: educational administration (PK-12 schools) and the leadership academy (two-year, postsecondary institutions). Cohorts for PK-12 school leaders include those in the metropolitan area, outstate Minnesota, and international schools. The Ed.D. degree is offered only in the context of cohort programs of 20-30 students each.

All Ed.D. cohort programs include department core courses, program core courses, other program courses, inquiry and research courses, supporting program or minor, and field research project credits. Within the overall 76 or more credit framework (some credits may be brought in from previous graduate work), specific course requirements are developed for each program emphasis and cohort.

Preliminary written and oral exams are required, and students must complete a professional field project that contributes to the improvement of educational policy or practice. The final exam is an oral defense.

Language Requirements—None.

Final Exam—The final exam is oral.

Educational Psychology

Contact Information—Director of Graduate Studies Assistant, Department of Educational Psychology, University of Minnesota, 204 Burton Hall, 178 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-624-1698; fax 612-624-8241; e-mail warho004@umn.edu; <www.education.umn.edu/EdPsych/default.html>).

For specific program materials, contact the program areas as follows: Counseling and Student Personnel Psychology, University of Minnesota, 129 Burton Hall, 178 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-624-6827; fax 612-625-4063; e-mail cspp-adm@umn.edu); Psychological Foundations of Education, University of Minnesota, 206 Burton Hall, 178 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-624-0042; fax 612-624-8241; e-mail psyf-adm@umn.edu); School Psychology, University of Minnesota, 344 Elliott Hall, 75 E. River Road, Minneapolis, MN 55455 (612-624-4156; fax 612-624-0879; e-mail schpsych@umn.edu); Special Education, University of Minnesota, 227 Burton Hall, 178 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-624-5064; fax 612-626-9627; e-mail sped-adm@umn.edu).

Professor

William M. Bart, FM
Jerome Beker, Social Work, FM
Robert H. Bruininks, FM
Sandra L. Christenson, FM
Mark L. Davison, FM
Stanley L. Deno, FM
Byron Egeland, Child Development, FM
L. Sunny Hansen (emeritus), FM
Michael R. Harwell, FM
Vernon L. Hendrix, (emeritus), AM
Thomas J. Hummel, FM
Susan C. Hupp, FM
David W. Johnson, FM
Paul E. Johnson, Information and Decision Sciences, FM
Roger T. Johnson, Curriculum and Instruction, AM
Frances P. Lawrenz, FM
Rodney G. Loper, AM
Geoffrey M. Maruyama, FM
Scott R. McConnell, FM
Mary A. McEvoy, FM
Anthony Pellegrini, FM
Joe E. Reichle, Communication Disorders, AM
John L. Romano, FM
John E. Rynders (emeritus), FM
S. Jay Samuels, FM
Thomas M. Skovholt, FM
Robert D. Tennyson, FM
James E. Turnure (emeritus), FM
Paulus W. van den Broek, FM
Patricia R. M. Veach, FM
Richard A. Weinberg, Child Development, FM
Frank B. Wilderson (emeritus), FM
James E. Ysseldyke, FM

Associate Professor

Ernest C. Davenport, FM
Marsha Davis, AM
V. Lois Erickson, FM
Christine A. Espin, FM
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David R. Johnson, AM
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Marie Knowlton (emeritus), FM
Susan Rose, FM
Jennifer York-Barr, Educational Policy and Administration, AM

Assistant Professor

Marika Ginsburg-Block, AM
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Jeffrey D. Long, AM
Jennifer J. McComas, AM
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Lecturer

Brian H. Abery, AM
Kimberly S. Adams, E
Ann M. Casey, AM
Daria Courtney, E
Robert C. DelMas, General College, AM
Michelle P. Eckart, E
Kimberly Gibbons, E
Jane S. Levin, AM
Douglas B. Marston, AM
Judith Puncochar, E
Richard J. Spicuzza, AM
Kay A. Thomas, AM
Teresa L. Wallace, E
Joyce D. Weinsheimer, AM

Other

Annie P. Baldwin, E
Ronald P. Matross, E
Martha L. Thurlow, E

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Program areas are counseling and student personnel psychology (CSPP); school psychology; special education; and psychological foundations of education (including research methodology, learning and cognition, human relations, personality and social psychology, and educational technology).

Prerequisites for Admission—There are no special prerequisites for admission at the M.A. level in any of the four program areas, or at the Ph.D. level in school psychology or psychological foundations of education. Applicants to the CSPP doctoral program should hold either a bachelor's or master's degree with a major in psychology, education, counseling, or a related field. CSPP applicants interested in earning the specialist certificate should hold an M.A. degree; if not, they should apply to both the M.A. and specialist certificate programs.

Special Application Requirements—Applicants must submit a department application *(with clear indication of the desired program area)*, a statement of goals and interests, three letters of recommendation, and a Graduate School application accompanied by official transcripts from all colleges and universities attended. These test scores are required: the CSPP, psychological foundations of education, and special education programs require the GRE; the school psychology program requires the GRE and later an interview for those who make the initial cut.

Applications to CSPP, school psychology, and special education are accepted for fall admission only. Applications to psychological foundations are accepted throughout the year. Please check directly with the program offices for current deadlines.

Use of 4xxx Courses—None of the four programs allow 4xxx or 6xxx coursework to be counted toward Graduate School degree program requirements.

Courses—Please refer to Educational Psychology (EPsy) in the course section of this catalog for courses pertaining to the program.

Educational Psychology—Counseling/Personnel

The counseling and student personnel psychology (CSPP) program subscribes to the scientist/practitioner model, which assumes that scholarly inquiry and counseling practice are interdependent and complementary. The program prepares counseling psychologists who will use their professional training to apply psychological and educational knowledge as skilled clinicians and critical producers and users of qualitative and quantitative research.

Certificate of Specialist Requirements

Students must complete at least 60 credits, including 11 credits in EPsy core courses (statistics, measurement, learning, social psychology, and personality), 26 credits in counseling theory and practice, and at least 10 additional credits within educational psychology.

Language Requirements—None.

Final Exam—The final exam is oral.

M.A. Degree Requirements

Students must complete at least 43 credits, including 11 credits in EPsy core courses (statistics, measurement, learning, social psychology, and personality), 26 credits in counseling theory and practice, and 6 credits in a related field or minor.

Language Requirements—None.

Final Exam—The final exam is written; students must also submit a portfolio.

Minor Requirements for Students Majoring in Other Fields—A master's minor requires at least 6 credits of graduate-level EPsy courses.

Ph.D. Degree Requirements

Students must complete 26 credits in EPsy core courses (statistics, measurement, learning, social psychology, personality, foundations, and research methods); 51 credits in counseling theory and practice, practica, and internships; 12 credits in a supporting program or minor; and 24 thesis credits.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor requires at least 14 credits of graduate-level EPsy courses: 8 credits in psychological foundations and 6 credits in applied areas, of which at least 8 credits must be in 8xxx courses. The minor is not covered in the preliminary exams.

Educational Psychology—Psychological Foundations

Graduate study in psychological foundations of education prepares students for research and teaching positions in colleges and universities, schools, private industry, human service organizations, health science units, government agencies, and other research and development centers. Graduates of the program are typically employed as professors, researchers, directors of testing, instructional designers, evaluation specialists, planning officers, statisticians, and computer programmers. Students may specialize in the methodological or psychological foundations of education.

The program offers M.A. and Ph.D. degrees with emphases in research methodology (with specializations in statistics, measurement, and evaluation), social psychology, personality, learning and cognition, human relations, and educational technology. Students typically choose one of these areas in addition to achieving broad competence in all aspects of the curriculum.

M.A. Degree Requirements

Students must complete at least 30 credits, including 11 credits in EPsy core courses (statistics, measurement, learning, social psychology, and personality) and 6 credits in a related field or minor. Plan A students must also take 10 thesis credits.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master's minor requires at least 6 credits of graduate-level EPsy courses.

Ph.D. Degree Requirements

Students must complete 26 credits in EPsy core courses (statistics, measurement, learning, social psychology, personality, foundations, and research methods), 12 credits of EPsy electives, 12 credits in a supporting program or minor, and 24 thesis credits.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor requires at least 14 credits of graduate level courses in EPsy: 8 credits in psychological foundations and 6 in applied areas, of which at least 8 credits must be in 8xxx courses. The minor is not covered in the preliminary exams.

Educational Psychology—School Psychology

School psychology is an interdepartmental program involving the Departments of Educational Psychology and Psychology and the Institute of Child Development. It is fully accredited by the American Psychological Association, the Minnesota Board of Teaching, and the National Association of School Psychologists. Through coursework and practica/internships, students develop competencies in assessment, consultation, intervention and program development, research, and evaluation. Graduates are employed as psychologists in local schools, university clinics and hospitals, community mental health centers, and as trainers/researchers in universities. Since 1988, training has focused on the delivery of psychological services in schools and school communities to promote children's and adolescent's academic, social, and behavioral success.

The program integrates didactic and experiential components of training and applied research. Students develop specific competencies through a broad range of applied experiences, including field placements, practical assignments, and a full-year internship.

Certificate of Specialist Requirements

The specialist program is for students who want to become practitioners. It meets the Minnesota certification requirements for school psychologists.

Students must complete at least 60 credits, including 11 credits in EPsy core courses (statistics, measurement, learning, social psychology, and personality) and 21 credits in school psychology theory and practice and child development, followed by a year-long internship designed to first meet requirements for the M.A. degree in educational psychology, then the specialist certificate in school psychological services and certification under Minnesota state regulations.

Language Requirements—None.

Final Exam—The final exam is a written, special field exam.

M.A. Degree Requirements

The M.A. is offered under Plan A (thesis) and Plan B (paper) and requires at least 30 credits: 11 credits in EPsy core courses (statistics, measurement, learning, social psychology, and personality) and 6 credits in a related field or minor. Plan A students must also take 10 thesis credits; Plan B students take 2 research credits (EPsy 8994).

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master's minor requires at least 6 credits of graduate-level EPsy courses.

Ph.D. Degree Requirements

The Ph.D. program educates future school-based researchers with emphases in family/school partnerships, outcome assessment, school dropouts, and school outcomes and interventions for children/adolescents at risk.

Students must complete 26 credits in EPsy core courses (statistics, measurement, learning, social psychology, personality, foundations, and research methods). In consultation with their advisers, students develop a curriculum and select courses and practica placements that are appropriate for their interests, prior experience, and career directions.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor requires at least 14 credits of graduate-level EPsy courses: 8 credits in psychological foundations and 6 credits in applied areas, of which at least 8 credits must be in 8xxx courses. The minor is not covered in the preliminary exams.

Educational Psychology—Special Education

M.A., Ph.D., and certificate of specialist degrees are offered in special education in the following specializations: deaf/hard-of-hearing, social/emotional disabilities, early childhood special education, learning disabilities, mild/moderate disabilities, and severe/profound disabilities. Early involvement in research projects and the development of original research programs in such areas as instructional strategies, social and cognitive development, behavioral and psychological management, child development, and technology are encouraged. Special projects and training programs supplement academic studies.

The program focuses on the attainment of core competencies and related skills, since special education professionals share many common concerns and goals. A complementary emphasis is placed on problems unique or extremely influential in the field, including social and cultural perceptions about disabilities, and federal, state, and local legislation regarding prevention and the care, treatment, education, training, and support of persons with disabilities.

Certificate of Specialist Requirements

Students must complete at least 60 credits, including 17 credits in EPsy core courses (statistics, measurement, learning, social psychology, personality, and research methods) and 6 credits of special education foundations. The remaining coursework usually focuses on two or more special education areas, determined in consultation with the adviser.

Language Requirements—None.

Final Exam—The final exam is oral.

M.A. Degree Requirements

Students may emphasize consulting, administration, college teaching, or research in one or more of the specializations.

Students must complete at least 30 credits, including 11 credits in EPsy core courses (statistics, measurement, learning, social psychology, and personality), 6 credits in special education foundations, and 6 credits in a related field or minor. Plan A students must take 10 thesis credits.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master's minor requires at least 6 credits of graduate-level EPsy courses.

Ph.D. Degree Requirements

The Ph.D. program trains graduates to address problems related to the full development of individuals with disabilities and their families. Intensive course-related learning and guided experiences prepare students to assume professional leadership. Further competencies may be achieved in four areas of emphasis: research, professional preparation, administration/policy, and clinical practice/community service.

Students must complete 26 credits in EPsy core courses (statistics, measurement, learning, social psychology, personality, foundations, and research methods), 12 credits in special education (EPsy 8701 and 8702 and 6 additional credits, of which at least 2 must be from EPsy 86xx or 87xx offerings), 12 credits in a supporting program or minor, and 24 thesis credits.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor requires at least 14 credits of graduate-level EPsy courses: 8 credits in psychological foundations and 6 in applied areas, of which at least 8 credits must be in 8xxx courses. The minor is not covered in the preliminary exams.

Electrical Engineering

Contact Information—Director of Graduate Studies, Department of Electrical Engineering, University of Minnesota, 4-178 Electrical Engineering/Computer Science, 200 Union Street S.E., Minneapolis, MN 55455 (612-625-3564; fax 612-625-4583; e-mail graduate_studies@ece.umn.edu; <www.ece.umn.edu>).

Professor

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Stephen A. Campbell, FM
Philip I. Cohen, FM
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David H. Du, FM
Gabriel C. Ejebe, AM
Tryphon T. Georgiou, FM
Georgios Giannakis, FM
Anand Gopinath, FM
Jack H. Judy, FM
Mostafa Kaveh, FM
John C. Kieffer, FM
Richard A. Kiehl, FM
Larry L. Kinney, FM
K. S. P. Kumar, FM
Vipin Kumar, AM
E. Bruce Lee, FM
James R. Leger, FM
David J. Lilja, FM
Christine Maziar, FM
Ned Mohan, FM
Jay Moon, FM
Marshall I. Nathan, FM
Nikolaos P. Papanikolopoulos, AM
Keshab K. Parhi, FM
Robert P. Patterson, Physical Medicine and Rehabilitation, FM
William T. Peria, FM
Dennis L. Polla, FM
William P. Robbins, FM
P. Paul Ruden, FM
James R. Slagle, FM
Allen R. Tannenbaum, FM
Ahmed H. Tewfik, FM
Randall H. Victora, FM
Bruce F. Wollenberg, FM
Paul R. Woodward, FM
Pen-Chung Yew, FM

Associate Professor

Vladimir Cherkassky, FM
Emad Ebbini, FM
Douglas W. Ernie, FM
Ramesh Harjani, FM
Ted K. Higman, FM
James E. Holte, FM
Thomas S. Lee, FM
Bradley J. Nelson, Mechanical Engineering, FM
Matthew T. O'Keefe, FM
Sachin Sapatnekar, FM
Guillermo Sapiro, FM
Nicholas D. Sidiropoulos, FM
Gerald E. Sobelman, FM
Bapiraju Vinnakota, FM

Assistant Professor

Mohamed-Slim Alouini, FM
Kiarash Bazargan, FM
Rhonda Drayton, FM
Joseph J. Talghader, FM
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Zhi-Li Zhang, AM
Babak Ziaie, FM

Other

Gregory T. Cibuzar, AM
Barry K. Gilbert, FM
Robert A. Sainati, AM
Frank G. Soltis, AM
Marian S. Stachowicz, AM
Bethanie J. Stadler, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The Department of Electrical and Computer Engineering offers diverse educational programs that encompass nearly all aspects of modern electrical and computer engineering, ranging from the very theoretical system and information theory to highly experimental work in novel device research and microelectronics. Emphases in the major are solid state and physical electronics, surface physics, thin films, sputtering, noise and fluctuation phenomena, quantum electronics, plasma physics, automation, power systems and power electronics theory, wave propagation, communication systems and theory, optics, lasers, fiber optics, magnetism, semiconductor properties and devices, VLSI and WSI engineering in theory and practice, network theory, signal and image processing, and computer and systems engineering. Interdisciplinary work is also available in bioelectrical sciences, control sciences, computer sciences, solar energy, applications of systems theory to urban transportation and economic planning, and biological modeling.

Prerequisites for Admission—Graduate work is open to students who have shown exceptional scholarship and ability in an accredited undergraduate curriculum in electrical engineering or physics. Consideration is given to students who have completed another curriculum in engineering, science, or mathematics that includes sufficient preparation to pursue a graduate program in electrical engineering. In some instances, additional preparatory studies may be required after admission. Students whose training is in engineering technology will not be considered for admission.

Special Application Requirements—Scores from the GRE (General Test only) are required of all students desiring financial aid. International students applying from within the country should furnish letters from United States faculty members attesting to their ability to understand technical instruction in English. Students submitting transcripts from non-American institutions should furnish letters of recommendation that verify their academic standing in a specific way (e.g., class rank). Entry other than in fall semester is not recommended. Applicants for fall semester admission interested in financial aid should file a completed admission application with the Graduate School by December 15 for admission the following September and should send a copy of their application materials directly to the department.

Use of 4xxx Courses—EE 4xxx courses acceptable for major field credit: EE 4301, 4541, 4701, 4721, and 4741. Non-EE 4xxx courses acceptable for supporting/related field credit: Math 4065, 4151, 4152, 4242, 4337, 4428, 4457, 4458, 4512, 4567, and 4606, and Stat 4101. All 4xxx physics courses are acceptable for graduate credit. No 4xxx computer science, mechanical engineering, or industrial engineering courses are acceptable for graduate credit.

Courses—Please refer to Electrical Engineering (EE) in the course section of this catalog for courses pertaining to the program.

M.E.E. Coursework Only Degree Requirements

The M.E.E. degree requires 30 credits, including at least 14 credits from EE courses at 5xxx and higher, at least 6 credits from courses numbered 4xxx and higher in a minor or related field, and 10 credits from EE or a supporting program. Colloquium and seminar credits cannot be used in any M.E.E. program.

Language Requirements—None.

Final Exam—No final exam is required.

Minor Requirements for Students Majoring in Other Fields—Credits for the master's minor must be from classroom and laboratory courses graded A-F. In particular, colloquia, seminar, and special investigations credits do not count tements.

M.S.E.E. Degree Requirements

Every M.S.E.E. degree program must include 30 credits including at least 14 credits from EE courses at 5xxx or higher (a few 4xxx EE courses can be used on the program) and at least 6 credits from courses outside EE at 4xxx or higher (normally from departments in the Institute of Technology or School of Statistics). These credits cannot come from colloquia or seminar registrations). A Plan A program (with thesis) cannot include more than 2 credits from projects, seminars, special investigations, or directed studies; in a Plan B program (without thesis) the limit is 3 credits. The Plan A program should include 10 thesis credits. Part-time students must choose Plan B; full-time students may choose either Plan A or Plan B.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—The 6 credits for the master's minor must be from classroom and laboratory courses graded A-F. In particular, colloquia, seminar, and special investigations credits do not count toward meeting the minor requirements.

Ph.D. Degree Requirements

The Ph.D. requires at least 40 course credits including at least 6 credits in 8xxx courses, at least 14 credits in EE courses, and at least 12 credits in the supporting program or minor, which cannot include EE courses. In addition, 24 thesis credits are required. The program may contain up to 2 credits from seminars or special investigations registrations and up to 8 credits of M.S. thesis registration, none of which can be used to meet the major requirements above. No credits can be included from colloquia or M.S. Plan B projects. At least 14 credits must be coursework taken at the University of Minnesota. The student's degree program form listing all courses to be included toward the degree should be submitted no later than the end of the second year of the Ph.D. program. Each Ph.D. student must participate in one of the department research area seminars and make at least three oral paper presentations before the thesis proposal will be approved.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—The 12 credits for the Ph.D. minor must be from classroom and laboratory courses graded A-F. In particular, colloquia, seminar, and special investigations credits do not count toward meeting the minor requirements.

Elementary Education

Contact Information—See Education: Curriculum and Instruction for M.A., and Ph.D. information.

Professor
Patricia G. Avery, AM
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Kerry J. Freedman, AM
Lee Galda, AM
Roger T. Johnson, AM
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Thomas R. Post, AM
Barbara M. Taylor, AM

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Patricia A. Heller, AM
Rosemarie J. Park, Work, Community, and Family Education, AM
Constance L. Walker, AM
Susan M. Watts-Taffe, AM

Assistant Professor
Deborah Ceglowski, AM

Lecturer
L. Joanne Buggey, AM
H. Michael Hartoonian, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—By focusing on the curricular and instructional processes central to all educational endeavors, graduate programs within the Department of Curriculum and Instruction prepare students for professional roles in pre K-12 education, in postsecondary and research settings, and in educational service agencies.

The M.A. in elementary education typically concentrates on one or two curriculum areas and includes foundational coursework in the area(s) of concentration, together with courses offering research review and preparation.

Prerequisites for Admission—Prerequisites vary among areas of emphasis or concentration. Generally a bachelor's degree with licensure and/or teaching experience fulfills the requirement. For some areas, however, there is no equivalent undergraduate program. In that case, 15 to 20 credits of work at the undergraduate level determined acceptable by advisers and the director of graduate studies are adequate.

Special Application Requirements—Scores from the GRE are required. Master's applications are reviewed by department faculty on continual basis throughout the academic year.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval. Students from other majors may include such courses subject to their own program's approval.

Courses—Please refer to Curriculum and Instruction (CI) and Education (Educ) in the course section of this catalog for courses pertaining to the program.

M.A. Plan B Degree Requirements

The program requires 30 credits, which includes a minimum of 14 credits in the major, a minimum of 4 credits in research (including 3-6 credits applied to the Plan B research paper), and a minimum of 6 credits in a supporting program or minor. A balanced program of coursework is selected in curriculum and instructional research related to each student's area of concentration.

Language Requirements—None.

Final Exam—The final exam is oral.

English

Contact Information—Director of Graduate Studies, Department of English, University of Minnesota, 204 Lind Hall, 207 Church Street S.E., Minneapolis, MN 55455 (612-625-3882; fax 612-624-8228; e-mail gradeng@umn.edu; <http://english.cla.umn.edu/graduateprogram/intro>).

Regents' Professor

Thomas S. Clayton, FM
Patricia M. Hampl, FM

Professor

Kent R. Bales, FM
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Lillian S. Bridwell-Bowles, FM
Michael D. Browne, FM
Andrew Elfenbein, FM
Genevieve J. Escure, FM
Peter E. Firchow, FM
Shirley N. Garner, FM
Edward M. Griffin, FM
David B. Haley, FM
Michael Hancher, FM
Gordon D. Hirsch, FM
Karen A. Hoyle, Children's Literature Research Collection, AM
Klaus P. Jankofsky, English, Duluth, FM
Richard J. Kelly, Library Collection Development: Arts & Humanities, AM
Calvin B. Kendall, FM
Toni A. H. McNaron, FM
Valerie J. Miner, FM
John W. Mowitt, Cultural Studies and Comparative Literature, FM
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Donald J. Ross, Jr., FM
Martin Roth, FM
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Associate Professor

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Maria J. Fitzgerald, FM
Ray Gonzalez, AM
Josephine D. Lee, FM
Archibald I. Leyasmeyer, AM
Ellen Messer-Davidow, FM
Angelita D. Reyes, Afro-American and African Studies, FM
Julie Schumacher, FM
Charles J. Sugnet, FM
John A. Watkins, FM
John S. Wright, FM

Assistant Professor

Thomas E. Augst, AM
Patricia A. Crain, AM
Lois B. Cucullu, AM
Lianna H. Farber, AM
Brian B. Goldberg, AM
Qadri Ismail, AM
Rebecca L. Krug, AM
David B. Luke, AM
Daniel J. Philippon, Rhetoric, AM
Rita Raley, AM
Janette Scandura, AM
David R. Treuer, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Over the past 20 years, the field of English studies has dramatically changed from a discipline concerned with studying the literary works produced by English speakers in Britain and the United States to encompass writings in English from around the globe. The concerns of literary scholars have broadened to include not only textual analyses but also cultural, social, political, and economic contexts. The field of literature itself now encompasses not only the traditional genres of poetry, prose (fiction and belles-lettres), and drama, but also extra-literary discourses: folklore, popular culture, film, television, legal documents, conduct books, and manifestoes. English as a field has moved to embrace its natural borders with cultural studies, feminist studies, and area studies. The department has been in the forefront of interdisciplinary projects, thanks to the efforts of a faculty committed to research in American studies, medieval studies, feminist studies, film studies, and cultural studies. At the same time, the department maintains the core concerns of the discipline—the traditional study of the literatures and languages in English—as well as develops writers for the present and future through the master of fine arts in creative writing degree The department is engaged in two simultaneous projects: to preserve the core curriculum and to reimagine its future shape.

The Department of English offers two master's degrees, the master of arts in English language and literature, and the master of fine arts in creative writing (see listing under Creative Writing). The M.A. offers training in the areas of literary history, literary theory and interpretation, language, linguistics, rhetoric, and composition. Students in the M.A. can develop specific concentrations through consultation with the director of graduate studies.

Course requirements for the Ph.D. and M.A. programs are broadly defined, allowing the student to shape a personal program of study. The English program encourages and supports interdisciplinary work. The M.F.A. program requires coursework in English and writing and emphasizes intensive work on a creative project.

Admission to the Program—Students with a bachelor's degree may apply either to the master's program or the doctoral program. An M.A. degree, but not an M.F.A. degree, can be gained en route to the Ph.D. degree. M.A. candidates who wish to continue their studies must formally apply for admission to the Ph.D. program.

Prerequisites for Admission—A minimum of four courses in English, three of which must be at the upper division level, is required for degree programs and the graduate minor. The courses should be widely distributed.

Special Application Requirements—Three letters of recommendation; scores from the General Test of the GRE; a short essay explaining scholarly, professional, and personal goals and reason(s) for choosing the University of Minnesota; and a writing sample, such as a course paper, are required. Applications to the M.F.A. in creative writing are reviewed by the writing faculty; these applications should include a substantial portfolio of writing. Candidates for all degrees are admitted fall semester only; all materials must be received by December 20.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please refer to English: Creative and Professional Writing (EngW), and English Language and Literature (EngL) in the course section of this catalog for courses pertaining to the program.

M.A. Plan B Degree Requirements

The minimum requirement for the M.A. is 30 credits. Coursework must include at least 24 credits in English and 6 credits in related fields outside of English or in a minor field. All M.A. students must complete an introductory sequence EngL 5001-02 on methods and theory of literary study, and three Plan B papers.

Language Requirements—A reading knowledge of one classical or modern language, approved by the director of graduate studies, is required.

Final Exam—Oral.

Minor Requirements for Students Majoring in Other Fields— The master's minor consists of 9 credits in English. Course selection is determined in consultation with the director of graduate studies.

Ph.D. Degree Requirements

A minimum of 66 credits, including 24 thesis credits, is required. Course requirements for the Ph.D. program are broadly defined, allowing students to shape a personal program of study. The following courses are required: EngL 5001 and 5002, preferably during the first year of doctoral study (6 credits); four English courses distributed among broad areas (minimum of 12 credits); four additional English courses in a focused area of emphasis (minimum of 12 credits); 12 credits in a supporting program. Students are encouraged to enroll in additional courses as appropriate.

Language Requirements—A reading knowledge of two languages, classical or modern, approved by the director of graduate studies, is required. Students specializing in medieval or early modern literature and culture are advised to include Latin as one of their languages.

Minor Requirements for Students Majoring in Other Fields—The Ph.D. minor consists of 12 credits in English. Course selection is determined in consultation with the director of graduate studies.

English as a Second Language

Contact Information—Director of Graduate Studies, English as a Second Language, University of Minnesota, 215 Nolte Center, 315 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-624-3331; fax 612-624-4579; e-mail iles@umn.edu; <www.iles.umn.edu/esl.htm>).

Professor
Andrew D. Cohen, AM
Elaine E. Tarone, AM

Assistant Professor
Anne Lazaraton, AM

Other
Jenise Rowekamp, EM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The program in English as a second language (ESL) offers a course of study leading to an M.A. Degree holders are qualified to teach ESL to adults at the college or university level. The program emphasizes research in language analysis, language acquisition, teaching methodology, materials development, and uses of technology in language teaching. Students are expected to do independent and creative work in one or two of these areas with the aim of developing a more complete understanding of the issues facing professionals in the field of ESL today.

Prerequisites for Admission—A bachelor's degree in the liberal arts or sciences with a strong academic record is required.

Special Application Requirements—Scores from the General (Aptitude) Test of the GRE, three letters of reference, and a statement of the applicant's research interests in the field are required. Non-native speakers of English must submit TOEFL scores (minimum 600). Students may begin the program fall semester or first summer session. Applications for both admission dates are due on March 1. Applications for financial aid must be submitted by January 15.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please refer to Teaching English as a Second Language (TESL) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements

The M.A. program in ESL normally takes at least two years to complete. The Plan A option requires a thesis demonstrating original work in areas related to the field, familiarity with research methodology, and knowledge of the effective presentation of investigative study results. The Plan B option requires two qualifying papers, usually consisting of course papers which have been rewritten under the supervision of a faculty member. The same standards of excellence are applied to both Plan A and Plan B options.

Plan A and Plan B students must complete 24 credits in required coursework and 6 credits of elective coursework in related fields. Plan A students must complete an additional 10 thesis credits for a total of 40 credits and Plan B students must complete an additional 3 credits in elective coursework for a total of 33 credits. Elective and related field courses must be chosen with the help of an adviser to ensure the relevance of courses to students' goals.

Language Requirements—Proficiency, demonstrated by exam or coursework, in one language not native to the student is required upon completion of the program.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—For a minor in ESL, students must take TESL 5721, 5401, and 5402, for a total of 11 credits.

Entomology

Contact Information—Director of Graduate Studies, Department of Entomology, University of Minnesota, 219A Hodson Hall, St. Paul, MN 55108 (612-624-3636; fax 612-625-5299; e-mail entodept@umn.edu; <www.entonmology.umn.edu>).

Professor
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Edward B. Radcliffe, FM
David W. Ragsdale, FM
David D. Walgenbach, FM

Adjunct Professor
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Associate Professor
Leonard C. Ferrington, FM
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Marla Spivak, FM
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Adjunct Associate Professor
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Dharma Sreenivasam, E
Robert C. Venette, E

Assistant Professor
Colleen A. Cannon, AM
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Steven J. Seybold, FM

Adjunct Assistant Professor
Steven A. Katovich, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Entomology centers on the study of insects and includes specializations in ecology, behavior, molecular biology, microbiology, neurobiology, physiology, population dynamics, systematics, and taxonomy. Specialized or applied areas include apiculture, biological control, cell culture, insect conservation, insect-vector relations, integrated pest management, and modeling. Research programs are active in aquatic systems, crop and animal agriculture, human health, and the natural and urban environments.

Prerequisites for Admission—A bachelors degree with a major in a biological science is a prerequisite. Preference is given to students with a broad background in the basic sciences.

Special Application Requirements—Applicants must submit a complete set of official transcripts and a written statement of career interests, goals, and objectives. Three letters of recommendation are required from persons well acquainted with the student's academic record. Although GRE scores are not required, they are highly recommended for applicants who may qualify for graduate school fellowships. For consideration for fellowships, applicants should submit materials by January 15. Applications are reviewed individually when all materials are complete. Students are admitted each semester.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please refer to Entomology (Ent) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements

Requirements for the M.S. include a minimum of 14 course credits in entomology including a core curriculum of fundamental entomology courses and 1 credit of graduate seminar. Additional requirements include credits from other programs to make a total of 20 course credits for Plan A or 30 course credits for Plan B students. These courses are flexible and are determined in consultation with the adviser and other members of the student's advisory committee. Plan A students take an additional 10 thesis credits, and Plan A is recommended for students contemplating a career in entomological research. Written and oral preliminary exams, in addition to the final oral exam, are required for all entomology graduate degrees.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master's minor requires 6 credits in 4xxx, 5xxx, or 8xxx entomology courses.

Ph.D. Degree Requirements

Ph.D. requirements include a core curriculum of fundamental entomology courses and 2 credits of graduate seminar. Additional requirements are flexible and are determined in consultation with the adviser and other members of the student's advisory committee.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—The doctoral minor requires 12 credits in 4xxx, 5xxx, or 8xxx entomology courses, including Ent 5021.

Environmental Health

Contact Information—Student Services Center, School of Public Health, University of Minnesota, Mayo Mail Code 819, 420 Delaware Street S.E., Minneapolis, MN 55455 (612-626-3500 or 1-800-774-8636; fax 612-624-4498; e-mail sph-ssc@umn.edu; <www.sph.umn.edu>).

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Instructor

Debra K. Olson, FM

Other

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L. Ronald French, AM
Jeffrey H. Mandel, AM
Marian C. Marbury, AM
Nicole V. McCullough, E
David L. Parker, E
Robert S. Skoglund, AM
Fay M. Thompson, E

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Environmental health is the study of how exposures to external hazards, including chemical, physical and biological agents, affect human health. Environmental health researchers and professionals seek to understand how to evaluate exposures that create risk to human health, how those exposures elicit biological responses that lead to disease and injury, and how policy is developed and used to prevent adverse health effects. This division offers academic programs at the master's and doctoral levels, conducts research in diverse areas of environmental health, offers continuing education, and conducts outreach. The academic programs prepare students to be leaders in environmental health in academia, industry, consulting groups, and government agencies. The division's training and research programs emphasize the importance of translating basic scientific knowledge into solutions for current societal problems and concerns. Applicants must indicate an interest in one of the following specialties within the major: environmental chemistry, environmental health policy, environmental microbiology, environmental and occupational epidemiology, environmental toxicology, the general environmental health program, occupational health nursing, occupational injury epidemiology and control, or work environments and industrial hygiene.

Prerequisites for Admission—Minimum requirements include a baccalaureate degree with coursework in the basic sciences. Each specialty requires slightly different preparation.

Special Application Requirements—GRE scores, a letter describing the applicant's professional objectives, and three letters of recommendation are required.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to the approval of the adviser and the director of graduate studies. Students from other majors may include such courses subject to their own program's approval.

Courses—Please refer to Public Health (PubH), particularly numbers 51xx-52xx and 81xx-82xx, in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements

The M.S. program prepares students for specialized careers in environmental and occupational health. M.S. students receive a solid technical background in their disciplines and by graduation are proficient in applied or basic research.

The minimum credits required for graduation depends on the chosen specialty area. Most specialty areas require a two-year program. M.S. students have the option of completing a Plan A with a thesis or a Plan B project.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—Students completing a minor in environmental health must complete 8 credits in environmental health, including PubH 5103—Exposure to Environmental Hazards (3 cr), PubH 5104—Environmental Health Effects: Introduction to Toxicology (2 cr), and PubH 5105—Environmental and Occupational Health Policy (3 cr).

Ph.D. Degree Requirements

The Ph.D. focuses on research, supplemented with advanced coursework developed under the guidance of a faculty adviser and a Ph.D. committee. Students are required to register for 24 thesis credits. Students usually need a minimum of two to three years beyond the master's degree to complete a doctorate.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—Students are required to take a minimum of 12 credits in environmental health, including PubH 5103—Exposure to Environmental Hazards (3 cr), PubH 5104—Environmental Health Effects: Introduction to Toxicology (2 cr), and PubH 5105—Environmental and Occupational Health Policy (3 cr).

Epidemiology

Contact Information—Student Services Center, School of Public Health, University of Minnesota, Mayo Mail Code 819, 420 Delaware Street S.E., Minneapolis, MN 55455 (612-626-3500 or 1-800-774-8636; fax 612-626-6931; e-mail sph-ssc@umn.edu; <www.sph.umn.edu>).

Professor

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Laël C. Gatewood, Laboratory Medicine and Pathology, AM
John H. Himes, FM
David R. Jacobs, Jr., FM
Robert W. Jeffery, FM
Robert L. Kane, FM
Harry A. Lando, FM
Russell V. Luepker, FM
Leslie L. Lytle, FM
A. Marshall McBean, AM
Paul G. McGovern, AM
Cheryl L. Perry, FM
Phyllis L. Pirie, FM
Eyal Shahar, College of Continuing Education, FM
Mary T. Story, AM
Alexander C. Wagenaar, FM
Carolyn L. Williams, FM

Adjunct Professor

Richard H. Grimm, Medicine, FM
Arthur S. Leon, Kinesiology and Leisure Studies, FM
Michael T. Osterholm, FM
Leslie L. Robison, FM

Associate Professor

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Charles E. Boult, AM

Marsha Davis, AM
Simone A. French, AM
Craig W. Hedberg, AM
Wendy L. Hellerstedt, AM
Rhonda J. Jones-Webb, AM
George Maldonado, AM
Dianne Neumark-Sztainer, AM
Pamela J. Schreiner, AM
Michelle van Ryn, AM
Seth L. Welles, AM

Adjunct Associate Professor
Alan P. Bender, AM
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Myron D. Gross, AM
Alan R. Lifson, AM
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Julie A. Ross, Pediatrics, FM
Thomas A. Sellers, FM

Assistant Professor
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Larry D. Atwood, AM
Moise Desvarieux, AM
Susan J. Duval, AM
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Deborah J. Hennrikus, AM
Kelli A. Komro, AM
DeAnn Lazovich, AM
Kathryn H. Schmitz, AM
Traci L. Toomey, AM
John T. Vessey, AM

Adjunct Assistant Professor
Sally A. Bushhouse, AM
James G. Gurney, Pediatrics, AM
Ann C. Mertens, Pediatrics, AM
Beth A. Virnig

Senior Research Fellow
Peter J. Hannan, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The program provides students with the core methodological skills needed to address chronic or acute diseases, long-term or newly emerging health problems, and behavioral and biologic aspects of health and disease. The master's program prepares students for careers in epidemiologic research in health agencies, medical institutions, universities, research institutes, regulatory agencies, and industries such as pharmaceuticals and health insurance. The doctoral program is for students interested in research and teaching careers in the health sciences. Courses are also available to students from other public health and health-related programs.

Students may select areas of concentration appropriate to their academic interests and career objectives, including the epidemiology and prevention of cancer, infectious diseases, and cardiovascular diseases; nutrition; genetic epidemiology; behavioral interventions; and epidemiologic research methods. A detailed description of the course of study may be obtained online or by writing to the director of graduate studies.

Prerequisites for Admission—For the master's program, a strong undergraduate background in biological and physical sciences and high scholastic achievement are desirable. For the doctoral program, applicants must have completed or be about to complete a master's degree in a related field. Applicants should have prior coursework in life or behavioral sciences. Applicants who have not completed a master's degree in epidemiology or a related field are usually admitted to the master's program in epidemiology, where they must demonstrate research capability. Because positions in the program are limited, selection is competitive with respect to academic background and experience.

Special Application Requirements—The following materials are required by the department: an acceptable score on the GRE (test results should be forwarded to the department); at least three recommendations (form and separate letter) from faculty or work supervisors with knowledge of the applicant's scholastic and professional capabilities and potential; and a statement of goals and objectives (letter of intent) for seeking a career in epidemiology.

In addition to the above materials, applicants for the Ph.D. program must submit a separate essay (statement of research interests) demonstrating evidence of their capability in or potential for original research in a specific epidemiologic area and, if possible, indicating interest in particular methodologies or study designs. Serious doctoral applicants are encouraged to contact the graduate studies coordinator before applying. M.S. and Ph.D. students should begin their studies in the fall semester. Applications must be completed by January 15 of the same year for the doctoral program; March 1 of the same year for the master's program.

Use of 4xxx Courses—Inclusion of any 4xxx courses on degree program forms of epidemiology majors or minors for the Ph.D. degree is subject to adviser and director of graduate studies approval.

Courses—Please refer to the Epidemiology Ph.D. curriculum sheet available on the School of Public Health Web site for courses pertaining to the program.

M.S. Degree Requirements

M.S. students gain the knowledge and skills needed either for a professional position in epidemiology or to proceed to a doctoral program in epidemiology or a related field.

The M.S. program offers a 30-credit curriculum for students who have completed a M.D., D.D.S., D.V.M., or Ph.D. in a related field, and a 45-credit curriculum for students with other backgrounds. Students complete a two-course sequence in epidemiology; a two-course sequence in biostatistics; public health core courses in management and environmental health; courses in statistical computing, data collection, behavioral science, and the epidemiology of cardiovascular disease, cancer, or infectious diseases; elective courses; and a master's project presentation seminar. The 45-credit program also requires at least one course in human physiology and one in the pathobiology of human disease. Students in both programs also complete a master's project and an internship.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—The master's minor requires at least 7 credits.

Ph.D. Degree Requirements

Students select one of two field concentrations; both have an applied perspective that emphasizes study design, measurement, quantitative analysis, and interpretation. Behavioral epidemiology focuses on origins and development of human behavior patterns and how they are influenced and formed by personality, family, culture and environment. Etiolgic epidemiology focuses on the biological causes of disease states, especially determinants of cardiovascular disease, cancer, and infectious diseases.

The Ph.D. program includes a core curriculum of 62-72 credits. Students must pass written and oral preliminary exams, write and defend a dissertation, and prepare a first-authored manuscript for publication.

Coursework includes 16 credits in epidemiology and biostatistics core courses; 8 credits in advanced courses (epidemiological theory, teaching practicum, writing research grants, seminars on epidemiologic issues); 4-6 credits in Ph.D.-specific electives; 24 thesis credits; 6-8 credits (three courses) of epidemiologic-related interventions/methods taken from a menu of courses (e.g., cancer epidemiology, public health policy as a prevention strategy, smoking intervention); and 7-9 credits in advanced biologically or behaviorally related courses.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—The minor requires 20 credits: 16 credits in epidemiology and biostatistics, and 4 credits in epidemiology elective courses. The director of graduate studies must approve the student's selection of elective credits. Contact the director of graduate studies in epidemiology for information.

Experimental Surgery

Contact Information and Faculty—See Surgery.

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The general surgery program trains medical doctors for the practice of surgery and for academic positions. See the *Medical School Catalog* for professional degree requirements; see below for academic degree requirements. Trainees spend two to

three years in laboratory research, either in a basic science or in surgery, after which they begin their senior residency and chief residency training. The Medical School's laboratory departments offer many graduate courses closely related to surgery (see the graduate programs in biochemistry, molecular biology, and biophysics; cellular and integrative physiology; microbiology, immunology, and molecular pathobiology; and pharmacology). These fields also offer opportunities for research work. The Department of Surgery offers supervised work in its experimental research laboratories, as well as in its hospital and outpatient departments, in the areas of surgical diagnosis and operative surgery and in some surgical specialties (such as colon and rectal surgery, transplantation, thoracic and cardiovascular surgery, and pediatric surgery). The experimental surgery program provides an opportunity to gain practical research experience.

Prerequisities for Admission—Prospective students must be in the general surgery training program and have 2-3 clinical years of training completed.

Use of 4xxx Courses—4xxx courses are not permitted toward degree requirements.

Courses—For courses pertaining to the program, please refer to Surgery (Surg) in the course section of this catalog.

M.S.Exp.Surg. Plan A Degree Requirements

The M.S.Exp.Surg. is offered under Plan A only. At least 32 course credits (26 in the major and 6 in the minor or related fields) plus 10 thesis credits are required for a total of 42 credits.

Language Requirements—None.

Final Exam—The final exam is oral.

Family Social Science

Contact Information—Department of Family Social Science, University of Minnesota, 290 McNeal Hall, 1985 Buford Avenue, St. Paul, MN 55108-6140 (612-625-3116 or 612-625-1900; fax 612-625-4227; e-mail LHaley@che.umn.edu; <http://fsos.che.umn.edu/graduate/>).

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Carolyn Y. Tubbs, AM
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Clinical Assistant Professor

Philip L. Colgan, AM

Lecturer

Wayne A. Caron, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The program of study uses methods of social science to examine family systems and their interactions with various environments. The curriculum supports study in several broad theme areas: family therapy and family process, family economics and resource management, families and health, intergenerational relationships, families and diversity, and family policy.

Prerequisites for Admission—The master's program requires two family courses; at least one course in economics, political science, government, or public policy; one course in sociology, anthropology, or human geography; one psychology course; and one statistics course. The doctoral program requirements include all requirements for the master's program plus three additional social or behavioral science courses and two additional statistics or research methods courses. It is important that students, especially those applying for the Ph.D. program, present evidence of interest in research and that they have experience working with families through paid employment or volunteer work. Occasionally, the graduate faculty admits a student who lacks one or more required courses. This is done with the understanding that the missing course(s) will be made up soon, ideally before entering the program.

The marriage and family therapy program is accredited by the American Association for Marriage and Family Therapy. Admission to the program is available only to doctoral students with a clinical master's degree.

Students may apply for admission to the Ph.D. program after completing either a bachelor's degree or a master's degree. Students who enter the Ph.D. program with a bachelor's degree are expected to fulfill the requirements for an M.A. degree in the process of working toward the Ph.D.

Admission to the accredited marriage and family therapy program is available only to doctoral students with a clinical master's degree.

Special Application Requirements—Consult the *Family Social Science Graduate Handbook* or the director of graduate studies. The *Graduate Handbook* and all materials needed for the application process may be found at <http://fsos.che.umn.edu/graduate/>.

Applicants for the doctoral program and Plan A master's program are reviewed only once per year. The application deadline is December 15 for admission fall semester of the following year. Applications for the Plan B master's program are considered once they are complete, and students may begin graduate study the semester after the application is approved.

Use of 4xxx Courses—The inclusion of 4xxx family social science courses in degree programs of family social science majors or minors for the M.A. or the Ph.D. degree is subject to approval of the instructor, the student's adviser, and the director of graduate studies. Students from other majors may take such courses with instructor approval and may include them on their degree programs subject to their own program's approval. 4xxx courses counted on graduate programs must be taught by a full member or associate member of the graduate faculty and must include assignments that are at the graduate level, as determined by the instructor.

Courses—Please refer to Family Social Science (FSoS) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements

The M.A. program is offered under Plan A and Plan B. Plan A requires at least 30 credits, including at least 20 course credits, of which 6 credits are outside the department in a related field, and 10 thesis credits. The Plan A master's is recommended for students who intend to pursue a Ph.D. degree.

Plan B requires at least 30 credits, including at least 26 course credits, of which 6 credits are outside the department in a related field, and at least 4 credits for a Plan B project. It is for students who wish to further their education so that they may hold positions of responsibility serving families. Although the instruction is based on research, the Plan B degree is not intended to provide intensive research training. Therefore, the Plan B program is understood to be a terminal degree and is thus not recommended for students who intend to pursue the Ph.D. degree. The Plan B program is available to students seeking one of several areas of specialization. The areas of study available are family economics and resource management and family policy. Consult the department for the most current information.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—Master's students must complete at least 6 credits of 5xxx or 8xxx in family social science. All courses must be taken A-F and completed with a GPA of at least 3.00.

Ph.D. Degree Requirements

The courses in a Ph.D. degree program must contribute to an organized program of study and research. The program includes at least 84 credits, including 60 course credits and 24 thesis credits. Coursework includes at least 12 credits in a minor or supporting program; the remaining 48 credits include at least 18 credits in research methods and statistics and at least 30 credits in family social science. An optional teaching internship program is recommended for students who are planning for careers in higher education.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor requires at least 12 credits of 8xxx in family social science. All courses for the minor must be taken A-F and completed with a GPA of at least 3.00. A written preliminary exam question is based on the minor.

Feminist Studies

Contact Information—Department of Women's Studies, University of Minnesota, 425 Ford Hall, 224 Church Street S.E., Minneapolis, MN 55455; (612-626-0332; fax 612-624-3573; e-mail wostgrad@umn.edu; <http://womenstudy.cla.umn.edu>).

Professor

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Anna Clark, History, AM
Mary Dietz, Political Science AM
Sara M. Evans, History, AM
Mary L. Fellows, Law School, AM
Shirley N. Garner, English, AM
Jane F. Gilgun, Social Work, AM
Ruth-Ellen B. Joeres, German, Scandinavian, and Dutch, FM
Indira Y. Junghare, Linguistics and Asian and Slavic Languages and Literatures, AM
Amy K. Kaminsky, Women's Studies, FM
Mary Jo Kane, Kinesiology and Leisure Studies, AM
Ruth Karras, History, AM
Sally J. Kenney, Public Affairs, AM
Sally G. Kohlstedt, Geology and Geophysics, AM
Helga Leitner, Geography, AM
Barbara Laslett, Sociology, AM
Mary M. Lay, Rhetoric, AM
Helen E. Longino, Women's Studies, FM
Elaine Tyler May, American Studies, AM
Mary J. Maynes, History, AM
Toni A. H. McNaron, English, AM
Valerie J. Miner, English, AM
Riv-Ellen Prell, American Studies, AM
Paula Rabinowitz, English, FM
Naomi B. Scheman, Philosophy, FM
Amy L. Sheldon, Speech-Communication, AM
Billie J. Wahlstrom, Rhetoric, E
Ann B. Waltner, History, AM
Gayle Graham Yates, American Studies, AM

Associate Professor

Lisa Albrecht, General College, FM
Jean M. Allman, History, AM
Maria M. Brewer, French and Italian, AM
Rose M. Brewer, Afro-American and African Studies, FM
Sarah Chambers, History, AM
Maria Damon, English, AM
Lisa J. Disch, Political Science, AM
Susanna Ferlito, French and Italian, AM
Amy Lee, General College, AM
Josephine Lee, English, AM
Richard W. McCormick, German, Scandinavian, and Dutch, AM
Ellen Messer-Davidow, English, FM
Richa Nagar, Women's Studies, AM
Lisa A. Norling, History, AM
Joanna O'Connell, Spanish and Portuguese, AM
Jennifer L. Pierce, American Studies, AM
Gloria Goodwin Raheja, Anthropology, AM
Angelita D. Reyes, Afro-American and African Studies, AM
Eileen B. Sivert, French and Italian, AM
Gary Thomas, Cultural Studies and Comparative Literature, AM
Monika Zagar, German, Scandinavian, and Dutch, AM
Jacquelyn N. Zita, Women's Studies, FM

Assistant Professor

Catherine Choy, American Studies, AM
Jigna Desai, Women's Studies, AM
Gwendolyn Pough, Women's Studies, AM
Eden Torres, Women's Studies, AM
Barbara Y. Welke, History, AM

Other

Karen Brown-Thompson, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The M.A. is available only to students admitted to the Ph.D. program who wish to secure this credential for ABD employment purposes or who must exit the program. It is similar to the Ph.D., but with fewer credits and no dissertation.

The Ph.D. program is an interdisciplinary, multicultural, and international study of women and gender in which students develop competence in interdisciplinary and disciplinary feminist theories, research methods, and pedagogy. The program pays attention to all aspects of women's diversity, nationally and globally. Students select a disciplinary focus from among feminist theory, literary studies, historical studies, social sciences and public policy, and gender in a global perspective. Students may, with the advice and consent of the director of graduate studies, design their own area of concentration.

Prerequisites for Admission—Admission to the graduate minor is contingent upon prior admission to a master's or doctoral degree-granting program within the Graduate School.

Special Application Requirements—Students interested in the minor program must submit a completed application by March 1 to be considered for admission in fall semester. Applications received after March 1 are considered as space allows. It is expected that no more than 15 students will be admitted into the minor each year. Admission to the minor program does not require an undergraduate major or minor in women's studies. However, applicants are expected to show general knowledge of feminist scholarship as evidenced, for example, in some combination of previous coursework, research, writing, or organizational experience.

Applicants for the Ph.D. program must submit scores from the General (Aptitude) Test of the GRE, three letters of recommendation sent directly to the department, a writing sample, and a clearly written statement of career interests, goals, and objectives. Graduate study in the program begins in the fall semester. The application deadline is Friday of the first week in January; all applications are evaluated once each year in January.

Use of 4xxx Courses—Inclusion of 4xxx feminist studies courses on degree program forms of feminist studies majors or minors for the Ph.D. degree is discouraged; such courses are only considered in exceptional circumstances, subject to adviser and director of graduate studies approval.

Courses—Please refer to Women's Studies (WoSt) in the course section of this catalog for courses pertaining to the program.

M.A. Plan B Degree Requirements

The courses required for the M.A. (which are the same as those required for the Ph.D.) fall into roughly two categories: interdisciplinary courses satisfying core requirements and courses constituting or enhancing a concentration. Students take 31 credits in required courses, including two elective courses that satisfy core requirements in cultural diversity and two courses that satisfy core requirements in research tools and methods. The remaining coursework includes 12 credits in an area of concentration and 12 credits in the minor field or supporting program (related to the concentration). Students are also expected to register for 4 credits of WoSt 8996 colloquium and to participate in a weekly or biweekly series of faculty, student, and guest lecturer presentations. In addition, three Plan B papers and a final oral exam are required (which are effectively identical to the Ph.D. preliminary written and oral exams).

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master's minor requires WoSt 8108 and 8109 and two graduate-level electives approved by the director of graduate studies for feminist studies.

Ph.D. Degree Requirement

The course and credit requirements for the Ph.D. are the same as those required for the master's. In addition, students are expected to register for 24 thesis credits while writing the dissertation.

Because some courses may fall into more than one category (e.g., courses in the concentration may also satisfy core course requirements), students are permitted to "double count" credits in the major program in consultation with the director of graduate studies. The minimum requirement of 42 graduate credits is therefore less than simple addition would suggest. Students entering the Ph.D. program with a master's degree may

transfer credits from that degree and apply them to the Ph.D. requirements in consultation with the director of graduate studies. All students, however, must take WoSt 8108 and 8109.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—The minor focuses on skills and competencies in four areas: interdisciplinary knowledge of women and gender; feminist theories and methods; feminist research in a specific field; feminist practice through teaching or internships. Students must apply for admission. To complete a Ph.D. minor, students must complete WoSt 8108 and 8109 and three graduate-level electives (9 credits) from a list of courses determined by the director of graduate studies for feminist studies.

Fisheries

Contact Information—Kathleen Walter, College of Natural Resources, University of Minnesota, 135 Natural Resources Administration Building, 2003 Upper Buford Circle, St. Paul, MN 55108-6146 (612-624-2748; fax 612-624-6282; e-mail kwalter@forestry.umn.edu; <www.fw.umn.edu>).

Professor
Ira R. Adelman, FM
Yosef Cohen, FM
Anne R. D. Kapuscinski, FM
James A. Perry, FM
Peter W. Sorensen, FM
George R. Spangler, FM

Adjunct Professor
Carl Richards, Duluth, AM

Associate Professor
Jay T. Hatch, General College, FM
Raymond M. Newman, FM

Adjunct Associate Professor
Gerald T. Ankley, FM
Bruce C. Vondracek, FM

Assistant Professor
Kristen C. Nelson, FM
Andrew M. Simons, FM

Adjunct Assistant Professor
Charles S. Anderson, E
David C. Fulton, AM
Donald L. Pereira, AM

Other
Fred W. Allendorf, E
Clayton J. Edwards, E

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The fisheries program combines basic biology and ecology with other academic areas and with applied problem solving in natural resource management and conservation. The main areas of specialization are fish ecology, fish behavior, fish physiology, fisheries ecology and management, population genetics and conservation, population modeling and management, stream ecology, exotic/introduced species management and control, and aquaculture.

Prerequisites for Admission—Prospective students are expected to have a basic background in the biological sciences. Some experience in fisheries or aquatic science is desirable, but not required. A strong background in physical sciences, chemistry, mathematics, statistics, and computer use is recommended. For admission to the Ph.D., a master's degree is recommended.

Special Application Requirements—Three letters of recommendation from persons able to evaluate the applicant's academic and professional experience and results from the GRE General Test are required. When registering for the GRE, prospective students should list the fishery sciences major field code (0106). Applications are accepted at any time. However, because the faculty reviews most applications in late January for admission the following fall, applications should be sent before January 1.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval. Students from other majors may include such courses subject to their own program's approval.

Courses—Please refer to Fisheries and Wildlife (FW) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements

Both Plan A (with thesis) and Plan B (without thesis) programs are offered. Plan A and Plan B require at least 14 course credits in the major and 6 course credits in a minor or related field; Plan A also requires at least 10 thesis credits, and Plan B requires at least 10 additional course credits. The Plan A thesis should be in an area of specialization. Coursework requirements are flexible, but typically include courses in fisheries, limnology or aquatic biology, statistics and biometrics, computer science, and related subjects. Programs may include a traditional minor or coursework in a related field. An oral preliminary exam is required.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master's minor requires at least 6 credits of courses approved by the director of graduate studies.

Ph.D. Degree Requirements

The doctoral program includes a major research effort in the areas of emphasis, resulting in a written dissertation. It also includes advanced coursework in fisheries, limnology or aquatic ecology, and related subjects.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor requires at least 12 credits of courses approved by the director of graduate studies.

Food Science

Contact Information—Graduate Program in Food Science, Department of Food Science and Nutrition, University of Minnesota, 1334 Eckles Avenue, St. Paul, MN 55108 (612-624-1290; fax 612-625-5272; e-mail fsgrad@umn.edu; <http://fscn.che.umn.edu/fscigrad/default.html>).

Professor
Paul B. Addis, FM
Mrinal Bhattacharya, FM
Linda J. Brady, FM
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Agnes S. Csallany, FM
R. Gary Fulcher, FM
Theodore P. Labuza, FM
Larry L. McKay, FM
Howard A. Morris (emeritus), FM
Gary A. Reineccius, FM
Rongsheng R. Ruan, FM
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David E. Smith, FM
Sita R. Tatini, FM
Zata M. Vickers, FM
Joseph J. Warthesen, FM

Associate Professor
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Daniel J. O'Sullivan, FM
H. William Schafer, FM

Assistant Professor
Francisco Diez-Gonzalez, FM
Lloyd E. Metzger, FM

Adjunct Assistant Professor
Mary K. Schmidl, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Food science applies scientific principles to the manufacture, distribution, marketing, and consumer aspects of food. Food scientists apply the basic principles and techniques of many disciplines, including chemistry, physics, microbiology, and nutrition, to food processing and preservation, new product development, and food marketing. Food scientists are concerned with the theoretical and practical aspects of the food chain, from the production of raw materials to the use of food products by consumers. Students may emphasize the chemistry, engineering, microbiology, nutrition, or technology of food products.

Prerequisites for Admission—Applicants with an undergraduate major in any physical or biological science usually have completed the necessary prerequisites. The minimum requirements are general chemistry, organic chemistry with laboratory, physics with laboratory, and calculus. If preparation appears inadequate, certain additional courses may be required after admission.

Special Application Requirements—Submission of scores from the General (Aptitude) Test of the GRE is required. Submission of three letters of reference is also required whether or not the prospective student is applying for financial assistance.

Use of 4xxx Courses—Inclusion of 4xxx food science courses on degree program forms is permitted with adviser and director of graduate studies approval. Students from other majors may include such courses subject to their own program's approval.

Courses—Please refer to Food Science and Nutrition (FScN) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements

The M.S. offers both Plan A (with thesis) and Plan B (without thesis) options. Both options require at least 14 course credits in the major and 6 course credits in the minor or related field. Plan A also requires at least 10 thesis credits. Plan B also requires at least an additional 10 graduate credits in approved courses and a Plan B paper. The minor may be chosen from fields such as biochemistry, chemistry, chemical engineering, microbiology, nutrition, and statistics.

M.S. students may exceed the 40 percent limit on transfer of College of Continuing Education credits customarily permitted in the Graduate School. Students wishing to do so must consult the director of graduate studies.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—For a master's minor, two of the following courses must be taken: FScN 4111, 4121, or 4331. The minor must be approved by the food science director of graduate studies.

Ph.D. Degree Requirements

The number of credits required will vary depending on preparation and the research undertaken. Most students take a total of about 60 credits. Of these, at least 12 credits must be in the minor or related fields and 24 credits must be doctoral thesis credits. The student and the adviser, with the approval of the graduate studies committee, determine coursework in the major.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—For a Ph.D. minor, students must take FScN 4111, 4121, 4331, and other courses, for a total of 12 credits. The minor must be approved by the food science director of graduate studies.

Forestry

Contact Information—Kathleen Walter, College of Natural Resources, University of Minnesota, 135 Natural Resources Administration Building, 2003 Upper Buford Circle, St. Paul, MN 55108-6146 (612-624-2748; fax 612-624-6282; e-mail kwalter@forestry.umn.edu; <www.cnr.umn.edu/grad/FRgrad/index.html>).

Professor

Dorothy H. Anderson, FM
Mark E. Ascerno, Jr., Entomology, FM
Marvin E. Bauer, FM
Melvin J. Baughman, FM
Robert A. Blanchette, Plant Pathology, FM
Charles R. Blinn, FM
James L. Bowyer, FM
Kenneth N. Brooks, FM
Thomas E. Burk, FM
John J. Cogan, Curriculum and Instruction, AM
Edward J. Cushing, Ecology, Evolution, and Behavior, FM
Steven B. Daley Laursen, AM
Alan R. Ek, FM
Paul V. Ellefson, FM
Joseph G. Massey, FM
Leo H. McAvoy, Jr., Kinesiology and Leisure Studies, FM
Carl A. Mohn (emeritus), FM
John L. Nieber, Biosystems and Agricultural Engineering, FM
Michael E. Ostry, AM
James A. Perry, FM
Peter B. Reich, FM
Don E. Riemenschneider, E
Dietmar W. Rose, FM
C. Ford Runge, Applied Economics, FM
Simo Sarkanen, FM
Elmer L. Schmidt, FM
J. L. David Smith, Fisheries and Wildlife, AM
Alfred D. Sullivan, AM

Adjunct Professor

William A. Befort, AM
Robert G. Haight, AM
William A. Hendrickson, E
Ronald E. McRoberts, AM
Elon S. Verry, AM
Jerrold E. Winandy, AM
John C. Zasada, AM

Associate Professor

Paul V. Bolstad, FM
Stephan P. Carlson, AM
Fred N. Finley, Curriculum and Instruction, AM
David T. Grimsrud, FM
Howard M. Hoganson, FM
Patrick H. Huelman, AM
Gary R. Johnson, AM
Shri Ramaswamy, FM
Steven J. Taff, Applied Economics, AM
Ulrike Tschirner, FM
Kewen Yin, FM

Adjunct Associate Professor

David N. Bengston, AM
Erwin R. Berglund, AM
Stephen M. Bratkovich, AM
Daniel L. Erkkila, AM
Mark H. Hansen, AM
J. G. Isebrands, E
Pamela J. Jakes, AM
Brian J. Palik, AM
Michael J. Phillips, E,
Thomas L. Schmidt, AM

Assistant Professor

Eileen V. Carey, AM
Andrew J. David, AM
Michael Demchik, AM
Karlyn Eckman, Institute for Global Studies, AM
Daniel W. Gilmore, AM
Sarah E. Hobbie, Ecology, Evolution, and Behavior, E
Kristen C. Nelson, FM
Harlan D. Petersen, E
Steven J. Severtson, AM
Steven J. Seybold, AM
Rubin Shmulsky, AM
Timothy M. Smith, AM

Adjunct Assistant Professor

David C. Fulton, Fisheries and Wildlife, FM

Research Associate Emeritus

Allen L. Lungren, AM

Research Associate

Lee E. Frelich, FM
Morteza Mozaffari, E
Jacek Oleksyn, AM
Robert T. Seavey, AM
Robert A. Stine, AM
Xiwei Yin, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Students normally emphasize one of the following subfields: chemistry of lignocellulosic materials; paper and fiber products recycling; deterioration of wood; wood mechanics; structural design with wood; wood moisture interaction and drying; processing and performance of wood composites; economics of manufacturing systems; technology and processing of solid wood products; design and production of housing components; energy-efficient building construction; ecology and silviculture; ecophysiology; economics in forest and related natural resource management; genetics and tree improvement; geographic information systems; hydrology and water quality; watershed management; survey, measurement, and modelling; policy and administration; tree physiology and tissue culture; recreation land management; remote sensing; and urban forestry. Faculty in forestry also offer courses in natural resources and environmental studies (NRES) listed after the forest products and forest resources courses below.

Prerequisites for Admission—Prerequisites vary by subfield. Most admitted students have earned degrees in forestry or forest products. Applicants with exceptional academic records bu no forestry background are eligible; if admitted, they may complete the prerequisites for advanced courses during the early stages of their graduate program. Applicants for the doctoral program should demonstrate a capacity for advanced study and independent research.

Special Application Requirements—Applications are processed continually, and students are admitted each semester. However, submission of application materials by January 15 (for fall admission) is encouraged to ensure consideration for fellowships and assistantships. GRE scores

are required. Letters of recommendation are optional but highly recommended. Applicants for the doctoral program should supply the names and addresses of three people who can provide evaluations of their capacity for advanced study and independent research.

Use of 4xxx Courses—Inclusion of 4xxx Forest Resources (FR), Natural Resources and Environmental Studies (NRES), and Wood and Paper Science (WPS) courses on degree program forms of forestry majors or minors for the M.S. or Ph.D. degree is subject to adviser and director of graduate studies approval. Students from other majors may include such courses subject to their own program's approval.

The Forestry Graduate Studies Committee reviews and must approve all graduate degree programs. Although there is no set maximum number of 4xxx credits, programs with insufficient 5xxx and 8xxx coursework will not be approved.

Courses—Please refer to Forestry (Fors), Forest Resources (FR), Natural Resources and Environmental Studies (NRES), and Wood and Paper Science (WPS) in the course section of this catalog.

M.F. Degree Requirements

The M.F. requires at least 30 course credits; no thesis or Plan B paper is required. Students are required to complete basic science and introductory forestry courses if not included in their undergraduate program.

Language Requirements—None

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—Students should contact the director of graduate studies. The selection of courses is influenced by the student's background and educational objective. Minor field competence is evaluated in the oral exam.

M.S. Degree Requirements

The M.S. is offered under Plan A (with thesis) and Plan B (without thesis). Plan A requires at least 20 credits and for Plan B requires at least 30 credits; Plan A students also register for 10 thesis credits. Plan A students usually design a program to support their specific thesis project. Plan B students design a program, in consultation with faculty members, that develops competence in at least one subfield. Students present a seminar on the thesis, the Plan B project, or a topic selected in consultation with the graduate adviser. Specific requirements vary by subfield; prospective students should contact the director of graduate studies or a prospective faculty adviser for specific information.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—Students should contact the director of graduate studies. The selection of courses is influenced by the student's background and educational objective. Minor field competence is evaluated in the oral exam.

Ph.D. Degree Requirements

The doctoral program varies from 30 to 60 credits, not including 24 thesis credits. Course selection and thesis proposals are developed by each student in consultation with the faculty adviser and are approved by the forestry graduate study committee.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—Students should contact the director of graduate studies. The selection of courses is influenced by the student's background and educational objective. Minor field competence is evaluated in the oral exam.

French and Italian

Contact Information—A department general information bulletin and a projection of graduate-level courses to be offered is available from the Department of French and Italian, University of Minnesota, 260 Folwell Hall, 9 Pleasant Street S.E., Minneapolis, MN 55455 (612-624-4308; fax 612-624-6021; e-mail fritgrad@umn.edu; <www.cla.umn.edu/frit/>).

Professor

F. Ronald P. Akehurst, FM
Susan J. Noakes, FM
Maria F. Paganini, FM

Associate Professor

Daniel Brewer, FM
Mària M. Brewer, FM
Susanna Ferlito, FM
Betsy K. Kerr, FM
Catherine Liu, Comparative Literature, FM
Ronald L. Martinez, FM
Judith E. Preckshot, FM
Peter H. Robinson, FM
Eileen B. Sivert, FM

Assistant Professor

Juliette Cherbuliez, AM
Kevin P. Lemoine, AM
Alan K. Smith, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The French program, which offers M.A. and Ph.D. degrees, covers all areas of French literature and culture from the Middle Ages to the present. Traditional areas of study and scholarship are inflected by the faculty's interests, expertise, and research in areas that have shaped—and continue to shape—the discipline of French studies. The program, which fosters interdisciplinary research, has particular strengths in literary and cultural studies, critical theory, feminist studies, medieval studies, and francophone studies.

The Italian M.A. program adopts an interdisciplinary approach to the study of the literatures and cultures of Italy. The curriculum emphasizes the study of cultural identities in Italy through literary and historical discourses. The program has special strengths in Dante and Early Modern studies, and in the Romantic and Modern periods.

Prerequisites for Admission—A B.A. in French or Italian (or equivalent), with a literary emphasis, is required for the M.A. programs. Prospective students whose undergraduate degree is in another field, but who have taken substantial coursework in French or Italian and are strongly motivated to pursue literary studies, are invited to contact the director of graduate studies. For the Ph.D. program, an M.A. in French (or equivalent) is required.

Special Application Requirements—Applicants must submit scores from the General Test of the GRE, three letters of recommendation from persons familiar with their scholarship and research potential, a complete set of official transcripts, a sample of their academic writing, an audio-tape of their spoken French or Italian, and a written statement of career interests and goals. International student applicants should also submit scores for the TOEFL. Students may apply at any time; however, submission of all application materials by January 15 is encouraged to ensure priority consideration for fellowships and teaching and research assistantships awarded for the next academic year. New teaching assistants and fellowship recipients are only admitted for fall semester; others may be admitted in mid-year.

Affiliated Research Centers—Students are encouraged to explore interdisciplinary approaches through outside coursework or participation in one of several academic centers with which the programs are affiliated. These centers include the Center for Advanced Feminist Studies, the Center for Advanced Research in Language Acquisition, the Center for German and European Studies, the Center for Medieval Studies, the Immigration History Research Center, and the University of Minnesota Humanities Institute. Students specializing in francophone literatures and cultures may pursue these interests through the Afro-American and African Studies program or the interdisciplinary MacArthur Program.

Use of 4xxx Courses—4xxx courses may, in exceptional cases, be used for graduate credit. Students should consult the director of graduate studies or adviser before registering.

Courses—Please refer to French (Fren), French and Italian (FrIt), and Italian (Ital) in the course section of this catalog.

M.A. Degree Requirements

In French, students may pursue Plan A (with thesis) or Plan B (without thesis). Plan A requires at least 24 credits, Plan B at least 33 credits. Both plans require at least 18 credits in the major and 6 credits in related

fields or, in a minor, the number of credits required by the minor program (usually 6 credits). Plan A also requires at least 10 thesis credits. (More detailed information is available through the program office.)

In Italian, the M.A. is offered under Plan A (with thesis) or Plan B (with paper). Plan A requires at least 22 course credits and 10 thesis credits. Plan B requires at least 30 course credits. (More detailed information is available through program office.)

Final Exam—The final exams in both French and Italian programs are written and oral.

Language Requirements—For the M.A. degree in French, students must demonstrate proficiency in one foreign language besides English and French. For the M.A. in Italian, by the time of their final exam, students must demonstrate proficiency in one ancient or modern language besides Italian and English; French, Spanish, or Latin is recommended.

Minor Requirements for Students Majoring in Other Fields—A master's minor in French requires at least 9 credits; a minor in Italian requires at least 6 credits.

Ph.D. Degree Requirements

The Ph.D. requires at least 57 course credits and 24 thesis credits. Coursework involves at least 45 credits in the major and at least 12 credits (usually four courses) in related fields or, in a minor, the number of credits required by the major program (usually 12 credits). Detailed information is available through program office.

Language Requirements—For the Ph.D., students must demonstrate proficiency in one foreign language besides English and French, at a level higher than for the M.A. and suitable for use in research. Doctoral students specializing in the Middle Ages, Renaissance, or Early Modern period (roughly to 1666) must also demonstrate knowledge of Latin.

Minor Requirements for Students Majoring in Other Fields—A Ph.D. minor requires at least 12 credits.

Genetics

See Molecular, Cellular, Developmental Biology, and Genetics.

Research Associate
John O. Look, Diagnostic/Surgical, AM

Geographic Information Science

Contact Information—See Geography.

Professor
John S. Adams, AM
Marvin E. Bauer, Forest Resources, AM
Dwight A. Brown, AM
Philip J. Gersmehl, AM
Robert B. McMaster, AM
Shashi Shekhar, Computer Science, AM
Richard H. Skaggs, AM

Associate Professor
Paul V. Bolstad, Forest Resources, AM
Katherine Klink, AM
Roger P. Miller, AM
Roderick H. Squires, AM

Adjunct Assistant Professor
William J. Craig, AM

Teaching Specialist
Robert Maki, AM

Cartographer
Mark B. Lindberg, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The master of geographic information science (M.G.I.S.), offered by the Department of Geography, provides graduate-level work in the theory, applications, and technology of geographic information science (GIS). The degree is for students who are working in GIS or a related area (such a surveying or planning), have a bachelor's degree but no formal work experience/education in GIS, or have recently obtained a B.A./B.S. in GIS. The program balances work in theoretical/conceptual aspects of GIS (core classes), technical aspects (software/hardware), and applications of GIS (applied project). The program emphasizes the societal impacts of such technologies.

Prerequisites for Admission—Prospective students should have completed a course in advanced algebra, a statistics course, and a beginning course in computer programming.

Special Application Requirements—Departmental application form, transcripts, statement of purpose, and three letters of recommendation must be sent to the department. All materials must be submitted by March 30 for fall semester entrance and by September 1 for spring semester entrance.

Use of 4xxx Courses—No more than two 4xxx courses may be included in the master's degree program without consent of the adviser and director of graduate studies.

Courses—Please refer to Geography (Geog) and Geographic Information Science (GIS) in the course section of this catalog for courses pertaining to the program.

M.G.I.S. Plan B Degree Requirements

The degree is offered Plan B (nonthesis) and requires at least 35 credits, with 18 credits in core/technology classes (a minimum of 9 credits of core courses and 3 credits of technology courses), 6 credits of electives, and 3 credits of capstone seminar (GIS 8990). All students are required to take Geog 5561, 5563, GIS 5571 and an approved 8xxx seminar. Students must also take GIS 8501 during the fall semester of their first year in the program. At least 6 credits must be taken outside the geography department (Geog and GIS designators) but may include the core GIS classes (e.g., forestry and natural resources).

Language Requirements—None

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master's minor is developed in consultation with a faculty adviser. Consult the M.G.I.S. director of graduate studies about selecting an adviser. The minor requires at least 9 credits (3 courses).

Geography

Contact Information—Department of Geography, University of Minnesota, 414 Social Sciences Building, 267 19th Avenue South, Minneapolis, MN 55455 (612-625-6080; fax 612-624-1044; e-mail willi046@umn.edu; <www.geog.umn.edu>).

Professor
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John F. Hart, FM
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Judith A. Martin, FM
Robert B. McMaster, FM
Abdi I. Samatar, FM
Earl P. Scott, FM
Eric S. Sheppard, FM
Richard H. Skaggs, FM

Associate Professor
Katherine Klink, AM
Roger P. Miller, FM
Roderick H. Squires, FM
Connie H. Weil, FM

Assistant Professor
Bruce W. Braun, AM
Vinay K. Gidwani, AM
Karen E. Till, AM
Susy S. Ziegler, AM

Adjunct Assistant Professor
William J. Craig, AM

Other
Mark B. Lindberg, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Geography studies human-environment relations and their visual representation. It emphasizes the significance of place, location, and scale in understanding the complexity of biophysical phenomena, patterns and processes of natural resource use, human settlements, economic development, political organization, and cultural and social landscapes. The program emphasizes research and teaching in the following areas: urban systems, environmental systems, regional geography and international development, geography of population and health, geographic information systems and cartography, and history and philosophy of geography. It is a highly individualized program with a limited number of requirements. Students work with their advisers to design individual programs suited to their educational and professional goals.

Prerequisites for Admission—Prospective students should have completed the equivalent of introductory courses in physical and human geography and at least seven upper division courses in systematic and regional geography. Students who were not undergraduate geography majors are encouraged to apply but may be required to make up deficiencies.

Special Application Requirements—Three letters of recommendation must be sent to the department. Scores from the General (Aptitude) Test of the GRE that are less than five years old are required of students with baccalaureate degrees from U.S. institutions. Graduate study in the program begins in the fall semester. The application deadline is January 1. All applications are evaluated once each year in early February.

Use of 4xxx Courses—No more than two 4xxx courses may be included on the degree program form without consent of the adviser and director of graduate studies.

Courses—Please refer to Geography (Geog) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements

The M.A. is offered under Plan A (with thesis) and Plan B (without thesis). Plan A requires at least 21 course credits (plus 10 thesis credits); Plan B requires at least 31 course credits. All students must take at least two proseminars and one research seminar in geography and two courses outside geography. The M.A. program is usually completed within two years.

Language Requirements—M.A. students are expected to acquire competency in the foreign language/research methodology necessary for their graduate research. This requirement is set by the advising committee, which is also responsible for certifying that the requirement has been met before the final exam.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master's minor must be developed in consultation with a faculty adviser. Consult the director of graduate studies about selecting an adviser. The minor requires at least 6 credits (two courses).

Ph.D. Degree Requirements

Each student is required to take at least two proseminars and two research seminars in geography, and four courses outside geography (at least one 8xxx). Students are also required to take 24 thesis credits and at least three elective courses. Course credits from the M.A. program may be transferred to the Ph.D. program. Further details on degree requirements may be found in the department publication *The Graduate Program in Geography at the University of Minnesota.*

Language Requirements—Ph.D. students are expected to acquire competency in the foreign language/research methodology necessary for their graduate research. This requirement is set by the advising committee, which is also responsible for certifying that the requirement has been met before the final exam.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor program must be developed in consultation with an appropriate faculty adviser. Consult the director of graduate studies about selecting an adivser. The minor requires at least 9 credits (three courses).

Geological Engineering

Contact Information—Geological Engineering Program, University of Minnesota, Civil Engineering Building, 500 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-625-5522; fax 612-626-7750; e-mail gradsec@ce.umn.edu; <www.ce.umn.edu>).

Professor

Steven L. Crouch, FM
Emmanuel M. Detournay, FM
Andrew Drescher, FM
Efi Foufoula-Georgiou, FM
Catherine E. French, FM
Theodore V. Galambos, FM
Gary Parker, FM
Henryk K. Stolarski, FM
Otto D. L. Strack, FM
Vaughan R. Voller, FM

Adjunct Professor

Peter A. Cundall, FM

Associate Professor

Randal J. Barnes, FM
Gary A. Davis, AM
Jerome F. Hajjar, FM
Miki Hondzo, AM
Joseph F. Labuz, FM
Carol K. Shield, FM
Karl A. Smith, FM

Assistant Professor

William A. Arnold, AM
Bojan B. Guzina, FM
Timothy M. LaPara, AM
Mihai O. Marasteanu, AM
Fernando Porté-Agel, AM

Senior Research Associate

Sofia G. Mogilevskaya, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Emphases are in fundamental aspects of geomechanics and its applications. Research focuses on the use and development of discrete and continuum theories such as elasticity, plasticity, fracture mechanics, and poroelasticity for solving engineering problems. Numerical methods are being developed for obtaining solutions; experimental methods and novel apparatus are being developed for gathering physical evidence. Applications include processes of comminution, flow of granular materials, hydraulic fracturing, and nondestructive testing. The graduate program in geological engineering is administered in the Department of Civil Engineering.

Prerequisites for Admission—A bachelor's degree in engineering, basic science, or mathematics is required. Admission depends primarily on the applicant's academic record and letters of recommendation. Applicants who lack geological engineering training are often required to complete at least one appropriate course from the undergraduate program. Graduate degree credit is not awarded for such preparatory work. For the M.Geo.E. program, an ABET-accredited bachelor's degree in geological engineering is preferred.

Special Application Requirements—Applicants are required to submit results of the GRE in support of their applications. The TOEFL is required of foreign applicants from non-English-speaking countries. A TOEFL score of at least 550 is required for admission. Applicants who take the computer-based TOEFL are required to have a score of at least 213. Admission requirements also include three letters of recommendation and a statement of purpose that outlines the prospective student's research interests, reasons for pursuing graduate studies, and career plans after graduation. Students are admitted each semester, but applicants are encouraged to begin fall semester and to submit their applications by December 31 before the year their studies are expected to begin.

Use of 4xxx Courses—Inclusion of 4xxx departmental courses on degree program forms is subject to adviser and director of graduate studies approval. Students from other majors may include such courses subject to their own program's approval.

Courses—Please refer to Geological Engineering (GeoE) in the course section of this catalog for courses pertaining to the program.

M.Geo.E. Design Project Degree Requirements

The master of geological engineering (M.Geo.E.) degree is for the practicing engineer who would like to obtain an advanced degree, enrolling part-time or full-time. Students who intend to proceed to the Ph.D. program or think they may later wish to be admitted to the Ph.D. program should apply for the master of science program. Students are expected to follow a coherent program of coursework selected with the help of a faculty adviser and approved by the director of graduate studies. Students also must demonstrate professional competence by carrying out and defending a design project. The degree typically takes 12 to 18 months, full-time, to complete.

The M.Geo.E. requires at least 30 credits and is offered under two plans. One requires at least 20 course credits and preparation of a design project (10 credits); the design project must be carried out by the student in consultation with a faculty adviser. The other plan is a coursework-only degree program and requires at least 30 course credits. At least 6 of the course credits must be taken outside the department for either plan.

Language Requirements—None.

Final Exam—A final oral exam is required of all M.Geo.E. students.

Minor Requirements for Students Majoring in Other Fields—For a master's minor, two or more 5xxx to 8xxx courses from the same area of geological engineering are required, for a total of 6 or more credits.

M.S. Degree Requirements

The master of science (M.S.) degree balances education in engineering fundamentals and design with research and development. The M.S. degree is for students wishing to pursue a career in industry or to continue toward a Ph.D. degree. Students follow a program selected with the help of a faculty adviser and approved by the director of graduate studies. A program typically takes 18 to 24 months to complete.

The M.S. requires at least 30 credits and is offered under two plans. Plan A emphasizes research and preparation of a thesis; Plan B emphasizes coursework. The thesis is written on a research project carried out in consultation with a faculty adviser. Under Plan B, students complete one to three Plan B papers as determined by the faculty adviser. Plan B papers include computer programs, annotated bibliographies, field investigations, and analysis/design of special engineering problems. Plan A requires at least 20 course credits and 10 thesis credits. Plan B requires at least 30 course credits. At least 6 credits of coursework must be from outside the department for either Plan A or Plan B.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—For a master's minor, two or more 5xxx to 8xxx courses from geological engineering are required, for a total of 6 or more credits.

Ph.D. Degree Requirements

The Ph.D. degree couples independent research with coursework in a comprehensive program. Research performance, as judged by preparation of a dissertation on an independently pursued research topic, is the primary requirement for the Ph.D. degree. Students usually enter the program after completing the M.S. degree. The program is typically completed in 5-6 years.

Each program of study is designed in consultation with a faculty adviser and must be approved by the director of graduate studies. A typical program consists of 45 credits of coursework and 24 thesis credits. A supporting program or minor of at least 12 credits outside the department must be included. Credits earned in a M.S. program may be presented in partial fulfillment of the Ph.D. requirements.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—For a Ph.D. minor, four or more 5xxx to 8xxx courses are required, for a total of at least 12 credits.

Geology

Contact Information—Department of Geology and Geophysics, University of Minnesota, 310 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-624-1333; fax 612-625-3819; e-mail geology@umn.edu; <www.geo.umn.edu>).

Regents' Professor

Herbert E. Wright, Jr. (emeritus), FM

Professor

E. Calvin Alexander, Jr., FM
Subir K. Banerjee, AM
R. Lawrence Edwards, FM
Peter J. Hudleston, FM
Emi Ito, FM
Thomas C. Johnson, Geology, Duluth, FM
Ronald L. Morton, Geology, Duluth, FM
V. Rama Murthy, FM
Richard W. Ojakangas, Geology, Duluth, FM
Christopher Paola, FM
Mark A. Person, FM
Hans-Olaf Pfannkuch, FM
William E. Seyfried, FM
Robert E. Sloan (emeritus), FM
David L. Southwick, AM
James H. Stout, FM
Christian P. Teyssier, FM
Paul W. Weiblen (emeritus), FM

Adjunct Professor

Val W. Chandler, AM
Daniel R. Engstrom, AM
Robert G. Johnson, AM
Peter L. McSwiggen, AM
James D. Miller, AM
Carrie J. Patterson, AM
Anthony C. Runkel, AM
Wayne C. Shanks III, AM

Associate Professor

Karen L. Kleinspehn, FM
Howard D. Mooers, Geology, Duluth, FM
Nigel J. Wattrus, Geology, Duluth, FM
Donna L. Whitney, FM

Assistant Professor

Christina Gallup, Duluth, FM
Marc Hirschmann, FM

Senior Research Associate

Michael E. Berndt, AM
Kang Ding, AM
Paul H. Glaser, AM
Linda C. K. Shane, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The geology major includes the areas of Quaternary studies, structural geology, stratigraphy, paleontology, mineralogy, economic geology, metamorphic geology, experimental and theoretical petrology, isotopic and aqueous geochemistry, experimental geochemistry, geomorphology, groundwater geology, hydrogeology, limnology, climate change, and sedimentology. Students may accommodate other areas of interest such as earth resources, engineering geology, environmental geology, materials science, soil science, and paleoecology by choosing a minor or supporting field from outside the department.

Prerequisites for Admission—Most candidates for advanced degrees have completed a bachelor's degree in geology, geophysics or in the broad field of earth and material sciences. However, applications from students in fields such as chemistry, physics, or biology are encouraged. At least one year of study in calculus, chemistry, and physics; and a full-time geological field course of at least five weeks' duration are required. In general, an outstanding academic record is expected.

Special Application Requirements—GRE scores are required for admission and financial aid consideration; three letters of recommendation are required for financial aid and admission consideration. Applications for admission are considered at any time, although applications for financial aid should be submitted to the Department by January 15 to ensure consideration. Studies may begin in any semester or summer session, although fall semester is preferable.

Use of 4xxx Courses—For both the MS and Ph.D., typically no more than 30 percent of the total course credits are 4xxx.

Courses—Please refer to Geology and Geophysics (Geo) in the course section of this catalog for courses pertaining to the program.

M.S.Plan A, Plan B, and Plan C Degree Requirements

The M.S. is offered Plan A (with thesis), Plan B (with project), and Plan C (coursework only with emphasis in hydrogeology and environmental geoscience). Plan A requires at least 14 course credits in the major, 6 course credits in the related field, and 10 thesis credits. Plan B requires at least 30 course credits, including 14 credits in the major (6 of which are in independent study leading to a Plan B project) and 6 credits in the related field. The coursework-only option requires at least 30 course credits, including 20 credits in the major and 10 credits in the related field or a minor. Courses in the minor and related field are normally taken from outside the department, although they may be taken from within in special cases.

Language Requirements—None.

Final Exam—Plan A and Plan B students must pass the final oral examination.

Minor Requirements for Students Majoring in Other Fields—The master's minor is established individually with approval by the graduate studies committee. Typically no more than 50 percent of the total course credits are 4xxx.

Ph.D. Degree Requirements

The Ph.D. requires at least 24 course credits in the major, 12 course credits in a supporting program, and 24 thesis credits. Courses in the minor and supporting program are normally taken from outside the department, although they may be taken from within in special cases.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—The Ph.D. minor is established individually with approval by the graduate studies committee. Typically, no more than 50 percent of the total course credits are 4xxx.

Geophysics

Contact Information—Department of Geology and Geophysics, University of Minnesota, 310 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-624-1333; fax 612-625-3819; e-mail geology@umn.edu; <www.geo.umn.edu>).

Professor

Subir K. Banerjee, FM
Shun-ichiro Karato, FM
David L. Kohlstedt, FM
Bruce M. Moskowitz, FM
V. Rama Murthy, FM
David L. Southwick, AM
James H. Stout, FM
Christian P. Teyssier, AM
David A. Yuen, FM

Associate Professor

Karen L. Kleinspehn, AM
Renata M. Wentzcovitch, Chemical Engineering and Materials Science Engineering, AM

Assistant Professor

Marc Hirschmann, AM

Other

Val W. Chandler, AM
Michael J. Jackson, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The geophysics major includes the areas of applied and theoretical geophysics, paleomagnetism and rock magnetism, and mineral and rock physics. Students may accommodate other areas of interest such as earth resources, engineering geology, environmental geology, materials science, soil science, and paleoecology by choosing a minor or supporting field from outside the department.

Prerequisites for Admission—Most candidates for advanced degrees have completed a bachelor's degree in geology, geophysics or earth and material sciences. However, applications from students in fields such as chemistry, physics, or biology are encouraged. At least one year of calculus, chemistry, and physics and a full-time geological field course of at least five weeks' duration are required. In general, an outstanding academic record is expected.

Special Application Requirements—GRE scores are required for admission and financial aid consideration; three letters of recommendation are required for financial aid and admission consideration. Applications for admission are considered at any time, although applications for financial aid should be submitted to the department by January 15 to ensure consideration. Studies may begin in any semester or summer session, although fall semester is preferable.

Use of 4xxx Courses—For both the M.S. and Ph.D., typically no more than 30 percent of the total course credits are 4xxx.

Courses—Please refer to Geology and Geophysics (Geo) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements

The M.S. is offered Plan A (with thesis) and Plan B (with project). Plan A requires at least 14 course credits in the major, 6 course credits in the related field, and 10 thesis credits. Plan B requires at least 30 course credits, including 14 credits in the major (6 of which are in independent study leading to a Plan B project) and 6 credits in the related field. Courses in the minor and related field are normally taken from outside the department, although they may be taken from within in special cases.

Language Requirements—None.

Final Exam—Plan A and Plan B students must pass a final oral exam.

Minor Requirements for Students Majoring in Other Fields—The master's minor is established individually with approval by the graduate studies committee. Typically no more than 50 percent of the total course credits are 4xxx.

Ph.D. Degree Requirements

The Ph.D. requires at least 24 course credits in the major, 12 course credits in a supporting program, and 24 thesis credits. Courses in the minor and supporting program are normally taken from outside the department, although they may be taken from within in special cases.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—The Ph.D. minor is established individually with approval by the graduate studies committee. Typically, no more than 50 percent of the total course credits are 4xxx.

Germanic Studies

Contact Information—Department of German, Scandinavian and Dutch, University of Minnesota, 205 Folwell Hall, 9 Pleasant St. SE, Minneapolis, MN 55455 (612-625-2080; fax 612-624-8297).

Professor

Evelyn S. Firchow, German, Germanic Medieval, FM
Poul Houe, Scandinavian, FM
Ruth-Ellen B. Joeres, German, FM
Ruth M. Karras, History, Scandinavian, AM
Anatoly Liberman, German, Germanic Medieval, Scandinavian, FM
James A. Parente, Jr., German, Scandinavian, Germanic Medieval, FM
Jochen Schulte-Sasse, German, FM
Goran K.N. Stockenstrom, Scandinavian, FM
Arlene A. Teraoka, German, FM
Gerhard H. Weiss (emeritus), German, FM
Jack D. Zipes, German, FM

Associate Professor

Leonard L. Duroche, Sr., German, FM
G. Lee Fullerton, German, AM
Kaaren E. Grimstad, Scandinavian, Germanic Medieval, FM
Richard W. McCormick, German, FM
William E. Mishler, Scandinavian, FM
Gary C. Thomas, Cultural Studies and Comparative Literature, German, AM
Mariann Tiblin, Scandinavian, AM
Ray M. Wakefield, German, Germanic Medieval, FM
Monika Zagar, Scandinavian, AM

Assistant Professor

Patrizia C. McBride, German, AM
Charlotte A. Melin, German, AM
Leslie Morris, German, AM

Along with the program- and track-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—There are five tracks within the Germanic studies graduate program: German, Scandinavian Studies (M.A. only), Teaching (M.A. only), Germanic Medieval Studies, and German and Scandinavian Studies (Ph.D. only).

Prerequisites for Admission—For major work, a B.A. or equivalent concentration in German, Scandinavian, or related field (depending on the track to which one applies) is required. Applicants to the Scandinavian studies M.A. must have a strong competency in a Scandinavian language, and they should

have taken at least four Scandinavian literature courses or the equivalent. Candidates whose preparatory work evidences gaps may be asked to complete supplemental work before admission.

Special Application Requirements—The following must be forwarded to the department: three letters of recommendation; a complete set of transcripts (in addition to transcripts sent to the Graduate School); a copy of one or more papers representative of the applicant's level of scholarly development; and a statement of professional goals describing the applicant's intellectual development and plans for the future. For master's program applicants, and for all students who wish to be considered for fellowships, the General (Aptitude) Text of the GRE is required; the GRE is optional for those applicants whose native language is not English and who are required to take the TOEFL. For the doctoral program, applicants must have a master's degree from an accredited institution or present other evidence of adequate background and competence. Prospective students should contact the department for further information. Students are admitted in the fall semester only. All financial application materials for the Graduate School Fellowship, departmental fellowships, and teaching assistantships must be received by January 10.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to the approval of the director of graduate studies.

Minor Requirements for Students Majoring in Other Fields—M.A. minors are required to take the basic seminar in either German (Ger 8002) or Scandinavian (Scan 8002) and two other courses, for at least 9 credits. Ph.D. minors who have not completed one of the basic seminars at the M.A. level must fulfill this requirement at the Ph.D. level. In addition, Ph.D. minors must complete at least three other courses for for a total of at least 12 credits (usually four courses).

German Track

M.A. Plan B Degree Requirements

The M.A. offers students the opportunity to do advanced work in German studies and prepares them with the theoretical and practical tools to enter a Ph.D. program. The M.A. requires at least 35 credits, including a course in contemporary literary and cultural theory (CLit 8001), an introductory course in German studies (Ger 8002), four different courses in different periods of German literature, a philology course, an elective in German literature/culture, a pedagogy course, and two courses outside the German track.

Courses—Please refer to German (Ger); German, Scandinavian and Dutch (GSD); and Dutch (Dtch) in the course section of this catalog for courses pertaining to the track.

Language Requirements—German. Students who intend to continue in the Ph.D. program are encouraged to acquire a reading proficiency in one other foreign language during their M.A. program (refer to requirements for the Ph.D.).

Ph.D. Degree Requirements

The Ph.D. offers students the opportunity to do advanced work in German studies and prepares them with theoretical and practical tools to serve as researchers, scholars, and teachers.

The Ph.D. requires at least 39 credits, including six courses in German literature/culture, a course in Germanic philology, a pedagogy course (if it has not been taken before the M.A.), the dissertation seminars (one before and one after the Ph.D. preliminary exams), and three courses outside the German track. At least 24 thesis credits are required.

Courses—Please refer to German (Ger); German, Scandinavian and Dutch (GSD); and Dutch (Dtch) in the course section of this catalog for courses pertaining to the program.

Language Requirements—The program requires reading competence in at least two languages or a high degree of proficiency in one language other than German or English.

Scandinavian Studies Track

M.A. Plan B Degree Requirements

The M.A. offers students the opportunity to do advanced work and prepares them with the theoretical and practical tools to enter the Ph.D. track in German and Scandinavian at the University of Minnesota, to enter a Ph.D. program in Scandinavian at another university, or to embark on a career that requires specialized knowledge of Scandinavia. Students enrolled in the M.A. in the Scandinavian track emphasize one of the three Scandinavian languages and literatures while acquiring a general knowledge of the other two. The M.A. in the Scandinavian track may also include Finnish.

The M.A. requires at least 35 credits, including a course in contemporary literary and cultural theory (CLit 8001), a course introducing students to graduate studies in Scandinavian (Scan 8002), five courses in different periods of Scandinavian literature/culture, a course in Old Norse or Scandinavian linguistics, a pedagogy course, and two courses outside the Scandinavian track.

Courses—Please refer to German (Ger), German, Scandinavian, and Dutch (GSD) and Scandinavian (Scan) in the course section of this catalog for courses pertaining to this track.

Language Requirements—The track requires advanced competency in at least one

Scandinavian language or Finnish, and reading knowledge of at least two other Scandinavian languages.

Teaching Track

M.A. Plan B Degree Requirements

The M.A. in teaching combines a disciplinary focus in Germanic studies with a concentration in foreign language teaching and second language acquisition. The track does not lead to teacher licensure. Students interested in teacher licensure should contact the College of Education and Human Development.

The M.A. requires at least 35 credits, including a pedagogy course; two courses in the history of the German language and one in the analysis of German; Introduction to Second Language Acquisition; Issues in Second Language Curriculum Design; two or more courses in language teaching, curriculum, and instruction or teaching English as a second language or linguistics; two literature and culture courses; and one elective.

Courses—Please refer to German (Ger), Linguistics (Ling), Curriculum and Instruction (CI), Language Teaching (LgTT), and Teaching English as a Second Language (TESL) in the course section of this catalog for courses pertaining to the track.

Language Requirement—German.

Germanic Medieval Studies Track

M.A. Plan B Degree Requirements

The M.A. offers students the opportunity to do advanced work and prepares them with theoretical and practical tools to enter the Ph.D. track.

The M.A. requires at least 35 credits, including a course in contemporary literary and cultural theory (CLit 8001); a course introducing students to graduate studies in either German or Scandinavian (Ger 8002 or Scan 8002); 12 credits (usually 4 courses) in each of two medieval foundation languages, literatures, and cultures chosen from two of Middle High German, Old Norse, and Old and Middle English; 6 credits (usually 2 courses) in Germanic medieval studies; a pedagogy course; and at least 6 credits (usually two courses) in related fields or a designated minor.

Courses—Please refer to English (EngL, EngC), Dutch (Dtch), German (Ger), German, Scandinavian and Dutch (GSD), and Scandinavian (Scan) in the course section of this catalog for courses pertaining to the track.

Language Requirement—German and the courses listed above in the two medieval foundation languages are required, but students who intend to continue in the Ph.D. program are encouraged to acquire a reading proficiency in Dutch or a modern Scandinavian language.

Ph.D. Degree Requirements

The Ph.D. offers students the opportunity to do advanced work in Germanic medieval studies and prepares them with theoretical and practical tools to serve as researchers, scholars, and teachers. The Ph.D. requires at

least 39 credits, including 12 credits (usually 4 courses) in Germanic Medieval Studies, 6 credits (usually 2 courses) in a third medieval Germanic language (supplementing the two languages for the M.A.), a pedagogy course (if it has not been taken before the M.A.), the dissertation seminars (one before and one after the Ph.D. preliminary exams), and 12 credits (usually 4 courses) in a designated minor or supporting field. 24 thesis credits are also required.

Courses—Please refer to English (EngL, EngC), Dutch (Dtch), German (Ger), German, Scandinavian, and Dutch (GSD), and Scandinavian (Scan) in the course section of this catalog for courses pertaining to the track.

Language Requirement—Reading competence in Medieval Latin and one modern Germanic language other than German or English (e.g., Dutch or one of the Scandinavian languages).

German and Scandinavian Studies Track

Ph.D. Degree Requirements

The Ph.D. offers the student the opportunity to do advanced work in German and Scandinavian studies and prepares students with theoretical and practical tools to serve as researchers, scholars, and teachers in either German or Scandinavian studies, with a basic foundation in the other field as well.

The Ph.D. requires at least 39 credits. The German emphasis requires at least four courses from the German list and one course from each of the three Scandinavian groups. The Scandinavian emphasis requires at least one course from each of the three Scandinavian groups plus an additional course from any of them and three courses from the German list. Students in both emphases are required to take a pedagogy course (if it has not been taken before the M.A.), the dissertation seminars (one before and one after the Ph.D. preliminary exams), and 12 credits (usually 4 courses) in a designated minor or supporting program. 24 thesis credits are required.

Courses—Please refer to Dutch (Dtch), German (Ger), German, Scandinavian, and Dutch (GSD), and Scandinavian (Scan) in the course section of this catalog for courses pertaining to the track.

Language Requirements—Near-native fluency in German or a Scandinavian language: if the former, an advanced level of proficiency in a Scandinavian language; if the latter, an advanced level of proficiency in German. Reading competence in two other Scandinavian languages.

Gerontology

Contact Information—Graduate Minor Program in Gerontology, Center on Aging, University of Minnesota, MMC 197, 420 Delaware Street S.E., Minneapolis, MN 55455 (612-624-3904; fax 612-624-8448; e-mail coa@umn.edu; <www.umn.edu/coa>).

Professor

Dennis A. Ahlburg, Industrial Relations, E
David O. Born, Preventative Services, E
Pauline G. Boss, Family Social Science, E
Charles E. Boult, Family Practice and Community Health, E
James C. Cloyd, Pharmacy Practice, E
Jim Curtsinger, Ecology, Evolution, and Behavior, E
Daniel F. Detzner, Family Social Science, E
Richard P. DiFabio, Physical Medicine and Rehabilitation, E
William Durfee, Mechanical Engineering, E
Maurice W. Dysken, Psychiatry, E
Nancy N. Eustis, Public Affairs, E
Judith M. Garrard, Public Health, E
David R. Guay, Pharmacy Practice, E
Peter A. Hancock, Kinesiology and Leisure Studies, E
Joseph T. Hanlon, Pharmacy, E
Lois J. Heller, School of Medicine, Duluth, E
Robert L. Kane, Public Health, E
Rosalie A. Kane, Public Health, E
Helen Q. Kivnick, Social Work, E
Thomas E. Lackner, Pharmacy, E
Frank Lassman (emeritus), E
Chap Le, Biostatistics, E
Matthew K. McGue, Psychology, E
Susan S. Meyers, Social Work, E
Steven H. Miles, E
Jeylan T. Mortimer, Sociology, E
Jean K. Quam, Social Work, E
Stephen Schondelmeyer, Pharmacy Practice, E
Virginia Seybold, Cell Biology and Neuroanatomy, E
Mariah Snyder, Nursing, E
Marc Swiontkowski, Orthopedic Surgery, E
David Thomas, Biochemistry, E
Michael Wade, Kinesiology and Leisure Studies, E
Jonathan D. Wirtschafter, Opthalmology, E
Jean Wyman, Nursing, E
Shirley L. Zimmerman (emeritus) E

Associate Professor

Leslie A. Grant, Carlson School of Management, E
Cynthia R. Gross, Pharmacy Practice, E
Kenneth W. Hepburn, Family Practice and Community Health, E
Merrie J. Kaas, Nursing, E
Kathleen Krichbaum, Nursing, E
March L. Krotee, Kinesiology and Leisure Studies, E
Alice Larson, Veterinary Pathobiology, E
Tom A Larson, Pharmacy Practice, E
Christine A. Mueller, E, Nursing, E
Mary E. O'Connell, Pharmacy Practice, E
James T. Pacala, Family Practice and Community Health, E
Rosemarie J. Park, Work, Community, and Family Education, E
James R. Reinardy, Social Work, E
Jon Schommer, Pharmaceutical Care and Health Systems, E
Robert C. Serfass, Kinesiology and Leisure Studies, E
Stephen K. Shuman, Preventive Sciences, E
Marlene S. Stum, Family Social Science, E
Carla E. S. Tabourne, Kinesiology and Leisure Studies, E
LaDora V. Thompson, Physical Medicine and Rehabilitation, E

Clinical Associate Professor

Brian E. Engdahl, Psychology, E

Assistant Professor

Lynn Blewett, School of Public Health, E
Karen S. Feldt, Nursing, E
Debra Ferrington, Ophthalmology, E
James Gambucci, Preventative Sciences, E
Thomas E. Lackner, Pharmacy, E
Terry Lum, Social Work, E
Stanley Smith, Family Practice and Community Health, E

Clinical Assistant Professor

Patrick W. Irvine, Medicine, E

Lecturer

Wayne Caron, Family Social Science, E
Celia W. Gershenson, Psychology, E

Research Associate

Lois Cutler, School of Public Health, E

Other

Ursala Bea Krinke, School of Public Health, E

Curriculum—The gerontology minor is available to master's (M.A. and M.S.) and doctoral students. The minor provides a multidisciplinary foundation in gerontology for master's minors and a more intensive preparation in aging for Ph.D. minors. Students who have minored in gerontology have majored in many departments, including but not limited to: curriculum and instruction (adult education); communication disorders; dentistry; design, housing, and apparel; family practice and community health; family social science; journalism and mass communication; kinesiology; nursing; psychology; social work; and sociology. The program of courses is tailored in advance consultation between the student and the director of graduate studies of the gerontology minor.

Prerequisites for Admission—Admission to a master's or doctoral degree-granting program within the Graduate School and preparation of a minor program of coursework approved by the director of graduate studies in gerontology. Potential programs can be discussed with the director of graduate studies.

Use of 4xxx Courses—4xxx courses may not be included on degree program forms.

Courses—Courses are ordinarily taken from a designated course list that is continuously updated by the minor program.

Freestanding Minor Requirements

The master's and doctoral minors are developed in consultation with, and should be approved in advance by, the director of graduate studies for gerontology. The master's minor requires at least 6 credits, ordinarily including Gero 5105—Multidisciplinary Perspectives on Aging (3 cr). Other courses may be substituted upon the recommendation of the director of graduate studies.

The doctoral minor requires at least 12 credits, ordinarily including Nurs 8320—Multidisciplinary Seminar on Social Perspectives of Aging (3 cr). Other courses may be substituted upon the recommendation of the director of graduate studies.

Greek

See Classical and Near Eastern Studies.

Health Informatics

Contact Information—Director of Graduate Studies in Health Informatics, Division of Health Informatics, University of Minnesota, MMC 511, 420 Delaware Street S.E., Minneapolis, MN 55455 (mailing address) (612-625-8440; fax 612-625-7166; e-mail grad@email.labmed.umn.edu; <www.hinf.umn.edu>).

Professor

Christopher G. Chute, AM
Donald P. Connelly, FM
Lynda B. Ellis, FM
David P. Fan, Genetics and Cell Biology, FM
Stanley M. Finkelstein, FM
John R Finnegan, Jr., Epidemiology, FM
James R. Fricton, Diagnostic/Surgical Sciences, FM
Laël C. Gatewood, FM
Ilene B. Harris, AM
Paul E. Johnson, Information and Decision Sciences, FM
George G. Klee, AM
Donald G. McQuarrie, Surgery, E
Robert P. Patterson, Physical Medicine and Rehabilitation, FM
Stuart M. Speedie, FM
Douglas R. Wholey, Health Services Research and Policy, FM
George L. Wilcox, Neuroscience, FM

Associate Professor

Sandra J. Potthoff, Healthcare Management, FM
Stephen C. Strother, Radiology, AM

Assistant Professor

Steven D. Hillson, Public Health, AM
Stephen T Parente, Healthcare Management, AM

Research Associate

Ernest F. Retzel, AM

Other

Denton R. Peterson, AM
Brian J. Westrich, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Health Informatics is an interdisciplinary field of scholarship that applies computer, information, and cognitive sciences to promote the effective and efficient use and analysis of information to improve the health, well being and economic functioning of society. Students take a core sequences in hatistics, and electives in technical and health science areas. Possible areas of emphasis include health information systems, telemedicine, user interface design, system impact evaluation, database construction and analysis, clinical decision-making, evaluation of health programs, image and signal processing, and physiological monitoring and control.

Prerequisites for Admission—Applicants are expected to have at least a bachelor of science or equivalent degree from a recognized institution of higher education. Although students are accepted into the program with different backgrounds and varying degrees of experience, some prerequisites are required, usually in the form of college coursework. Acceptance into the program is not precluded by minor deficiencies in background; rather it is conditional on these being made up before or during the first year of study. The prerequisites listed in the table on the following page must be completed before admission to the program. Courses used to fulfill prerequisites are not given graduate credit. Courses in the curriculum assume that these prerequisite courses have been taken.

Note: these prerequisites are subject to change. Please check our Web site for the current information on prerequisites.

		Before Admission		
	For Ph.D.		***Area Complete***	***Amount For M.S.***
Biological or Life Sciences	1 year	Yes	Yes	Yes
Mathematics				
Calculus	1 year	Yes	Yes	Yes
Linear Algebra (qtr or sem)	1 course		Yes	Yes
Differential Equations	1 course		No	Yes
Computer Programming (FORTRAN, C, JAVA, etc)	1 course	Yes	Yes	Yes

Special Application Requirements—The GRE or similar professional examination (e.g., MCAT) is required. Three letters of recommendation and a statement of purpose must be submitted with the application. Student are advised to apply for admission for fall semester, since spring semester admission may entail the student taking longer to complete the program.

Use of 4xxx Courses—4xxx courses in computer science may be used to satisfy the elective requirements for the Plan A or Plan B master's degree, provided the student has not previously taken a computer science course in the same sub area (e.g., database design) at a higher level. Acceptance of 4xxx courses from other departments or programs requires the approval of the adviser and the director of graduate studies.

Courses—Please refer to Health Informatics (HInf) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements

The research-oriented Plan A master's degree is available to advanced applicants, such as those with a professional degree in a health sciences discipline. It requires 32 course credits and 10 thesis credits. The Plan B option requires 42 course credits, including 6-7 credits from a technical area and 6-7 credits from the health sciences. Both plans require seven core courses, a sequence in statistics or biostatistics, and registration in the health informatics seminar (5436) for the first year and for at least two semesters after that (1 credit each semester). For most students, the program requires two academic years and one summer.

Ph.D. Degree Requirements

The Ph.D. program is for students who want to obtain advanced training and to conduct research. Students are expected to complete the same requirements as those for the Plan B master's program (a survey of health informatics, biostatistics, selected health science areas and advanced training in selected informatics areas), as well as advanced coursework in health informatics and an area of concentration complementary to health informatics. The work is completed with an original research project reported in the doctoral dissertation. Students are expected to have earned the equivalent of at least 70 credits including 24 thesis credits.

Language Requirement—None.

Minor Requirements for Students Majoring in Other Fields—Master's students majoring in other fields who wish to complete a minor in health informatics must successfully complete the introductory sequence in health informatics (5430 and 5431). Ph.D. students majoring in other fields who wish to complete such a minor must take the introductory sequence as well as medical decision support techniques (8434).

Health Services Research, Policy, and Administration

Contact Information—Division of Health Services Research and Policy (HSRP), School of Public Health, University of Minnesota, MMC 729 Mayo Building, 420 Delaware Street S.E., Minneapolis, MN 55455 (612-626-3500; fax 612-624-4498; e-mail sph-ssc@umn.edu; <www.sph.umn.edu>).

Professor

James W. Begun, Carlson School of Management, FM
Jon B. Christianson, Public Health, FM
Bryan E. Dowd, Public Health, FM
Roger D. Feldman, Public Health, FM
Judith M. Garrard, Public Health, FM
Robert L. Kane, Public Health, FM
Rosalie A. Kane, Public Health, FM
John E. Kralewski, Public Health, FM
Nicole Lurie, Medicine, FM
A. Marshall McBean, Public Health, FM
Ira S. Moscovice, Public Health, FM
John A. Nyman, Public Health, FM
Michael D. Resnick, Pediatrics, FM
Vernon E. Weckwerth, Management, FM
Douglas R. Wholey, Public Health, FM

Associate Professor

Kathleen T. Call, Public Health, FM
Robert A. Connor, Carlson School of Management, AM
Michael D. Finch, Public Health, FM

Assistant Professor

Boris Bershadsky, Public Health, AM
Lynn A. Blewett, AM
Leslie A. Grant, Carlson School of Management, AM
Jeremy L Holtzman, AM
Sandra J. Potthoff, Management, AM
David M Radosevich, AM
Todd H. Rockwood, Public Health, AM
Beth A. Virnig, AM

Other

N. Tor Dahl, E
George O. Johnson, E
Stephen T. Parente, E

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Health services research focuses on the organization and delivery of cost-effective health services. It deals with policy issues related to costs, access, and quality of health services and equitable distribution of health resources. The M.S. program prepares health services researchers and health policy analysts to carry out empirical studies, formulate policy options, work in the political arena to shape and implement policies, and evaluate policies once implemented. The M.S. can serve as a terminal degree or as a first step toward the Ph.D.

Health services research at the Ph.D. level is for those interested in affecting public policy related to health-care systems. Students come from a variety of educational backgrounds, including economics, political science, sociology, and public affairs. Strong quantitative skills are essential. The program is primarily for students interested in academic careers or senior research positions in government or the private sector. The core curriculum is a multidisciplinary examination of the social, political, and economic forces that affect the organization, financing, and delivery of health-care services. The emphasis is on theory, modeling, and quantitative methods. Coursework is supported by the student's involvement with faculty on research projects. The program provides further interchange with faculty through research seminars and doctoral colloquia.

Prerequisites for Admission—Calculus, statistics, and intermediate microeconomics. Applicants who have not completed the prerequisites, but are otherwise qualified for admission, are required to take relevant courses at the University or another accredited institution before beginning the program.

Special Application Requirements—Above average performance on the GRE is required for admission, (minimum score of 1500 for the M.S., 1800 for Ph.D.). A statement indicating reasons for seeking the health services research, policy, and administration M.S. or Ph.D., plus three letters of reference attesting to the applicant's academic ability and potential for a career in research or teaching, are required. Students are admitted in fall semester only. The program is full time.

Use of 4xxx Courses—Use of 4xxx courses toward degree requirements requires the approval of the director of graduate study.

Courses—Please refer to Public Health (PubH), particularly numbers 58xx and 88xx, in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements

The M.S. is offered under Plan A, for students with a professional degree in medicine, dentistry, nursing, or pharmacy, and Plan B, for students with a non-health professional background. Plan A requires a thesis (publishable research paper) and a final oral exam; Plan B requires an internship and a research proposal. A critique of the research proposal is required. Both Plan A and Plan B are full-time, two year programs.

Plan A requires 30 course credits, 6 credits in a minor, and 10 thesis credits; Plan B requires 38 course credits and 6 credits in a minor.

Ph.D. Degree Requirements

The Ph.D. requires at least 47 credits, including 35 credits in the major and 12 credits in the minor or supporting program; 24 thesis credits are also required. The minor or supporting program may be in areas such as economics, statistics, sociology, bioethics, gerontology, business administration, or epidemiology in the School of Public Health.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—The minor is developed uniquely for each student with the advice and counsel of the director of graduate studies. The proposed minor is then reviewed and approved by the full faculty.

Hispanic and Luso-Brazilian Literature and Linguistics

Contact Information—Department of Spanish and Portuguese, University of Minnesota, 34 Folwell Hall, 9 Pleasant Street S.E., Minneapolis, MN 55455 (612-625-5858; fax 612-625-3549).

Professor

René Jara, FM
Amy K. Kaminsky, Women's Studies, FM
Antonio Ramos-Gascón, FM
Nicholas Spadaccini, FM
Hernán Vidal, FM
Anthony N. Zahareas (emeritus), FM

Associate Professor

Fernando E. Arenas, AM
Carol A. Klee, FM
Francisco A. Ocampo, FM
Joanna O'Connell, FM
Constance A. Sullivan, FM

Assistant Professor

Alberto Egea Fernández-Montesinos, AM
Ofelia Ferrán, AM
Horacio Machín, AM
Elide Oliver, AM
Luis Ramos-García, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The department offers three M.A. programs: Hispanic literature, Luso-Brazilian literature, and Hispanic linguistics. The department offers a Ph.D. in Hispanic and Luso-Brazilian literatures and linguistics. The Ph.D. offers four areas of emphasis: Spanish peninsular literature, Spanish-American literature, Luso-Brazilian literatures, and Hispanic linguistics.

The department integrates cultural and language areas into each degree program. Students study the main problems, issues, topics, and polemics that constitute their various fields and develop skills, theories, and methodologies to research, analyze, organize, reproduce, and communicate the material. Ph.D. students are expected to make scholarly contributions based on a thorough understanding of the history of the field of specialization and of the approaches used to study it. The department encourages and promotes a diversity of philosophies, approaches, and methods.

Prerequisites for Admission—Prospective students generally have completed an undergraduate degree or substantial coursework in the field, although individuals with other backgrounds may be admitted.

The Graduate Studies Committee may require completion of background coursework, without graduate degree credit, for admitted students with insufficient preparation.

Special Application Requirements—Three letters of recommendation from previously attended institutions evaluating the applicant's scholarship, a sample of a writing project, and a complete set of transcripts in addition to that required by the Graduate School should be sent to the director of graduate studies. The GRE is recommended, and is required for fellowship candidates. The deadline for application for admission and financial aid is January 15 for fall entry.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please refer to Portuguese (Port), Spanish (Span), and Spanish-Portuguese (SpPt) in the course section of this catalog for courses pertaining to the program.

Ph.D. Degree Requirements

The Ph.D. requires at least 54 course credits (seventeen courses, excluding SpPt 5999), including 39 credits in the major and 15 credits (five courses) in either a related field or a minor, depending on the requirements of the minor program. The program also requires 24 thesis credits.

Language Requirements—For the Ph.D., students must have proficiency in both Spanish and Portuguese. Proficiency is usually demonstrated by use of the language in written and oral forms (see the department's *Graduate Handbook*).

Minor Requirements for Students Majoring in Other Fields—The doctoral minor requires at least 18 credits of 5xxx or 8xxx courses (six courses), to be determined in consultation with the director of graduate studies.

Hispanic Linguistics

Contact Information—See Hispanic and Luso-Brazilian Literature and Linguistics.

Associate Professor

Carol A. Klee, AM
Francisco A. Ocampo, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—See Hispanic and Luso-Brazilian Literatures and Linguistics for program description.

Prerequisites for Admission—Prospective students generally have completed an undergraduate degree or substantial coursework in the field, although individuals with other backgrounds may be admitted. The Graduate Studies Committee may require completion of background coursework, without graduate degree credit, for admitted students with insufficient preparation.

Special Application Requirements—Three letters of recommendation from previously attended institutions evaluating the applicant's scholarship, a sample of a writing project, and a complete set of transcripts in addition to that required by the Graduate School should be sent to the director of graduate studies. The GRE is recommended, and is required for fellowship candidates. The deadline for application for admission and financial aid is January 15 for fall entry.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval

Courses—Please refer to Portuguese (Port), Spanish (Span), and Spanish-Portuguese (SpPt) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements

The M.A. is offered under Plan A and Plan B. Plan A requires at least 33 credits, including 15 credits in the major field taken from among designated 5xxx core courses, 6 credits outside the program, and 12 thesis credits. Plan B requires at least 33 course credits and two Plan B papers. Most students pursue Plan B.

Language Requirements—For the M.A., students must have a reading knowledge of English and at least one foreign language in addition to Spanish and Portuguese.

Final Exam—The final exams are written and oral.

Minor Requirements for Students Majoring in Other Fields—For a master's minor, students may choose any 6 credits (two courses), preferably in related areas, in consultation with the director of graduate studies.

Hispanic Literature

Contact Information—See Hispanic and Luso-Brazilian Literature and Linguistics.

Professor

René Jara, AM
Antonio Ramos-Gascón, AM
Nicholas Spadaccini, AM
Hernán Vidal, AM
Anthony N. Zahareas (emeritus), AM

Associate Professor

Fernando E. Arenas, AM
Joanna O'Connell, AM
Constance A. Sullivan, AM

Assistant Professor

Alberto Egea Fernández-Montesinos, AM
Ofelia Ferrán, AM
Horacio Machín, AM
Elide Oliver, AM
Luis A. Ramos-García, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—See Hispanic and Luso-Brazilian Literatures and Linguistics for program description.

Prerequisites for Admission—Prospective students generally have completed an undergraduate degree or substantial coursework in the field, although individuals with other backgrounds may be admitted. The Graduate Studies Committee may require completion of background coursework, without graduate degree credit, for admitted students with insufficient preparation.

Special Application Requirements—Three letters of recommendation from previously attended institutions evaluating the applicant's scholarship, a sample of a writing project, and a complete set of transcripts in addition to that required by the Graduate School should be sent to the director of graduate studies. The GRE is recommended, and is required for fellowship candidates. The deadline for application for admission and financial aid is January 15 for fall entry.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please refer to Portuguese (Port), Spanish (Span), and Spanish-Portuguese (SpPt) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements

The M.A. is offered under both Plan A and Plan B. Plan A requires at least 33 credits, including 15 credits in the major field taken from among designated 5xxx core courses, 6 credits outside the program, and 12 thesis credits. Plan B requires at least 33 course credits and two Plan B papers. Most students pursue Plan B.

Language Requirements—For the M.A., students have a reading knowledge of English and at least one foreign language in addition to Spanish and Portuguese.

Final Exam—The final exams are written and oral.

Minor Requirements for Students Majoring in Other Fields—A master's minor requires at least 6 credits.

History

Contact Information—Department of History, University of Minnesota, 646 Social Sciences Building, 267 19th Avenue S., Minneapolis, MN 55455 (612-624-5840; fax 612-624-7096; e-mail histdgs@umn.edu; <http://www.hist.umn.edu>).

Regents' Professor

Allen F. Isaacman, FM

Professor

Josef L. Altholz, FM
Bernard S. Bachrach, FM
Hyman Berman, FM
Clarke A. Chambers (emeritus), FM
Anna K. Clark, FM
John K. Evans, FM
Sara M. Evans, FM
John M. Eyler, History of Medicine, FM
Caesar E. Farah, Afro-American and African Studies, FM
Edward L. Farmer, FM
Stephen C. Feinstein, Holocaust and Genocide Studies, AM
David F. Good, FM
Andrea Hinding, AM
John R. Howe, Jr. (emeritus), FM
Ruth M. Karras, FM
Sally G. Kohlstedt, History of Science and Technology, FM
Elaine Tyler May, American Studies, FM
Lary May, American Studies, FM
Mary J. Maynes, FM
Robert E. McCaa, FM
Russell R. Menard, FM
John K. Munholland, FM
David W. Noble, FM
Thomas S. Noonan, FM
Carla R. Phillips, FM
William D. Phillips, Jr., FM
Kathryn L. Reyerson, FM
David Roediger, FM
Steven Ruggles, FM
Joel B. Samaha, FM
Theofanis G. Stavrou, FM
John A. Thayer, FM
James D. Tracy, FM
Carol L. Urness, AM
Rudolph J. Vecoli, FM
Ann B. Waltner, FM

Associate Professor

Jean M. Allman, FM
Keletso E. Atkins, Afro-American and African Studies, AM
Sarah C. Chambers, FM
George D. Green, FM
Lisa A. Norling, FM
Jean M. O'Brien-Kehoe, FM
Ajay Skaria, AM
Dennis N. Valdes, FM
Eric D. Weitz, FM

Assistant Professor

Jennifer Alexander, History of Science and Technology, AM
Brenda Child, American Studies, AM
Catherine Choy, American Studies, AM
Victoria B. Coifman, Afro-American and African Studies, AM
Kirsten Fischer, AM
Christopher M. Isett, AM
Erika Lee, AM
Michael Lower, AM
Patrick J. McNamara, AM
J.B. Shank, AM
Michele Wagner, AM
Liping Wang, AM
Barbara Welke, AM
Thomas C. Wolfe, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Areas of concentration include Africa; Asia; British Isles; comparative women's history; Medieval, early modern, and modern Europe; early modern world; Latin America; and the United States and its colonial background. Scholarly resources include Center for Austrian Studies, Center for Advanced Feminist Studies, Center for German and European Studies, Center for Medieval Studies, Immigration History Research Center, Minnesota Population Center, Modern Greek Studies, Center for Early Modern History, and Social Welfare History Archives.

Prerequisites for Admission—Applicants for the master's degree normally should have completed general undergraduate survey courses in two or three broad areas of history, two years of advanced undergraduate work in two areas of history, and training in a foreign language. Some prerequisites may be made up after admission. In some circumstances, students without undergraduate history majors may be admitted to the M.A. program. Applicants for the Ph.D. program normally should have completed a master's degree, but highly qualified applicants may apply without having completed an M.A. degree. In admitting students, priority is given to applicants who are likely to continue on to a doctoral degree even if they are originally admitted to the M.A. program.

Special Application Requirements—The following are required by the department: a statement of purpose, three letters of recommendation, a writing sample, training in a foreign language, a statement of specific areas and subareas of interest, and scores from the General (Aptitude) Test of the GRE. Deadline for financial aid applications is December 15. Forms and instructions should be requested from the department or may be downloaded from the Web site at <www.hist.umn.edu>.

Use of 4xxx Courses—4xxx history courses may not normally be included on degree program forms for the History graduate major or minor.

Courses—Please refer to History (Hist) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements

The M.A. is offered under Plan A and Plan B. Both plans require six history courses (one of which is 8015) and two courses in other departments (at least 6 credits). Plan A also requires 10 thesis credits, for a total of at least 31 credits, and Plan B requires an additional two courses in history or another department, for a total of at least 30 credits.

Language Requirements—A reading knowledge of one foreign language is required before admission to the master's exam.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master's minor is offered for Plan A students only. At least two related courses in history (at least 6 credits) is required.

Ph.D. Degree Requirements

The Ph.D. requires 36 credits in 12 history courses (Hist 8015, nine courses in the major, and two courses in an outside subarea) plus 12 credits in four supporting program courses; 24 thesis credits are also required.

Language Requirements—A reading knowledge of two foreign languages is required before admission to the preliminary exam. Some areas of concentration may require additional foreign languages. In some cases, competence in quantitative methods may replace one of the foreign languages.

Minor Requirements for Students Majoring in Other Fields—For the doctoral minor, at least four history courses, including a proseminar or seminar, are required, along with a written and oral exam.

History of Medicine and Biological Sciences

Contact Information—Program in the History of Medicine, University of Minnesota, Mayo Mail Code 506, 420 Delaware Street S.E., Minneapolis, MN 55455 (612-624-4416; fax: 612-625-7938; <www.med.umn.edu/history/home.htm>).

Professor

John H. Beatty, Ecology and Behavioral Biology, FM
C. Carlyle Clawson, Pediatrics, E
John M. Eyler, FM
Sally Gregory Kohlstedt, History of Science and Technology, FM
Elaine Tyler May, American Studies, FM

Assistant Professor

Jennifer L. Gunn, FM

Adjunct Assistant Professor

David J. Rhees, AM
Jole Shackelford, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalogue for Graduate School requirements that apply to all major fields.

Curriculum—The history of medicine explores the changing ideas of health and disease, the evolution of health care, and the changing patterns of disease from antiquity to the present. It employs the methods of intellectual, social, and cultural history to explicate the forces that created the biomedical world in which we live. Students enter with diverse backgrounds, typically in medicine, science, or history. Some begin their graduate study immediately after receiving the bachelor's degree. Others do their training in mid-career. The Ph.D.

program is for those who seek a career of historical research and teaching. The M.A. is especially suitable for those who intend to combine historical pursuits with a career in one of the health sciences.

Prerequisites for Admission—There are no universal prerequisites for admission, but some training in both history and the biological sciences is desirable.

Special Application Requirements—Applicants must submit scores from the General Test of the GRE and arrange to have three persons who know their academic work well submit letters of recommendation on their behalf to the director of graduate studies, Program in the History of Medicine and Biological Sciences. Applicants should submit a statement describing their historical interests and their goals for graduate study. They are also encouraged to submit a writing sample. New students are ordinarily admitted for fall semester. For an applicant to be considered for financial aid, the applicant's materials must be received by January 15.

Use of 4xxx Courses—Use of 4xxx courses is not permitted toward degree requirements.

Courses—Please refer to History of Medicine (HMed) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements

The M.A. is offered under Plan A or Plan B. The degree is normally completed in two to three semesters of full-time study or its part-time equivalent.

For Plan A, twelve hours of required courses in the history of medicine, plus two elective hours in the history of medicine, 6 credits in a minor or related field, and ten hours of thesis credits.

For Plan B, twelve hours of required courses in the history of medicine, plus an approved program of twelve hours of electives in history of medicine and related subjects, and 6 credits in a minor or related field.

Language Requirements—M.A. students must demonstrate competence in one foreign language, preferably French or German.

Final Exam—The final exam is oral. For Plan A, the examination centers on the thesis. For Plan B, it focuses on two or more revised course or seminar papers.

Minor Requirements for Students Majoring in Other Fields—A master's minor requires 6 credits in the history of medicine and biological sciences.

Ph.D. Degree Requirements

Twelve hours of required courses in the history of medicine, plus nine additional elective hours in history of medicine, a minor or related field of twelve hours, and twenty-four hours of thesis credits. A comprehensive written and oral preliminary examination precedes admission to candidacy.

Language Requirements—Ph.D. students must demonstrate competence in two foreign languages, preferably French and German. One language examination must be passed before the end of the first academic year.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A Ph.D. minor requires at least 12 credits in the history of medicine and biological sciences.

History of Science and Technology

Contact Information—Including the publication *A Guide to Graduate Study in the History of Science and Technology,* which supplies more detailed information about requirements, contact the Program in History of Science and Technology, University of Minnesota, 381 Tate Laboratory of Physics, 116 Church Street S.E., Minneapolis, MN 55455 (612-624-7069; fax 612-624-4578).

Professor

John Beatty, Ecology, Evolution, and Behavior, FM
John M. Eyler, History of Medicine, FM
Ronald N. Giere, Philosophy, AM
Sally G. Kohlstedt, Geology and Geophysics, FM
Helen E. Longino, Women's Studies, AM
Arthur L. Norberg, Computer Science, FM
Robert W. Seidel, Chemical Engineering, FM
Alan E. Shapiro, Physics, FM
Roger H. Stuewer, (emeritus), Physics, FM

Assistant Professor

Jennifer Karns Alexander, Mechanical Engineering, FM
Michel H. P. Janssen, Physics, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The program offers opportunities for advanced research and study in three general areas: history of the physical sciences, history of the biological sciences, and history of technology. Students focus on the following approaches: conceptual development of the disciplinary fields; social, economic, and cultural contexts; the interaction among science, technology, and society; or a combination of these. The faculty's interests span the period from the Scientific Revolution of the sixteenth and seventeenth centuries through twentieth-century developments.

Prerequisites for Admission—Students must have a bachelor's degree with a minimum grade average of B and should be capable of interdisciplinary study. Depending on background and career objectives, additional preparatory studies may be necessary in either the science-technology area or in the humanities and social sciences.

Special Application Requirements—Three letters of recommendation are required.

Use of 4xxx Courses—Use of 4xxx courses on degree programs is subject to director of graduate studies approval.

Courses—Please refer to History of Science and Technology (HSci) in the course section of this catalog for courses pertaining to this program.

M.A. Degree Requirements

The M.A. is offered under Plan A and Plan B. Plan A requires a minimum of 20 course credits and 10 thesis credits; Plan B requires a minimum of 30 course credits. M.A. students must choose two of the general areas (history of the physical sciences, biological sciences, or technology). Six courses (18 credits) must be taken in these two areas with at least two courses (6 credits) in any one area. Two courses (6 credits) must cover the pre-1800 period and two courses (6 credits) the post-1800 period. Courses used to satisfy the area requirements also can be used to satisfy these period requirements. Because of this possible overlap, these course credits may not add up to 18 credits. In addition, each student must take the historiography course (HSci 8111) and two courses (6 credits) in a minor or related field. Under the Plan A option, students must also take 10 thesis credits. All of the courses selected for the requirements must be passed with a grade of B or better. HSci 4xxx courses may be included as appropriate for the area and period requirements.

Language Requirements—M.A. students must demonstrate reading proficiency in one foreign language, normally French or German.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—The master's minor requires 6 credits and is structured for the student's interests.

Ph.D. Degree Requirements

The Ph.D. is for those planning professional careers that require a high degree of scholarly competence, including teaching and research. Students must choose two of the general areas (history of the physical sciences, the biological sciences, or technology) in preparation for preliminary written and oral exams. Six courses (18 credits) must be taken in these two areas with at least two courses (6 credits) in any one area. Two courses (6 credits) must cover the pre-1800 period and two courses (6 credits) the post-1800 period. Courses used to satisfy the area requirements also can be used to satisfy these period requirements. In addition, each student must take the historiography course (HSci 8111) and a minor or supporting program consisting of four courses (12 credits). Students must also take 24 thesis credits. All of the courses selected for the requirements must be passed with a grade of B or better.

Language Requirements—Before taking the preliminary exams, students must demonstrate reading proficiency in two foreign languages, normally French and German.

Minor Requirements for Students Majoring in Other Fields—The doctoral minor requires 12 credits and is structured for the student's interests.

Human Factors/ Ergonomics

Contact Information—Doctoral Minor Program in Human Factors/Ergonomics, Human Factors Research Laboratory, School of Kinesiology and Leisure Studies, College of Education and Human Development, University of Minnesota, 141 Mariucci Arena, 1901 Fourth Street S.E., Minneapolis, MN 55455 (612-625-5300).

Professor

Arthur G. Erdman, Mechanical Engineering, E
Laël C. Gatewood, Laboratory Medicine and Pathology, E
Susan G. Gerberich, E
Denise A. Guerin, Design, Housing, and Apparel, E
Peter A. Hancock, Kinesiology and Leisure Studies, E
Tarald O. Kvalseth, Mechanical Engineering, E
Gordon E. Legge, Psychology, E
Shashi Shekhar, Computer Science, E
Michael Wade, Kinesiology and Leisure Studies, E

Associate Professor

Karen L. LaBat, Design, Housing, and Apparel, E

Assistant Professor

Joseph A. Konstan, Computer Science, E

Senior Research Fellow

John C. Carmody, E

Curriculum—Human factors/ergonomics (HF/E) is an interdisciplinary area of study focusing on how human performance and behavior are influenced by design factors in the performance environment. HF/E has its roots in psychology, engineering, physiology, kinesiology, cognitive science, computer science, software engineering, and operations research. The minor, which is available to master's (M.A. and M.S.) and doctoral students, provides integrated coursework that emphasizes conceptual, empirical, and practical aspects of HF/E. The minor complements graduate training in traditional disciplines as a foundation for diverse career opportunities in the field.

Coursework addresses the question of how and why variability in human performance—with quality, productivity, efficiency, safety, and health implications—is influenced by interaction with designs of systems and system components such as machines and tools, computers and software, complex technological systems, jobs and working conditions, organizations, and sociotechnical institutions.

Prerequisites for Admission—Admission to the minor is contingent upon prior admission to a doctoral degree-granting program within the Graduate School. Admission is limited and only by permission of the director of graduate studies in the human factors/ergonomics minor.

Use of 4xxx Courses—Use of 4xxx courses is permitted based on adviser and director of graduate studies approval.

Courses—Please refer to Human Factors/Ergonomics (HumF) in the course section of this catalog for courses pertaining to this program.

Freestanding Minor Requirements

A master's minor requires 10 graduate credits, including 7-8 credits of core courses and 2-3 credits of electives. A doctoral minor requires 16 credits, including the three core courses (7-8 credits) and 8-9 credits of electives. The core courses consist of HumF 5001, 8001, and 8002.

Human Resources and Industrial Relations

Contact Information—Industrial Relations Center, University of Minnesota, 3-300 Carlson School of Management, 321 19th Avenue S., Minneapolis, MN 55455-0438 (612-624-5810; fax 612-624-8360; e-mail rirgrad@umn.edu; <ww.irc.csom.umn.edu).

Professor

Dennis A. Ahlburg, FM
Richard D. Arvey, FM
Avner Ben-Ner, FM
Hyman Berman, History, FM
Mario F. Bognanno, FM
John P. Campbell, Psychology, FM
John A. Fossum, FM
Maria J. Hanratty, Public Affairs, FM
Jo-Ida C. Hansen, Psychology, FM
Morris M. Kleiner, Public Affairs, FM
Jeylan T. Mortimer, Sociology, FM
Deniz S. Ones, Psychology, FM
John Remington, FM
Paul R. Sackett, Psychology, FM
James G. Scoville, FM
Andrew F. Whitman, FM
Mahmood A. Zaidi, FM

Associate Professor

Ross E. Azevedo, FM
John W. Budd, FM
Brian P. McCall, FM
Connie R. Wanberg, FM
Yijiang Wang, FM

Assistant Professor

Theresa M. Glomb, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Human resources and industrial relations studies the employment relationship. Teaching and research are guided by the belief that the employment relationship must be investigated through the lenses of different disciplines using systems thinking. The professional M.A. degree is for individuals interested in private and public sector careers in human resource management, labor relations, and related fields. The Ph.D. degree is a research degree for individuals interested in academic careers.

The curriculum is structured around five areas: staffing, training, and development; organization behavior and theory; compensation and benefits; labor market analysis; and labor relations and collective bargaining. Research methods and quantitative analysis of employment problems and issues are also included. Specialization in two areas is required for Ph.D. candidates, while M.A. candidates are encouraged to choose electives to support a generalist orientation.

Prerequisites for Admission—An undergraduate course in microeconomics must be completed with a grade of at least C before enrolling.

Special Application Requirements—Applicants must submit three letters of recommendations, a complete set of transcripts, GRE scores, and a clearly written statement of career interests, goals, and objectives. M.A. applicants may substitute the GMAT for the GRE. M.A. applicants must also submit a resume. Applicants whose native language is not English must also submit score results from the TOEFL.

Entry in both the day and evening M.A. programs is in fall or spring semester, and the application deadlines are June 15 and October 15. The financial aid deadline for fall semester is February 1. Entry in the Ph.D. program is only in the fall, and the application deadline is February 1. Applicants for all programs are encouraged to apply early, particularly for fall semester.

Use of 4xxx Courses—4xxx courses are not permitted toward M.A. or Ph.D. degree requirements.

Courses—Please refer to Human Resources and Industrial Relations (HRIR) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements

The M.A. is offered under Plan A (thesis) and coursework only (capstone project) in day (full-time) and evening (part-time) programs. Coursework only requires at least 48 credits and a capstone project. Major coursework includes 8011, 8012, 8031, 8041, 8051, 8061, and 8071 and 14 credits of HRIR electives. At least 8 credits must be earned in related fields. Plan A requires at least 38 course credits and 10 thesis credits. Major coursework includes 8011 and 8012; three courses from among 8031, 8041, 8051, 8061, and 8071; and 10-14 additional HRIR credits. Also required are 6-10 credits in an approved field or fields of study related to human resources and industrial relations. Plan A is generally limited to students who have considerable related graduate coursework.

Commonly-selected related fields include accounting, finance, operations management, managerial communications, economics, human resource development, law, psychology, public affairs, sociology, and research methods.

Language Requirements—None.

Final Exam—The final exam is oral.

Ph.D. Degree Requirements

Students must complete at least 12 credits of research methods (most complete 18 or more credits); at least 6 credits of human resources and industrial relations doctoral seminars in each of two areas of specialization and other credits in these areas as needed; at least 3 credits in each of the other three subfields; and at least 12 credits in a minor or supporting program in one or more of the following behavioral sciences—anthropology, business administration, economics, history, political science, psychology, and sociology. Research methods courses taken outside the program may be applied toward the minor or supporting program requirement. Specific coursework is planned in consultation with the student's adviser and the director of graduate studies. Students must pass preliminary exams in each of their subfields and research methods.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor or supporting program may be selected by students majoring in business administration, education, hospital and health-care administration, or the social and behavioral sciences. The minor must consist of at least 21 credits, including five courses in at least four subfields, plus a doctoral seminar.

Immunology

See Microbiology, Immunology, and Cancer Biology.

Industrial Engineering

Contact Information—Mechanical Engineering and Industrial Engineering Graduate Programs, University of Minnesota, 1120 Mechanical Engineering, 111 Church Street S.E., Minneapolis, MN 55455 (612-625-2009; fax 612-624-2010; e-mail gradinfo@me.umn.edu; <www.me.umn.edu/>).

Professor

Sant Ram Arora, FM
Avram Bar-Cohen, FM
Tarald O. Kvalseth, FM
Yechiel Shulman (emeritus), FM
Patrick J. Starr, FM

Associate Professor

Saifallah Benjaafar, FM
Diwakar Gupta, FM
Caroline C. Hayes, FM
Michael R. Taaffe, Opearations and Management Science, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Industrial engineering offers coursework and research in industrial engineering, operations research, and human factors. Special emphasis is on methodologies for design, planning, and management of manufacturing and production systems. Additional emphases are in logistics, transportation, computer-aided design and manufacturing, health systems, and management of technology.

Prerequisites for Admission—An undergraduate degree in engineering or in a closely related scientific field such as or mathematics, statistics, business or psychology, is required. Unusually well-qualified students with a baccalaureate degree may be admitted directly to the Ph.D. program.

Special Application Requirements—GRE General Test scores are required for admission and also are used in evaluating requests for financial aid. For the Ph.D. program, three letters of recommendation from senior faculty members at the previous educational institution are required, including one from the master's degree adviser. Students are admitted in fall and spring semesters only, the departmental deadlines for which are December 15 and October 15, respectively.

Use of 4xxx Courses—Selected 4xxx courses from other departments may be applied toward the degree in consultation with the student's adviser and the director of graduate studies. No 4xxx IE courses may be applied toward the degree.

Courses—Please refer to Industrial Engineering (IE) in the course section of this catalog for courses pertaining to the program.

M.S.I.E. Degree Requirements

The M.S.I.E. requires at least 30 credits, including at least 14 course credits in the major and 6 course credits in a minor or related field. At least 1 credit of graduate seminar is to be included in the 30 credits.

Plan A (thesis) required courses include IE 5531, 5551, and 8532, along with 10 thesis credits.

Plan B (non-thesis) required courses include IE 5531, 5551, 5553, and 8532, along with one to three Plan B papers (the number in part depending on their length) determined in consultation with the adviser. The papers may derive from courses in the major or may address topics chosen by a graduate faculty member and the student.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—At least 6 credits in industrial engineering is required for a master's minor.

Ph.D. Degree Requirements

The Ph.D. requires at least 44 course credits, including at least 12 course credits in a minor field or supporting program and at least 2 credits of graduate seminar; 24 thesis credits are also required. The following 4 courses are required for the Ph.D. degree: IE 5531, 5551, 5553, and 8532.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—At least 12 credits in industrial engineering is required for a doctoral minor.

Industrial Relations

See Human Resources and Industrial Relations.

Infrastructure Systems Engineering

Contact Information—Center for the Development of Technological Leadership, University of Minnesota, 1300 South Second Street, Suite 510, Minneapolis, MN 55454 (612-624-5474; fax 612-624-7510; e-mail degrees@cdtl.umn.edu; <www.cdtl.umn.edu>).

Professor

Andrew, Drescher, AM
Catherine E. French, AM
John S. Gulliver, AM
Panos G. Michalopoulos, AM
Michael J. Semmens, AM
Heinz G. Stefan, AM
Vaughan R. Voller, AM

Associate Professor

Randal J. Barnes, AM
Gary A. Davis, AM
Robert J. Dexter, AM
Joseph F. Labuz, AM
Arturo E. Schultz, AM
Carol K. Shield, AM
Karl A. Smith, AM

Assistant Professor

Raymond M. Hozalski, AM

Lecturer

Eil Kwon, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The master of science in the infrastructure systems engineering (M.S.I.S.E.) program focuses on developing management and engineering tools that address the issues in local, county and state infrastructure. It is an interdisciplinary program offered through the Institute of Technology's Center for the Development of Technological Leadership and the

Department of Civil Engineering. The two-year, professional-format program integrates the fields of water systems, pavement, structures, mechanics modeling, traffic engineering, transportation policy, and environmental issues, among others.

Prerequisites for Admission—A B.S. degree in engineering plus a minimum of one year of professional work experience in an infrastructure area or a B.S. degree in a related science or technology field and a minimum of two years professional work experience in an infrastructure area are required.

Special Application Requirements—None.

Use of 4xxx Courses—Applying 4xxx courses toward degree requirements is extremely limited. Such requests will be reviewed on a case by case basis and will require director of graduate studies approval.

Courses—Please refer to Infrastructure Systems Engineering (ISE) in the course section of this catalog for courses pertaining to the program.

M.S.I.S.E. Plan B Degree Requirements

The M.S.I.S.E. in infrastructure systems engineering requires 30 credits with 23 semester credits in required core courses and seven semester credits in related fields, such as geography and public administration. In addition students must complete a capstone project to address an on-the-job issue or problem.

Language Requirements—None.

Final Exam—An oral presentation and defense of the capstone project is required.

Interdisciplinary Archaeological Studies

Admissions have been suspended for this program.

International Education

Contact Information—Director of Graduate Studies, International Education Minor, R. Michael Paige, Comparative and International Development Education, Educational Policy and Administration, University of Minnesota, 330 Wulling Hall, 86 Pleasant Street S.E., Minneapolis, MN 55455 (612-626-7456 or 612-624-1006; e-mail r-paig@umn.edu).

Professor

Patricia G. Avery, Curriculum and Instruction, E
Ayers Bagley, Educational Policy and Administration, E
William M. Bart, Educational Psychology, E
James M. Brown, Work, Community, and Family Education, E
David Chapman, Educational Policy and Administration, E
John J. Cogan, Curriculum and Instruction, E
Gerald W. Fry, Educational Policy and Administration, E
Theodore Lewis, Work, Community, and Family Education, E
Gary N. McLean, Work, Community, and Family Education, E
S. Jay Samuels, Educational Psychology, E
Robert D. Tennyson, Educational Psychology, E

Associate Professor

V. Lois Erickson, Educational Psychology, E
Philip R. Goodrich, Biosystems and Agricultural Engineering, E
March L. Krotee, Kinesiology and Leisure Studies, E
R. Michael Paige, Educational Policy and Administration, E
Jane E. Plihal, Work, Community, and Family Education, E

Lecturer

Kay A. Thomas, Educational Psychology, E

Curriculum—The interdisciplinary minor in international education is for students enrolled in any M.A. or doctoral program who wish to enter careers in research, consulting, administration, and teaching in an international context. The minor offers a coordinated set of courses from the Departments of Curriculum and Instruction; Educational Policy and Administration; Educational Psychology; Work, Community, and Family Education; School of Kinesiology and Leisure Studies; and Institute of Child Development.

Prerequisites for Admission—Admission to the international education minor is contingent upon prior admission to the Graduate School and to an M.A. or Ph.D. program at the University of Minnesota. Admission to the minor program is limited and only by permission of the International Education Committee and the director of graduate studies. Students interested in this option are welcome to consult with the director of graduate studies.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree programs is subject to adviser and director of graduate studies approval.

Courses—Please contact the minor program office for information on relevant coursework.

Freestanding Minor Requirements

At least 9 graduate credits at the master's level, 12 at the doctoral level. Each program is developed in consultation with the student, the student's adviser, major director of graduate studies, and director of graduate studies for international education. Requirements include critical issues in international education; foundations of international education (EdPA 5103, 5124; one for M.A., both for doctoral minor); research (EdPA 5121; for doctoral students only); and area-specific coursework (at least one course for M.A. and doctoral minors: AgEE 5351, CI 5055, 5403, 5747, EdHD 5001, EdPA 5032, 5048, 5080, 5101, 5121, 5132, EPsy 5101, 5112, 5113, 5401, 5431, 5432, 5461, 8403, HRD 5408, 5496, HRD/WCFE 5821, Kin 5371, 8607, WCFE 8142).

Interpersonal Relationships Research

Contact Information—Doctoral Minor Program in Interpersonal Relationships Research, Institute of Child Development, University of Minnesota, 104 Child Development, 51 East River Road, Minneapolis, MN 55455 (612-624-2396; fax 612-624-6373; e-mail wcollins@umn.edu.)

Regents' Professor

Ellen S. Berscheid, Psychology, E

Professor

W. Andrew Collins, Child Development, E
Nicki R. Crick, Child Development, E
Byron Egeland, Child Development, E
Harold D. Grotevant, Family Social Science, E
Dean E. Hewes, Speech-Communication, E
Robert K. Leik, Sociology, E
James W. Maddock, Family Social Science, E
Geoffrey M. Maruyama, Educational Psychology, E
Mark Snyder, Psychology, E
L. Alan Sroufe, Child Development, E
Ruth G. Thomas, Work, Community, and Family Education, E

Associate Professor

Patricia A. Frazier, Psychology, E

Assistant Professor

Terry A. Kinney, Speech-Communication, E

Curriculum—The minor in interpersonal relationships research provides doctoral students with a broad theoretical and methodological foundation for research on behavioral interaction patterns between two persons and the impact of these interactions.

A recently recognized and rapidly advancing interdisciplinary field of scientific inquiry, interpersonal relationships research has its roots in psychology, sociology, family studies, communication, and nursing. The program brings together faculty and students from eight University departments and schools.

Prerequisites for Admission—Admission to the interpersonal relationships research graduate minor is contingent upon prior admission to the Graduate School and to a doctoral program in a degree-granting department. Admission to the minor program is limited and only by permission of the director of graduate studies in interpersonal relationships research.

Use of 4xxx Courses—4xxx courses, other than those required by the program, are permitted based on director of graduate studies approval.

Courses—Please refer to Interpersonal Relationships Research (IRel) in the course section of this catalog for courses pertaining to the program.

Freestanding Minor Requirements

The doctoral minor requires at least 14 graduate credits, including three required core courses and additional elective courses selected from an approved list. The required courses are 8001 (2 credits), 8021 (2 credits), and Psy 5204 (3 credits).

Italian

See French and Italian.

Japanese

See Asian Languages and Literatures.

Journalism

See Mass Communication.

Kinesiology

Contact Information—Linda Estrem, Office of the Director of Graduate Studies, School of Kinesiology and Leisure Studies, University of Minnesota, 220 Cooke Hall, 1900 University Avenue S.E., Minneapolis, MN 55455 (612-624-5017, 612-625-5300; fax 612-626-7700; e-mail kin@umn.edu; <www.kls.coled.umn.edu/>).

Professor

Fred S. Apple, Laboratory Medicine and Pathology, FM
Allen W. Burton, FM
Richard S. Crow, Epidemiology, AM
Arthur Erdman, Mechanical Engineering, AM
Peter A. Hancock, FM
David W. Johnson, Educational Psychology, AM
Roger T. Johnson, Curriculum and Instruction, AM
Mary Jo Kane, FM
Arthur S. Leon, FM
Herbert L. Pick, Jr., Child Development, AM
Michael Wade, FM
Albert Yonas, Child Development, AM

Associate Professor

Bruce D. Anderson, FM
Juergen Konczak, AM
March L. Krotee, FM
Robert C. Serfass, FM
Diane M. Wiese-Bjornstal, FM

Assistant Professor

Donald Dengel, AM
Roger D. Harrold, Institutional Research and Reporting, AM
M. Kathryn Schmitz, Epidemiology, AM

Lecturer

JoAnn Buysse, AM
James Larson, AM
Aynsley Smith, AM
Thomas J. Smith, AM

Senior Fellow

Victor S. Koscheyev, AM

Research Associate

Carol Leitschuh, AM
Ava J. Walker, AM

Other

David W. Bacharach, E
Anthony Brown, Recreational Sports, AM
Glenn M. Street, E

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Emphasis areas in the master's and doctoral programs are adapted physical education, biomechanics/neural control, exercise physiology, human factors/ergonomics, international/comparative sport, motor learning/development, sport management, sport psychology, or sport sociology.

Prerequisites for Admission—Although prospective masters students generally have an undergraduate degree in kinesiology, physical education, or sport and exercise science, others with a baccalaureate degree may be admitted who have related preparation and a significant background and interest in the scientific study of physical activity. Prospective doctoral students have generally completed a master's degree in a field related to kinesiology. Admitted students may be required by their adviser to complete background preparation in undergraduate and graduate kinesiology and related coursework.

Special Application Requirements—Applicants must submit a completed kinesiology application form; written statement of academic interests, goals, and objectives; scores from the General Test of the GRE (verbal and quantitative) or Miller Analogies Test that are less than five years old; three letters of recommendation from persons familiar with their scholarship and research potential; scholarly paper; and copies of official transcripts. Students may apply at any time; however, submission of all application materials by January 15 is encouraged to ensure priority consideration for admission and for teaching and research assistantships awarded for the next academic year. Students can be admitted any term.

Research Facilities—Research facilities for graduate students in kinesiology include the following: Human Factors Research Laboratory; Human Sensorimotor Control Laboratory; Gait and Posture Laboratory, Laboratory of Physiological Hygiene and Exercise Science; Tucker Center for Research on Girls and Women in Sport.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please refer to Kinesiology (Kin) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements

Kinesiology M.A. students select an emphasis in adapted physical education, biomechanics/neural control, exercise physiology, human factors/ergonomics, international/comparative sport, motor learning/development, sport management, sport psychology, or sport sociology.

The M.A. is offered under Plan A and Plan B. Plan A requires 30 credits, including at least 14 course credits in kinesiology, 6 course credits in a minor or related field, and 10 thesis credits (8777). Plan B also requires 30 credits, including at least 14 course credits in kinesiology, 6 course credits in a minor or related field, 4 credits of a research project (8995), and 6 additional credits in any of these areas. For both Plan A and Plan B, students must take 5981 (3 credits), 8980 (1 credit), and in the related field or minor, EPsy 5261 (3 credits) or 8261 (3 credits) or equivalent. A 3.00 GPA of at least is required to maintain good standing and to graduate.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master's minor requires at least 6 credits of graduate-level kinesiology courses.

Ph.D. Degree Requirements

Kinesiology Ph.D. students pursue an individualized program with an emphasis in adapted physical education, biomechanics/neural control, exercise physiology, human factors/ergonomics, international/comparative sport, motor learning/development, sport management, sport psychology, or sport sociology.

The Ph.D. requires at least 48 course credits and 24 thesis credits, for a total of 72 credits. Course credits include 24 credits in kinesiology, 9 credits in statistical methods, 12 credits in a supporting program or minor (statistical methods courses may be included), and an additional 3 credits in any of these areas. Kinesiology course credits must include 5171 and 5981 (achieving a grade of A or B in each), 2 to 6 credits of 8980, and at least 12 credits of 8xxx. Statistical methods courses must include EPsy 8261 or equivalent and EPsy 8262 or equivalent (achieving a grade of A or B in each). A GPA of at least 3.00 is required to maintain good standing and to graduate.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor requires at least 12 credits of graduate-level kinesiology courses, including 5171 (3 credits) and 8980 (1 credit).

Landscape Architecture

Contact Information—Department of Landscape Architecture, University of Minnesota, 125 Architecture Building, 89 Church Street S.E., Minneapolis, MN 55108 (612-625-6860; fax 612-625-0710; e-mail gsland@tc.umn.edu; <www.cala.umn.edu/landscape_architecture/>).

Professor

John F. Hart, Geography, AM
Roger B. Martin, AM
Lance M. Neckar, AM
Peter J. Olin, Horticultural Science, AM
David G. Pitt, AM

Associate Professor

Susan M. Galatowitsch, Horticultural Science, AM
John A. Koepke, AM
Robert D. Sykes, AM

Assistant Professor
Dean F. Abbott, E
Robert J. Gunderson, E
Rebecca J. Krinke, AM
Kristine F. Miller, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Landscape architecture is the design, planning, and management of the landscape to create environments that embody ecological function and realize human aspirations for community, health and safety, and beauty. Landscape architects are concerned with a wide range of projects, including large-scale regional landscape planning; design of exterior environments for working, living, and recreation; commercial, institutional, and industrial development; transportation systems; and multiple-use areas. Professional services include studies of land-use allocation and management; detail grading; construction drawings; and planting plans.

The department teaches students to be professional landscape architects who use ecological systems thinking as the basis for artistic design. The department offers the professional master of landscape architecture (M.L.A.), required to become a registered landscape architect, and the master of science (M.S.), a research-oriented degree allowing a specialized focus within landscape architecture.

Prerequisites for Admission—M.L.A. program applicants must have completed a baccalaureate degree. M.S. program applicants must have completed a baccalaureate degree in landscape architecture or a related discipline. All applicants are asked to explain the relationship of their previous academic work and work experience to their proposed graduate study.

Special Application Requirements—M.L.A. program applicants must apply by January 15 for entry the following fall. The department requires a letter of intent that also indicates whether the applicant is interested in financial aid; three letters of reference; a photocopy of official transcripts; and examples of creative work. Applicants with degrees in related design professions such as architecture or planning should clearly indicate in their letter of intent an interest in being evaluated for advanced standing in design. The GRE is not required for entry but can be helpful to applicants applying for fellowships.

M.S. program applicants must apply by January 15 for entry the following fall. The department requires GRE scores; a statement of intent outlining research objectives that also indicates whether the applicant is interested in financial aid; and examples of previous research or design work related substantively or methodologically to the applicant's proposed research, or examples of academic or professional work that include 10 to 30 pages of writing, published or unpublished. Successful applicants will have secured the participation of a faculty adviser before completing their applications.

Use of 4xxx Courses—Inclusion of 4xxx courses in degree programs is subject to adviser and director of graduate studies approval.

Courses—Please refer to Landscape Architecture (LA) in the course section of this catalog for courses pertaining to the program.

M.L.A. Plan B, Coursework Only Degree Requirements

The M.L.A. program, which is accredited by the national Landscape Architecture Accreditation Board (LAAB), is for students who wish to become registered landscape architects. Areas of coursework within the program include design, technology and ecology, graphic and written communication, landscape history, and research methods. Students are encouraged to select from among graduate seminars to develop a special focus or particular point of view. To meet the LAAB standards, 90 graduate credits are required for students without previous design experience. Because coursework is organized in a sequential framework of six design studios, commitment to the program for three successive years in important.

Students who hold an accredited professional bachelor's degree in landscape architecture may complete the M.L.A. with 30 credits, including 12 credits of landscape architecture studio courses, 3 credits of landscape architecture research issues and methods, and 15 elective credits, 6 credits of which must be outside of the department. Up to 9 credits earned as part of the M.L.A. may be applied to the M.S.

Language Requirements—None.

Final Exam—The final examination is a design portfolio.

M.S. Plan A Degree Requirements

The M.S. is for students with a clear focus in research related to landscape architecture. M.S. students build expertise related to the practice of landscape architecture as they learn how to conduct research. Students specialize within areas of faculty expertise, which may include art and landscape architecture, landscape ecology, landscape architectural history and theory, park and recreation design, rural and suburban landscape planning, and transportation. Prospective students may request a summary of current faculty research for a description of potential specializations.

The M.S. requires 30 credits, including at least 6 credits within landscape architecture, 10 thesis credits, and at least 6 credits in an area of focus outside of landscape architecture.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—Minor requirements are determined in consultation with the director of graduate studies.

Latin

See Classical and Near Eastern Studies.

Law

Contact Information—Meredith M. McQuaid, Associate Dean of Students and Director of International and Graduate Programs, Law School, University of Minnesota, 285 Law Building, 229 19th Avenue S., Minneapolis, MN 55455 (612-625-3025; fax 612-626-1874).

Professor
Stephen F. Befort, E
Karen B. Brown, E
David P. Bryden, E
Karen C. Burke, E
Laura Cooper, E
John J. Cound, E
Daniel A. Farber, E
Barry C. Feld, E
Mary L. Fellows, E
Richard S. Frase, E
Philip P. Frickey, E
Daniel J. Gifford, E
Joan S. Howland, E
Robert E. Hudec, E
William D. Kilbourn, Jr., E
K. Bart Koeppen, E
Robert J. Levy, E
Donald G. Marshall, E
John H. Matheson, E
C. Robert Morris, E
Fred L. Morrison, E
Steve H. Nickles, E
Roger C. Park, E
Michael S. Paulsen, E
john a. powell, E
M. Kathleen Price, E
Stephen B. Scallen, E
Ferdinand P. Schoettle, Jr., E
Suzanna Sherry, E
Robert A. Stein, E
Michael Tonry, E
Gerald Torres, E
Thomas L. Waterbury, E
David Weissbrodt, E
Judith T. Younger, E

Associate Professor
Edward S. Adams, E
Ann M. Burkhart, E
Jim C. Chen, E
Carol L. Chomsky, E
Tahirih V. Lee, E
Susan M. Wolf, E

Other
Carl Auerbach, E
Beverly Balos, E
Keith Bellairs, E
Victor H. Kramer, E
Maury S. Landsman, E
Kathryn J. Sedo, E
Stephen M. Simon, E
Carl M. Warren, E

Curriculum—A law minor is available to both master's (M.A. and M.S.) and doctoral students and is individually tailored to their academic interests.

Prerequisites for Admission—Admission to the law graduate minor is contingent upon prior admission to a master's or doctoral degree-granting program within the Graduate School.

Courses—Please contact the minor program office for information on relevant coursework.

Freestanding Minor Requirements

A master's minor requires at least 6 graduate credits; a doctoral minor requires at least 12 graduate credits.

Liberal Studies

Contact Information—College of Continuing Education, University of Minnesota, 170 Wesbrook Hall, 77 Pleasant Street S.E., Minneapolis, Minnesota 55455 (612-626-8724; fax 612-626-0077; e-mail mls@cce.umn.edu).

Professor

William Ammentorp, Work, Community and Family Education, AM
Fred Amran, General College, AM
Kent R. Bales, English, AM
Laird H. Barber, Humanities Division, Morris, AM
Linda Brady, Food Science, AM
Frank Busta, Food Science, AM
Terrence Collins, General College, AM
Vasilikie Demos, Morris, AM
Stephen Feinstein, History, AM
Jill Gidmark, General College, AM
Maria Gini, Computer Science, AM
Stephen Granger, Morris, AM
William H. Hanson, Philosophy, AM
Roger S. Jones, Physics, AM
Peter Lock, AM
Paul Magee, Molecular, Cellular, Developmental Biology and Genetics, AM
Judith A. Martin, Geography, AM
Toni A. H. McNaron, English, AM
Frederick Peterson, Morris, AM
Dwight H. Purdy, Humanities Division, Morris, AM
Naomi B. Scheman, Philosophy, AM
John Wallace, Philosophy, AM
Jack Zipes, Germanic Studies, AM

Adjunct Professor

Aldo Rescigno, Pharmacy, AM

Associate Professor

Rose Brewer, Studies in Africa and the African Diaspora, AM
William Dikel, AM
George Green, History, AM
Arthur M. Harkins, Educational Policy and Administration, AM
Nicholas Hayes, AM
Carol A. Miller, American Studies, AM
William E. Mishler, German, Scandinavian, and Dutch, AM
Robert Silberman, Art History, AM
David Taylor, General College, AM
Jacquelyn N. Zita, Feminist Studies, AM

Assistant Professor

Stephen Gross, Morris, AM
Linda Halcón, Nursing, AM
John Hitchcock, AM
Richard Lee, Psychology, AM
Julie R. Patterson-Pratt, Humanities Division, Morris, AM
Peter Whelan, AM

Lecturer

J. Edward Anderson, College of Continuing Education AM
Michael M. Andregg, College of Continuing Education, AM
Roberta Cordano, College of Continuing Education, AM
Stephen L. Daniel, College of Continuing Education, AM
Sarah Dennison, College of Continuing Education, AM
Brenda Fiala, College of Continuing Education, AM
Isabel Gomez, College of Continuing Education, AM
Donna Mae J. Gustafson, College of Continuing Education, AM
John Hasselberg, College of Continuing Education, AM
John R. Husted, Social Sciences Division, Morris, AM
Jeremy F. Iggers, College of Continuing Education, Duluth, AM
Jack Johnson, College of Continuing Education, AM
Alan R. Kahn, College of Continuing Education, AM
Judith Katz, College of Continuing Education, AM
Sherry Lee, College of Continuing Education, AM
Roseann Lloyd, College of Continuing Education, AM
Nicholas Pease, College of Continuing Education, AM
David A. Shupe, College of Continuing Education, AM
Victor Sorell, College of Continuing Education, AM
Jack Stuart, College of Continuing Education, AM
Roslye Ultan, College of Continuing Education, AM
Sandra Wilson, College of Continuing Education, AM
D. Wynne Wright, College of Continuing Education, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The graduate major in liberal studies offers an interdisciplinary curriculum that includes an introductory seminar, a choice of liberal studies seminars, a choice of electives from disciplines throughout the Graduate School, and a final project seminar. Although seminars for the M.L.S. are scheduled mainly late afternoons and evenings, and some Saturday mornings, most graduate-level courses offered during the day are also open to M.L.S. students.

Prerequisites for Admission—In addition to a bachelor's degree, students must indicate an ability to succeed in graduate study.

Special Application Requirements—A statement of purpose, letters of support, an undergraduate transcript, and examples of written work should accompany the application. GRE scores may also be submitted, but are not required. International students are required to achieve a passing score on the TOEFL.

Use of 4xxx Courses—A 4xxx course may be used as an elective, if the instructor is approved to teach at the graduate level.

Courses—Please refer to Liberal Studies (LS) in the course section of this catalog for courses pertaining to the program.

M.L.S. Plan B Degree Requirements

The M.L.S. is a specific variation of the master's Plan B option. The program requires at least 30 credits. Required are the Introduction to Interdisciplinary Inquiry (3 credits) and the Final Project (3 credits) seminars. Students must take at least 9 credits of liberal studies seminars. The remaining 15 credits are composed of electives from disciplines throughout the Graduate School, or directed study, directed research, or additional liberal studies seminars. Courses are selected with the help of the student's graduate faculty adviser.

Language Requirements—None.

Final Exam—The final project must be prepared as part of 8002 and must be approved by at least two faculty members.

Linguistics

Contact Information—Director of Graduate Studies, Linguistics, University of Minnesota, 315 Pillsbury Drive, S.E., Minneapolis, MN 55455 (612-624-3331; fax 612-624-4579; e-mail ILES@umn.edu).

Professor

Andrew D. Cohen, FM
Genevieve J. Escure, English, AM
Jeanette K. Gundel, FM
Michael B. Kac, Philosophy, FM
Michael P. Maratsos, Child Development, AM
Amy L. Sheldon, Speech-Communication, FM
Joseph P. Stemberger, Communication Disorders, FM
Elaine E. Tarone, FM

Associate Professor

Bruce T. Downing, FM
Charles R. Fletcher, Psychology, AM
G. Lee Fullerton, German, Scandinavian, and Dutch, AM
Betsy K. Kerr, French and Italian, AM
Carol A. Klee, Spanish and Portuguese, AM
Maria D. Sera, Child Development, AM
Nancy J. Stenson, FM
Polly E. Szatrowski, AM

Assistant Professor

Hooi Ling Soh, AM

Other

Joan Bachenko, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Linguistics is the scientific study of human language. Investigation in phonology, syntax, and semantics/pragmatics seeks to determine general principles governing the structure of human language and the parameters that determine degree and manner of variation across languages. These core areas of language structure constitute the foundation for other subfields of linguistics, including psycholinguistics, sociolinguistics, historical linguistics, and computational linguistics.

Prerequisites for Admission—There are no specific prerequisites for admission. Students admitted normally have a broad undergraduate background that includes some linguistics courses.

Special Application Requirements—Applicants must submit a completed application, scores from the GRE, three letters of recommendation, and a supplementary questionnaire detailing background, interests, and accomplishments. Applicants wishing to be considered for financial support should apply no later than

January 15 of the preceding academic year. Entry is usually in fall semester but may be permitted in other semesters in exceptional cases.

Use of 4xxx Courses—Inclusion of 4xxx courses in degree programs is subject to adviser and director of graduate studies approval. Students from other majors may include such courses subject to their own program's approval.

Courses—Please refer to Linguistics (Ling) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements

The requirements for the M.A. degree (both Plan A and Plan B) include eight required courses in the major: six courses covering core areas of language structure (phonetics, phonology, syntax, semantics/pragmatics); one course in field methods; and one research paper course. The total number of credits, assuming no prior coursework in linguistics, is 32 (including 6 credits in related fields). Students who have already taken required courses or their equivalents as undergraduates (or as graduates in another program), can substitute electives in the major or in related fields, in accordance with M.A. requirements set by the Graduate School. In addition to course requirements, Plan A requires a thesis and thesis credits; Plan B requires a Plan B paper.

Language Requirements—The M.A. program requires knowledge of one language not native to the student. Mechanisms for demonstrating knowledge are described in the program's *Graduate Student Handbook.*

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—Courses required for a master's minor in linguistics are Ling 5001 (4 credits); 5201 (3 credits); and 5301 (4 credits). Students who have had these courses or their equivalents as undergraduates can substitute other linguistics courses. The M.A. minor requires at least 9 credits.

Ph.D. Degree Requirements

The Ph.D. program focuses on language structure (phonology, syntax, semantics/pragmatics), language acquisition (first and second), and language/discourse processing (cognitive processes that underlie language use). The program especially emphasizes research that integrates core areas of theoretical linguistics with language acquisition or processing.

For the Ph.D., no minimum number of credits is required besides the 12 credits in related fields and 24 thesis credits. However, all Ph.D. students are expected to complete M.A. course requirements (15-26 credits in the major, depending on amount of prior coursework in linguistics), a second-semester course in field methods (4 credits), and an individualized plan of study (including at least three 8xxx courses) to be determined in consultation with the student's committee.

Upon completion of required coursework, students must pass a preliminary written exam in phonology, syntax, and their primary and secondary areas of concentration. Papers judged to be of near publishable quality by the student's committee can be substituted for exam questions in any of these areas. The preliminary oral exam is a defense of a research paper-length dissertation prospectus, which introduces and motivates the student's dissertation topic and provides a detailed plan for completion of the dissertation.

Language Requirements—The Ph.D. degree requires knowledge of two languages not native to the student. Mechanisms for demonstrating such knowledge are described in the program's *Graduate Student Handbook.*

Minor Requirements for Students Majoring in Other Fields—The doctoral minor requires at least 15 credits (five courses). Students who have had no prior coursework in linguistics must take six courses approved by the director of graduate studies, including the three courses required for the M.A. minor: Ling 5001, 5201, and 5301. Students who have taken 5001 or its equivalent as undergraduates do not have to substitute another course. Students who have had 5301 can substitute a 3-credit linguistics course.

Luso-Brazilian Literature

Contact Information—See Hispanic and Luso-Brazilian Literatures and Linguistics.

Associate Professor

Fernando E. Arenas, AM

Assistant Professor

Elide Oliver, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Please see Hispanic and Luso-Brazilian Literature and Linguistics for program description

Prerequisites for Admission—Prospective students generally have completed an undergraduate degree or substantial coursework in the field, although individuals with other backgrounds may be admitted. The Graduate Studies Committee may require completion of background coursework, without graduate degree credit, for admitted students with insufficient preparation.

Special Application Requirements—Three letters of recommendation from previously attended institutions evaluating the applicant's scholarship, a sample of a writing project, and a complete set of transcripts in addition to that required by the Graduate School should be sent to the director of graduate studies. The GRE is recommended, and is required for fellowship candidates. The deadline for application for admission and financial aid is January 15 for fall entry.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please refer to Portuguese (Port), Spanish (Span), and Spanish-Portuguese (SpPt) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements

The M.A. is offered under both Plan A and Plan B. Plan A requires at least 33 credits, including 15 credits in the major field taken from among designated 5xxx core courses, 6 credits outside the program, and 12 thesis credits. Plan B requires at least 33 course credits and two Plan B papers. Most students pursue Plan B.

Language Requirements—For the M.A., students must have a reading knowledge of English and at least one foreign language in addition to Spanish and Portuguese.

Final Exam—The final exams are written and oral.

Minor Requirements for Students Majoring in Other Fields—The master's minor requires at least 6 credits.

Management of Technology

Contact Information—Management of Technology Graduate Program, Center for the Development of Technological Leadership, University of Minnesota, 510 West Bank Office Building, 1300 S. Second Street, Minneapolis, MN 55454-1082 (612-624-5747; fax 612-624-7510; e-mail MOT@cdtl.umn.edu; <www.cdtl.umn.edu>).

Professor

Avram Bar-Cohen, Mechanical Engineering, AM
Philip Bromiley, Strategic Management, AM
Balaji S. Chakravarthy, Strategic Management, AM
Norman L. Chervany, Information and Decision Sciences, AM
W. Bruce Erickson, Strategic Management, AM
Arthur V. Hill, Operations and Management Science, AM
George John, Marketing and Logistics Management, AM
Edward J. Joyce, Accounting and Business Law, AM
Kenneth H. Keller, Hubert H. Humphrey Institute of Public Affairs, AM
Ian H. Maitland, Strategic Management, AM
Timothy J. Nantell, Finance, AM
Dennis L. Polla, Electrical Engineering, AM
Kenneth J. Roering, Marketing and Logistics Management, AM
Robert W. Ruekert, Marketing and Logistics Management, AM

Associate Professor

Karl A. Smith, Civil Engineering, AM

Other

Dileep Rao, AM
Rias J. van Wyk, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The master of science in the management of technology (M.S.MOT.) program is administered by the Institute of Technology's Center for the Development of Technological Leadership in partnership with the Carlson School of Management. The two-year, executive-format program integrates the fields of technology and management and provides working engineers and scientists with management knowledge and skills needed to assume a technical leadership role within their organizations. The program focuses on management in technology-based environments in traditional and emerging industries. The curriculum includes technical and advanced management courses such as manufacturing, pivotal technologies, technology forecasting, project management, quality engineering, management of innovation, and strategic management of technology. The core management curriculum includes areas such as finance, marketing, accounting, strategic planning and decision making, and conflict management. Students enter the program in the fall and advance as a cohort, taking a prescribed sequence of courses together. Case studies, class discussions, and study-group interaction stimulate the learning process. Students also participate in several off-campus residencies, including one in the Asia-Pacific region; complete individual and team projects; and develop final projects as part of a capstone course. Most students receive corporate financial support.

Prerequisites for Admission—A bachelor's degree in engineering or in a natural science discipline from an accredited program. Applicants should also have completed coursework (or show proficiency) in economics, mathematical modeling, statistics, and computer literacy.

Special Application Requirements—At least five years of professional experience in the applicant's technical field (in exceptional circumstances, promising candidates with less experience may be considered). Applicants must submit three letters of recommendation, a résumé, a statement of purpose, and GRE or Graduate Management Admission Test scores (if the applicant already holds a master's or Ph.D. degree, this test requirement is waived). The professional track record of the applicant weighs heavily in the admissions process. A personal interview with the director of graduate studies is required. Admission is in fall semester only.

Use of 4xxx Courses—4xxx courses may not be included on degree program forms.

M.S.MOT. Plan B Degree Requirements

The M.S.MOT. requires 36 credits. In addition to course requirements, students must complete an oral exam and a written report for the capstone project (8234), which consists of an independent, original investigation requiring between 110 and 130 hours of effort.

Language Requirements—None.

Final Exam—An oral presentation of the capstone project is required.

Manufacturing Systems Engineering

Contact Information—Management of Technology Graduate Program, Center for the Development of Technological Leadership, University of Minnesota, 510 West Bank Office Building, 1300 S. Second Street, Minneapolis, MN 55454-1082 (612-624-5747; fax 612-624-7510; e-mail general@cdtl.umn.edu; <www.cdtl.umn.edu>).

Professor

Avram Bar-Cohen, AM
Arthur G. Erdman, AM
Barney E. Klamecki, AM
Karl Smith, AM
Kim A. Stelson, AM
Rias van Wyk, AM

Associate Professor

Saifallah Benjaafar, AM
Diwakar Gupta, AM
Caroline Hayes, AM
Susan C. Mantell, AM
Brad Nelson, AM
Michael Taaffe, AM

Assistant Professor

William Cooper, AM
Frank Kelso, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The master of science in manufacturing systems engineering (M.S.M.S.E) program is an interdisciplinary program offered through the Institute of Technology's Center for the Development of Technological Leadership and the Department of Mechanical Engineering. Students gain familiarity with manufacturing systems and practices. The program emphasizes issues surrounding factory logistics and supply chain management, global markets and their implications for manufacturing, and manufacturing processes that are friendly to the environment.

Use of 4xxx Courses—4xxx courses may not be included on degree program forms for the M.S.M.S.E.

Courses—Please refer to Manufacturing Systems (MS) in the course section of this catalog for courses pertaining to the program.

M.S.M.S.E. Plan B Degree Requirements

At least 30 credits, including 23 credits from the manufacturing systems program, 4 credits from the capstone project, and 3 elective credits from systems and technology themes. The curriculum includes six core courses, four short courses, three elective short courses, and a capstone course (Plan B final project).

Language Requirements—None.

Final Exam—The final exam is oral. An oral presentation and written report on a final project are also required.

Mass Communication

Contact Information—Graduate Studies Office, School of Journalism and Mass Communication, University of Minnesota, 110 Murphy Hall, 206 Church Street S.E., Minneapolis, MN 55455 (612-625-4054; fax 612-626-8251; e-mail sjmcgrad@umn.edu; <www.sjmc.umn.edu/>).

Professor

Hazel Dicken-Garcia, FM
Ronald J. Faber, FM
Irving E. Fang, FM
Kathleen A. Hansen, FM
Jane E. Kirtley, FM
Chin-Chuan Lee, FM
Nancy L. Roberts, FM
Daniel J. Sullivan, FM
Daniel B. Wackman, FM

Associate Professor

William A. Babcock, FM
Tsan-Kuo Chang, FM
Kenneth O. Doyle, Jr., FM
Dona B. Schwartz, FM
Albert R. Tims, Jr., FM

Assistant Professor

Colette Gaiter, AM
Shelly L. Rodgers, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The general mass communication M.A. emphasizes the theoretical study of mass communication and analysis of media systems. The degree is primarily for those who wish to pursue Ph.D. degrees or teaching and research careers, or to enter the communication industry. The general M.A. program does not offer professional skills training in journalism.

Individuals who have extensive professional experience in mass communication or a B.A. degree in journalism are encouraged to enter the general M.A. program. Individuals with strong liberal arts backgrounds in areas such as political science, psychology, sociology, history, philosophy, and English also are encouraged to apply.

The Ph.D. offers training for academic careers primarily in communication instruction, research, or policy. Areas of specialization include media processes,

influences, and effects (strategic communication); media law, ethics, and history; international communication; and media management. All programs are suffused with the study of visual communication and new media communication.

Prerequisites for Admission—The minimum requirement for admission is the B.A. or equivalent.

Special Application Requirements—Applicants must submit an application; a written statement of career interests, goals, and objectives; three letters of recommendation from persons familiar with their scholarship and research potential; a complete set of transcripts; academic work samples in English; and scores from the General Test of the GRE. Students whose native language is not English are required to submit scores from the TOEFL, but not from the GRE. Admission is considered for fall semester only; the application deadline is December 30.

Special Facilities—Special facilities include Minnesota Journalism Center for Professional Studies, Silha Center for the Study of Media Ethics and Law, China Times Center, Institute for New Media Studies, Digital Information Resource Center (houses Eric Sevareid Library), and SJMC Research Division.

Use of 4xxx Courses—Use of 4xxx courses towards degree requirements is subject to adviser or director of graduate studies approval.

Courses—Please refer to Journalism and Mass Communication (Jour) in the course section of this catalog for courses pertaining to the program.

M.A. Plan A Degree Requirements

At least 27 course credits and 10 thesis credits are required. Coursework must include 12 credits in required core courses and 15 other credits (6-9 credits in other journalism and mass communication seminars or courses, and 6-9 credits in other departments). All coursework must be taken A-F.

Language Requirements—For the master's program, foreign language study is recommended for students in international mass communication.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—Minor programs are planned in consultation with the director of graduate studies or another member of the mass communication graduate faculty. The master's minor consists of at least 9 credits in a coherent area, with at least 6 credits of 8xxx.

Ph.D. Degree Requirements

At least 54 course credits and 24 thesis credits are required. Coursework must include 12 credits in required core courses, 24 credits in dissertation area courses, and at least 18 credits in other departments.

Language Requirements—Doctoral students pursuing international study are expected to have high language proficiency, or obtain it, in the appropriate area. Doctoral students in other areas are encouraged to consult advisers regarding the appropriateness of language study for their chosen specialization.

Minor Requirements for Students Majoring in Other Fields—A Ph.D. minor program consists of at least 14 credits in a coherent disciplinary area. Students completing a minor in mass communication are required to take a preliminary written exam covering their coursework.

Materials Science and Engineering

See Chemical Engineering and Material Science and Engineering.

Mathematics

Contact Information—School of Mathematics, University of Minnesota, 127 Vincent Hall, 206 Church Street S.E., Minneapolis, MN 55455 (612-625-1306; fax 612-626-2017; e-mail gradprog@math.umn.edu).

Regents' Professor

Avner Friedman, FM

Professor

Scot Adams, FM
Stephen B. Agard, FM
Greg W. Anderson, FM
Donald G. Aronson, FM
John R. Baxter, FM
Sergei Bobkov, FM
Maury D. Bramson, FM
J. Bernardo Cockburn, FM
Mark F. Feshbach, FM
Bert E. Fristedt, FM
Paul B. Garrett, FM
Jay R. Goldman, FM
Lawrence F. Gray, FM
Robert D. Gulliver II, FM
Morton E. Harris, FM
Dennis A. Hejhal, FM
Naresh C. Jain, FM
Max A. Jodeit, Jr., FM
Donald W. Kahn, FM
Harvey B. Keynes, FM
Nicolai V. Krylov, FM
Walter Littman, FM
John S. Lowengrub, FM
Mitchell B. Luskin, FM
Gennady Lyubeznik, FM
Albert Marden, FM
Charles A. McCarthy, FM
Richard P. McGehee, FM
William Messing, FM
Norman G. Meyers, FM
Willard Miller, Jr., FM
Richard B. Moeckel, FM
Wei-Ming Ni, FM
Peter J. Olver, FM
Hans Othmer, FM
Marian Pour-El, FM
Karel L. Prikry, FM
Victor Reiner, FM
Fernando Reitich, FM
Peter A. Rejto, FM
Joel L. Roberts, FM
Mikhail Safonov, FM
Fadil Santosa, FM
George R. Sell, FM
Yasutaka Sibuya, FM
Steven I. Sperber, FM
Dennis W. Stanton, FM
David A. Storvick, FM
Vladimir Sverak, FM
Allen R. Tannenbaum, Electrical Engineering, AM
Peter J. Webb, FM
Dennis E. White, FM

Associate Professor

Jack F. Conn, FM
David L. Frank, FM
Hillel H. Gershenson, FM
Dihua Jiang, FM
Rachel A. Kuske, AM
Nai-Chung Leung, FM
Chester L. Miracle, FM
Wayne H. Richter, FM
Jiaping Wang, FM

Assistant Professor

Ionut Ciocan-Fontanine, FM
Jianhong Jackie Shen, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Special areas of research include ordinary and partial differential equations; probability; real, complex, harmonic, functional and numerical analysis; differential and algebraic geometry; topology; number theory; commutative algebra; group theory; logic; combinatorics; mathematical physics; and applied and industrial mathematics. The M.S. Plan A includes a program with emphasis in applied and industrial mathematics. The M.S. Plan B includes a program with emphasis in mathematics education.

See also control science and dynamical systems, and fluid mechanics, in this catalog for Ph.D. programs that rely heavily on mathematics.

Prerequisites for Admission—A solid background in undergraduate-level mathematics is expected. For students whose goal is the Ph.D. degree, background should include full-year courses in analysis, abstract algebra, and a semester of topology (roughly equivalent to 5615H-5616H, 5285H-5286H, and 5345).

Entering students are ordinarily admitted to the master's degree program. Transfer to the Ph.D. program is made when the Ph.D. preliminary written examination is passed (and does not require earning a master's degree).

Special Application Requirements—All applicants are expected to submit three letters of recommendation, a score from the GRE Subject (Advanced) Test in mathematics, and a supplementary application form available from the mathematics department. Applicants desiring financial assistance should submit their applications, including the departmental form, GRE scores, and letters of recommendation, to the director of graduate studies no later than January 15 to be considered for a fellowship, and no later than

February 15 to be considered for a teaching assistantship. Students normally are admitted fall semester only.

Use of 4xxx Courses—In exceptional cases 4xxx courses may be permitted as part of degree programs subject to director of graduate studies approval.

Courses—Please refer to Mathematics (Math) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements

The School of Mathematics offers a M.S. in mathematics. M.S. degrees are also offered with emphasis in applied and industrial mathematics, with emphasis in mathematics education, and with emphasis in actuarial science. For more information, see the *Graduate Studies in Mathematics* brochure.

The M.S. is offered under Plan A and Plan B. Plan A requires at least 20 course credits and 10 thesis credits. Plan B allows more breadth; students complete at least 30 course credits, half of which may be in areas outside of mathematics.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—The master's minor requires a two-semester 8xxx or 4xxx sequence.

Ph.D. Degree Requirements

The School of Mathematics offers a general Ph.D. in mathematics and a Ph.D. in mathematics with emphasis in applied and industrial mathematics.

Special areas of research include ordinary and partial differential equations; probability; real, complex, harmonic, functional, and numerical analysis; differential and algebraic geometry; topology; number theory; commutative algebra; group theory; logic; combinatorics; mathematical physics; and applied and industrial mathematics.

The Ph.D. preliminary written examination, given twice each year, covers real analysis, complex analysis, algebra, and manifolds and topology. Students must pass the exam by the end of their second year. After passing the exam and completing the coursework, students may take the preliminary oral exam, which they must pass by the end of their fourth year. If a supporting program is chosen, it may consist partly or entirely of mathematics courses.

The choice of courses and exams for the emphasis in applied and industrial mathematics is different from those in the general program. In particular, applications are stressed early on.

For more information, see the program's *Graduate Studies in Mathematics* brochure.

Language Requirements—Two foreign languages are required from among the following: French, German, Russian, and Italian.

Minor Requirements for Students Majoring in Other Fields—Two year-long sequences of 5xxx or 8xxx courses. Consult the director of graduate studies in mathematics.

Mathematics Education

Contact Information—See Education: Curriculum and Instruction for M.A. and Ph.D. information.

Professor
Thomas R. Post, AM

Associate Professor
Kathleen Cramer, AM

Assistant Professor
Jeremy Kahan, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—By focusing on the curricular and instructional processes central to all educational endeavors, graduate programs within the Department of Curriculum and Instruction prepare students for professional roles in pre K-12 education, in postsecondary and research settings, and in educational service agencies.

The M.A. in mathematics education serves students interested in teaching at the elementary, middle grades, and secondary school levels. Students design their program of study in consultation with their adviser.

Prerequisites for Admission—Prerequisites vary among areas of emphasis or concentration. Generally a bachelor's degree with licensure or teaching experience fulfills the requirement. For some areas, however, there is no equivalent undergraduate program. In that case, 15 to 20 credits of work at the undergraduate level determined acceptable by advisers and the director of graduate studies are adequate.

Special Application Requirements—Scores from the GRE are required. Master's applications are reviewed by department faculty continually throughout the academic year.

Use of 4xxx—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval. Students from other majors may include such courses subject to their own program's approval.

Courses—Please refer to Mathematics Education (MthE), Curriculum and Instruction (CI), and Education (Educ) in the course section of this catalog for courses pertaining to the program.

M.A. Plan B Degree Requirements

The program requires 30 credits: at least 14 credits in the major, at least 7 credits in research (including a 6-credit Plan B research paper), and at least 6 credits from a related field chosen with the consent of the adviser. Typically courses also are taken in mathematics and educational psychology.

Language Requirements—None.

Final Exam—The final exam is oral.

Mechanical Engineering

Contact Information—Mechanical Engineering and Industrial Engineering Graduate Programs, University of Minnesota, 1120 Mechanical Engineering, 111 Church Street S.E., Minneapolis, MN 55455 (612-625-2009; fax 612-624-2010; e-mail radinfo@me.umn.edu; <www.me.umn.edu/>).

Regents' Professor
Ernst R. G. Eckert (emeritus), FM
Richard J. Goldstein, FM
Benjamin Y. H. Liu, FM

Professor
Avram Bar-Cohen, FM
Perry L. Blackshear (emeritus), FM
Jane H. Davidson, FM
Max Donath, FM
William K. Durfee, FM
Arthur G. Erdman, FM
Edward A. Fletcher (emeritus), FM
Steven L. Girshick, FM
Peter A. Hancock, Kinesiology, AM
Joachim V. R. Heberlein, FM
Warren E. Ibele (emeritus), FM
David B. Kittelson, FM
Barney E. Klamecki, FM
Thomas H. Kuehn, FM
Francis A. Kulacki, FM
Tarald O. Kvalseth, FM
Jack L. Lewis, FM
Virgil A. Marple, FM
Peter H. McMurry, FM
Katsuhiko Ogata, FM
Suhas V. Patankar (emeritus), FM
Emil Pfender (emeritus), FM
David Y. H. Pui, FM
Subbiah Ramalingam, FM
James W. Ramsey, FM
Terrence W. Simon, FM
Ephraim M. Sparrow, FM
Patrick J. Starr, FM
Kim A. Stelson, FM
Paul J. Strykowski, FM
Kumar K. Tamma, FM

Associate Professor
Saifallah Benjaafar, FM
John C. Bischof, FM
Thomas R. Chase, FM
Caroline C. Hayes, FM
Uwe R. Kortshagen, FM
Susan C. Mantell, FM
Bradley J. Nelson, FM
Michael R. Zachariah, FM

Assistant Professor
Sean C. Garrick, FM
Perry Y. Li, FM
Rajesh Rajamani, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Coursework and research for all graduate degrees are offered in bioengineering; biomechanics; combustion; computer-aided design; computer-aided manufacturing; computer graphics; control systems; design; energy conservation; environmental control; environmental engineering; fluid mechanics; heat and mass transfer; history of science and technology; human factors engineering; industrial engineering; innovative methodologies; integration of structural and environmental systems; lubrication; manufacturing engineering; particle technology; plasma chemistry; plasma heat transfer; power, propulsion, and applied thermodynamics; socioeconomic systems; solar energy; solar processing and thermochemistry; statistics; structures; systems dynamics; technology assessment; thermal energy storage; thermal environmental engineering; thermodynamics; transportation; tribology; vibration; and interdisciplinary finite element methodology. Additional instructional and research programs can be formulated.

Prerequisites for Admission—An undergraduate degree in engineering or in a closely related scientific field such as physics, chemistry, or mathematics, is required. Unusually well-qualified students may be admitted directly to the Ph.D. program with a baccalaureate degree.

Special Application Requirements—GRE General Test scores are required for admission and also are used in evaluating requests for financial aid. For the Ph.D. program, three letters of recommendation from senior faculty members at the previous educational institution are required, including one from the master's degree adviser. Students are admitted in the fall and spring semesters only, the departmental deadlines for which are December 15 and October 15, respectively.

Use of 4xxx Courses—Selected 4xxx courses from other departments may be applied toward the degree in consultation with the student's adviser and the director of graduate studies. No 4xxx ME courses may be applied toward the degree.

Courses—Please refer to Mechanical Engineering (ME) in the course section of this catalog for courses pertaining to the program.

M.S.M.E. Degree Requirements

The M.S.M.E. requires at least 30 credits, including at least 14 course credits in the major and 6 course credits in a minor or related field. At least 1 credit of graduate seminar and 1 mathematics/numerical methods course from an approved list must be included in the 30 credits. Also, of the 30 credits, Plan A (thesis) students must enroll for 10 thesis credits. For Plan B (non-thesis), one to three Plan B papers are required (the number in part depending on their length), determined in consultation with the adviser. The papers may derive from courses in the major or may address topics chosen by a graduate faculty member and the student.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—At least 6 credits in mechanical engineering are required for a master's minor.

Ph.D. Degree Requirements

The Ph.D. requires at least 44 course credits, including at least 12 course credits in a minor field or supporting program and at least 2 credits of graduate seminar, along with at least one mathematical/numerical methods course from an approved list; 24 thesis credits are also required.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—At least 12 credits in mechanic engineering is required for a doctoral minor.

Mechanics

See Aerospace Engineering and Mechanics.

Medical Physics

See Biophysical Sciences and Medical Physics.

Medicinal Chemistry

Contact Information—Department of Medicinal Chemistry, University of Minnesota, 8-101 Weaver-Densford Hall, 308 Harvard Street S.E., Minneapolis, MN 55455-0343 (612-624-9919; fax 612-624-0139; e-mail medchem@umn.edu; <www.pharmacy.umn.edu/resgrad/medchem/index.htm>).

Professor

Yusuf J. Abul-Hajj, FM
S. Mbua Ngale Efange, Radiology, FM
Patrick E. Hanna, FM
Stephen S. Hecht, Laboratory Medicine and Pathology, FM
Rodney L. Johnson, FM
Philip S. Portoghese, FM
Rory P. Remmel, FM
David H. Sherman, Microbiology, FM
W. Thomas Shier, FM
Marilyn K. Speedie, FM
Robert Vince, FM

Adjunct Professor

Herbert T. Nagasawa, FM

Associate Professor

David M. Ferguson, FM
William B. Gleason, Lab Medicine and Pathology, FM
Deborah A. Kallick, FM
Lisa A. Peterson, Environmental and Occupational Health, FM
Carston R. Wagner, FM

Assistant Professor

Natalia Y. Tretyakova, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The program emphasizes the application of chemical principles to research on the action of drugs on biological systems. Courses offered by the program focus on general principles of medicinal chemistry, drug design and synthesis, chemical aspects of drug metabolism, chemical mechanisms of drug toxicity and carcinogenicity, computer-assisted drug design and receptor modeling, and combinatorial chemistry.

Prerequisites for Admission—Applicants should have a B.S. or M.S. degree in an appropriate related science field such as pharmacy, chemistry, or biology. Students majoring in other degree programs that encompass chemical, biochemical or biological fields of study are also encouraged to apply. All applicants should have completed undergraduate chemistry through elementary organic chemistry. Undergraduate coursework in biochemistry and physical chemistry also is a prerequisite, but under certain circumstances such coursework may be taken during the first year. Students usually are admitted fall semester only and admissions are generally for the Ph.D. program only.

Special Application Requirements—Scores from the General (Aptitude) Test of the GRE, three letters of recommendation from college-level faculty, a complete set of official transcripts, and a statement of immediate and long range career objectives are required. All application materials should be submitted by mid January to ensure priority consideration for fellowship, teaching and research assistantships awarded for the next academic year.

Use of 4xxx-level Courses—Use of 4xxx courses is not permitted toward degree requirements.

Courses—Please refer to Medicinal Chemistry (MedC) in the course section of this catalog for courses pertaining to the program.

M.S. Plan A Degree Requirements

Students must complete a core curriculum of advanced courses in organic chemistry (4 credits) medicinal chemistry (10 credits), and 6 credits in a minor or related field.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A minimum of 6 credits is required for a master's minor.

Ph.D. Degree Requirements

All students must complete a core curriculum of advanced courses in organic chemistry (7 credits), biochemistry (8 credits), and medicinal chemistry (12 credits). Students

must also participate in the department seminar program, successfully complete a cumulative exam requirement that serves as the preliminary written exam, and prepare and defend an original research proposal which serves as the preliminary oral exam.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A minimum of 12 credits is required for the doctoral minor, including an introductory course (MedC 5600), advanced medicinal chemistry courses, and other courses in the medicinal chemistry core curriculum.

Medieval Studies

Contact Information—Center for Medieval Studies, University of Minnesota, 304 Walter Library, 117 Pleasant Street S.E., Minneapolis, MN 55455 (612-626-0805; fax 612-626-7735; e-mail cmedst@umn.edu).

Professor

Ronald F. Akehurst, French and Italian, E
Bernard S. Bachrach, History, E
Caesar E. Farah, Afro-American and African Studies, E
Evelyn S. Firchow, German, Scandinavian, and Dutch, E
Donna G. Cardamone Jackson, Music, E
Klaus P. Jankofsky, English, Duluth, E
Calvin B. Kendall, English, E
Anatoly Liberman, German, Scandinavian, and Dutch, E
Susan J. Noakes, French and Italian, E
Thomas S. Noonan, History, E
James A. Parente, Jr., German, Scandinavian, and Dutch, E
William D. Phillips, Jr., History, E
Kathryn L. Reyerson, History, E
Anthony N. Zahareas, Spanish and Portuguese, E

Associate Professor

G. Lee Fullerton, German, Scandinavian, and Dutch, E
Kaaren E. Grimstad, German, Scandinavian, and Dutch, E
Michal A. Kobialka, Theatre Arts, E
Nita Krevans, Classical and Near Eastern Studies, E
Ronald L. Martinez, French and Italian, E
Oliver Nicholson, Classical and Near Eastern Studies, E
John W. Steyaert, Art History, E
Ray M. Wakefield, German, Scandinavian, and Dutch, E
John A. Watkins, English, E

Curriculum—The medieval studies minor is available to master's (M.A. and M.F.A.) and doctoral students. The Center for Medieval Studies (CMS) encourages collegial interaction and scholarly collaboration among faculty and students in all areas of medieval studies. CMS seeks to provide an opportunity for scholars of all disciplines and at all levels to focus intensively on historical, literary, anthropological, social, economic, religious, artistic, cultural, and methodological inquiries into the medieval period, which may fall within the chronology of roughly 300 to 1500 A.D. and may include the geographical area of Europe, the Middle East, and Russia. The primary emphasis of the program is on Latin, which is the most common learned and written language of the period, and secondarily on an interdisciplinary approach to medieval culture. The minor involves the Departments of History; Art History; Theatre Arts; Music; English; French and Italian; German, Scandinavian, and Dutch; Spanish and Portuguese; and Classical and Near Eastern Studies.

Prerequisites for Admission—Admission to a medieval studies graduate minor is contingent upon prior admission to a master's or doctoral degree-granting program in the Graduate School.

Use of 4xxx Courses—Use of 4xxx courses toward degree requirements is permitted based on director of graduate study approval.

Courses—Please refer to Medieval Studies (MeSt) in the course section of this catalog for courses pertaining to the program.

Freestanding Minor Requirements

The master's minor requires 6 graduate credits: two courses in medieval studies outside the student's major department, including a Latin course (Latin 33xx or 34xx taken as 8120 or any Latin course at 5xxx or above) and either one MeSt core course (5610 or 8110) or another approved course with medieval or Latin content; if the latter option is chosen, MeSt 8010 (the medieval colloquium course) is also required.

The doctoral minor requires 12 graduate credits, comprising courses in medieval studies outside the student's major department and including an additional Latin course at 5xxx or above. Students from Classical fields using Latin to satisfy requirements in those fields must substitute an equivalent quantity of a medieval vernacular language for the medieval studies Latin requirement.

Microbial Ecology

Contact Information—Michael Sadowsky, Microbial Ecology Minor Program, University of Minnesota, 258 Borlaug Hall, 1991 Upper Buford Circle, St. Paul, MN 55108 (612-624-2706; e-mail sadowsky@soils.umn.edu).

Professor

Iris D. Charvat, Plant Biology, E
Arnold G. Fredrickson, Chemical Engineering and Materials Science, E
Gregory R. Germaine, Oral Sciences, E
Richard S. Hanson, Microbiology, E
Linda L. Kinkel, Plant Pathology, E
Timothy J. Kurtti, Entomology, E
David J. McLaughlin, Plant Biology, E
Robert O. Megard, Ecology, Evolution, and Behavior, E
Jean-Alex E. Molina, Soil, Water, and Climate, E
Philip J. Regal, Ecology, Evolution, and Behavior, E
Michael J. Sadowsky, Soil, Water, and Climate, E
G. David Tilman, Ecology, Evolution, and Behavior, E
Lawrence P. Wackett, Biochemistry, E

Associate Professor

Randall E. Hicks, Biology, Duluth, E

Curriculum—This minor is available to master's (M.S.) and doctoral (Ph.D.) students. Microbial ecology is an interdisciplinary research area concerned with the relationships of microorganisms to their natural environment. The microbial ecology minor offers core coursework in microbiology, microbial physiology, microbial genetics, and theoretical ecology as well as in microbial ecology. Additional courses and opportunities to interact with others interested in microbial ecology are also part of the minor. The microbial ecology/biotechnology seminar series allows students and faculty to interact with microbial ecologists from other universities. The curriculum encourages interdisciplinary interaction, communication, and synthesis.

Prerequisites for Admission—To be admitted to the minor, a student must be admitted to a master's or doctoral degree-granting program within the Graduate School, should have broad training in the biological sciences, and must be accepted by the director of graduate studies of the microbial ecology minor program. All students are expected to have had the equivalent of introductory microbiology (MicB 5105) and general ecology, but may fulfill deficiencies in these areas by taking these courses while in the program.

Special Application Requirements—Consult the director of graduate studies. Students are admitted each semester.

Use of 4xxx Courses—Inclusion of more than one 4xxx course on degree program forms is subject to adviser and director of graduate study approval.

Courses—Please contact the minor program office for information on relevant coursework.

Freestanding Minor Requirements

The master's minor requires 6 graduate credits, all of which must be outside the student's major department and must include at least one laboratory course in microbiology (e.g., MicB 4215) and one ecology (EEB) course chosen from the list below. The remaining courses also are chosen from this list with the guidance and approval of the director of graduate studies in microbial ecology.

The doctoral minor requires 12 graduate credits, 9 credits of which must come from the core courses listed below (contact the director of graduate studies for potential alternatives to these courses). The remaining credits must come from at least two courses chosen from this list, but may not be in the student's major.

Core Courses: EEB 5053—Ecology Theory and Concepts (4 cr); MicB 4111—Microbial Physiology and Diversity (3 cr); MicB 4121—Microbial Ecology and Applied Microbiology (3 cr); MIMP 8002—Structure, Function, and Genetics of Bacteria and Viruses (4 cr).

Additional Courses: CE 8551—Environmental Microbiology/Lab; CE 8541—Aquatic Chemistry; CE 8542—Chemistry of Organic Pollutants in Environmental Systems; EEB 4601—Limnology; EEB 4609—Ecosystem Ecology; EEB 8620—Advanced Limnology; MicB 4215—Advanced Laboratory: Microbial Physiology and Diversity; PlPa 5203—Biology and Ecology of Fungi; PlPa 8102—Epidemiology and Ecology of Plant Disease; PlPa 8103—Physiological and Molecular Plant-Microbe Interactions; Soil 5515—Soil Genesis and Landscape Relations; Soil 5611—Soil Biology and Fertility.

Microbial Engineering

Contact Information—M.S. Program in Microbial Engineering, Biological Process Technology Institute, University of Minnesota, 1479 Gortner Avenue, Suite 240, St. Paul, MN 55108 (612-625-0212; fax 612-625-1700; e-mail bpti@biosci.cbs.umn.edu).

Professor

Robert J. Brooker, Genetics and Cell Biology, AM
Peter W. Carr, Chemistry, AM
Paul P. Cleary, Microbiology, AM
Gary M. Dunny, Microbiology, AM
Lynda B. Ellis, Laboratory Medicine and Pathology, AM
Anthony J. Faras, Microbiology, AM
Michael C. Flickinger, Biochemistry, AM
James A. Fuchs, Biochemistry, AM
Richard S. Hanson, Microbiology, AM
Alan B. Hooper, Genetics and Cell Biology, AM
Wei-Shou Hu, Chemical Engineering and Materials Science, AM
Theodore P. Labuza, Food Science and Nutrition, AM
R. Scott McIvor, Laboratory Medicine and Pathology, AM
Larry L. McKay, Food Science and Nutrition, AM
Michael J. Sadowsky, Soil, Water, and Climate, AM
Janet L. Schottel, Biochemistry, AM
David H. Sherman, Microbiology, AM
W. Thomas Shier, Medicinal Chemistry and Pharmacognosy, AM
David A. Somers, Agronomy and Plant Genetics, AM
Friedrich Srienc, Chemical Engineering and Materials Science, AM
Robert T. Tranquillo, Chemical Engineering and Materials Science, AM
Lawrence P. Wackett, Biochemistry, AM

Associate Professor

Peter Southern, Microbiology, AM
Carston R. Wagner, Medicinal Chemistry and Pharmacognosy, AM

Assistant Professor

Daniel J. O'Sullivan, Food Science and Nutrition, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Microbial engineering is an interdisciplinary program that combines an understanding of basic principles in microbiology, biochemistry, molecular biology, chemical engineering, and related sciences. Students are trained in the industrial application of microorganisms, cultured cells, and immunologic agents. They learn both modern basic microbiology and biological engineering and can either proceed to a Ph.D. program in a related discipline or work directly with research and development staff in biotechnology industries. Supporting courses may be chosen from specific fields including biochemistry, food science, genetics and cell biology, or pharmacognosy. The program is coordinated by the Biological Process Technology Institute (BPTI), involving faculty from ten departments and four institutes of the University.

Prerequisites for Admission—A baccalaureate degree in biological sciences, biochemistry, chemistry, or chemical engineering is preferred. Undergraduate coursework should include one year each of calculus, organic chemistry, physics, microbiology, and basic chemical engineering, as well as a background in basic biology, physical chemistry, biochemistry, and genetics. Deficiencies may be made up during the first year of graduate studies.

Special Application Requirements—Three letters of recommendation, scores from the General Test of the GRE, the TOEFL score for international applicants, transcripts, and an autobiographical statement including occupational goals must be submitted to the director of graduate studies. Applications are accepted at any time, but the majority of students are accepted for fall semester. To receive full consideration for financial aid, students must apply for fall semester admission by February 1.

Use of 4xxx Courses—A limited number of 4xxx courses are permitted toward degree requirements based on director of graduate studies approval.

Courses—Please refer to Microbial Engineering (MicE) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements

The M.S. requires 32 credits (including 10 thesis credits) for Plan A and 32 credits (including 1-3 research credits) for Plan B. The two-year program comprises coursework in a specialized program of microbiology, molecular biology, immunobiology, and chemical engineering. In addition, students present two seminars and teach one laboratory course in advanced microbiology, biochemistry, molecular biology, immunobiology, or chemical engineering. Students may choose supporting coursework (at least 6 credits) from specified fields, including biochemistry, food science, pharmacognosy, genetics, and cell biology and must demonstrate proficiency in computer programming and one computer language. Plan A students carry out a research project resulting in a thesis. Plan B students complete a summer preceptorship (about 2 1/2 months) in a private company research laboratory or at a research institute in the University and prepare a Plan B paper based on the research project. Presentation of the original laboratory research thesis/project to the graduate faculty is required at the end of the second year.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A minor in microbial engineering is offered at the doctoral level only. Students must complete at least 12 credits, selected in consultation with the director of graduate studies for microbial engineering.

Microbiology, Immunology, and Cancer Biology

Contact Information—Microbiology, Immunology, and Cancer Biology Program, University of Minnesota, Mayo Mail Code 196, 420 Delaware Street S.E., Minneapolis, MN 55455 (mailing address) (612-624-5947; fax: 612-626-0623; e-mail mica@mail.ahc.umn.edu).

Regents' Professor

Ashley T. Haase, FM

Professor

Khalil Ahmed, Laboratory Medicine and Pathology FM
Dwight L. Anderson, Oral Sciences, FM
Fred S. Apple, Laboratory Medicine and Pathology, FM
Timothy W. Behrens, Medicine, FM
Judith G. Berman, Genetics, Cell Biology, and Development, FM
Peter B. Bitterman, Medicine, FM
Bruce R. Blazar, Pediatrics, FM
Paul P. Cleary, FM
Anath Das, Biochemistry, FM
Gary M. Dunny, FM
Lynda B. Ellis, Laboratory Medicine and Pathology, FM
Anthony J. Faras, FM
Leo T. Furcht, Laboratory Medicine and Pathology, FM
Vincent F. Garry, Laboratory Medicine and Pathology, FM
Dale S. Gregerson, Opthalmology, FM
Richard S. Hanson, FM
Robert P. Hebbel, Medicine, FM
Alan B. Hooper, Biochemistry, FM
Harry S. Jacob, Medicine, FM
Marc K. Jenkins, FM
Russell C. Johnson, FM
John H. Kersey, Laboratory Medicine and Pathology, FM
Tucker W. LeBien, Laboratory Medicine and Pathology, FM
Walter C. Low, Neurosurgery, FM
Paul T. Magee, Genetics and Cell Biology, FM
James B. McCarthy, Laboratory Medicine and Pathology, FM
R. Scott McIvor, Laboratory Medicine and Pathology, FM
Larry L. McKay, Food Science and Nutrition, FM
Matthew F. Mescher, Laboratory Medicine and Pathology, FM
Jeffrey S. Miller, Medicine, FM
Theodore R. Oegema, Jr., Orthopaedic Surgery, FM
Harry T. Orr, Laboratory Medicine and Pathology, FM
Peter G. W. Plagemann, FM
Sundaram Ramakrishnan, Pharmacology, FM
Gundu H. R. Rao, Laboratory Medicine and Pathology, FM
Michael J. Sadowsky, Soil, Water, and Climate, FM
Michel M. Sanders, Biochemistry, Molecular Biology, and Biophysics, FM
Patrick M. Schlievert, FM

Janet L. Schottel, Biochemistry, FM
David H. Sherman, FM
Yoji Shimizu, Laboratory Medicine and Pathology, FM
Keith M. Skubitz, Medicine, FM
Daniel A. Vallera, Therapeutic Radiology, FM
Brian G. Van Ness, Biochemistry, FM
Gregory M. Vercellotti, Medicine, FM
Catherine M Verfaillie, Medicine, FM
Lawrence P. Wackett, Biochemistry, FM
Lee W. Wattenberg, Laboratory Medicine and Pathology, FM
Carol L. Wells, Laboratory Medicine and Pathology, FM

Associate Professor

Mitchell S. Abrahamsen, Veterinary Pathobiology, FM
Vivian J. Bardwell, Biochemistry, FM
Kathleen F. Conklin, FM
Alejo Erice, Laboratory Medicine and Pathology, FM
William B. Gleason, Laboratory Medicine and Pathology, FM
Betsy A. Hirsch, Laboratory Medicine and Pathology, FM
Kristin A. Hogquist, Laboratory Medicine and Pathology, FM
Stephen C. Jameson, Laboratory Medicine and Pathology, FM
Ronald R. W. Jemmerson, FM
Vivek Kapur, Veterinary Pathobiology, FM
Daniel L. Mueller, Medicine, FM
Christopher A. Pennell, Laboratory Medicine and Pathology, FM
Leslie A. Schiff, FM
Amy P. Skubitz, Laboratory Medicine and Pathology, FM
Peter Southern, FM
Carston R. Wagner, Medicinal Chemistry and Pharmacognosy, FM

Assistant Professor

Sandra K. Armstrong, FM
Paul Bohjanen, FM
Michael A. Farrar, Laboratory Medicine and Pathology, FM
Linda K. Hansen, Laboratory Medicine and Pathology, FM
Alexander Khoruts, FM
Carol A. Lange, Medicine, FM
David A. Largaespada, Laboratory Medicine and Pathology, FM
Christian D. Mohr, FM
Yun Qiu, Laboratory Medicine and Pathology, FM
Robert Sheaff, Biochemistry, FM
Wufan Tao, Medicine, FM
Johannes van der Loo, Medicine, FM
Bruce K. Walcheck, Veterinary Pathobiology, FM
Jennifer J. Westendorf, Orthopedic Surgery, FM

Lecturer

Agustin P. Dalmasso, Medicine, FM

Research Associate

Rod M. Feddersen, Laboratory Medicine and Pathology, AM
Brett K. Levay-Young, Surgery, FM
Stephen Rice, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Students prepare for careers in biomedical research and teaching by completing broad training in molecular biology or biological sciences, and focused specialization in one of three concentrations (microbiology, immunology, or cancer biology). The program offers exceptional research opportunities for graduate training in autoimmunity, biotechnology, cancer biology, environmental microbiology, genetic engineering of microorganisms, lymphocyte activation and development, microbial pathogenesis, molecular genetics of disease, superantigens, and vascular biology and inflammation.

Prerequisites for Admission—College coursework, including a year of general chemistry; organic chemistry; physics; calculus; and one academic year or the equivalent of courses in the biological sciences supplemented by courses in biochemistry and genetics. A course in microbiology, immunology, or histology is highly recommended but not required.

Special Application Requirements—The following must be submitted to the program: three letters of recommendation; scores from the General (Aptitude) Test of the GRE; a copy of your transcripts; a copy of the Graduate School application; and a brief description of reasons for seeking an advanced degree, areas of research interest and reasons for these interests, and career objectives. A minimum TOEFL score of 600 is required of applicants whose native language is not English. Applicants are encouraged to apply for fall semester admission only because the core curriculum begins in fall. Applications should be submitted by December 15; those received after that date are considered only if space in the desired program is available.

Use of 4xxx Courses—Use of 4xxx courses on degree program forms is permitted based on director of graduate study approval.

Courses—Please refer to Microbiology, Immunology, and Cancer Biology (MICa) in the course section of this catalog for courses pertaining to the program.

M.S. Plan A Degree Requirements

Students are not admitted directly into the master's program; it is available only by special arrangement with the program. Students complete 14 MICa course credits, 6 credits in the minor or related field, and 10 thesis credits. Students must write and defend a thesis based on original research.

Language Requirements—None.

Final Exam—The final exam is oral.

Ph.D. Degree Requirements

The Ph.D. requires a minimum of 22 course credits in the major, 12 course credits in a minor or supporting program, and 24 thesis credits.

Beginning study in the fall, students spend their first year on major coursework, identifying an adviser by doing laboratory rotations, selecting a concentration, and initiating their thesis research project. All students take courses on the structure, function, and metabolism of microorganisms; molecular immunology; and cancer biology, as well as in their chosen concentration during their first two years.

In addition to coursework and research, students have opportunities to participate in laboratory meetings, journal clubs, and student research seminars, and to assist in laboratory courses. Most students complete the Ph.D. in four to five years.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor requires MICa 8001 (3 credits), MICa 8910 (1 credit), and other 8xxx MICa courses at 3 or 4 credits, totaling a minimum of 12 credits.

Molecular, Cellular, Developmental Biology and Genetics

Contact Information—Director of Graduate Studies, Molecular, Cellular, Developmental Biology and Genetics, University of Minnesota, 250 Biological Sciences Center, 1445 Gortner Avenue, St. Paul, MN 55108-1095 (612-624-7470; fax 612-625-5754; e-mail mcdbg@cbs.umn.edu; <http://cbs.umn.edu/mcdbg/>).

Inquiries about graduate program activities, courses, and research opportunities should be directed to the director of graduate studies at the same address and phone number.

Regents' Professor

Ronald L. Phillips, Agronomy and Plant Genetics, FM

Professor

Dwight L. Anderson, Oral Sciences, FM
Timothy W. Behrens, Medicine, FM
Judith G. Berman, FM
Susan A. Berry, Pediatrics, FM
Robert M. Brambl, Plant Biology, FM
Robert J. Brooker, FM
Bianca M. Conti-Fine, Biochemistry, Molecular Biology, and Biophysics, FM
Robert P. Elde, Neuroscience, FM
Leo T. Furcht, Laboratory Medicine and Pathology, FM
Stuart F. Goldstein, FM
Dale S. Gregerson, Opthalmology, FM
Perry B. Hackett, FM
David W. Hamilton, FM
Robert K. Herman, FM
Mark C. Herzberg, Preventive Sciences, FM
Ross G. Johnson, FM
Richard A. King, Medicine, FM
Ryoko Kuriyama, FM
Paul A. Lefebvre, FM
Paul C. Letourneau, Neuroscience, FM
Richard W. Linck, FM
Dennis M. Livingston, Biochemistry, Molecular Biology, and Biophysics, FM
Paul T. Magee, FM
Cary N. Mariash, Medicine, FM
James B. McCarthy, Laboratory Medicine and Pathology, FM
R. Scott McIvor, FM
Steven C. McLoon, Neuroscience, FM
Matthew F. Mescher, Laboratory Medicine and Pathology, FM
Michael B. O'Connor, FM
Neil E. Olszewski, Plant Biology, FM
Harry T. Orr, Laboratory Medicine and Pathology, FM
Janet L. Schottel, Biochemistry, Molecular Biology, and Biophysics, FM
Yoji Shimizu, Laboratory Medicine and Pathology, FM

Carolyn D. Silflow, FM
Michael J. Simmons, FM
D. Peter Snustad, FM
Robert L. Sorenson, FM
Clifford J. Steer, Medicine, FM
Howard C. Towle, Biochemistry, Molecular Biology, and Biophysics, FM
Brian G. Van Ness, FM
Patricia R.M. Veach, Educational Psychology, E
Catherine M. Verfaillie, Medicine, FM
Chester B. Whitley, Pediatrics, FM
Susan M. Wick, Plant Biology, FM

Associate Professor

Vivian J. Bardwell, FM
Kathleen F. Conklin, FM
Stephen C. Ekker, FM
J. Stephen Gantt, Plant Biology, FM
Thomas S. Hays, FM
Betsy A. Hirsch, Laboratory Medicine and Pathology, AM
Kristin A. Hogquist, Laboratory Medicine and Pathology, FM
Victoria Iwanij, FM
Stephen C. Jameson, Laboratory Medicine and Pathology, FM
M. David Marks, Plant Biology, FM
Charles Peters, Pediatrics, E
Mary E. M. Pierpont, Pediatrics, FM
Mary E. Porter, FM
Laura P. W. Ranum, FM
Ann E. Rougvie, FM
Joceyln E. Shaw, FM
Jeffrey A. Simon, FM
Amy P. Skubitz, Laboratory Medicine and Pathology, FM
Margaret A. Titus, FM
David A. Zarkower, FM

Assistant Professor

Linda M. Boland, Physiology, FM
Linda H. Burns, Obstetrics and Gynecology, E
Electra C. Coucouvanis, FM
David T. Kirkpatrick, FM
Lakshmanan Krishnamurti, Pediatrics, E
David A. Largaespada, FM
Brett K. Levay-Young, Surgery, AM
Nancy J. Mendelsohn, Pediatrics, E
Jeffrey R. Miller, FM
Thomas P. Neufeld, FM
Sue V. Petzel, Obstetrics and Gynecology, E
Yun Qiu, Laboratory Medicine and Pathology, FM
Kenneth P. Roberts, Urologic Surgery, FM
William Shawlot, FM

Other

Mary J. Ahrens, E
Shari R. Baldinger, E
Vicki L. Couch, E
Maryann V. Fox, E
Judy Garza, E
Joy Gustin, E
Bonnie A. Hatten, E
Beth A. Henderson-Conrad, E
Bonnie S. LeRoy, AM
Carol J. Ludowese, E
Vickie L. Matthias Hagan, E
Nancy J. Mendelsohn, E
Katherine A. Nelson, E
Karol R. Rubin, E
Alysia B. Spear, E
Catherine M. Walsh Vockley, E

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—This program provides scientific training in the basic life sciences, with emphasis on the molecular basis of genetics, development, and cell biology. Areas of specialization include membranes, receptors, and membrane transport; cell interactions; macromolecular structure; extracellular matrix; cytoskeleton and cell motility; regulation of gene expression; neuroscience; developmental mechanisms; human genetics; plant cell and molecular biology; genetic mechanisms; and genomics.

The program is interdisciplinary and involves faculty from several departments in the College of Biological Sciences, the Medical School, the College of Agricultural, Food, and Environmental Sciences, the School of Dentistry, the College of Veterinary Medicine, and the School of Public Health. Special institutes in human genetics, plant molecular genetics, and biological process technology provide opportunities for graduate study, as does a specialty in genetic counseling.

Prerequisites for Admission—The program is sufficiently flexible to accommodate students with a wide range of backgrounds. Students with bachelor's degrees in any of the biological, chemical, or physical sciences are encouraged to apply. Recommended academic preparation includes one year each of calculus, organic chemistry, and physics, and background in basic biology including biochemistry and genetics. Research experience is highly desirable. For students of demonstrated ability, background deficiencies can be made up during the first year of graduate study. Exceptional international applicants with TOEFL scores of 650 or better will be considered.

Special Application Requirements—Applicants are required to submit three letters of recommendation from persons familiar with their academic and research capabilities; scores from the General (Aptitude) Test of the GRE; and a statement of interests, goals, and research experience. The Subject (Advanced) Test (in biology; chemistry; or biochemistry, cell and molecular biology) of the GRE is not required but highly recommended. Recommended date for receipt of completed applications is January 15. Graduate studies typically begin in summer session or fall term.

Use of 4xxx Courses—Use of 4xxx courses is not permitted toward degree requirements.

Courses—Please refer to Molecular, Cellular, Developmental Biology and Genetics (MCDG) and Genetics, Cell Biology, and Development (GCD) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements

Students are admitted to the M.S. program only under exceptional circumstances (e.g., if they can be in the area for only two years) or if they are accepted into the genetic counseling specialization; in both cases, applicants must also be competitive for admission at the Ph.D. level.

The M.S. is offered under Plan A and Plan B. Plan A requires a minimum of 20 course credits and 10 thesis credits; Plan B requires a minimum of 30 course credits and the completion of Plan B papers. Students take a core curriculum, which is multidisciplinary and contributes to both the major and minor or related field requirements. Students may choose a concentration or specialization within the program such as cell biology, developmental biology, genetics, or human genetics. The M.S. on average takes two years to complete.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master's minor requires 6 credits.

Ph.D. Degree Requirements

The Ph.D. program is designed by the student and the adviser to meet individual interests and goals. Advanced courses in genetics, molecular biology, cell biology, developmental biology, and biochemistry are required, in addition to special courses, topical seminar courses, laboratory research rotations, thesis research, student research seminars, departmental seminars, and journal clubs.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor typically includes the genetics core (GCD 8131 and 8121 or 4034), cell biology (GCD 8151 or 5036), and developmental biology (GCD 8161, 4151 or 4161), as appropriate to the student's field of specialization.

Molecular Veterinary Biosciences

Contact Information—See Veterinary Medicine.

Professor

Trevor R. Ames, Clinical and Population Sciences, FM
Alvin J. Beitz, Veterinary Pathobiology, FM
Russell F. Bey, Veterinary Pathobiology, FM
David R. Brown, Veterinary Pathobiology, FM
James E. Collins, Veterinary Diagnostic Medicine, FM
Agustin P. Dalmasso, Medicine, FM
Mohamed Elhalawani, Animal Science, FM
Douglas N. Foster, Animal Science, FM
Esther M. Gallant, Veterinary Pathobiology, FM
Sagar Goyal, Veterinary Diagnostic Medicine, FM
Mathur S. Kannan, Veterinary Pathobiology, FM
Alice A. Larson, Veterinary Pathobiology, FM
Samuel K. Maheswaran, Veterinary Pathobiology, FM
Thomas W. Molitor, Clinical and Population Sciences, FM
Michael P. Murtaugh, Veterinary Pathobiology, FM
Scott M. O'Grady, Animal Science, FM
John W. Osborn, Animal Science, FM
F. Abel Ponce de Leon, Animal Science, FM
Douglas J. Weiss, Veterinary Pathobiology, FM

Associate Professor

Mitchell S. Abrahamsen, Veterinary Pathobiology, FM
Cathy Sue Carlson, Veterinary Diagnostic Medicine, FM
Vivek Kapur, Veterinary Pathobiology, FM

James R. Mickelson, Veterinary Pathobiology, FM
Michael Gerard O'Sullivan, Veterinary Pathobiology, FM
Mark S. Rutherford, Veterinary Pathobiology, FM
Stephanie J. Valberg, Clinical and Population Sciences, FM

Assistant Professor
Leeson J. Alexander, Veterinary Pathobiology, FM
Fredrik Aslund, Veterinary Pathobiology, FM
John Collister, Veterinary Pathobiology, FM
Yang Da, Animal Science, FM
Kay S. Faaberg, Veterinary Pathobiology, FM
Laura J. Mauro, Animal Science, FM
Moses Njenga, Veterinary Pathobiology, FM
Albert Paszek, Veterinary Pathobiology, AM
Kent Reed, Veterinary Pathobiology, FM
Anthony Tobias, Small Animal Clinical Science, FM
Bruce K. Walcheck, Veterinary Pathobiology, FM

Lecturer
Frank G. Williams, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The mission of the graduate program in molecular veterinary biosciences is to educate students in basic biological mechanisms associated with or responsible for animal health and disease. This mission makes it unique among other biomedical science graduate programs at the University. Faculty research interests focus on molecular mechanisms of pathogenesis, including areas of immunobiology, microbiology, parasitology, virology, and pathology, and on comparative biomedical sciences, including areas of cellular and molecular biology, biochemistry, genetics, neuroscience, physiology, and pharmacology.

The program brings together basic and clinical scientists to provide students with biomedical research training and to apply new knowledge toward the understanding of animal disease, animal populations, comparative aspects of biology and pathology across species, and animal models of human disease. This program thus facilitates the application of basic knowledge toward the improvement of animal health and productivity, disease prevention, and diagnostic techniques.

Prerequisites for Admission—A bachelor's degree in biological sciences is required.

Use of 4xxx Courses—Use of 4xxx courses is not permitted toward degree requirements.

Courses—Please refer to Molecular Veterinary Biosciences (MVB) in the course section of this catalog for courses pertaining to the program.

M.S. Plan A Degree Requirements

The M.S. requires a core curriculum of fundamental coursework and laboratory experiences followed by one or more courses (6 credits) in the area of specialization. Students complete 20 course credits and 10 thesis credits; the thesis is based on original laboratory research.

Language Requirements—None.

Final Exam—The final exam is oral.

Ph.D. Degree Requirements

The Ph.D. requires a core curriculum of fundamental coursework and laboratory experiences followed by one or more courses in areas of special interest. Considerable flexibility is available for students to construct a program around their own interests. Students also take 12 credits in a minor or supporting program and 24 thesis credits. All students are expected to participate in two continuing series of seminars: one involving reports on current literature and research and the other involving seminars by prominent national and international scientists.

Language Requirements—None.

Museum Studies

Contact Information—Museum Studies Graduate Minor; 300 Bell Museum, 10 Church Street S.E, University of Minnesota, Minneapolis, MN 55455 (612-624-6380; fax 612-626-7704).

Regent's Professor
Joanne B. Eicher, E

Professor
Kerry J. Freedman, E
Robert J. Poor, E
Peter S. Wells, E
Gayle Graham Yates, E

Associate Professor
Margaret K. DiBlasio, E

Assistant Professor
David J. Rhees, E

Lecturer
Anita F. Cholewa, E

Other
Robert D. Jacobsen, E
Lyndel I. King, E
Patricia J. McDonnell, E
Gordon R. Murdock, E
Colleen J. Sheehy, E

Curriculum—The museum studies minor offers a structured graduate curriculum for master's (M.A. and M.S.) and doctoral students interested in museums. It provides students from a variety of disciplines with an introduction to the issues involved in museum practices (e.g., educational, curatorial, administrative, and conservation). The curriculum includes seminars and internships

Prerequisites for Admission—Admission to the museum studies graduate minor is contingent upon prior admission to a master's or doctoral degree-granting program within the Graduate School. It is anticipated that no more than 15 students will be admitted to this minor each year.

Use of 4xxx Courses—Use of 4xxx courses towards degree requirements is permitted based on director of graduate studies approval.

Courses—Please refer to Museum Studies (MSt) in the course section of this catalog for courses pertaining to the program.

Freestanding Minor Requirements

The master's and doctoral minors require an introductory seminar (MSt 5011; 3 credits) and the museum practices course (MSt 5012; 3 credits). An internship (MSt 5020) is also required, 1 credit for the master's minor, 6 credits for the doctoral minor.

Music

Contact Information—School of Music, University of Minnesota, 100B Ferguson Hall, 2106 4th Street S., Minneapolis, MN 55455 (612-624-0071; fax 612-626-2200; e-mail mus-adm@umn.edu).

Professor
John E. Anderson, FM
Lydia Artymiw, FM
Thomas J. Ashworth, FM
David B. Baldwin, FM
Alexander Braginsky, FM
Michael Cherlin, FM
Margo Garrett, FM
David A. Grayson, FM
Paul A. Haack, FM
Donna G. Cardamone Jackson, FM
Craig J. Kirchhoff, FM
Korey B. Konkol, FM
Thomas S. Lancaster, FM
Alex J. Lubet, FM
Glenda Maurice, FM
Ronald C. McCurdy, AM
Sally O'Reilly, FM
Tanya Remenikova, FM
Rebecca P. Shockley, FM
Everett L. Sutton, FM
D. Clifton Ware, Jr., FM
Lawrence Weller, FM
Judith L. Zaimont, FM

Associate Professor
Dean W. Billmeyer, FM
Mark P. Bjork, FM
David A. Damschroder, FM
Jean Del Santo, FM
Charles E. Furman, FM
Young Nam Kim, FM
Fernando A. Meza, FM
Jerry Luckhardt, FM
Karl Paulnack, AM
Paul M. A. Shaw, FM

Assistant Professor
Kelley A Harness, AM
Edward D. Latham, AM
Mirjana Lausevic, AM
Akira Mori, FM
Kathy S. Romey, AM
Keith Underwood, AM

Instructor
David W. Eagle, E
Elaine K. Eagle, E
Rosalind L. Laskin, E
John W. Miller, Jr., E
Dean Sorenson, E
Ross Tolbert, E

Lecturer
Kendall A. Betts, E
James L. Clute, E
Charles D. Kavalovski, E
Peter M. Lloyd, E
James P. McGuire, E
Basil Reeve, E

Charles Ullery, E
Jeffrey W. Van, E
Herbert E. Winslow, E

Other

Julia Bogorad, E
Gary A. Bordner, E
Christopher Brown, E
Jorja Fleezanis, E
Kathryn Greenbank, E
Barbara G. Kierig, E
Adam Kuenzel, E
Timothy Paradise, E

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The School of Music offers a master of arts (M.A.) in music, an M.A. in music education, a master of music (M.M.), a doctor of musical arts (D.M.A.), and a doctor of philosophy (Ph.D.) degree. Specific degree plans and emphases are listed in each degree's requirements below.

Prerequisites for Admission—Applicants must hold a bachelor's degree or its equivalent with a major emphasis in one of the following areas of music: musicology and/or ethnomusicology, theory and/or composition, performance, or music education and/or music therapy.

Special Application Requirements—Applicants must submit three letters of recommendation and GRE General Test scores. Applicants whose primary language is not English must score a minimum of 500 on the TOEFL test for admission and 550 for exemption from further English study (ESL).

The various degree programs also require the following additional application materials:

Degree Objective	*Additional Materials*
Theory (M.A., Ph.D.)	Original papers (tonal and post-tonal analysis)
Composition (M.A., Ph.D)	Original scores
Musicology/ Ethnomusicology (M.A., Ph.D.)	Original paper(s)
Music Education/ Music Therapy (M.A.)	None
Music Education/ Music Therapy (Ph.D.)	Original paper(s)
Accompanying/Coaching (M.M., D.M.A.)	Audition/ Repertoire list
Choral Conducting (M.M.)	Audition/Interview
Church Music (M.M.)	Audition/Interview
Orchestral Conducting (M.M., D.M.A.)	Audition/Interview
Wind Ensemble/ Band Conducting (M.M.)	Audition/Interview
Piano Pedagogy (M.M.)	Audition/Interview
Performance (M.M., D.M.A.)	Audition/ Repertoire list

For the M.M. and D.M.A. programs in performance, applicants living more than 200 miles from Minneapolis may submit a tape in lieu of a live audition. In the case of admission based on a taped recording, the appropriate level of study, including the possibility of remedial work, is determined by a live audition before registration. For the M.M. and D.M.A. in accompanying and coaching, a preliminary (audio) tape screening is required. For the M.M. and D.M.A. in orchestral conducting and the M.M. in wind ensemble/band conducting, a preliminary tape screening is required in both audio and video formats.

Although students may be admitted any semester, opportunities for financial assistance are maximized by applying before January 15 for fall admission. Applicants to the musicology/ethnomusicology, theory, and composition emphases maximize their chances for admission by completing their applications before March 1 for fall admission.

Diagnostic Tests—Music Theory and Music History Placement Tests are administered to all entering students. All graduate students in music must demonstrate proficiency in the material found in the undergraduate music theory and ear training sequences, including the form and structure of tonal music and twentieth-century music theory and ear training. Similarly, they must demonstrate proficiency in music history from the Middle Ages to the present. Students in musicology and ethnomusicology degree programs must take an additional discipline-specific diagnostic examination at the onset of their study; during the first year, a piano proficiency test is administered for the musicology specialization and a transcription test for ethnomusicology. An audition is required for registration in all applied music courses.

Use of 4xxx Courses—Use of 4xxx courses toward degree requirements is subject to adviser and/or director of graduate studies approval.

Courses—Please refer to Music (Mus), Music Applied (MusA), and Music Education (MuEd) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements

The master of arts in music offers emphases in musicology and ethnomusicology (Plan A and Plan B), theory (Plan B only), and composition (Plan B only).

The M.A. in music with emphasis in musicology and ethnomusicology requires 34 credits (24 course credits and 10 thesis credits) for Plan A and 30 course credits for Plan B; the emphasis in composition requires 41 course credits (Plan B only), and the emphasis in music theory requires 30 course credits (Plan B only). The credit totals for all emphases include 6 credits required for courses outside the major field.

Language Requirements—A reading knowledge of French, German, or Italian is required for all degree emphases.

Final Exam—For the emphasis in musicology and ethnomusicology, the final exams are written and oral. For the emphases in theory and composition, the final exam is oral.

M.M. Plan B Degree Requirements

The master of music degree (Plan B only) offers emphases in piano, harpsichord, organ, voice, violin, viola, cello, double bass, flute, oboe, clarinet, saxophone, bassoon, French horn, trumpet, trombone, euphonium, tuba, percussion, harp, guitar, piano pedagogy, accompanying and coaching, orchestral conducting, wind ensemble and band conducting, choral conducting, and church music (choral and organ concentrations).

The M.M. Plan B requires credit distribution among the following for each emphasis: applied music, study directly related to the emphasis (literature, pedagogy, performance practice, conducting, secondary instrument, chamber music, etc.), ensemble, and Mus 5xxx or 8xxx musicology/ethnomusicology and theory/composition, with a minimum of one 3-credit course in each area. At least one recital is required.

The minimum credit requirement for each emphasis is as follows: 30 credits are required for piano, instrumental performance, harp, guitar, piano pedagogy, orchestral conducting, wind ensemble and band conducting, and church music (choral concentration); 32 credits for choral conducting; 33 credits for organ and voice; 40 credits for church music (organ concentration); and 41 credits for accompanying and coaching (two recitals are required).

Language Requirements—None.

Final Exam—A final oral exam is required that covers coursework and the final project and/or recital.

D.M.A. Degree Requirements

For the doctor of musical arts (D.M.A.), emphases and minimum credit requirements are as follows: 85 credits for piano, instrumental performance, guitar, and conducting; 87 credits for organ and woodwinds; 89 credits for voice; and 93 credits for accompanying and coaching.

Beginning spring semester 2001, the School of Music will offer two ways of fulfilling D.M.A. degrees.

The first option for the D.M.A. requires a minimum of 85 credits: 32 credits of applied study; 12 credits in musicology/ ethnomusicology and theory/composition, with at least one 3-credit course in each area; a minimum of 8 credits directly related to the emphasis (literature, pedagogy, performance practice, conducting, secondary instrument, chamber music, etc.); 9 credits in a supporting program outside of music; 20 recital credits for five recitals; and 4 thesis credits for the D.M.A. project document.

The second options allows students to choose a secondary area of concentration to become professionally prepared in an area that complements the performance major. The secondary area option requires the approval of the student's adviser and of the director of graduate studies, and is limited to secondary areas approved by the Graduate Committee of the School of Music. Under this option, students perform three doctoral recitals instead of five (12 credits total, at 4 credits each). The remaining requirements are the same as in the first option for a D.M.A. Students must also fulfill the requirements for a secondary area as described below.

Criteria for Secondary Areas

A secondary area comprises a minimum of 15 credits in total—normally five 3-credit courses, at least two of which must be 8xxx courses. Students choosing this option apply the 8 credits that result from reducing the number of doctoral recitals from five to three toward the secondary area. The remaining credits are derived principally from the other areas of music study already built into the D.M.A.—the areas of musicology, theory, pedagogy, etc. The distribution of these credits depends upon the specific secondary area chosen.

A secondary area concentrates either on a single discipline—e.g., musicology, music theory, or composition—or on an interrelated body of courses—e.g., technology and music, or pedagogy. All 15 credits of a secondary area must be achieved at the University of Minnesota School of Music (i.e. no transfer credits or credits from outside of the School of Music can be used). Students who choose a secondary area are encouraged but not obligated to write their thesis in that area. A list of secondary areas and their course requirements is available upon request from the Graduate Studies Office of the School of Music.

Language Requirements—The D.M.A. with emphasis in accompanying and coaching requires two languages chosen from French, German, and Italian; the emphasis in conducting requires German and either French or Italian.

Ph.D. Degree Requirements

For the doctor of philosophy in music, emphases and minimum course credit requirements are as follows: 51 credits for musicology, ethnomusicology, and theory; 62 credits for composition; and 66 credits for music education. Programs are individualized and build on the core of coursework required for the corresponding master's degrees. Coursework includes 12-18 credits outside the major. In addition, 24 thesis credits are required.

Language Requirements—The language requirement for each emphasis is as follows:

Musicology, ethnomusicology, and composition—Two languages chosen from French, German, and Italian (substitution may be made when a different language is needed for the thesis. For composition, one language may also, with approval, be replaced by a collateral field of knowledge or a special research technique).

Theory—German and either French or Italian (substitution may be made when a different language is needed for the thesis; with approval, the second language may also be replaced by a collateral field of knowledge or a special research technique).

Music education—None.

Music Education

Contact Information—See Music.

Professor

Paul A. Haack, AM
Jeffrey Kimpton, AM

Associate Professor

Charles E. Furman, AM

Assistant Professor

Akosua Addo, AM
David J. Teachout, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The M.A. in music education offers two emphases: music education and music therapy. The music education emphasis involves planning, teaching, learning, and evaluating processes with musical content applied to formal schooling, kindergarten through college. While knowledge of acculturation phenomena is included, applications generally are directed toward formal educational settings. The music therapy emphasis furthers the preparation of professionals who use music to accomplish therapeutic aims. The two emphases are highly compatible and mutually enhancing. The M.A. is a research-oriented degree with coursework fairly evenly divided between scholarly skill development, musical knowledge and skills, theoretical music education content, and applications.

Prerequisites for Admission—See Music.

Special Application Requirements—See Music.

Use of 4xxx Courses—Use of 4xxx courses towards degree requirements is subject to adviser and/or director of graduate studies approval.

Courses—Please refer to Music (Mus), Music Applied (MusA), and Music Education (MuEd) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements

The M.A. requires 30 course credits: 12 credits in music education for the major; 8 credits in music; 5 credits of electives from professional education, music, and music education; and a 5-credit research project (Plan B).

Language Requirements—None.

Final Exam—The final exam is oral.

Neuroscience

Contact Information—Neuroscience Program, University of Minnesota, D-610 Mayo Building, MMC 265, 420 Delaware St. S.E., Minneapolis, MN 55455 (612-626-5898; fax 612-626-6460; e-mail: neurosci@umn.edu; <www.neuroscience.umn.edu>).

Professor

Karen Hsiao Ashe, Neurology, FM
Alvin J. Beitz, Veterinary Pathobiology, FM
David R. Brown, Veterinary Pathobiology, FM
Dwight A. Burkhardt, Psychology, FM
Marilyn E. Carroll, Psychiatry, FM
H. Brent Clark, Laboratory Medicine and Pathology, FM
Bianca M. Conti-Fine, Biochemistry, FM
Timothy J. Ebner, FM
S. Mbua Ngale Efange, Radiology, FM
Robert P. Elde, FM
Esam E. El-Fakahany, Psychiatry, FM
William C. Engeland, Surgery, FM
Martha Flanders, FM
William H. Frey, Pharmacy, FM
Apostolos P. Georgopoulos, FM
Glenn J. Giesler, Jr., FM
Boyd K. Hartman, Psychiatry, FM
William G. Iacono, Psychology, FM
Costantino Iadecola, Neurology, FM
Paul A. Iaizzo, Anesthesiology, FM
William R. Kennedy, Neurology, FM
Daniel J. Kersten, Psychology, FM
Seong-gi Kim, Radiology, AM
James F. Koerner, Biochemistry, FM
Alice A. Larson, Veterinary Pathobiology, FM
Ping-Yee Law, Pharmacology, FM
Gordon E. Legge, Psychology, FM
Paul C. Letourneau, FM
Allen S. Levine, Surgery, FM
Walter C. Low, Neurosurgery, FM
Patrick W. Mantyh, Preventive Sciences, FM
Steven C. McLoon, FM
Karen A. Mesce, Entomology, FM
Robert F. Miller, FM
Charles A. Nelson, Child Development, FM
Eric A. Newman, FM
Harry T. Orr, Laboratory Medicine and Pathology, FM
John W. Osborn, Animal Science, FM
J. Bruce Overmier, Psychology, FM
Richard E. Poppele, FM
Richard L. Purple, Physiology, FM
M. Elizabeth Ross, Neurology, FM
David A. Rottenberg, Neurology, FM
Peter A. Santi, Otolaryngology, FM
Ronald J. Sawchuk, Pharmaceutics, FM
Virginia S. Seybold, FM
John F. Soechting, FM
Peter W. Sorensen, Fisheries and Wildlife, FM
Sheldon B. Sparber, Pharmacology, FM
Stanley A. Thayer, Pharmacology, FM
David D. Thomas, Biochemistry, FM
Kamil Ugurbil, Radiology, FM
Govind T Vatassery, Psychiatry, FM
Neal F. Viemeister, Psychology, FM
George L. Wilcox, Pharmacology, FM

Associate Professor

John H. Anderson, Otolaryngology, FM
James Ashe, Neurology, FM
W. Dale Branton, AM
John W. Day, Neurology, FM
Janet M. Dubinsky, FM
Patricia L. Faris, Psychiatry, FM
S. Hossein Fatemi, Psychiatry, FM
Jurgen F. Fohlmeister, Physiology, FM
Christopher M. Gomez, Neurology, FM

Christopher N. Honda, FM
Eric Javel, Otolaryngology, FM
Juergen Konczak, Kinesiology and Leisure Studies, FM
Linda K. McLoon, Ophthalmology, FM
Jose V. Pardo, Psychiatry, FM
Laura P. W. Ranum, Molecular, Cellular, Developmental Biology, and Genetics, FM
John J. Sidtis, Neurology, FM
Donald A. Simone, Psychiatry, FM
Richard L. Sutton, Neurosurgery, AM
Martin W. Wessendorf, FM

Assistant Professor

Bagrat Amirikian, AM
Vincent A. Barnett, Physiology, FM
Linda M. Boland, Physiology, FM
Frank H. Burton, Pharmacology, FM
Jian M. Ding, Medicine, FM
Janet L Fitzakerley, Pharmacology UMD, FM
Jonathan Gewirtz, Psychology, FM
Sheng He, Psychology, FM
Paulo Kofuji, FM
Scott M. Lewis, Neurology, AM
Paul G. Mermelstein, FM
Giuseppe Pellizzer, AM
A. David Redish, FM
Kevin D. Wickman, Pharmacology, FM

Research Associate

Rod M. Feddersen, Veterinary Pathobiology, AM
Jon Gottesman, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Neuroscience is an interdisciplinary field of inquiry. The objects of this inquiry, the brain and nervous system, are sufficiently complex and unique among biological systems to require experimental and analytical approaches that cross the traditional boundaries of molecular and cell biology, behavioral biology, biochemistry, genetics, pharmacology, physiology, and psychology. In some instances, neuroscientific inquiry may also encompass computer science, information processing, engineering, physics, and mathematics.

The neuroscience Ph.D. curriculum begins in the summer session with the intensive laboratory course in cellular and molecular neurobiology (NSc 5551), held at the Lake Itasca Biological Station. The core curriculum continues on the Twin Cities campus with NSc 5461, 5481, 5561, 5661, and 8211. While taking these courses, students explore research opportunities in the faculty's laboratories (NSc 8334) and thereby select a thesis adviser. Most students take a course in cell biology (such as Biol 4004) in the first semester. Because thesis research is expected to include statistical analysis of data, a course in statistics (such as Stat 5021) is required.

Elective courses and at least 12 credits in a minor or supporting program are selected in consultation with the adviser (typical minors include cell biology, physiology, statistics, psychology, and medicine; medicine is primarily for students in the M.D./Ph.D. program). Students with sufficient background and previous course experience may apply for a waiver of specific requirements. Proficiency in at least one computer programming language is highly recommended.

Students are also expected to participate in teaching neuroscience and to attend the weekly colloquium as well as neuroscience seminars and sessions devoted to professional development. Students are strongly encouraged to attend seminars in other areas and departments that may interest them.

Prerequisites for Admission—Applicants to the Ph.D. program must have a bachelor's degree or its foreign equivalent from a recognized college or university. Undergraduate coursework should include instruction in several of the following disciplines: biology, neuroscience, mathematics, physics, chemistry, and psychology.

Special Application Requirements—Applicants are required to take the GRE General Test. The Subject Test appropriate to their field of emphasis is optional. Foreign students must take the TOEFL and obtain a minimum score of 550.

Use of 4xxx Courses—Use of 4xxx courses toward degree requirements is permitted based on director of graduate studies approval.

Courses—Please refer to Neuroscience (NSc) in the course section of this catalog for courses pertaining to the program.

M.S. Plan A Degree Requirements

The course requirements for a master's are the same as those for a Ph.D. degree. They are described under Curriculum (above).

Ph.D. Degree Requirements

The course requirements for a Ph.D. degree are described under Curriculum above. More detailed information may be found in the *Neuroscience Student Handbook* <www.neuroscience.umn.edu/CurStu/studHand.html>.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor program is developed in consultation with the director of graduate studies for neuroscience. Students must take one of NSc 5461, 5561, or 6111 and elective courses in neuroscience, for a minimum of 12 credits (including core courses).

Nursing

Contact Information—Jennifer Rosand, Recruiter, School of Nursing, University of Minnesota, 5-160 Weaver Densford Hall, 308 Harvard Street S.E., Minneapolis, MN 55455 (612-624-4454; fax 612-624-3174; e-mail nursing.grad@umn.edu; <www.nursing.umn.edu/>).

Professor

Linda H. Bearinger, FM
Sandra R. Edwardson, FM
Barbara J. Leonard, FM
Mariah Snyder, FM
Jean Wyman, FM

Associate Professor

Donna Bliss, FM
Derryl E. Block, AM
Joanne Disch, E
Laura J. Duckett, FM
Ann Garwick, FM
Cynthia R. Gross, Pharmacy Practice, FM
Helen Hansen, FM
Susan Henly, FM
Felicia Hodge, AM
LaVohn Josten, AM
Merrie J. Kaas, FM
Kathleen Krichbaum, FM
Marsha Lewis, FM
Betty Lia-Hoagberg, FM
Linda L. Lindeke, FM
Ruth D. Lindquist, FM
Marilee A Miller, E
Christine Mueller, AM
Carol Pederson, FM
Janice Post-White, FM

Assistant Professor

Melissa D. Avery, FM
Diane K. Bohn, AM
Donna J. Brauer, FM
Linda Chlan, AM
Karen S. Feldt, FM
Linda Gerdner, AM
Janis Gerkensmeyer, AM
Linda Halcon, AM
Madeline J. Kerr, FM
Elizabeth Kraatz, AM
Mary Jo Kreitzer, E
Margaret Moss, AM
Cynthia Peden-McAlpine, FM
Cheryl Robertson, AM
Elizabeth Saewyc, AM
Renee Sieving, E
Roxane Struthers, AM
Barbara Vellenga, AM

Adjunct Assistant Professor

Kathleen A. Fagerlund, E
Jane Giedt, AM

Other

Karen Alaniz, E
Catherine Juve, AM
Carol O'Boyle, AM
Jennifer Peters, E
Sharon Ridgeway, E
Mary Rowan, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Emphases in the M.S. program include nurse education, nurse administration, advanced clinical practice in psychiatric mental health nursing, child and family nursing, adult health nursing, gerontology nursing, oncology nursing, nursing for children with special health needs, and public health nursing; or practitioner preparation as a nurse midwife, pediatric nurse practitioner, gerontological nurse practitioner, women's healthcare nurse practitioner, and family nurse practitioner. The Ph.D. program prepares creative and productive scholars in nursing. Students can gain a depth of knowledge and experience in one or more of these areas: the development and modification of health-related behaviors; human responses to environmental and life process events disruptive to health; phenomenon of health organization and

system of delivery of nursing knowledge; and organization and system of delivery of nursing care. An individualized program and independent research are planned by the student and advisor.

Prerequisites for Admission—In the M.S. program, a bachelor's degree with a major in nursing or evidence of ability in health promotion, community health nursing, leadership/management, teaching/counseling, and systematic investigation, as well as licensure as a registered nurse, are required. For the Ph.D. program, a master's degree with a strong background in the physical and/or behavioral sciences or a bachelor's degree with an exceptionally strong background are required.

Special Application Requirements—For the M.S. degree, three letters of reference and a goal statement are required. GRE General Test scores are required for applicants with narrative transcripts from previous college work; the scores are recommended for students competing for a Graduate School Fellowship. For the Ph.D. degree, GRE General scores, two letters of reference, and a statement of goals, objectives, and research interest are required. The application deadlines for the M.S. program are August 15 (spring semester), December 15 (summer), and February 15 (fall semester). Acceptance into the Graduate School before February 1 is required for the nurse practitioner areas of study. The application deadline for the Ph.D. program is December 1 for the following fall semester deadline.

Use of 4xxx Courses—4xxx courses are not routinely accepted on degree program forms. However, CPsy 4307—Adolescent Psychology is used on M.S. programs for public health nursing-adolescent nursing.

Courses—Please refer to Nursing (Nurs) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements

The master's program prepares students for advanced practice nursing positions that address complex health and illness issues. The program is offered under Plan A and Plan B. Plan A emphasizes research; Plan B prepares students to integrate research into advanced practice roles or leadership positions.

Coursework is offered in adult health nursing; child and family nursing; children with special health-care needs; family nurse practitioner; gerontological clinical nurse specialist; gerontological nurse practitioner; nurse midwifery; nursing administration; nurse education; oncology nursing; pediatric nurse practitioner; public health nursing with emphases in administration, adolescent health, older adult health, school health, and parent, child and family health; psychiatric-mental health nursing; and women's health care nurse practitioner.

Plan A requires 30 credits: 14 credits in the major, including Nurs 8170—Research in Nursing (3 cr); Nurs 8100—The Discipline of Nursing (3 cr); Nurs 8140—Moral and Ethical Positions in Nursing (3 cr); 6 credits in a minor or related fields; and 10 thesis credits.

Plan B requires 30 credits: 9 credits of disciplinary core course; 12 credits of advanced nursing core courses, including Nurse 8194—Problems in Nursing (3 cr); 6 credits of specialty core courses; and 6 credits in related fields.

Language Requirements—None.

Final Exam—The final exam is oral.

Ph.D. Degree Requirements

The Ph.D. program prepares creative and productive scholars in nursing. Students can gain a depth of knowledge and experience in one or more of these areas: the development and modification of health-related behaviors; human responses to environmental and life process events disruptive to health; the phenomenon of health; and the organization and system of delivery of nursing knowledge and of nursing care.

Students plan with their advisers individualized programs of study and independent research, subject to approval by a faculty committee. The Ph.D. requires 12 credits in a minor or supporting field, Nurs 8177—Advanced Nursing Research Practicum (4 cr), Nurs 8110—Developing Nursing Knowledge, and 24 thesis credits.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor requires 12 credits in nursing with at least 8 credits of 8xxx courses.

Nutrition

Contact Information—Nutrition Graduate Program, Department of Food Science and Nutrition, University of Minnesota, 1334 Eckles Avenue, St. Paul, MN 55108 (612-624-1290; fax 612-625-5272; e-mail nutrgrad@umn.edu; <http://fscn.che.umn.edu/nutrgrad/>).

Professor

Paul B. Addis, Food Science and Nutrition, FM
Linda J. Brady, Food Science and Nutrition, FM
Judith E. Brown, Epidemiology, FM
Frank B. Cerra, Surgery, FM
Agnes S. Csallany, Food Science and Nutrition, FM
William R. Dayton, Animal Science, FM
Mary E. Dempsey, Biochemistry, FM
John H. Himes, Epidemiology, FM
Joseph M. Keenan, Family Practice and Community Health, FM
Mindy S. Kurzer, Food Science and Nutrition, FM
Theodore P. Labuza, Food Science and Nutrition, FM
Arthur S. Leon, Kinesiology and Leisure Studies, FM
Allen S. Levine, Surgery, FM
Mark Lyte, Food Science and Nutrition, FM
Joanne L. Slavin, Food Science and Nutrition, FM
Mary T. Story, Epidemiology, FM
Michael E. White, Animal Science, FM

Associate Professor

Roderick A. Barke, Surgery, FM
Margot P. Cleary, Hormel Institute, FM
Daniel D. Gallaher, Food Science and Nutrition, FM
Craig A. Hassel, Food Science and Nutrition, FM
Marla M. Reicks, Food Science and Nutrition, FM
Sally S. Weisdorf, Pediatrics, FM

Adjunct Associate Professor

Mary K. Schmidl, Food Science and Nutrition, FM

Assistant Professor

Paul S. Brady, Food Science and Nutrition, AM
Diane Neumark-Sztainer, Epidemiology, FM

Adjunct Assistant Professor

Mary C. Gannon, Food Science and Nutrition, FM
Darlene G. Kelly, Food Science and Nutrition, FM
Catherine M. Kotz, Food Science and Nutrition, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Nutrition is the study of how nutrients, both essential and non-essential, affect health and all life processes. Consequently, nutrition is an extremely broad field that encompasses physiology, biochemistry, education, public health, and public policy. The nutrition graduate program is interdisciplinary. Advisers and financial support may come from any of the departments or schools in which nutrition graduate faculty reside, including the Department of Food Science and Nutrition (Colleges of Human Ecology and Agricultural, Food, and Environmental Sciences), Division of Epidemiology (School of Public Health), Department of Pediatrics (Medical School), Department of Surgery (Medical School), Department of Animal Science (College of Agricultural, Food, and Environmental Sciences), School of Kinesiology and Leisure Studies (College of Education and Human Development), Hormel Institute (Austin, MN), and Veterans Administration Hospital (Minneapolis, MN).

Three subspecialty areas are offered in the doctoral degree program: human nutrition, nutritional biochemistry, and public health nutrition. Thesis work can be conducted in the laboratory, clinic, or field, locally or internationally.

Prerequisites for Admission—A strong foundation in the biological and physical sciences is required. This background includes college mathematics through calculus, physics, the equivalent of one year of general and one year of organic chemistry, general biology, biochemistry, physiology, and two additional courses in the biological sciences. If there is evidence that the applicant has a good background in the sciences, some of the prerequisites can be met after admission.

Applicants interested in the M.S. degree with clinical emphasis must offer as prerequisites courses in general biology, human nutrition, microbiology, college algebra, one year each of general and organic chemistry, 20 or more semester credits in food science and nutrition, and a dietetic internship or equivalent.

Applicants to the Ph.D. program who have completed the M.S. degree with a clinical emphasis must have completed the requirements described in the first paragraph above.

Special Application Requirements—GRE scores and three letters of recommendation evaluating the applicant's scholarship must be submitted. At least two letters should be from professorial-rank faculty. The GRE Writing Assessment Test is recommended.

Use of 4xxx Courses—Use of 4xxx courses toward degree requirements is subject to adviser and/or director of graduate studies approval.

Courses—Please refer to Nutrition (Nutr) and Food Science and Nutrition (FScN) in the course section of this catalog for courses pertaining to the program

M.S. Degree Requirements

The M.S. is offered under both Plan A (thesis) and Plan B (non-thesis). Plan A requires a minimum of 20 course credits and 10 thesis credits; Plan B requires a minimum of 30 course credits, including a Plan B project. General requirements include the graduate nutrition core series (three courses), an orientation and presentation skills class, graduate courses in biochemistry, physiology, statistics, an advanced topics course, and presentation of the thesis or project work. All students also are expected to obtain teaching experience, subject to the policies of the adviser's department or division.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master's minor requires a minimum of 6 course credits in nutrition, including FScN 5621.

Ph.D. Degree Requirements

The Ph.D. offers three areas of specialization: human nutrition, nutritional biochemistry, and public health nutrition. Thesis work may be conducted in the laboratory, clinic, or field, either locally or internationally.

The Ph.D. requires the graduate nutrition core series (three courses), an orientation and presentation skills class, graduate level courses in biochemistry, physiology, statistics, two advanced topics courses, and presentation of the thesis. All students also are expected to obtain teaching experience, subject to the policies of the adviser's department or division.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor may be completed by taking FScN 5621, 5622, 5623, and three additional credits in nutrition, including at least one 8xxx course.

Occupational Therapy

Contact Information—Program in Occupational Therapy, University of Minnesota, 388 Mayo Mail Code, 426 Church St. S.E., Minneapolis, MN 55455 (612-626-5887; fax 612-625-7192; e-mail otprog@umn.edu; <www.med.umn.edu/ot>). Program office is in 271 Children's Rehabilitation Center, 426 Church St. S.E., Minneapolis MN, 55455.

Associate Professor

James R. Carey, AM
Virgil G. Mathiowetz, AM
Judith E. Reisman, AM
Erica B. Stern, AM

Assistant Professor

Diane R. Anderson, AM
Cheryl A. Meyers, AM
Deborah D. Roman, AM

Examining Member

Rebecca B. Catterton, E
Jill L. Christenson, E
Margaret A. Christenson, E
Kay Dole, E
Barbara A. Larson, E
Sue Lasoff, E
Peggy Mueller, E
Marcia A. Sitz, E
Deborah J. Voydetich, E

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The program offers academic study and clinical education for preparing occupational therapy clinicians and researchers. Emphasis is on application of the critical thinking model to diverse areas of practice and to diagnostic groups in both clinic and community settings. Fieldwork education is available in such areas as physical, psychosocial, and developmental disabilities. Research emphasizes investigation of treatment effectiveness.

The program is accredited by the Accreditation Council for Occupational Therapy Education (ACOTE) of the American Occupational Therapy Association. Graduates of the program may sit for the national certification exam administered by the National Board for Certification of Occupational Therapists. Most states require licensure in order to practice; however, state licenses are usually based on the results of this certification exam.

Prerequisites for Admission—Individuals with a bachelor's degree in any field may apply.

Special Application Requirements—Applicants must submit a program application, including one to three letters of reference, GRE General Test scores (no minimum required for consideration), and evidence of work or volunteer experience in occupational therapy. International students must also submit TOEFL scores (550 minimum paper version, 213 minimum computer version) and TSE (Test of Spoken English) scores (50 minimum). Prerequisite coursework in statistics, the biological sciences, developmental and abnormal psychology, and related areas is also required.

Use of 4xxx Courses—Use of 4xxx courses is not permitted toward degree requirements.

Courses—Please refer to Occupational Therapy (OT) and Physical Medicine and Rehabilitation (PMed) in the course section of this catalog for courses pertaining to the program.

M.S. Plan B Degree Requirements

Students take 57 credits of predetermined academic coursework, 12 credits of fieldwork education, and 4 project credits (Plan B). There is no minor or related field requirement.

Language Requirements—None

Final Exam—The final exam is oral.

Oral Biology

Contact Information—Oral Biology Graduate Program, University of Minnesota, 17-252 Moos Health Sciences Tower, 515 Delaware Street S.E., Minneapolis, MN 55455 (612-624-9123).

Professor

Alvin J. Beitz, Veterinary Pathobiology, FM
Edward C. Combe, Oral Sciences, FM
Ralph DeLong, Oral Sciences, FM
William H. Douglas, Oral Sciences, FM
Gregory R. Germaine, Oral Sciences, FM
Mark C. Herzberg, Preventive Sciences, FM
William F. Liljemark, Oral Sciences, FM
Patrick W. Mantyh, Preventive Sciences, FM
Charles F. Schachtele, Oral Sciences, FM
Burton L. Shapiro, Oral Sciences, FM
Larry F. Wolff, Preventive Sciences, FM

Associate Professor

Pamela R. Erickson, Preventive Sciences, FM
Tom W. Korioth, Oral Sciences, FM
Robert H. Ophaug, Oral Sciences, FM
Joel D. Rudney, Oral Sciences, FM
Donald A. Simone, Psychiatry, FM

Assistant Professor

Ching-Chang Ko, Oral Sciences, FM
Antheunis Versluis, Oral Sciences, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—This program is offered by the Department of Oral Science in the School of Dentistry and gives students a broad understanding of the development, structure, function, and pathology of the orofacial region. Advanced coursework and research emphasize specialized areas of interest, including salivary glands and secretions, oral microbial ecology and physiology, immunobiology, neurobiology, mineral metabolism and nutrition, pathobiology of oral structures, physical biology of the masticatory system, and development and evaluation of dental materials. Considerable flexibility is encouraged in planning

individual programs to accommodate the student's specific areas of interest, and courses from other disciplines may be included as part of the major.

Prerequisites for Admission—Applicants should have completed requirements for graduation with high standing from dental or medical schools and have a desire to undertake advanced studies in oral biology. In some cases, those who have not obtained the D.D.S. (D.M.D.) or M.D. degree, but who have demonstrated exceptional potential for graduate study, may be admitted for a combined program. Individuals with a bachelor's or master's degree who can demonstrate an appropriate background and an interest in oral biology are considered.

Special Application Requirements—Applicants must submit three letters of recommendation from persons familiar with their academic and research experience and a statement describing how training in oral biology will help them attain their professional objectives. Students may enter the program in any semester, but fall semester is recommended.

Use of 4xxx Courses—Use of 4xxx courses is not permitted toward degree requirements.

Courses—Please refer to Oral Biology (OBio) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements

The M.S. generally requires a minimum of two years, and may be taken as Plan A (with thesis) or Plan B (without thesis); both plans require a total of 30 credits. Students in both plans must complete a minimum of 14 credits in the major, including 4 credits of oral biology topics courses (8021-8028). Courses in the major may be taken from other disciplines with the approval of the adviser and the director of graduate studies. Registration and participation in the oral biology student seminar series (8030) is required each semester. Students must also complete a minor or related field program in a related nonclinical discipline (minimum 6 credits). Plan A requires 10 thesis credits and Plan B requires 10 credits of additional coursework and three Plan B papers. The Plan B papers consist primarily of critical reviews of the literature, but at least one must include a laboratory study. Students must maintain a GPA of at least 3.00 in both the major and minor. Only grades of A or B are acceptable in the core courses.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master's minor in oral biology consists of 6 credits and must include OBio 8011, at least two advanced courses in oral biology, and other coursework determined in consultation with the director of graduate studies.

Ph. D. Degree Requirements

Coursework for the Ph.D. is selected to give students a broad background in oral biology plus advanced coursework directly related to students' research interests. Although there is no Graduate School minimum credit requirement for the degree, most students are expected to complete a core curriculum of 23-25 credits; all students must satisfactorily complete 8 credits of oral biology topics courses (8021-8028) and participate in the oral biology student seminar series (8030) each semester. The remaining coursework is tailored to the student's research interests and may be selected from departments/programs outside of the oral biology program with the approval of the adviser and director of graduate studies. A minor (minimum 12 credits) in a nonclinical discipline is also required. A cumulative GPA of at least 3.00 in both the major and minor is required. Only grades of A or B are acceptable in the core courses. The preliminary written exam consists of two research proposals, one representing the student's anticipated thesis research and the other on a topic assigned by the graduate faculty. The preliminary oral exam consists primarily of a defense of the two research proposals described above. Students must also present a seminar describing their thesis research (which is attended by the final oral exam committee) no later than six months before defense of the thesis.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A Ph.D. minor in oral biology consists of 12 credits and must include OBio 8011, at least two advanced courses in oral biology, and other coursework in consultation with the director of graduate studies.

Otolaryngology

Contact Information—Department of Otolaryngology, University of Minnesota, Mayo Mail Code 396, 420 Delaware Street S.E., Minneapolis, MN 55455 (mailing address) (612-625-3200; fax 612-625-2101; <www.med.umn.edu/otol/>).

Professor

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Arndt J. Duvall III, FM
G. Scott Giebink, AM
Sung K. Juhn, FM
Frank M. Lassman (emeritus), FM
Robert H. Maisel, AM
Robert H. Margolis, FM
David A. Nelson, FM
Peter A. Santi, AM

Clinical Professor

Michael M. Paparella, FM

Associate Professor

John H. Anderson, AM
Lawrence R. Boies, Jr., AM
Kathleen Ann Daly, AM
Markus Gapany, AM
George S. Goding, Jr., AM
Peter A. Hilger, AM
David B. Hom, AM
Lisa L. Hunter, AM
Eric Javel, FM
Samuel C. Levine, AM

Clinical Associate Professor

Marcos V. Goycoolea, AM
Stephen L. Liston, AM

Assistant Professor

Gail S. Donaldson, AM
David D. Hamlar, AM
Jizhen Lin, AM
Rick M. Odland, AM
Frank G. Ondrey, AM
Franklin L. Rimell, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—This program prepares students in both clinical and experimental aspects of otolaryngology. The M.S., M.S.Otol., and Ph.D. degrees require a publishable thesis. Rotations at Fairview-University Medical Center, Minneapolis Veterans Administration Medical Center, Regions Hospital, and Hennepin County Medical Center provide a wide range of opportunity for clinical education and surgical experience. Opportunities for independent research are provided in the research laboratories of audiology, auditory electrophysiology, auditory neurophysiology, biochemistry, cancer biology, cell biology and genetics, electronmicroscopy, electrophysiology, histochemistry, morphometry, psychoacoustics, temporal bone pathology, tumor immunology, skin-flap physiology, laryngeal physiology, mandibular bone physiology, microvascular tissue transfer, and vestibular physiology. Each student selects an adviser and prepares a preliminary research proposal by February 1 of the first year. A full proposal in NIH style is expected by June 1. Both proposals must be reviewed by the graduate research committee. A minimum of six months in basic research begins in the second year. Graduates of the program have careers in teaching, research, and professional practice.

Prerequisites for Admission—The M.S. requires a bachelor's degree from an accredited university or equivalent. The M.S.Otol. requires an M.D. degree and is usually pursued in conjunction with a residency in otolaryngology. The Ph.D.Otol. requires a bachelor's or master's degree, preferably in an area related to otolaryngology or, for those pursuing the degree in conjunction with a residency in otolaryngology, an M.D. degree.

Use of 4xxx Courses—Otolaryngology does not offer 4xxx courses. Use of 4xxx courses from other departments is permitted toward degree requirements with the permission of the director of graduate studies.

Courses— Please refer to Otolaryngology (Otol) in the course section of this catalog for courses pertaining to the program.

M.S. Plan A Degree Requirements

The M.S. (Plan A only) requires a minimum of 30 credits: 20 course credits (14 in the major and 6 in the minor or related fields) and 10 thesis credits. Students are expected to complete and publish a research paper in a peer-reviewed journal or a presentation/poster at a national scientific meeting.

Language Requirements—None.

Final Exam—The final exam is oral. M.S. students also take a national exam. Those who receive less than 70 percent on the exam must complete a written exam for the degree.

M.S.Otol. Plan A Degree Requirements

The M.S.Otol. (Plan A only) requires a minimum of 35 credits, including 25 course credits (19 in the major and 6 in the minor or related fields) and 10 thesis credits. Some courses for the M.S.Otol. are more clinical than those for the M.S., and four years of academic preparation are expected. Students are expected to complete and publish a research paper in a peer-reviewed journal or a presentation/poster at a national scientific meeting.

Language Requirements—None.

Final Exam—The final exam is oral. Students also take a national exam. Those who receive less than 70 percent on the exam must complete a written exam for the degree.

Ph.D.Otol. Degree Requirements

For students concurrently completing an otolaryngology residency, the Ph.D.Otol. requires a minimum of 55 credits, including 31 course credits (19 in the major and 12 in the minor or supporting program) and 24 thesis credits. At least one seminar is selected from seminars such as Otol 8247, 8248, 8249, 8250. Most students concurrently in an otolaryngology residency take five to six years to complete research, course, and dissertation requirements.

For students not engaged in a residency, a minimum of 12 semester hours in the minor or supporting program, and 19 in the major are required plus courses and faculty chosen by the student, advisor, and director of graduate studies. All students are expected to publish a research paper in a peer-reviewed journal.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A minor is not available, but otolaryngology courses may be taken for related fields or supporting program credits.

Pharmaceutics

Contact Information—Department of Pharmaceutics, College of Pharmacy, University of Minnesota, 9-177 Weaver-Densford Hall, 308 Harvard Street S.E., Minneapolis, MN 55455 (612-624-5151; fax 612-626-2125; e-mail pceuts@umn.edu; <www.pharmacy.umn.edu/resgrad/pceutics/pharmaceuticshome.html>).

Professor

David J. W. Grant, FM
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Ronald A. Siegel, FM
Raj G. Suryanarayanan, FM

Adjunct Professor

William H. Frey II, Pharmacy, AM
Aldo Rescigno, Pharmacy, AM

Associate Professor

Eric J. Munson, Chemistry, AM
Timothy S. Wiedmann, FM
Cheryl L. Zimmerman, FM

Adjunct Associate Professor

Walid Awni, Pharmacy, AM
Keith K. Chan, AM
Lawrence J. Felice, AM
Michael D. Karol, Pharmacy, AM

Adjunct Assistant Professor

Ray Skwierczynski, Pharmacy, AM
Lian Yu, Pharmacy, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Emphases are available in physical pharmacy, biopharmaceutics and pharmacokinetics. Coursework in supporting fields typically includes chemistry, chemical engineering, mechanical engineering, physiology, biochemistry, cell biology, biometry, and pharmacology

Prerequisites for Admission—Students with a degree in pharmacy or in a relatively wide range of academic fields (such as chemistry, engineering, biochemistry, and biology) are considered provided they have an exceptional scholastic record. For students with a degree other than pharmacy, the program advisor may recommend additional coursework to provide the necessary background in pharmaceutical sciences.

Special Application Requirements—For applicants to both the M.S. and Ph.D. programs, recent GRE scores (contact the Pharmaceutics Department for minimum requirements), and a statement of career goals, a complete set of official transcripts, and three letters of recommendation are required. Fall semester admission is preferred; under exceptional circumstances spring or summer admission may be considered. Applicants for fall semester should send application materials by December 31.

Use of 4xxx Courses—Use of 4xxx courses towards degree requirements is permitted based on the approval of the graduate faculty and director of graduate studies.

Courses—Please refer to Pharmaceutics (Phm) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements

The M.S. requires 20 course credits, including 6 credits in a minor or related field. Students must take advanced courses in pharmaceutics, chemistry, mathematics, statistics, and pharmacology. A complete list of degree requirements may be obtained from the director of graduate studies.

Language Requirements—None.

Final Exam—The final exam is oral.

Ph. D Degree Requirements

The Ph.D. requires 33 course credits, including 12 credits in a minor or supporting program. Students must take advanced courses in pharmaceutics, chemistry, mathematics, statistics, and pharmacology. A complete list of degree program requirements may be obtained from the director of graduate studies.

Language Requirements—One foreign language or a collateral field of knowledge chosen with the consent of the director of graduate studies is required. The choice of option must have the approval of the major adviser.

Pharmacology

Contact Information—Graduate Program in Pharmacology, University of Minnesota, 6-120 Jackson Hall, 321 Church Street, S.E., Minneapolis, MN 55455 (612-625-9997; fax 612-625-8408; e-mail fider@lenti.med.umn.edu; <www.pharmacology.med.umn.edu>).

Professor

Bianca M. Conti-Fine, FM
Richard M. Eisenberg, Duluth, FM
Robert P. Elde, FM
Esam E. El-Fakahany, FM
Patrick E. Hanna, FM
Stephen S. Hecht, FM
Jordan L. Holtzman, FM
Donald B. Hunninghake, FM
Ping-Yee Law, FM
Horace H. Loh, FM
Paul R. Pentel, FM
Philip S. Portoghese, FM
Michael A. Raftery, FM
Jean F. Regal, Duluth, FM
Virginia S. Seybold, FM
Alan R. Sinaiko, AM
Norman E. Sladek, FM
Sheldon B. Sparber, FM
Sundaram Ramakrishnan, FM
Stanley A. Thayer, FM
George J. Trachte, Duluth, FM
Kendall B. Wallace, Duluth, FM
George L. Wilcox, FM
Wellington G. Wood III, FM
Ben G. Zimmerman, FM

Associate Professor

Colin R. Campbell, FM
Earl W. Dunham, FM
Edward T. Knych, Duluth, AM
Rita B. Messing, AM
Sabita Roy, FM
Timothy F. Walseth, FM
Elizabeth V. Wattenberg, E
Li-Na Wei, FM

Assistant Professor

Frank H. Burton, FM
Gregory J. Connell, FM
Hiroshi Hiasa, FM
Carol A Lange, FM
Duanqing Pei, FM
Yun Qiu, FM
Daniel P. Romero, FM
Kevin D. Wickman, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Pharmacology is the study of the interactions of chemicals with biological systems. Courses and research training in biochemistry, biophysics, genetics, and molecular biology provide a solid foundation for performing original research in pharmacology, neuropharmacology, and cancer chemotherapy.

Prerequisites for Admission—A four-year B.A. or B.S. degree (or its equivalent) in a basic science program is generally required. Candidates for admission are evaluated on the basis of undergraduate record, GRE score, previous research experience, and letters of recommendation.

Special Application Requirements—Applicants must submit scores from the General Test of the GRE, three letters of recommendation from persons familiar with their scholarship and research potential, a complete set of official transcripts, and a clearly written statement of career interests, goals, and objectives. Students may apply at any time; however, submission of all application materials by January 15 is strongly encouraged to ensure priority consideration for fellowships and research assistantships awarded for the next academic year. Students can be admitted any term.

Research Facilities—Graduate faculty members in the pharmacology program have state-of-the-art laboratories located in the Basic Sciences Biomedical Engineering Building, Moos Tower, and Jackson Hall. The Drug Abuse Research Center in Molecular and Cell Biology is comprised of pharmacology program graduate faculty.

Use of 4xxx Courses—Use of 4xxx courses on degree program forms is subject to adviser and/or director of graduate studies approval.

Courses—Please refer to Pharmacology (Phcl) in the course section of this catalog for courses pertaining to this program.

M.S. Degree Requirements

Plan A requires a minimum of 20 course credits (14 in pharmacology, and 6 in biochemistry and physiology) and 10 thesis credits. Plan B requires a minimum of 30 course credits (14 in pharmacology, and 16 in biochemistry, physiology, and/or other related areas) and a Plan B project.

Students are expected to maintain a 3.00 grade point average. Students who fail to maintain this standard must petition the director of graduate studies for permission to remain in the program.

For more detailed information, contact the director of graduate studies in pharmacology.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master's minor requires a minimum of 9 credits in pharmacology approved by the director of graduate studies in pharmacology.

Ph.D. Degree Requirements

The Ph.D. requires a minimum of 21 course credits in the major (excluding the required 24 thesis credits).

Students are expected to maintain a 3.00 grade point average. Students who fail to maintain this standard must petition the director of graduate studies for permission to remain in the program.

For more detailed information, contact the director of graduate studies in pharmacology.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor requires a minimum of 12 credits in pharmacology approved by the director of graduate studies in pharmacology. There are no special requirements (e.g., specific courses, written examination).

Philosophy

Contact Information—Further details about the program are on the Department's Web site at <www.philosophy.umn.edu/>, and in two publications, *Graduate Studies: Philosophy* and *Department Degree Programs: M.A. and Ph.D.*, available from the Department of Philosophy, University of Minnesota, 831 Walter Heller Hall, 271 19th Avenue South, Minneapolis, MN 55455 (612-625-6563; fax 612-626-8380; e-mail umphil@umn.edu).

Professor

Elizabeth S. Belfiore, Classical and Near Eastern Studies, FM
Norman E. Bowie, Strategic Management, FM
Norman O. Dahl, FM
Marcia M. Eaton, FM
Ronald N. Giere, FM
Jeanette K. Gundel, Linguistics and Asian and Slavic Languages and Literatures, AM
Keith Gunderson, FM
William H. Hanson, FM
Geoffrey Hellman, FM
Jasper S. Hopkins, FM
Michael B. Kac, FM
Jeffrey P. Kahn, Public Health, FM
Douglas E. Lewis, FM
Helen E. Longino, Women's Studies, FM
H. E. Mason, emeritus, FM
Joseph I. Owens, FM
Sandra L. Peterson, FM
C. Wade Savage, FM
Naomi B. Scheman, FM
John R. Wallace, FM

Associate Professor

John H. Beatty, Ecology, Evolution, and Behavior, FM
John M. Dolan, FM
Carl Elliott, FM
Michael D. Root, FM
C. Kenneth Waters, FM

Assistant Professor

Sarah W. Holtman, AM
Michelle Mason, AM
Valerie Tiberius, AM
Byeong-Uk Yi, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The Department of Philosophy offers both Ph.D. and M.A. degrees. Students are generally admitted to the Ph.D. program, while admission to the M.A. is generally intended for those with professional goals in other fields.

Philosophy is noteworthy for its emphasis on the individual student's research interests. With the help of an adviser, students design their own program of study, which consists of the philosophy major and either a supporting program or a minor. The minor or supporting program, drawn at least in part from a department or departments other than philosophy, complements the student's research focus. Students gain a broad base of knowledge through required coursework. Ph.D. students take courses from four main areas: history of philosophy, logic, ELMS (epistemology, philosophy of language, metaphysics, philosophy of science), and value theory. These areas provide a firm foundation for research and teaching beyond the Ph.D. program.

Prerequisites for Admission—Recognizing that evidence of ability to pursue graduate study in philosophy is diverse, the department does not specify prerequisites for admission. Normally, those admitted have a broad undergraduate background that includes some courses in philosophy.

Special Application Requirements—Students must apply to both the Graduate School and the Department of Philosophy. The Graduate School application is available online from the Graduate School Web site. Departmental applications for admissions and aid are available from the Committee on Admissions and Aid at the address listed above.

Department applications should include a completed application form, transcripts, scores from the GRE General Test, three letters of recommendation, and a writing sample. Students interested in Opportunity or MacArthur Fellowships should include a statement expressing their interest. Students interested in the MacArthur Fellowship should also contact the MacArthur Program.

Applications, together with all supporting materials, must be received by January 7. The Philosophy Department generally admits students only for fall semester.

Use of 4xxx Courses—Students may take 4xxx courses for graduate credit only by enrolling concurrently in a related one credit 8xxx workshop course. Students from other majors are not required to register for the concurrent workshop, but are permitted to do so with the permission of the instructor of the 4xxx course. A rich array of 4xxx courses are suitable for graduate students in other fields.

Courses—Please refer to Philosophy (Phil) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements

The M.A. is offered under two plans: Plan A requires 14 course credits in philosophy, 6 course credits outside the department, and 10 thesis credits. Plan B requires 24 course credits in philosophy, 6 course credits outside the department, and three Plan B papers.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master's minor requires 6 course credits in philosophy approved by the director of graduate studies in philosophy. Programs are tailored to meet the interests and needs of the student.

Ph.D. Degree Requirements

No minimum credits are required for the Ph.D., though specific philosophy courses are required that total 26-28 credits; 24 thesis credits are also required. After a student has satisfied the logic and history course requirements and passed the three-paper exam, the student's entire record is reviewed by the faculty. Successful review represents passing the preliminary written exam. Students then write a dissertation proposal, successful defense of which constitutes passing the preliminary oral exam.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor requires 12 course credits in philosophy approved by the director of graduate studies in philosophy. Programs are tailored to meet the interests and needs of the student.

Physical Education and Recreation

See Kinesiology and Leisure Studies.

Physical Therapy

Contact Information—Physical Therapy Program Office, MMC 388, University of Minnesota, Minneapolis, MN 55455 (612-626-5303; fax 612-625-7192; e-mail ptqust@umn.edu; <www.physther.med.umn.edu>).

Professor

Richard P. DiFabio, AM
Robert Patterson, AM

Associate Professor

James R. Carey, AM
Judith Reisman, AM
Glenn N. Scudder, E
LaDora V. Thompson, AM

Assistant Professor

Lisa L. Dorsey, E
Paula M. Ludewig, AM
Kirsten Ness, E

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Physical therapy is a health-care discipline involved with the study and rehabilitation of movement impairments such as muscular weakness, joint stiffness, and pain, which can lead to functional problems affecting self care, employment, ambulation, etc. Students learn the diseases and injuries that cause these impairments, as well as the evaluation and treatment to correct them. The program prepares graduates to promote proper health care and quality of living by maximizing human movement following disease or injury or by preventing its loss.

The Physical Therapy Program, a division within the Department of Physical Medicine and Rehabilitation, offers two M.S. programs: entry-level and postprofessional. The entry-level professional education program takes two and a half years to complete and prepares students to become physical therapists. Graduates must pass a licensure exam to begin clinical practice. The postprofessional education program trains practicing physical therapists in research skills, teaching skills, and higher clinical skills.

Prerequisites for Admission—Applicants must have a baccalaureate degree with a major in any field. Students must be able to use word processing and spread sheet software. Prerequisite courses that must be completed before enrolling in the program are listed at <www.physther.med.umn.edu>.

Special Application Requirements—Submission of GRE scores is required. For international students, a TOEFL score of at least 550 is required. The entry-level program accepts only applications completed on the Web at <www.physther.med.umn.edu>.

Use of 4xxx Courses—Use of 4xxx courses towards degree requirements is subject to adviser and director of graduate studies approval.

Courses—Please refer to Physical Therapy (PT) and Physical Medicine and Rehabilitation (PMed) in the course section of this catalog for courses pertaining to the program.

M.S. Plan B, Plan A and Plan B Degree Requirements

The entry-level program (Plan B only) requires 81 major field credits, of which 68 are core academic credits and 13 are clinical internship credits. Students must maintain a cumulative GPA of 2.80. Instead of a thesis, a scholarly research project is required (in connection with PMed 8193—Research Problems). No minor or related field is required for this program.

The postprofessional Plan A program requires 24 major field credits, of which 14 are core academic credits and 10 are thesis credits; 6 elective credits outside the major are also required.

The postprofessional Plan B program requires 24 major field credits, all of which are core academic credits; 6 elective credits outside the major are also required. Instead of a thesis, a scholarly research project is required (in connection with PMed 8193—Research Problems).

Language Requirements—None.

Final Exam—The final exam is oral.

Physics

Contact Information—Physics Program, School of Physics and Astronomy, University of Minnesota, 145 Tate Laboratory of Physics, 116 Church Street S.E., Minneapolis, MN 55455 (612-624-6366; fax 612-624-4578; e-mail grad@physics.spa.umn.edu; <www.spa.umn.edu>).

Professor

Benjamin F. Bayman (emeritus), FM
John H. Broadhurst, FM
Charles E. Campbell, FM
Cynthia A. Cattell, FM
James R. Chelikowsky, Chemical Engineering and Materials Science, FM
Hans W. Courant (emeritus), FM
Priscilla B. Cushman, FM
E. Dan Dahlberg, FM
Kris Davidson, Astronomy, FM
Dietrich K. Dehnhard, FM
Paul J. Ellis, FM
Robert D. Gehrz, Astronomy, FM
Clayton F. Giese, FM
Leonid Glazman, FM
Allen M. Goldman, FM
Anand Gopinath, Electrical and Computer Engineering, FM
J. Woods Halley, FM
Kenneth Heller, FM
Cheng-Cher Huang, FM
Roberta Humphreys, Astronomy, FM
Thomas W. Jones, Astronomy, FM
James Kakalios, FM
Joseph I. Kapusta, FM
Paul J. Kellogg (emeritus), FM
Anatoly Larkin, FM
Robert L. Lysak, FM
Marvin Marshak, FM
Keith A. Olive, FM
Robert O. Pepin, FM
Earl A. Peterson, FM
Ronald A. Poling, FM
Dennis L. Polla, Electrical Engineering, FM
Serge Rudaz, FM
Keith Ruddick, FM
Roger W. Rusack, FM
Mikhail Shifman, FM
Boris Shklovskii, FM
Roger H. Stuewer (emeritus), AM
David D. Thomas, Biochemistry, FM
Arkady Vainshtein, FM
Oriol T. Valls, FM
Randall H. Victora, Electrical Engineering, FM
Mikhail Voloshin, FM
Thomas F. Walsh, FM
William Zimmermann, Jr. (emeritus), FM

Associate Professor

Eric Ganz, FM
Uwe R. Kortshagen, Mechanical Engineering, FM
Yuichi Kubota, FM
John R. Wygant, FM

Assistant Professor

Paul A. Crowell, FM
Michael DuVernois, FM
Shaul Hanany, FM

Joachim Mueller, FM
Yong-Zhong Qian, FM
Renata M. M. Wentzcovitch, Chemical Engineering and Materials Science, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Physics is the study of the fundamental structure and interactions of matter. Research areas in the program include elementary particle physics, condensed matter physics, nuclear physics, space physics, plasma physics, statistical mechanics, biophysics, atomic and molecular physics, astrophysics and cosmology. Interdisciplinary study is also available with the programs in astrophysics, chemical physics, and the history of science and technology. Research areas in experimental physics are biophysics, condensed matter, cosmic rays, cosmology, elementary particles, low temperature, molecular collisions, nuclear physics, space plasmas, solar system, and solid state. Research areas in theoretical physics are astrophysics, biophysics, elementary particles, low temperature, nuclear, space plasmas, solid state, and statistical mechanics.

Prerequisites for Admission—For major work, an undergraduate major in physics or a strong undergraduate minor in physics is required.

Special Application Requirements—Teaching assistantships and a few fellowships are available on application to the School of Physics and Astronomy; three letters of recommendation are required. Submission of GRE scores is strongly recommended. Fall semester entry is strongly recommended for students who have not completed previous graduate study.

Special Examination—During the week before the beginning of fall semester, new graduate students are expected to participate in the department orientation program.

Use of 4xxx Courses—Use of 4xxx physics courses is permitted for either major or minor degree requirements.

Courses—Please refer to Physics (Phys) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements

The M.S. requires a minimum of 20 course credits (Plan A) or 30 course credits (Plan B), including classical physics (Phys 5011-5012) or quantum mechanics (Phys 5001-5002) and a minimum of 6 credits in a minor or related field; Plan A also requires 10 thesis credits. The minor or related field requirement may be satisfied by completion of courses in one or two areas outside the specialization; some or all of these courses may be in physics.

Language Requirements—There is no language requirement. However, in some instances the thesis adviser may require a reading knowledge of one or more foreign languages if justified by the nature of the topic.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A physics minor requires a background in differential and integral calculus and one year of calculus-level college physics. For the master's minor, students must complete a minimum of 6 credits in physics.

Ph.D. Degree Requirements

The Ph.D. requires a minimum of 40 credits, including classical physics (Phys 5011-5012), quantum mechanics (Phys 5001-5002), and two semesters of a seminar in the student's research area. The minor or supporting program requirement may be satisfied by completion of courses in one or two areas outside the specialization; some or all of these courses may be in physics.

Language Requirements—There is no language requirement. However, in some instances the thesis adviser may require a reading knowledge of one or more foreign languages if justified by the nature of the topic.

Minor Requirements for Students Majoring in Other Fields—A physics minor requires a background in differential and integral calculus and one year of calculus-level college physics. For the doctoral minor, students must complete a minimum of
12 credits in physics, including either the classical physics sequence (Phys 5011-5012) or the quantum mechanics sequence (Phys 5001-5002).

Physiology

See Cellular and Integrative Physiology.

Planning

See Urban and Regional Planning.

Plant Biological Sciences

Contact Information—Plant Biological Sciences Graduate Program, University of Minnesota, 220 Biological Sciences Center, 1445 Gortner Avenue, St. Paul, MN 55108-1095 (612-625-4222; fax 612-625-1738).

Regents' Professor

Ronald L. Phillips, Agronomy and Plant Genetics, FM

Professor

David D. Biesboer, Plant Biology, FM
Robert M. Brambl, Plant Biology, FM
Iris D. Charvat, Plant Biology, FM
Edward J. Cushing, Ecology, Evolution, and Behavior, FM
Anath Das, Biochemistry, FM
Gary M. Gardner, Horticultural Science, FM
Burle G. Gengenbach, Agronomy and Plant Genetics, FM
Florence K. Gleason, Plant Biology, FM
Peter H. Graham, Soil, Water, and Climate, FM
Robert J. Jones, Agronomy and Plant Genetics, FM
Willard L. Koukkari, Plant Biology, FM
Paul A. Lefebvre, Genetics, Cell Biology, and Development, FM
Pen Hsiang Li, Horticultural Science, FM
Albert H. Markhart III, Horticultural Science, FM
David J. McLaughlin, Plant Biology, FM
Neil E. Olszewski, Plant Biology, FM
James A. Perry, Forest Resources, FM
Peter B. Reich, Forest Resources, FM
Michael J. Sadowsky, Soil, Water, and Climate, FM
Carolyn D. Silflow, Genetics, Cell Biology, and Development, FM
D. Peter Snustad, Genetics, Cell Biology, and Development, FM
David A. Somers, Agronomy and Plant Genetics, FM
Joseph R. Sowokinos, Horticultural Science, FM
Kate Vanden Bosch, Plant Biology, FM
Clifford M. Wetmore, Plant Biology, FM
Susan M. Wick, Plant Biology, FM
Nevin D. Young, Plant Pathology, AM

Adjunct Professor

John W. Gronwald, Agronomy and Plant Genetics, FM
Carroll P. Vance, Agronomy and Plant Genetics, FM

Associate Professor

Deborah L. Allan, Soil, Water, and Climate, FM
Judith G. Berman, Genetics, Cell Biology, and Development, FM
Jerry D. Cohen, Plant Biology, FM
J. Stephen Gantt, Plant Biology, FM
Michael D. Marks, Plant Biology, FM
Georgiana May, Plant Biology, FM
Ruth G. Shaw, Ecology, Evolution, and Behavior, FM
Alan G. Smith, Horticultural Science, FM
Thomas K. Soulen, Plant Biology, AM
Cindy B. Tong, Horticultural Science, AM

Adjunct Associate Professor

Deborah A. Samac, Plant Pathology, FM

Assistant Professor

Arun Goyal, Biology, Duluth, FM
Gary J. Muehlbauer, Agronomy and Plant Genetics, FM
Min Ni, FM
John Ward, FM
George Weiblen, FM

Adjunct Assistant Professor

Les J. Szabo, Plant Pathology, FM

Lecturer

Anita F. Cholewa, College of Continuing Education, E

Other

Paula M. Pijut, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Plant biological sciences encompasses all aspects of the basic biology of both higher and lower plants. Major emphases include molecular and physiological approaches to development; physiological, structural, and functional studies at the cellular and organismal levels; systematic and evolutionary biology; and molecular genetics and applied biotechnology. Students study plants from the subcellular and molecular to the whole plant and community levels of biological organization. They also have opportunities for laboratory and field research at state, national, and international levels. Each student's program is planned to meet individual requirements within the framework of a multidisciplinary core of coursework. Seminars are an integral part of the program.

Prerequisites for Admission—Prospective students are expected to have completed a year of coursework in at least three of the following four areas: differential and integral calculus; organic and inorganic chemistry; biology; and physics. For students of demonstrated ability, background deficiencies, as determined by the admissions committee, can be made up during the first year of graduate studies. All admitted students are assigned to an adviser in the graduate program before they begin their studies.

Special Application Requirements—Applicants must submit scores from the General Test of the GRE, three letters of recommendation from persons familiar with their scholarship and research potential, a complete set of official transcripts, and a clearly written statement of career interests, goals, and objectives. Students may apply at any time; however, submission of all application materials by January 15 is strongly encouraged to ensure priority consideration for fellowships and teaching and research assistantships awarded for the next academic year. Students can be admitted any semester.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please refer to Plant Biology (PBio) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements

Course programs are planned in consultation with an advisory committee. Students are expected to take a minimum of five courses in the major in addition to the two 1-credit current topics courses taken during their first year.

Students participate in a teacher-training program and then serve as a teaching assistant for one semester. Regular attendance at the weekly Plant Biological Sciences Colloquium seminars is expected.

Plan A students write a thesis proposal and present the results of their research at a colloquium seminar. Plan B students develop a thesis proposal.

Language Requirements—None, except as specified by a faculty adviser in consultation with the student.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master's minor requires a minimum of 6 credits approved by the director of graduate studies.

Ph.D. Degree Requirements

Doctoral requirements are the same as those for a master's degree. In addition, a dissertation proposal and the presentation of two noncredit seminars are required.

Language Requirements—None, except as specified by a faculty adviser in consultation with the student.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor requires a minimum of 12 credits approved by the director of graduate studies.

Plant Pathology

Contact Information—Department of Plant Pathology, University of Minnesota, 495 Borlaug Hall, 1991 Buford Circle, St. Paul, MN 55108 (612-625-8200; e-mail anna@umn.edu; <www.plpa.agri.umn.edu>).

Professor

Robert A. Blanchette, FM
James V. Groth, FM
Roger K. Jones, FM
Linda L. Kinkel, FM
Sagar V. Krupa, FM
Philip O. Larsen, FM
Benham E.L. Lockhart, FM
David H. MacDonald, FM
Robert F. Nyvall, FM
James A. Percich, FM
Francis L. Pfleger, FM
Carol E. Windels, FM
Nevin D. Young, FM
Richard J. Zeyen, FM

Adjunct Professor

H. Corby Kistler, FM
Kurt J. Leonard, FM

Associate Professor

Ruth Dill-Macky, AM
Brian J. Steffenson, FM

Adjunct Associate Professor

James Kolmer, AM
Donald V. McVey, AM
Deborah A. Samac, FM
Les J. Szabo, AM

Assistant Professor

Senyu Chen, AM
James E. Kurle, AM
Jon F. Powell, AM
Hala Toubia-Rattme, AM

Adjunct Assistant Professor

Jennifer Juzwik, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Plant pathology interfaces with all plant science disciplines and with food sciences and veterinary medicine. Areas of concentration include biological control of plant disease, forest pathology and microbial degradation of wood, microbial ecology, mycotoxicology, physiological and molecular plant-microbe interactions, disease resistance, environmental pollution and climate change, and virology. The course of study varies with the requirements of the area of concentration and interests of the student.

Prerequisites for Admission—Master's degree applicants must have a sound college background in the basic biological and physical sciences and mathematics, including 35 semester credits in biology with at least one course in each of the following areas: botany, zoology, genetics, plant physiology, and microbiology. Applicants must also have completed at least one course in inorganic chemistry, organic chemistry, biochemistry, and physics. If deficiencies exist in the prerequisites, they must be corrected during the first year of the graduate program. All students accepted into the department with a B.S. degree are admitted into the M.S. degree program. After a minimum of two semesters, students who qualify may elect to change their degree status to a Ph.D. program. Criteria for the change includes scholastic standing, potential for success in completing a Ph.D., and writing competency. Such a change in status must be approved by the appropriate departmental committees and the director of graduate studies. Ph.D. applicants must satisfy all the prerequisites for the master's degree program in plant pathology or have a master's degree in plant pathology or in a field of natural science.

Special Application Requirements—GRE scores are required for all students and TOEFL scores are required for international students. A statement of objectives and three letters of recommendation are required of all students and must be submitted to the department.

Use of 4xxx Courses—For M.S. Plan A and Ph.D. students, 4xxx courses are not permitted toward degree requirements.

Courses—Please refer to Plant Pathology (PlPa) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements

Plan A (thesis) and Plan B (non-thesis) both require a minimum of 16 course credits in plant pathology and 6 course credits in a minor or related field. In addition, Plan A requires 10 thesis credits and Plan B requires 8 project or elective credits.

Language Requirements—A foreign language is generally not required. However, knowledge of a foreign language may be necessary for students doing research in non-English-speaking countries.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A minimum of 6 credits is required for a master's minor.

Ph.D. Degree Requirements

The Ph.D. requires a minimum of 21 course credits in plant pathology, 12 credits in a minor or supporting program, and 24 thesis credits.

Language Requirements—A foreign language is generally not required. However, knowledge of a foreign language may be necessary for students doing research in non-English-speaking countries.

Minor Requirements for Students Majoring in Other Fields—A minimum of 12 credits is required for a doctoral minor.

Policy Issues on Work and Pay

Contact Information—Policy Issues on Work and Pay, 101 Wesbrook Hall, 77 Pleasant Street S.E., Minneapolis, MN 55455 (612-624-4000; e-mail adv@cce.umn.edu; <www.cce.umn.edu/pdm/bmcmain.shtml>).

Professor

Morris Kleiner, Hubert H. Humphrey Institute of Public Affairs, E

Associate Professor

John Budd, Human Resources and Industrial Relations, E
Maria Hanratty, Hubert H. Humphrey Institute of Public Affairs, E

Curriculum—This certificate provides an understanding of and the ability to evaluate federal, state, and local policies that affect the employment relationship. Students learn about the role of government in the employment relationship including statutes and how employers, unions, and the government interpret policies. Courses are drawn from the Humphrey Institute of Public Affairs as well as the Industrial Relations Center in the Carlson School of Management, with auxiliary courses in law, history, and sociology.

Prerequisites for Admission—Students must have a bachelor's degree from an accredited U.S. university or its foreign equivalent. Applicants should have mathematics courses at least up through algebra and a course in microeconomics (Econ 1101—Principles of Economics: Microeconomics is offered via distance education at the University). A grade point average of 3.00 is required and, for international students, a TOEFL score consistent with the Graduate School's requirements.

Use of 4xxx Courses—4xxx courses may not be used to meet certificate requirements.

Courses—Core courses (5 credits): PA 5431 (3 cr); HRIR 5053 (2 cr). Elective courses: HRIR 5021 (4 cr); HRIR 5023 (2 cr); HRIR 8071 (4 cr); HRIR 8021 (3 cr); HRIR 8024 (2 cr); PA 8386 (3 cr); PA 5401 (3 cr); Hist 5844 (3 cr); Law 6203 (3 cr); Law 6231 (3 cr).

Postbaccalaureate Certificate Requirements

The certificate consists of at least 15 credits: 5 credits in the core (required courses), and 10 credits of supporting electives. Courses are drawn primarily from the Humphrey Institute of Public Affairs and Industrial Relations Center in the Carlson School of Management, with additional courses from the College of Liberal Arts and the Law School. Courses are taught only at the post-baccalaureate level. Students complete 10 elective credits which allows them to focus on the area of public policy that is most relevant to their professional and educational goals and needs. Note that some elective courses require prerequisites which do not count toward the certificate.

Completion Requirements—Early in the program, each student should file a certificate program plan with the College of Continuing Education indicating the courses that will be taken, subject to change with faculty approval. Completion of the certificate program requires completion of the indicated courses with core courses requiring a grade of B or better and with an overall GPA in certificate coursework of 3.00 or better.

Political Psychology

Contact Information—Doctoral Minor in Political Psychology, Center for the Study of Political Psychology, University of Minnesota, 1227 Social Sciences Building, 267 19th Avenue S., Minneapolis, MN 55455; (612-624-0864; fax 612-626-7599; e-mail polipsyc@polisci.umn; <www.polisci.umn.edu/polipsyc/index.html>).

Professor

Patricia G. Avery, Curriculum and Instruction, E
Eugene Borgida, Psychology, E
Karlyn K. Campbell, Speech-Communication, E
Ronald J. Faber, Journalism and Mass Communication, E
William H. Flanigan, Political Science, E
David W. Johnson, Educational Psychology, E
Paul E. Johnson, Information and Decision Sciences, E
Geoffrey M. Maruyama, Educational Psychology, E
W. Phillips Shively, Political Science, E
Mark Snyder, Psychology, E
John L. Sullivan, Political Science, E
Daniel B. Wackman, Journalism and Mass Communication, E

Associate Professor

Guy Charles, Law, E
Martha H. Gonzales, Psychology, E
R. Michael Paige, Educational Policy and Administration, E
Wendy M. Rahn, Political Science, E
Martin W. Sampson III, Political Science, E
Albert R. Tims, Jr., Journalism and Mass Communication, E

Assistant Professor

James N. Druckman, Political Science, E
Joanne Miller, Political Science, E
Alexander J. Rothman, Psychology, E

Curriculum—This minor is available to doctoral students only. Political psychology is a rapidly advancing field of scientific inquiry concerned with psychological aspects of political behavior. It encompasses a variety of interdisciplinary research perspectives, drawing on the theories and methods of core disciplines such as psychology, political science, law, and sociology, as well as interdisciplinary fields such as mass communication and decision sciences. The minor's structured curriculum provides a foundation in basic areas in political psychology: social attitudes and cognition, judgment and decision making, group relations, personality and leadership, mass communication, public opinion, mass political behavior, and political socialization. In addition to providing a background in political psychology, the program trains students in the theory and methods useful to this field, such as content analysis, survey analysis, and experimental design. The faculty is drawn from ten programs within the Graduate School and Law School.

Prerequisites for Admission—Admission is contingent upon prior admission to the Graduate School and a doctoral program in a degree-granting department. Applicants are required to demonstrate knowledge of research methods useful in the study of political psychology by successfully completing (grade of B or above) two or more of the following: EPsy 8261, 8262, or 8266; Pol 8101, 8123, or 8131; Psy 5862, or 8884; Soc 8811; or Stat 5021 or 5302. The director of graduate studies in political psychology must approve admission

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to director of graduate studies approval.

Courses—Please contact the minor program office for information on relevant coursework.

Freestanding Minor Requirements

The doctoral minor requires a minimum of 14 graduate credits, including 8 credits in required courses and 6 credits from at least two electives from outside the student's department or program and from a minimum of two of the following four modules: 1) psychological aspects of political behavior; 2) political socialization and human development; 3) politics in socio-cultural context; and 4) psychological approaches to political decision making: public policy and international relations. Students are able to tailor the minor to complement their major programs. The required courses are the Proseminar in Political Psychology (Pol 8307, 8308; 2 credits), Political Psychology and Socialization (Pol 8311; 3 credits), and Social Cognition (Psy 8201; 3 credits).

Political Science

Contact Information—Department of Political Science, University of Minnesota, 1414 Social Sciences Building, 267 19th Avenue S., Minneapolis, MN 55455 (612-624-4144; fax 612-626-7599; e-mail office@polisci.umn.edu; <www.polisci.umn.edu/graduate/>).

Professor

Mary G. Dietz, FM
Raymond D. Duvall, FM
James Farr, FM
William H. Flanigan, FM
Edwin Fogelman, FM
John R. Freeman, FM
Lawrence R. Jacobs, FM
Ethan B. Kapstein, FM
Robert B. Kvavik, FM
August H. Nimtz, Jr., FM
Steven J. Rosenstone, FM
Thomas M. Scott, FM
W. Phillips Shively, FM
Kathryn A. Sikkink, FM
John L. Sullivan, FM

Associate Professor
Lisa J. Disch, FM
Daniel Kelliher, FM
Richard M. Price, AM
Wendy M. Rahn, FM
Diana E. Richards, FM
Martin W. Sampson III, FM
William Scheuerman, FM
David E. Wilkins, AM

Assistant Professor
Timothy R. Johnson, AM
Colin H. Kahl, AM
Jeffrey D. Lomonaco, AM
Joane Miller, AM
David J. Samuels, AM
Gordon Silverstein, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The curriculum is divided into five subfields: formal models and methodology, political theory, American politics, international relations, and comparative politics.

Prerequisites for Admission—The department's graduate admissions committee selects the strongest applicants it finds based upon consideration of all componenets of the application file. The committee accepts students who have or are completing B.A. or B.S. degrees and students who have or are completing M.A. degrees.

Special Application Requirements—All students, except those in the special master's program, are admitted directly into the Ph.D. program. The following should be sent directly to the department: department application form; GRE scores; a complete set of transcripts in addition to that required by the Graduate School; a brief statement expressing the applicant's purpose and goals in pursuing graduate work (in addition to and separate from the statement required as part of the Graduate School application form); three letters of recommendation from professors who know the applicant's academic work, particularly in political science; and samples of the applicant's written work (papers written for political science courses preferred). Send photocopies of written work; the department cannot guarantee that materials will be returned.

Graduate study in the Ph.D. program must begin in fall semester; the application deadline is January 1. Graduate study in the special M.A. program may begin in any semester; the application deadline for fall semester is May 1; spring semester is October 1.

The department and the Humphrey Institute of Public Affairs jointly offer a program that leads to an M.A. in public affairs and a Ph.D. in political science. To be eligible, students must be admitted separately by political science and public affairs. Normally, students begin their study in public affairs and later apply to the Ph.D. program in political science. However, students may begin in either program, so it is possible to apply initially to either program or both. Students interested in this joint degree program should contact the director of graduate studies.

Use of 4xxx Courses—4xxx and 5xxx courses usually are acceptable for supporting or minor programs with consideration of the stipulations of the department that teaches the course. Political science courses at these levels are generally not open to Ph.D. students, who are expected to take 8xxx seminars. They are open to professional M.A. students.

Courses—Please refer to Political Science (Pol) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements Plan B Only

This program is for secondary school teachers, journalists, government employees, political professionals, and others who would like to cover broad areas of study in political science and related disciplines without the depth and extensive research emphasized in the Ph.D. program. Students may choose among several subfields, including political theory, comparative politics, international relations, American politics, and formal models and methodology.

The M.A. degree, Plan B (without thesis), requires 34 credits, distributed between major courses and minor or related field courses; three research papers, usually written in connection with coursework, are also required.

Language Requirements—None.

Final Exam—The final exams are written and oral.

Ph.D. Degree Requirements

The program is divided into five subfields: American politics, comparative politics, political theory, international relations, and formal models and methodology. A joint M.A.-Ph.D. program is also available that leads to an M.A. in public affairs from the Hubert H. Humphrey Institute of Public Affairs and a Ph.D. in political science.

Students concentrate in two of the five subfields and take a minimum of 10 political science seminars, including Pol 8101 and two of four core seminars in their subfields (Pol 8201, 8301, 8401, 8601). In addition, they take three advanced seminars in their first subfield and three in their second, or four advanced seminars in their first subfield and two in their second subfield (formal models and methodology can be used only as a second subfield).

Language Requirements—Students must demonstrate one of the following: a) high proficiency in one foreign language, b) high proficiency in research methodology, c) low proficiency in two foreign languages, d) low proficiency in one foreign language and low proficiency in research methodology.

Students who concentrate in comparative politics must have appropriate language competence in their area(s) of specialization.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor requires a minimum of 9 credits of graduate-level courses and an exam.

Portuguese

See Hispanic and Luso-Brazilian Literatures and Linguistics.

Program Evaluation

Contact Information—Director of Graduate Studies, Program Evaluation Program, University of Minnesota, 330 Wulling Hall, 86 Pleasant Street S.E., Minneapolis, MN 55455 (612-624-1006: fax 612-624-3377; e-mail kingx004@umn.edu; <http://education.umn.edu/EdPA/>).

Professor
Michael Baizerman, Social Work, Work, Community, and Family Education, Educational Policy and Administration, E
Judith Garrard, Health Services Research, Policy and Administration, E
Richard A. Krueger, Work, Community, and Family Education, E
Frances P. Lawrenz, Curriculum and Instruction, E
Darrell R. Lewis, Educational Policy and Administration, E

Associate Professor
Nancy N. Eustis, Hubert H. Humphrey Institute of Public Affairs, E
David R. Johnson, Institute on Community Integration, E
Jean A. King, Educational Policy and Administration, E

Curriculum—A minor in program evaluation may be pursued at both the doctoral and the master's levels. The core of the curriculum consists of courses in the foundations of evaluation, evaluation theory, and internship experiences.

Prerequisites for Admission—Prior admission into an established M.A. or Ph.D. is required. Admission to the minor, therefore, will be contingent upon enrollment in good standing within a recognized degree-granting program of the University of Minnesota Graduate School.

Special Application Requirements—Students apply for admission through the director of graduate studies and faculty. Students must demonstrate relevant academic background, including research methodology, and experience in a field in which program evaluation is practiced (e.g., public health, social work, and education). Students from existing evaluation programs in EdPA and EPsy are not eligible for the minor.

Use of 4xxx Courses—Use of 4xxx courses is not permitted.

Courses—Please refer to Educational Policy and Administration (EdPA), Educational Psychology (EPsy), Family Social Science (FSoS), Public Health (PubH), and Work, Community, and Family Education (WCFE) in the course section of this catalog for courses pertaining to the program.

Freestanding Minor Requirements

Students need a minimum of 15 credits for the doctoral minor and the minimum of 9 credits for the master's minor. Individual programs are designed through consultation among the student, the major adviser, and the director of graduate studies.

Psychological Foundations of Education

See Educational Psychology.

Psychology

Contact Information—Department of Psychology, University of Minnesota, 249 Elliott Hall, 75 East River Road, Minneapolis, MN 55455 (612-624-4181; fax 612-626-2079; e-mail psyapply@umn.edu; <www.psych.umn.edu>).

Regents' Professor

Ellen S. Berscheid, FM

Professor

Richard D. Arvey, Human Resources and Industrial Relations, FM
Eugene Borgida, FM
Thomas J. Bouchard, Jr., FM
Dwight A. Burkhardt, FM
James N. Butcher, FM
John P. Campbell, FM
Marilyn E. Carroll, Psychiatry, FM
Robert A. Cudeck, FM
Mark L. Davison, Educational Psychology, FM
Byron Egeland, Child Development, FM
Paul W. Fox (emeritus), FM
Peter A. Hancock, Kinesiology, FM
Jo-Ida C. Hansen, FM
Dorothy K. Hatsukami, Psychiatry, FM
William G. Iacono, FM
Paul E. Johnson, Information and Decision Sciences, FM
Daniel J. Kersten, FM
Thomas J. Kiresuk, Psychiatry, AM
Eric Klinger, Social Sciences, Morris Campus, FM
Gordon E. Legge, FM
Gloria R. Leon, FM
Allen S. Levine, Psychiatry, FM
Rodney G. Loper, University Counseling and Consulting Services, FM
David T. Lykken (emeritus), FM
Matthew K. McGue, FM
Stephan J. Motowidlo, FM
J. Bruce Overmier, FM
Christopher J. Patrick, FM
Herbert L. Pick, Jr., Child Development, FM
Paul R. Sackett, FM
Mark Snyder, FM
Sheldon B. Sparber, Pharmacology, FM
L. Alan Sroufe, Child Development, FM
Auke Tellegen (emeritus), FM
Neal F. Viemeister, FM
Richard A. Weinberg, Child Development, FM
David J. Weiss, FM
James E. Ysseldyke, Educational Psychology, FM

Associate Professor

Charles R. Fletcher, FM
Patricia A. Frazier, FM
Martha H. Gonzales, FM
William M. Grove, FM
Darwin D. Hendel, Educational Policy and Administration, AM
Matt G. Kushner, Psychiatry, FM
Chad J. Marsolek, FM
Deniz S. Ones, FM
Carol H. Pazandak, AM
Gail Burton Peterson, FM
Connie R. Wanberg, Human Resources and Industrial Relations, AM
Carolyn L. Williams, Epidemiology, FM

Clinical Associate Professor

James P. Cleary, AM

Assistant Professor

Kathy J. Christensen, Neurology, AM
Jonathan C. Gewirtz, AM
Theresa M. Glomb, Human Resources and Industrial Relations, AM
Harriett L.C. Haynes, University Counseling and Consulting Services, E
Sheng He, AM
Robert F. Krueger, AM
Richard M. Lee, AM
Monica Luciana, AM
Shigehiro Oishi, AM
Alexander J. Rothman, FM

Clinical Assistant Professor

Celia W. Gershenson, AM
John C. Gonsiorek, AM
Scott R. Sponheim, AM
Linda K. Van Egeren, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Except for the psychometric methods specialization and in special circumstances, students are admitted only for the Ph.D. However, a number of Ph.D. subareas require a Plan A master's to ensure that research training starts early. Doctoral program specialties are offered in biological psychopathology, clinical science and psychopathology research, cognitive and biological psychology, counseling psychology, differential psychology/behavior genetics, industrial/organizational psychology, personality research, psychometric methods, school psychology, and social psychology.

Prerequisites for Admission—Prospective students generally have completed 12 credits (three to four courses) of psychology work beyond introductory psychology, including one course in statistics or psychological measurement. For the clinical science program, a course in abnormal psychology is required. An undergraduate major in psychology is desirable, but not necessary.

Special Application Requirements—Applications are accepted for fall admission only; the deadline is January 5. A department application, a statement of career interests, goals, and objectives, three letters of recommendation from persons familiar with the applicant's scholarship and research potential, and scores from the General Test of the GRE should accompany applications. The GRE Subject Test in psychology is recommended. Clinical science program applicants must submit a recently scored MMPI-2 profile. Although there are no specific required minimums for GPAs and GRE scores, the range of scores for those admitted in previous years, as well as other specific requirements, are available from the psychology graduate admissions office.

To ensure full consideration for fellowships and teaching and research assistantships, send the Graduate School application form, transcripts, and application fee to the Graduate School by December 1.

Use of 4xxx Courses—Certain 4xxx courses may be taken for graduate credit. Students should consult the instructor or director of graduate studies.

Courses—Please refer to Psychology (Psy) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements

Each student's program is planned in consultation with an adviser. Plan A requires a minimum of 14 credits in psychology and 6 credits in a minor/related field, and a research thesis. Plan B requires one to three review papers in lieu of a thesis, and a minimum of 30 course credits, of which 14 credits must be in psychology and 6 credits in one or more related fields. For Plan A, the final exam is oral; for Plan B, it may be written, oral, or both.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A master's minor requires a minimum of 6 credits, with specific courses determined in consultation with an adviser and other faculty.

Ph.D. Degree Requirements

Students must satisfy the general area distribution requirement using selected courses in four areas outside their specialization. There are no other general departmental course requirements. Each student's program is individually planned in consultation with an adviser to meet both the individual's goals and the area requirements. The programs in clinical psychology and counseling psychology include specific requirements for applied coursework and practicum and internship experience. Each specialization also requires completion of a series of Ph.D. seminars covering scholarship and research skills. Students also complete 12-15 credits in a minor or supporting program.

Language Requirement—None

Minor Requirements for Students Majoring in Other Fields—The doctoral minor requires a minimum of 12 credits and is designed according to student needs.

Public Affairs

Contact Information—Director of Admissions, Hubert H. Humphrey Institute of Public Affairs, University of Minnesota, 301 19th Avenue South, Minneapolis, MN 55455, (612-624-3800; fax 612-625-3513; e-mail admissions@hhh.umn.edu; <ww.hhh.umn.edu).

Regents' Professor
G. Edward Schuh, AM

Professor
John S. Adams, AM
Sandra O. Archibald, AM
John E. Brandl, AM
John M. Bryson, AM
Nancy N. Eustis, AM
Katherine Fennelly, AM
Stephen A. Hoenack, AM
Ethan B. Kapstein, AM
Kenneth H. Keller, AM
Sally J. Kenney, AM
Morris M. Kleiner, AM
Robert T. Kudrle, AM
Ann R. Markusen, AM
George W. Morse, Applied Economics, AM
Samuel L. Myers, AM
Carlisle F. Runge, Applied Economics, AM
Esther Wattenberg, Social Work, AM

Associate Professor
Ragui A. Assaad, AM
Robert A. Connor, Healthcare Management, AM
Edward G. Goetz, AM
Maria J. Hanratty, AM
Deborah Levison, AM
Melissa M. Stone, AM

Assistant Professor
Karen Chapple, AM
Kenneth A. Kriz, AM

Other
Zbigniew M. Bochniarz, AM
Harry C. Boyte, AM
Barbara C. Crosby, AM
William A. Diaz, AM
Marsha A. Freeman, AM
Thomas F. Luce, AM
Barbara L. Lukermann, AM
Lee Munnich, AM
Joseph H. Nathan, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The master of public affairs (M.P.A.) is intended for mid-career professionals and working professionals seeking new skills and understandings. It is a broad, generalist program that emphasizes leadership and the study of specific policy and skill areas. Completion of degree requirements should be possible within a calendar year (two semesters and a summer) of full-time work, or two years of part-time work. Structured concentrations include advanced policy analysis methods; economic and community development; foreign policy and international affairs; public and nonprofit leadership and management; science and technology policy; social policy; women and public policy; land use/urban design planning; regional, economic and workforce development; housing and community development; environmental planning; and transportation planning.

Prerequisites for Admission—Ten years or more of career or public affairs experience and a U.S. bachelor's degree or a comparable foreign degree from a recognized college or university are required.

Special Application Requirements—In addition to the materials submitted to the Graduate School, applicants must submit to the Humphrey Institute a photocopy of the Graduate School admission application, a Humphrey Institute Applicant Data form, copies of all transcripts, a statement of purpose, at least three letters of recommendation, and a work résumé. Entry is for fall semester.

Use of 4xxx Courses—Use of 4xxx courses on degree program forms is permitted with instructor's and adviser's permission.

Courses—Please refer to Public Affairs (PA) in the course section of this catalog for courses pertaining to the program.

M.P.A. Degree Requirements

The M.P.A. requires 30 credits, including PA 8001—Synthesis Seminar (4 cr, PA 8002—Synthesis Workshop (4 cr), and PA 5941—Leadership for the Common Good (4 cr); 9 credits in concentration electives such as economic development, foreign policy and international affairs, social policy, or other related courses; 6 credits in skills courses; and 3 credits of free electives. Participants have the option to pursue a minor or related field offered by another college within the University .

Language Requirements—None.

Final Exam—Projects in the synthesis seminar and workshop take the place of a Plan B paper and final oral exam.

Public Health

Contact Information—Student Services Center, School of Public Health, University of Minnesota, MMC 819, 420 Delaware Street S.E., Minneapolis, MN 55455 (612-626-3500 or 1-800-774-8636; fax 612-626-6931; e-mail sph-uofm@greg2.sph.umn.edu; <www.sph.umn.edu>).

Professor
Michael Baizerman, Social Work, E
Robert W. Blum, Pediatrics, E
Judith E. Brown, E
Judith M. Garrard, E
Susan G. Gerberich, E
Robert W. Jeffery, E
Barbara J. Leonard, Nursing, E
A. Marshall McBean, E
Michael D. Resnick, Pediatrics, E
Robert L. Veninga, E
Carolyn L. Williams, E

Associate Professor
Lester E. Block, E
Ann W. Garwick, E
Leslie A. Grant, Carlson School of Management, E
Wendy L. Hellerstedt, E
Patricia M. McGovern, E
Joan M. Patterson, E
Barbara A. Spradley (emeritus), E

Other
Lee E. Schacht, E

Curriculum—The public health minor is available to master's (M.A. and M.S.) and doctoral students.

Prerequisites for Admission—Admission is contingent upon prior admission to a master's or doctoral degree-granting program within the Graduate School. Students enrolled in graduate programs within the School of Public Health are not eligible for this minor.

Special Application Requirements—Students declaring a minor in public health should contact the director of graduate studies in public health as early as possible. Enrollment is contingent upon approval of the application by the director of graduate studies, after which a minor program adviser(s) is assigned.

Use of 4xxx Courses—Use of 4xxx courses is not permitted.

Courses—Please refer to Public Health (PubH) in the course section of this catalog for courses pertaining to the program.

Freestanding Minor Requirements

The master's minor requires a minimum of 8 graduate credits; the doctoral minor a minimum of 14 graduate credits. Courses for the minor must be selected from those offered by the School of Public Health. In order to meet the minor requirements, students must successfully complete graduate coursework in each of the following disciplines: biostatistics, epidemiology and environmental health. These courses should meet the content level of the School's basic courses in those subjects: PubH 5414—Biostatistical Methods I, PubH 5320—Fundamentals of Epidemiology and PubH 5200—Environmental Health.

If students have already taken comparable graduate level courses in these disciplines, other public health courses could be used to complete the minor requirement with the approval of the public health adviser and the director of graduate studies. Since public health courses may have prerequisites or enrollment limitations, early planning with your adviser is suggested.

Language Requirements—None.

Public Policy

Contact Information—Director of Admissions, Hubert H. Humphrey Institute of Public Affairs, University of Minnesota, 301 19th Avenue South, Minneapolis, MN 55455 (612-624-3800; fax 612-625-313; e-mail admissions@hhh.umn.edu; <www.hhh.umn.edu>).

Regents' Professor
G. Edward Schuh, AM

Professor
Dean E. Abrahamson, AM
John S. Adams, AM
Sandra O. Archibald, AM
Richard S. Bolan (emeritus), AM
John E. Brandl, AM
John M. Bryson, AM
Nancy N. Eustis, AM

Katherine Fennelly, AM
Stephen A. Hoenack, AM
Ethan B. Kapstein, AM
Kenneth H. Keller, AM
Sally J. Kenney, AM
Morris M. Kleiner, AM
Robert T. Kudrle, AM
Ann R. Markusen, AM
George W. Morse, Applied Economics, AM
Samuel L. Myers, AM
Carlisle F. Runge, Applied Economics, AM
Esther Wattenberg, Social Work, AM

Associate Professor
Ragui A. Assaad, AM
Robert A. Connor, Healthcare Management, AM
Edward G. Goetz, AM
Maria J. Hanratty, AM
Deborah Levison, AM
Melissa Stone, AM

Assistant Professor
Karen Chapple, AM
Kenneth A. Kriz, AM

Other
Zbigniew M. Bochniarz, AM
Harry C. Boyte, AM
Barbara C. Crosby, AM
William A. Diaz, AM
Marsha A. Freeman, AM
Thomas F. Luce, AM
Barbara L. Lukermann, AM
Lee W. Munnich, AM
Joseph H. Nathan, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The master of public policy (M.P.P.) curriculum is built upon a core of required theoretical and methodological courses. In remaining courses, students choose either to emphasize more advanced study of analysis or management, or to focus on a particular substantive area of public policy. Structured concentrations include advanced policy analysis methods, economic and community development, foreign policy and international affairs, public and nonprofit leadership and management, science and technology policy, social policy, and women and public policy. Students have multiple opportunities to apply the concepts learned in their coursework to real-life policy problems—through cases presented in courses, through their internships, and in the capstone seminar or workshop.

Prerequisites for Admission—Students are expected to have completed the equivalent of an introductory course in microeconomics.

Special Application Requirements—In addition to the materials submitted to the Graduate School, applicants must submit to the Humphrey Institute a photocopy of the Graduate School admission application, the Humphrey Institute Applicant Data Form, copies of all academic transcripts, a statement of purpose, at least three letter of recommendation, and a GRE official score report. Students who wish to be considered for financial aid should apply no later than January 15 of the preceding academic year. Entry is for fall semester.

Use of 4xxx Courses—Use of 4xxx courses towards degree requirements is permitted with instructor's and adviser's permission.

Courses—Please refer to Public Affairs (PA) in the course section of this catalog for courses pertaining to the program.

M.P.P. Plan B Degree Requirements

The M.P.P. requires 45 credits including up to 21credits in required core courses, a three-course concentration (9 credits minimum), and a 3-credit capstone seminar or workshop course. Remaining credits are taken in elective courses. A non-credit internship is also required, unless the student is exempted based on previous relevant employment.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A minor is constructed in consultation with the student's minor adviser.

Quaternary Paleoecology

Contact Information—Emi Ito, Director of Graduate Studies, Quaternary Paleoecology Graduate Program, University of Minnesota, 108 Pillsbury Hall, 310 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-624-7881; fax 612-625-3819; e-mail qpminor@umn.edu).

Regents' Professor
Herbert E. Wright, Jr. (emeritus), Geology and Geophysics, E

Professor
Subir K. Banerjee, Geology and Geophysics, E
Dwight A. Brown, Geography, E
Edward J. Cushing, Ecology, Evolution, and Behavior, E
R. Lawrence Edwards, Geology and Geophysics, E
Guy E. Gibbon, Anthropology, E
Emi Ito, Geology and Geophysics, E
Thomas C. Johnson, Geology, E
Edward A. Nater, Soil, Water, and Climate, E
Richard H. Skaggs, Geography, E
Peter S. Wells, Anthropology, E

Associate Professor
James Cotner, Ecology, Evolution, and Behavior, E
Katherine Klink, Geography, E

Assistant Professor
Greg Laden, Anthropology, E
Martha Tappen, Anthropology, E

Curriculum—This minor offers a structured interdisciplinary graduate curriculum for students working in quaternary paleoecology. Students learn analytical techniques and research approaches that they can apply to their research from other disciplines.

The minor in quaternary paleoecology is available to master's (M.A. and M.S.) and doctoral students. Students benefit from the broad range of expertise and experience available from faculty at a large research university.

Prerequisites for Admission—Admission is contingent on prior admission to a Graduate School degree-granting program.

Special Application Requirements—Students apply by sending a letter of application to the director of graduate studies (qpminor@umn.edu) as well as a letter of recommendation from their current adviser. Application may be made at any time.

Use of 4xxx Courses—Any 4xxx course included in the published list at <http://lrc.geo.umn.edu/QP/> may be used to satisfy the minor requirement.

Courses—See <http://lrc.geo.umn.edu/QP/> and contact the director of graduate studies at qpminor@umn.edu for information on relevant coursework.

Freestanding Minor Requirements

Students develop their program in consultation with their major adviser and the director of graduate studies in quaternary paleoecology. Students must take a series of required courses, but some requirements may be waived depending on the student's background. The master's minor requires at least 6 graduate credits from the minor course lists, including one of the three required courses. The doctoral minor requires at least 9 graduate credits from the lists, including two of the three required courses (the third course may be from the required list or from the additional course list).

The required courses include Geo 4631—Earth System: Geosphere/Biosphere Interactions (3 cr); Geog 5426—Climatic Variations (3 cr); and Anth 4069—Environmental Archaeology (3 cr).

Recreation, Park, and Leisure Studies

Contact Information—Linda Estrem, Office of the Director of Graduate Studies, School of Kinesiology and Leisure Studies, University of Minnesota, 220 Cooke Hall, 1900 University Avenue S.E., Minneapolis, MN 55455 (612-624-5017; 612-625-5300; fax 612-626-7700; e-mail rpls@umn.edu; <www.kls.coled.umn.edu/>).

Professor
Dorothy H. Anderson, Forest Resources, AM
William C. Gartner, Applied Economics, AM
Mary Jo Kane, AM
Leo H. McAvoy, Jr., AM
John E. Rynders, Educational Psychology, AM
Michael Wade, AM

Associate Professor
Bruce D. Anderson, AM
Carla E. S. Tabourne, AM
Diane M. Wiese-Bjornstal, AM

Assistant Professor
W. Corliss Outley, AM

Instructor
JoAnn Buysse, AM
Maurice K. Fahnestock, AM
Stephan P. Carlson, Forest Resources, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Emphasis areas in the master's program are leisure services management, outdoor recreation/education, sport management, and therapeutic recreation.

Prerequisites for Admission—Although prospective students generally have an undergraduate degree in recreation, park, and leisure studies, others with a baccalaureate degree including related preparation and a significant background and interest in the scientific study of recreation, park and leisure studies may be admitted. Admitted students may be required to complete background preparation in undergraduate and graduate recreation, park, and leisure studies and related coursework.

Special Application Requirements—Applicants must submit a completed application form including a clearly written statement of academic interests, goals, and objectives, scores from the General Test of the GRE (verbal and quantitative) or the Miller Analogies Test that are less than five years old, three letters of recommendation from persons familiar with their scholarship and research potential, a scholarly paper, and copies of official transcripts. Students may apply at any time; however, submission of all application materials by January 15 is strongly encouraged to ensure priority consideration as well as teaching and research assistantships awarded for the next academic year. Students can be admitted any term.

Research Facilities—Research facilities include the Institute on Community Integration and the Tucker Center for Research on Girls and Women in Sport.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please refer to Recreation, Park, and Leisure Studies (Rec) in the course section of this catalog for courses pertaining to the program.

M.A Degree Requirements

Students select an emphasis in leisure services management, outdoor education/recreation, sport management, or therapeutic recreation.

The M.A. is offered under Plan A and Plan B. Plan A requires 30 credits, including at least 14 credits in recreation, park, and leisure studies, 6 credits in a minor or related field, and 10 thesis credits (Rec 8777). Plan B also requires 30 credits, including at least 14 credits in recreation, park, and leisure studies, 6 credits in a minor or related field, 4 credits of a research project (Rec 8995), and 6 additional credits in any of these areas. A 3.00 minimum GPA is required to maintain good standing and to graduate.

Language Requirements—None.

Final Exam—The final exam is oral.

Rehabilitation Science

Contact Information—LaDora Thompson, Ph.D., PT, Director of Graduate Studies, University of Minnesota; Mayo Mail Code 388, 420 Delaware St. S.E., Minneapolis, MN 55455; (612-626-5271; fax 612-625-7192; e-mail thomp067@umn.edu; <www.med.umn.edu/rehabsci/>).

Professor
Richard DiFabio, FM
Robert Patterson, FM

Associate Professor
James Carey, FM
Dennis Dykstra, AM
Virgil Mathiowetz, FM
Judith Reisman, AM
Glenn Scudder, E
Erica Stern, AM
LaDora Thompson, FM

Assistant Professor
Lisa Dorsey, E
Paula Ludewig, FM
Kirsten Ness, E

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Physical rehabilitation optimizes recovery from disease or injury. The program prepares individuals to have a critical mind and research skills that will advance this clinical science. Emphasis areas in neurological rehabilitation and musculoskeletal rehabilitation are offered.

Prerequisites for Admission—Applicants must hold a bachelor's degree or graduate degree in a discipline related to rehabilitation such as biomedical engineering, medicine, occupational therapy, physical therapy, or speech/audiology. International students must hold a comparable foreign degree from an accredited program. Depending on the educational background of the applicant, admission may be contingent upon completion of selected prerequisite coursework (i.e., physics, etc.).

Special Application Requirements—Applicants must submit the following materials: Graduate Record Examination (GRE) general test scores; three letters of reference; Test of Spoken English (TSE) score and TOEFL score for international students. All applicants must have a minimum undergraduate GPA of 3.0 and an agreement from a Rehabilitation Science faculty member to serve as an adviser. Compatibility of research interests is a major determinant in the selection of a student/advisor relationship.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms requires adviser and director of graduate studies approval. The use of 4xxx courses on degree program forms is highly discouraged.

Courses—Please refer to Rehabilitation Science (RSc) and Physical Medicine and Rehabilitation (PMed) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements

Plan A (thesis) requires a minimum of 33 credits: a minimum of 14 credits in the major, including 6 credits of rehabilitation science seminars (PMed 5100, 8101, and 8102) and a research design course in rehabilitation science; a minimum of 6 credits in a minor or related fields; a statistics course (EPsy 5261 or equivalent); and a minimum of 10 thesis credits (RSc 8777). In place of the 10 thesis credits for Plan A, Plan B (nonthesis) requires courses chosen in consultation with an adviser and a Plan B project. Students must maintain a 3.00 minimum GPA for all coursework taken in the program.

Language Requirements—None.

Final Exam—For Plan A, the final exam is oral; for Plan B, it may be written, oral, or both.

Ph.D. Degree Requirements

The Ph.D. requires a minimum of 36 course credits: 16 credits in core courses (including 6 credits of rehabilitation science seminars), 12 credits in a minor or supporting program, 8 credits in statistics (credits earned in core courses and statistics cannot be applied to the minor or supporting program); and 24 thesis credits. Students must maintain a 3.00 minimum GPA for all coursework taken in the program.

Language Requirements—None.

Religions in Antiquity

See Classical and Near Eastern Studies.

Religious Studies

Contact Information—Director of Graduate Studies, Department of Classical and Near Eastern Studies, University of Minnesota, 305 Folwell Hall, 9 Pleasant Street S.E., Minneapolis, MN 55455 (612-625-5353).

Professor
Josef L. Altholz, History, E
Frederick M. Asher, Art History, E
Bernard S. Bachrach, History, E
Caesar E. Farah, Afro-American and African Studies, E
Jasper S. Hopkins, Philosophy, E
Riv-Ellen Prell, American Studies, E
Theofanis G. Stavrou, History, E
James D. Tracy, History, E
Gayle Graham Yates, American Studies, E

Associate Professor
William W. Malandra, E
Jonathan S. Paradise, E
Philip H. Sellew, E

Lecturer
David A. Shupe, E

Curriculum—The minor in religious studies is available to master's (M.A. and M.S.) and doctoral students in relevant fields, such as history, classics, English, anthropology, philosophy, and American studies and is under the general direction of members of the graduate faculty, who represent a broad spectrum of disciplines.

Prerequisites for Admission—Admission is contingent on prior admission to a master's or doctoral degree-granting program within the Graduate School.

Special Application Requirements—Students should consult with the director of graduate studies for the program as early as possible, and in any case no later than their third semester of study. The director of graduate studies must approve the applicant's proposed course of study and sign the student's degree program form.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to approval by the director of graduate studies.

Freestanding Minor Requirements

The minor requires 9 credits for an M.A. and 12 semester credits for the Ph.D. All minors will have at least one of the religious studies graduate faculty as members of their examination committees. All students enrolled in the minor take RelA 5700—Theory and Method in Religious Studies, and choose two (M.A.) or three (Ph.D.) of the following courses to complete the program: Afro 5036, AmSt 5101, ANE 5501/2, 5503/4, Anth 5059, Arab 5542, ArtH 5795, Clas 5088/9, 5252, JwSt 5013, 5960, 5111, Phil 8081, 8550, RelA 5071, 5072, 5073, 5080, 8310, SALC 5412/3.

Language Requirements—There are no special language requirements beyond those of the student's major program.

Rhetoric and Scientific and Technical Communication

Contact Information—Department of Rhetoric, University of Minnesota, 64 Classroom Office Building, 1994 Buford Avenue, St. Paul, MN 55108 (612-624-4761; fax 612-624-3617; e-mail rhetoric@umn.edu; <www.rhetoric.umn.edu>).

Rhetoric and Scientific and Technical Communication Graduate Faculty

Professor

John H. Beatty, Ecology, Evolution, and Behavior, FM
Lillian S. Bridwell-Bowles, English, FM
Karlyn K. Campbell, Speech-Communication, FM
Terence G. Collins, General College, AM
Shirley N. Garner, English, FM
Michael F. Graves, Curriculum and Instruction, FM
Alan G. Gross, Rhetoric, FM
Mary M. Lay, Rhetoric, FM
Helen E. Longino, Women's Studies, AM
Earl E. McDowell, Rhetoric, FM
Victoria M. Mikelonis, Rhetoric, AM
Donald J. Ross, Jr., English, AM
Edward A. Schiappa, Speech-Communication, FM
Robert L. Scott (emeritus) Speech-Communication, FM
Richard A. Swanson, Work, Community, and Family Education, FM
Billie J. Wahlstrom, Rhetoric, FM

Associate Professor

Lisa Albrecht, General College, AM
William A. Babcock, Journalism and Mass Communication, AM
Robert L. Brown, Jr., Cultural Studies and Comparative Literature, FM
Simon Hooper, Curriculum and Instruction, AM
Laura J. Gurak, Rhetoric, FM
Thomas M. Scanlan, Rhetoric, AM
Arthur E. Walzer, Rhetoric, FM

Assistant Professor

Lee-Ann Kastman Breuch, AM
Richard J. Graff, AM
John Logie, AM
Daniel J. Philippon, AM

Scientific and Technical Communication Graduate Faculty

Professor

Alan G. Gross, Rhetoric, AM
Mary M. Lay, Rhetoric, AM
Earl E. McDowell, Rhetoric, AM
Victoria M. Mikelonis, Rhetoric, AM
Billie J. Wahlstrom, Rhetoric, AM

Associate Professor

Laura J. Gurak, Rhetoric, AM
Thomas M. Scanlan, Rhetoric, AM
Arthur E. Walzer, Rhetoric, FM

Assistant Professor

Lee-Ann Kastman Breuch, AM
Richard J. Graff, AM
John Logie, AM
Daniel J. Philippon, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The M.S. focuses on applying basic theory and research to the practice of scientific and technical communication in the workplace. It is designed for students who plan to be technical communicators or information developers in business and industry. Required courses cover audience analysis, new media, message design, human factors and usability research, strategic planning, and technical training.

The M.A. and Ph.D. in rhetoric and scientific and technical communication prepare students to address complex issues in language, science, and technology. The programs are flexible enough to allow students to approach their studies from a variety of perspectives and research methods. This option prepares students for teaching at a university and conducting research in rhetoric and scientific and technical communication. The programs can also prepare students for specialist positions in industry and government that require the analysis and design of human communication systems. Required courses include theory, research, and practice in rhetoric and scientific and technical communication and in a minor or related field.

Prerequisites for Admission—All M.S. applicants are required to have a bachelor's degree from an accredited college or university; 15 credits in science, technology, mathematics, and/or engineering; 9 credits in advanced communication courses such as writing/editing, oral communication, visual communication, organizational communication, and communication theory; and 3 credits in computer science or management information systems, or demonstrated equivalent experience.

All M.A. and Ph.D. applicants must meet the admission requirements of the Graduate School and will be expected to have completed coursework or have equivalent experience in advanced communication (e.g., writing/editing, oral communication, visual communication, organizational communication, or communication theory) and one of the following areas: computer science, management information systems, science, technology, mathematics, engineering, or other related fields.

Special Application Requirements—Scores from the General Test of the GRE that are less than five years old are required of students with baccalaureate degrees from U.S. institutions. Nonnative speakers of English are required to take the TOEFL with satisfactory scores. All applicants must submit three letters of recommendation, two writing samples, and a professional objective statement. M.S. deadlines are June 15 for fall semester admission and October 15 for spring semester admission. All M.A. and Ph.D. applicants begin in the fall semester and have a January 15 deadline.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses— Please refer to Rhetoric (Rhet) in the course section of this catalog for courses pertaining to the program.

M.S. and M.A. Degree Requirements

The M.S. in scientific and technical communication requirements for Plan A and Plan B are the same except that Plan A requires a thesis (10 credits) and Plan B requires a project (5 credits). Students take six courses in theory, research, and practice in technical communication. An internship is required for any student who has not yet worked as a technical communicator in industry. Students take additional electives in rhetoric to complete 34 credits for Plan A or 30 credits for Plan B.

The M.A. requirements for Plan A and Plan B are the same except that Plan A requires a thesis (10 credits) and Plan B requires a project (5 credits). Students take six courses (18 credits) in theory, research, and practice in rhetoric and scientific and technical communication and in a minor or related field. An internship (3 credits) is required for those intending to pursue research or specialist positions in industry. Minor or related fields (6 credits) may focus on areas

such as speech-communication, English, curriculum and instruction, women's studies, cognitive psychology, and history of science. Students take additional electives in rhetoric to complete 30 credits.

Language Requirements—None for M.S. students. M.A. students must demonstrate proficiency in a foreign language of their choice either by taking 3 credits of a beginning level language course or having their adviser and the director of graduate studies certify that they have reading comprehension in a particular language. A student could fulfill this requirement by taking a beginning 3 credit course or by completing a non-credit course such as Fren 0001—Reading French in the Arts and Sciences or Ger 1001—Begininging German. These courses are non-credit and are offered through the College of Continuing Education.

Final Exam—For both Plans A and B, students must pass an oral examination in which they defend their master's work and demonstrate competence in their chosen field of study.

Ph.D. Degree Requirements

Ph.D. students in rhetoric and scientific and technical communication are required to earn a minimum of 42 credits beyond the master's. This plan requires a minimum of 21 credits in rhetoric seminars—two of those seminars must be in rhetorical theory and criticism within rhetoric course offerings. Students take two courses (6 credits) in rhetorical theory and criticism beyond the M.A. requirements; two courses in technical communication research and theory (6 credits) including Rhet 8011 and 8012; two courses (6 credits) in a particular area of study such as science and rhetoric; feminist theory in science, technology, and communication; scientific and technical communication pedagogy; or technology and culture; 6 credits in research methods courses; and 12 credits in a minor or related field. Minor or supporting programs may focus on areas such as speech-communication, English, curriculum and instruction, women's studies, cognitive psychology, or history of science. In addition, 6 elective credits are needed to fulfill the minimum credit requirement. Students may fulfill 18 credits of Ph.D. work in completing M.A. requirements (usually two courses in rhetorical theory and three courses in other core areas). Twenty-four thesis credits are also required. The final exam is oral.

Language Requirements—Ph.D. students must demonstrate proficiency in a foreign language of their choice either by taking 3 credits of a beginning level language course or having their adviser and the director of graduate studies certify that they have reading comprehension in a particular language. A student could fulfill this requirement by taking a beginning 3 credit course or by completing a non-credit course such as Fren 0001—Reading French in the Arts and Sciences or Ger 222—Reading German. These courses are non-credit and are offered through the College of Continuing Education.

Minor Requirements for Students Majoring in Other Fields—For M.A. and M.S. students, the minor requires 6 credits in 5xxx and 8xxx rhetoric courses. The minor for Ph.D. students requires 12 credits of 5xxx and 8xxx courses (6 of which can be taken for the M.A. or M.S. degree) with one course being in rhetorical theory and criticism. Students may choose the remaining courses from any of Rhetoric's graduate courses.

Russian Area Studies

Contact Information—Russian Area Studies, Area Studies Programs, University of Minnesota, 214 Social Sciences Building, 267 19th Avenue S., Minneapolis, MN 55455 (612-624-8543; fax 612-626-2242).

Professor

John S. Adams, Public Affairs, AM
Iraj Bashiri, Linguistics and Asian and Slavic Languages and Literatures, AM
Gary R. Jahn, Linguistics and Asian and Slavic Languages and Literatures, AM
Anatoly Liberman, German, Scandinavian, and Dutch, AM
Thomas S. Noonan, History, AM
Herbert L. Pick, Jr., Child Development, AM
Miranda Beaven Remnek, AM
Theofanis G. Stavrou, History, AM
Carol L. Urness, AM
Rudolph J. Vecoli, History, AM

Associate Professor

Irina H. Corten, Linguistics and Asian and Slavic Languages and Literatures, AM
Leonard A. Polakiewicz, Linguistics and Asian and Slavic Languages and Literatures, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—This program provides students with the knowledge to better understand the Russian world, its history, culture, and restructuring in the post-Soviet era. As Russia redefines its place in the world, and as trade and cultural links between Russian and the United States grow, Russian area specialists are increasingly needed. Areas of concentration include Russian history, Russian literature, and twentieth-century Russia.

Prerequisites for Admission—A bachelor's degree from an accredited university or college is required.

Special Application Requirements—The following must be forwarded directly to the department: three letters of recommendation, a copy of one or more papers representative of current level of scholarly development, and a statement of the student's purpose. Scores from the General Test of the GRE are required. Prospective students should contact the department for further information. Students are admitted each semester.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please refer to Russian Area Studies (RAS), Russian (Russ), Global Studies (GloS), Central Asian Studies (CAS), Polish (Plsh), and Slavic (Slav) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements

The M.A. program uses an interdisciplinary approach involving both the humanities and the social sciences. Students must complete required coursework, master appropriate theoretical frameworks, and acquire a concise understanding of topic(s) developed in the Plan A thesis or in three Plan B papers. The thesis/papers must show a broad knowledge of the Russian area, methodological sophistication, and clear evidence of research in Russian language sources. Students must also demonstrate advanced Russian language proficiency.

All students complete six distribution courses (18 credits), including two courses on Russian literature (Russ 5421—Literature: Middle Ages to Dostoevsky in Translation and Russ 5422—Literature: Tolstoy to the Present in Translation), one course in social science (Geog 5181—Russia and Environs), two graduate level courses in Russian history, and a scope and methods course (Area 8061). Plan A students must complete three additional courses (9 credits) in their declared area of concentration and 10 thesis credits. Plan B students must complete four additional courses (12 credits) in their declared area of concentration.

Language Requirements—Students must demonstrate advanced Russian language proficiency by passing a special exam or by earning a B or higher average in Russ 3101-02 or the equivalent.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—The master's minor requires intermediate proficiency in the Russian language (as demonstrated by passing a special exam or by earning a B or higher average in Russ 3001-02 or the equivalent) and completion of three courses (9 credits) in the field, including at least two semesters of seminars/proseminars.

Scandinavian Studies

See Germanic Studies.

School Psychology

See Educational Psychology.

Science, Technology, and Environmental Policy

Contact Information—Director of Admission, Hubert Humphrey Institute of Public Affairs, University of Minnesota, 301 19th Avenue South, Minneapolis, MN 55455 (612-624-3800; fax 612-625-3513; e-mail admissions@hhh.umn.edu; <www.hhh.umn.edu>).

Regents' Professor
G. Edward Schuh, AM

Professor
Dean E. Abrahamson, AM
John S. Adams, AM
Sandra O. Archibald, AM
John E. Brandl, AM
John M. Bryson, AM
Nancy N. Eustis, AM
Katherine Fennelly, AM
Stephen A. Hoenack, AM
Ethan B. Kapstein, AM
Kenneth H. Keller, AM
Sally J. Kenney, AM
Morris M. Kleiner, AM
Robert T. Kudrle, AM
Ann R. Markusen, AM
Samuel L. Myers, AM
Carlisle F. Runge, Applied Economics AM
Esther Wattenberg, Social Work, AM

Associate Professor
Ragui A. Assaad, AM
Edward G. Goetz, AM
Maria J. Hanratty, AM
Deborah Levison, AM
Melissa M. Stone, AM

Assistant Professor
Karen Chapple, AM
Kenneth A. Kriz, AM

Other
Zbigniew M. Bochniarz, AM
Harry C. Boyte, AM
Barbara C. Crosby, AM
William A. Diaz, AM
Marsha A. Freeman, AM
Thomas F. Luce, AM
Barbara L. Lukermann, AM
Lee W. Munnich, AM
Joseph H. Nathan, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The M.S. program provides students with an understanding of the role of science and technology in food and health, the economy, energy and the environment, security, and education; the impact of science and technology on the political and economic relationships among nations; and the analysis and design of policies for appropriate promotion and regulation of science and technology regionally, nationally, and internationally. The program educates students with natural and social science backgrounds to assume roles in public policy development.

Prerequisites for Admission—Students typically have undergraduate degrees or advanced coursework in one of the natural or engineering sciences. They are also expected to have completed the equivalent of an introductory course in microeconomics.

Special Application Requirements—In addition to the materials submitted to the Graduate School, applicants must submit to the Humphrey Institute a photocopy of the Graduate School application, the Humphrey Institute Applicant Data Form, copies of all academic transcripts, a statement of purpose, at least three letters of recommendation, and a GRE official score report. Students who wish to be considered for financial aid should apply no later than January 15 of the preceding academic year. Entry is for fall semester.

Use of 4xxx Courses—Use of 4xxx courses toward degree requirements is permitted with instructor's and adviser's permission.

Courses—Please refer to Public Affairs (PA) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements

The M.S., which is offered under both Plan A (thesis) and Plan B (non-thesis), requires 40 credits including 21 credits in five core areas—12 credits in the area of science, technology, and environmental policy and 9 credits of the politics of public affairs, economic reasoning, and empirical analysis. Students should take an additional 6 credits to complement their previous training: appropriate courses in natural or engineering science or its history or philosophy for those with social science backgrounds; appropriate courses in the social sciences for those with natural or engineering science backgrounds. Plan A also requires 10 thesis credits. Plan B requires completion of a Plan B paper (3 credits). The remaining elective credits (3 for Plan A; 10 for Plan B) are chosen in consultation with the student's adviser.

Language Requirements—None.

Final Exam—The final exam is oral.

Scientific and Technical Communication

See Rhetoric and Scientific and Technical Communication.

Scientific Computation

Contact Information—Director of Graduate Studies, 151 Amundson Hall, 421 Washington Ave. S.E., Minneapolis, MN 55455 (612-625-8881; fax 612-626-7246; e-mail scic@cems.umn.edu; <http://scicomp.cs.umn.edu>).

Regents' Professor
Avner Friedman, Mathematics, FM
L. E. Scriven, Chemical Engineering and Materials Science, FM

Professor
Ronald E. Anderson, Sociology, FM
Daniel L. Boley, Computer and Information Sciences, FM
Graham V. Candler, Aerospace Engineering and Mechanics, FM
James R. Chelikowsky, Chemical Engineering and Materials Science, FM
J. Bernardo Cockburn, Mathematics, FM
Jeffrey J. Derby, Chemical Engineering and Materials Science, FM
Timothy J. Ebner, Neuroscience, FM
Jiali Gao, Chemistry, FM
Efi Foufoula-Georgiou, Civil Engineering, FM
Alexander Y. Grosberg, Physics and Astronomy, FM
Daniel J. Kersten, Psychology, FM
Vipin Kumar, Computer Science, FM
John S. Lowengrub, Mathematics, FM
Mitchell B. Luskin, Mathematics, FM
John L. Nieber, Biosystems and Agricultural Engineering, FM
Hans George Othmer, Mathematics, FM
N.P. Papanikolopoulos, Computer and Information Sciences, FM
Haesun Park, Computer and Information Sciences, FM
Yousef Saad, Computer Science, FM
George R. Sell, Mathematics, FM
Charles C. S. Song, Civil Engineering (emeritus), FM
Harlan W. Stech, Mathematics and Statistics, Duluth, FM
Ahmed H. Tewfik, Electrical Engineering, FM
David D. Thomas, Biochemistry, FM
Luke Jon Tierney, Statistics, FM
Donald G. Truhlar, Chemistry, FM
Vaughan R. Voller, Civil Engineering, FM
George L. Wilcox, Neuroscience, FM
Paul R. Woodward, Astronomy, FM
David A. Yuen, Geology and Geophysics, FM

Associate Professor
John V. Carlis, Computer and Information Sciences, FM
Christopher J. Cramer, Chemistry, FM
David M. Ferguson, Medicinal Chemistry and Pharmacognosy, FM
David J. Lilja, Electrical and Computer Engineering, FM
J. Ilja Siepmann, Chemistry, FM
Jaideep Srivastava, Computer and Information Sciences, FM
Michael R. Taaffe, Operations and Management Science, FM

Assistant Professor
Norman J. Troullier, Computer and Information Sciences, AM

Other
Phillip Barry, Computer Science, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—This program encompasses coursework and research on the fundamental principles for using intensive computation to support research in the physical, biological, and social sciences and engineering. Emphasis is on research issues, state-of-the-art methods, and applying these methods to outstanding problems in science, engineering, and other fields that use scientific computation, numerical analysis and algorithm development, symbolic and logic analysis, high-performance computing tools, supercomputing and heterogeneous networks, and visualization. A handbook that describes the program and degree requirements in detail is available from the program.

Prerequisites for Admission—Applicants fill out a form provided by the program as well as applicable Graduate School forms. A bachelor's degree in a field that uses scientific computation is required for admission. Applicants without such a degree who expect to obtain one before the date on which admission in the graduate program is sought may also apply.

Special Application Requirements—Applicants must submit scores from the General Test of the GRE, three letters of recommendation from persons familiar with their scholarship and research potential, a complete set of official transcripts, and a clearly written statement of career interests, goals, and objectives. Students may apply at any time; however, submission of all application materials by January 1 is strongly encouraged to ensure priority consideration for fellowships and assistantships; late applications are considered if space is available.

M.S. Plan A Degree Requirements

The program is offered under Plan A (thesis), which includes a minimum of 20 course credits and 10 thesis credits. The course credits must include at least 14 credits from the scientific computation core or supplementary courses (with at least 6 credits from the core courses) and at least 6 credits in a minor. A core or supplementary course that is also in the minor area may be counted toward either requirement but not toward both; however, a maximum of 3 credits in such courses may be counted toward the core/supplementary requirement.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval. Students from other majors may include such courses subject to their own program's approval.

Courses—Please refer to the Scientific Computation (SciC) in the course section of this catalog for courses pertaining to the program.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—The master's minor requires approval of the director of graduate studies and a minimum of 6 credits from the core curriculum; the credits may not be from courses in the student's major field.

Ph.D. Degree Requirements

A minimum of 32 course credits is required with a minimum of 16 credits in core courses; 24 thesis credits are also required. Students have two options:

1) Ph.D. with supporting program. In addition to the core credits, this option requires 10 credits in subjects that support computational science—these can include core credits beyond the required 16—and 6 credits of interdisciplinary coursework.

2) Ph.D. with minor. In addition to the core credits, this option requires 12 credits for the minor and an additional 4 course credits. Many minor programs have greater requirements; in such cases, the greater requirements will be in effect. The minor field must be declared before the student takes the preliminary oral exam.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor requires approval of the director of graduate studies and a minimum of 12 credits (a minimum of 8 of these in core courses with remaining credits from supplementary courses). If a minor course is also in the student's major field, a student may use that course for the minor provided no more than one such course is used for the minor, there is no rule prohibiting this in the student's major field, and other courses are used to satisfy the major requirement.

Social, Administrative, and Clinical Pharmacy

Contact Information—College of Pharmacy, University of Minnesota, 7-155 Weaver-Densford Hall, 308 Harvard Street S.E., Minneapolis, MN 55455 (612-624-2973; fax 612-625-9931; e-mail tesda001@umn.edu).

Professor

Robert J. Cipolle, Pharmaceutical Care and Health Systems, FM
James C. Cloyd, Experimental and Clinical Pharmacology, FM
Courtney V. Fletcher, Experimental and Clinical Pharmacology, FM
Judith M. Garrard, Public Health, FM
Laël C. Gatewood, Laboratory Medicine and Pathology, FM
Cynthia R. Gross, Experimental and Clinical Pharmacology, FM
David R. Guay, Experimental and Clinical Pharmacology, AM
Joseph T. Hanlon, Experimental and Clinical Pharmacology, FM
Thomas E. Lackner, Experimental and Clinical Pharmacology, E
Henry J. Mann, Experimental and Clinical Pharmacology, AM
Peter C. Morley, Pharmaceutical Care and Health Systems, FM
John C. Rotschafer, Experimental and Clinical Pharmacology, AM
Rory P. Remmel, Medicinal Chemistry, FM
Stephen W. Schondelmeyer, Pharmaceutical Care and Health Systems, FM
Stuart M. Speedie, Health Informatics, Medical School, FM
Linda M. Strand, Pharmaceutical Care and Health Systems, FM
Vernon E. Weckwerth, Health Services Administration, FM
Darwin E. Zaske, Experimental and Clinical Pharmacology, AM

Adjunct Professor

Paul C. Langley, Pharmaceutical Care and Health Systems, E

Associate Professor

Sidney B. Benson, Pharmaceutical Care and Health Systems, AM
Ronald S. Hadsall, Pharmaceutical Care and Health Systems, FM
Brian J. Isetts, Pharmaceutical Care and Health Systems, AM
Tom Alan Larson, Pharmaceutical Care and Health Systems, AM
MaryBeth E. O'Connell, Experimental and Clinical Pharmacology, AM
Jon C. Schommer, Pharmaceutical Care and Health Systems, FM
Robert J. Straka, Experimental and Clinical Pharmacology, AM
Donald L. Uden, Pharmaceutical Care and Health Systems, AM
Cheryl L. Zimmerman, Pharmaceutics, FM

Assistant Professor

Margaret Artz, Experimental and Clinical Pharmacology, AM
Angela K. Birnbaum, Experimental and Clinical Pharmacology, AM
Richard C. Brundage, Experimental and Clinical Pharmacology, AM
Charles E. Daniels, Pharmacy, AM
Pamala A. Jacobson, Experimental and Clinical Pharmacology, AM
Kristin K. Janke, Pharmaceutical Care and Health Systems, AM
Michael Kotlyar, Experimental and Clinical Pharmacology, AM
Raquel Rodriguez, Pharmaceutical Care and Health Systems, AM
Debra J. Skaar, Experimental and Clinical Pharmacology, E

Adjunct Assistant Professor

Samuel Wagner, Pharmaceutical Care and Health Systems, E

Clinical Professor

Daniel E. Keyler, Experimental and Clinical Pharmacology, E

Clinical Associate Professor

John V. St. Peter, Experimental and Clinical Pharmacology, AM

Clinical Assistant Professor

Angeline M. Carlson, Pharmaceutical Care and Health Systems, AM
Patrick P. Gleason, Pharmaceutical Care and Health Systems, AM
Ricci M. Giese, Pharmacy, E
Alan H. Heaton, Pharmacy, E
Bruce E. Scott, Pharmacy, E
Leo J. Sioris, Experimental and Clinical Pharmacology, E

Professional and Academic

Nancy Ann Hardie, Experimental and Clinical Pharmacology, E

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Students are prepared for research and related activities investigating relationships between biological and physical factors in social settings that involve the drug use process. This flexible interdisciplinary program uses the resources of the University's many health and social science departments. Programs include courses and offerings from public health, geriatrics, management, sociology, psychology, and public affairs.

The program focuses on the discovery and dissemination of new knowledge to foster appropriate use of drugs in order to improve patient outcomes at the individual and societal level. Students are educated and mentored to become professional scientists. Those who complete the program will understand the process of conducting high quality research and problem solving through the application of disciplinary and interdisciplinary knowledge, theory, and research methodology.

Two program tracks are available. The emphasis of the social and administrative pharmacy (SAPh) track is the application of behavior-oriented interdisciplinary theories to pharmacy problem solving and pharmacy system development. This includes the study of the social, psychosocial, political, legal, public policy, historic, and economic factors that impinge upon the use, non-use, and abuse of drugs.

The emphasis of the experimental and clinical pharmacology (ECP) track is to advance the science of human pharmacology and therapeutics to improve the safe, effective, and economical use of drugs by patients. This includes the translation of both laboratory and clinical research to the medical use process.

Prerequisites for Admission—Although the majority of students in the program are pharmacists, a pharmacy education is not required. A bachelor's degree or its foreign equivalent from a recognized college of pharmacy and a strong scholastic record are desirable. Individuals from other fields such as economics, engineering, computer science, medicine, psychology, sociology or public health may be admitted if their undergraduate coursework satisfies the prerequisites for graduate coursework.

Special Application Requirements—Applicants must complete a department supplementary application form in addition to the Graduate School forms. The supplementary form along with three letters of recommendation should be sent directly to the department. GRE scores are required and a minimum score of 580 is required on the TOEFL for all international applicants whose native tongue is not English.

Use of 4xxx Courses—Use of 4xxx courses towards degree requirements is permitted with director of graduate studies approval.

Courses—Please refer to Social, Administrative and Clinical Pharmacy (SACP), Social and Administrative Pharmacy (SAPh), and Experimental and Clinical Pharmacology (ECP) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements

The M.S. program is offered under Plan A and Plan B.

Plan A requires at least 31 credits, including 15 credits in the major field, at least 6 credits in a minor or related field, and 10 thesis credits.

Plan B requires at least 30 credits, including 15 credits in the major field and at least 6 credits in a minor or related field; the balance of coursework is determined by agreement between the student and adviser. Plan B also requires two papers of publishable quality; one paper must include a research component with an analysis of data.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master's minor requires 6 credits in program courses, which is determined in consultation with the director of graduate studies.

Ph.D. Degree Requirements

The Ph.D. requires 34 credits in the major, 12 credits in a minor or supporting program, and 24 thesis credits. Two preliminary written exams are required: one concentrates on research design, methodological issues, and statistical analysis, the other on material specific to the student's chosen track. Students must also pass a preliminary oral exam.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor requires a minimum of 12 credits in program courses determined in consultation with the director of graduate studies.

Social and Philosophic Studies of Education

Contact Information—Department of Educational Policy and Administration, University of Minnesota, 330 Wulling Hall, 86 Pleasant Street S.E., Minneapolis, MN 55455 (612-624-1006; fax 612-624-3377).

Professor

Ayers Bagley, Educational Policy and Administration, E
John J. Cogan, Curriculum and Instruction, E
Darrell R. Lewis, Educational Policy and Administration, E
Karen S. Louis, Educational Policy and Administration, E
Josef A. Mestenhauser, Educational Policy and Administration, E
Patrick J. Starr, Mechanical Engineering, E
Caroline S. V. Turner, Educational Policy and Administration, E

Associate Professor

Arthur M. Harkins, Educational Policy and Administration, E
Jean A. King, Educational Policy and Administration, E
R. Michael Paige, Educational Policy and Administration, E

Lecturer

Richard Nunneley, Educational Policy and Administration, E

Senior Fellow

Dean Honetschlager, Educational Policy and Administration, E

Other

Carol M. Boyer, E
Timothy J. Delmont, E
Richard B. Heydinger, E

Curriculum—The graduate minor provides a multidisciplinary foundation for the study of education from the perspectives of history, philosophy, and the social sciences. The minor program is shaped to suit the particular needs and interests of the student at either the master's or doctoral level. In consultation with a faculty member in social and philosophic studies of education in the Department of Educational Policy and Administration (EdPA), 5xxx and 8xxx courses are selected both in EdPA and in related fields.

Prerequisites for Admission—Admission is contingent upon prior admission to a master's or doctoral degree-granting program within the Graduate School. Interested students should consult with a faculty member in social and philosophic studies of education in the Department of Educational Policy and Administration.

Special Application Requirements—Prospective students should contact the director of graduate studies in the Department of Educational Policy and Administration, which provides the administrative home for this graduate minor. The director of graduate studies in this department must approve the applicant's proposed course of study by signing the student's degree program form.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please contact the minor program office for information on relevant coursework.

Freestanding Minor Requirements

M.A. students must complete at least 9 graduate credits (at least one course each) in the two areas of study below. Doctoral students must complete at least 12 graduate credits (at least two courses each) in the two areas of study.

Area I—history and philosophy of education: EdPA 5021, 5023, 5024, 5028, 5032, Phil 4324, WoSt 5103.

Area II—social sciences and education: EdPA 5041, 5044, 5103, 5128, 5302, 5352, 8104.

Social Work

Contact Information—School of Social Work, University of Minnesota, 105 Peters Hall, 1404 Gortner Avenue, St. Paul, MN 55108 (612-625-1220; fax 612-624-3744; e-mail jreinard@che.umn.edu; <http://ssw.che.umn.edu>).

Professor
Michael Baizerman, FM
Jerome Beker, FM
Neil F. Bracht, FM
Clarke A. Chambers (emeritus), History, FM
Jeffrey L. Edleson, FM
Jane F. Gilgun, FM
Clifton D. Hollister, FM
Rosalie A. Kane, Public Health, FM
Helen Q. Kivnick, FM
David J. Klaassen, AM
Dario Menanteau-Horta, FM
Susan S. Meyers, AM
Jean K. Quam, FM
Ronald H. Rooney, FM
Mark S. Umbreit, FM
Esther Wattenberg (emeritus), FM
Oliver J. Williams, FM

Associate Professor
Sandra Beeman, FM
William Bradshaw, AM
Irl E. Carter (emeritus), FM
Linda E. Jones, FM
James R. Reinardy, FM

Assistant Professor
Laura Abrams, AM
Mark G. Frenzel, AM
Yat-Sang (Terry) Lum, AM
Ronald L. Pitzer, AM

Instructor
Mary K. Burnison, AM

Lecturer
Nancy M. Abramson, AM

Other
Ann S. Ahlquist, AM
Kevin John Burke, AM
Sonia Davila-Williams, AM
Trude D. Hendrickson, AM
Nancy J. Johnston, AM
Nan L. Kalke, AM
Gloria M. McGee, AM
Megan H. Morrissey, AM
Maura Sullivan, AM
Gail M. Walters, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The M.S.W. prepares students for advanced social work practice. A 50-credit program and a 34-credit advanced standing program are available. Concentrations in the master's program include practice in two areas: direct practice, and community practice. Two dual programs are also available: M.S.W./master of public health and M.S.W./master of public policy.

The Ph.D. program prepares students to provide intellectual leadership for the social work profession through advanced levels of scholarship, research, theory development, and policy analysis. Students are expected to acquire skill in research design and statistics and to develop a comprehensive knowledge of social work and social welfare history, theory, and policy.

The Ph.D. program does not focus on the development of advanced skills for clinical practice, although students gain knowledge of practice theory and research related to social work practice is encouraged. Many graduates assume positions as university faculty. Consequently, the program offers opportunities for students to acquire skills in teaching and curriculum development.

Prerequisites for Admission—Applicants must present 26 semester credits or 39 quarter credits in the social sciences, e.g., sociology, political science, economics, psychology, history, and anthropology. Applicants must also have completed a college-level course in statistics and one in biology that has content on human anatomical and physiological development. One year of paid or volunteer social work experience is required of all applicants who do not have a bachelor's degree in social work. Doctoral applicants must meet requirements and standards set by the Graduate School and the School of Social Work. It is preferred that applicants have earned the master's degree in social work from a school of social work accredited by the Council on Social Work Education. However, applicants with a master's degree in a related discipline will be considered for admission. Preference is also given to candidates with at least two years of post-M.S.W. practice experience.

Special Application Requirements—Three letters of recommendation, a complete set of transcripts (in addition to that required by the Graduate School), an example of written work, a personal statement, and a department application form are required of all applicants. GRE scores are not required for admission to the master's program, but are required from applicants who wish to be considered for a Graduate School Fellowship and from applicants who do not have an official grade point average from their undergraduate degree. GRE scores are required for admission to the doctoral program. Application deadlines for both degrees is January 8. The Ph.D program has a March 5 deadline for the second review. Beginning students in either program are admitted fall semester only.

Use of 4xxx Courses—Use of 4xxx courses toward degree requirements is permitted with director of graduate studies approval.

Courses—Please refer to Social Work (SW) in the course section of this catalog for courses pertaining to the program.

M.S.W. Coursework Only Degree Requirements
The M.S.W. requires 50 credits; a 34-credit advanced standing program is available to graduates of undergraduate social work programs accredited by the Council on Social Work Education. All credits must be completed within five years of the date of the earliest coursework students want to apply to their degree.

The 50-credit program includes a set of required foundation courses (25 credits), courses from a selected concentration, two field internships, and social work electives. A maximum of 24 credits may be transferred from the following sources with School of Social Work approval: up to 8 credits as a non-degree seeking student registered through the PRD process at the University of Minnesota; up to 24 credits from another regionally and professionally accredited school of social work, if the student was registered as a graduate student in the program.

The 34-credit advanced standing program includes courses from a selected concentration, one field internship, and social work electives. A maximum of 16 credits may be transferred from the following sources with School of Social Work approval: 16 credits completed as a graduate student in another accredited M.S.W. program; up to 6 credits as a non-degree seeking student registered through the PRD process at the University of Minnesota.

Language Requirements—None.

Final Exam—None.

Ph.D. Degree Requirements
The Ph.D. program emphasizes mastery of student-determined and program-determined objectives rather than an accumulation of course credits. Degree requirements vary according to background and educational goals. Typically 40 credits plus 24 required thesis credits beyond the M.S.W. are required. Required courses include core seminars in social work research, social welfare history, social welfare policy, and theory and model development; a social work teaching course; a supervised research practicum and practicum seminar; supporting program courses; statistics courses. Students must also have teaching experience in the School of Social Work while in the program and fulfill the computer skills requirement.

Language Requirements—None.

Sociology

Contact Information—Graduate Secretary, Department of Sociology, University of Minnesota, 909 Social Sciences Building, 267 19th Avenue S., Minneapolis, MN 55455 (612-624-2093; fax 612-624-7020; e-mail socdept@atlas.socsci.umn.edu).

Regents' Professor
Joanne B. Eicher, Design, Housing, and Apparel, AM

Professor
Ronald R. Aminzade, FM
Ronald E. Anderson, FM
John Arthur, Sociology-Anthropology, Duluth, AM
George A. Donohue (emeritus), FM
Barry C. Feld, Law School, AM
Robert L. Fulton (emeritus), FM
Joseph Galaskiewicz, FM

David Knoke, FM
Candace M. Kruttschnitt, FM
Barbara Laslett, FM
Theodor J. Litman, Health Care Management, AM
Karen S. Louis, Educational Policy and Administration, AM
Ian H. Maitland, Strategic Management and Organization, AM
Carl P. Malmquist, FM
Margaret M. Marini, FM
Dario Menanteau-Horta, Social Work, AM
Jeylan T. Mortimer, FM
Joel I. Nelson, FM
Steven Ruggles, History, AM
Joel B. Samaha, AM
Mark Snyder, Psychology, AM
Robin S. Stryker, FM

Associate Professor
Yanjie Bian, FM
Rose M. Brewer, African and Afro-American Studies, AM
Jeffrey P. Broadbent, FM
Kathleen T. Call, Public Health, AM
Scott R. Eliason, FM
March L. Krotee, Kinesiology and Leisure Studies, AM
Jennifer L. Pierce, FM
Joachim J. Savelsberg, FM
Christopher Uggen, AM

Assistant Professor
Elizabeth H. Boyle, AM
Joseph Gerteis, AM
Douglas Hartmann, AM
Ann M. Hironaka, AM
Erin L. Kelly, AM
Karen E. Lutfey, AM
Ian R. Macmillan, AM
Evan A. Schofer, AM

Lecturer
Michael D. Finch, Healthcare Management, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Sociology is concerned with the study of human societies, groups, and social life. The program offers substantive training in five areas of specialization: family and life course; law, criminology, and deviance; organizations and work; political sociology and social movements; and stratification: race, class, and gender. Methodological training is available in historical and comparative research, survey research, network analysis, advanced statistical analysis, and qualitative research. Training for students interested in both academic and applied employment is generally available.

Prerequisites for Admission—A background in basic sociology, usually consisting of the equivalent of 18 credits in undergraduate work, including 9 credits of social science statistical methods, or an M.A. degree in sociology or a closely related field is required. Individuals who have completed fewer than 18 credits may be admitted but are generally required to complete background coursework in theory and statistics during their first year of residence.

Special Application Requirements—Applicants are evaluated on their general academic potential, commitment to the field, creativity, and potential for contribution to the field. In addition to the Graduate School application, applicants must submit the following: GRE scores; a complete set of transcripts in addition to that required by the Graduate School; an application for department support (if desired); a sample of written work, usually a term paper, written in English; three letters of recommendation; and a statement of professional objectives. The department accepts new students for fall admission only. The final application deadline for admittance is March 1. For maximum fellowship support, the final application deadline is January 1.

Use of 4xxx Courses—Use of 4xxx courses is not permitted toward degree requirements.

Courses—Please refer to Sociology (Soc) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements

Students are admitted only for the Ph.D.; the M.A. is an optional degree for students in the doctoral program.

Students take four required courses or their equivalent (13 credits) and two additional substantive courses in sociology (6 credits). Substantive courses are chosen in consultation with the adviser and program committee to meet the student's educational and professional goals. Students must also complete a minimum of 6 credits in a minor or related field. Plan B students submit two papers, at least one of which is empirical. Plan A requires 10 thesis credits.

Language Requirements—None

Final Exam—The final exam is oral.

Ph.D. Degree Requirements

The doctoral program is for students planning to do research or teach.

Students take four required courses or their equivalent (13 credits), including a course on professional skills development. Beyond that, each student's program is individually planned in consultation with the adviser and program committee to meet both the student's goals and broad program requirements. Those requirements include four substantive courses in sociology (12-credit minimum) and at least one semester of training in advanced methods (3-credit minimum). Students must also complete a minimum of 12 credits in a minor or supporting program and 24 thesis credits. Students who enter the program with an M.A. in sociology must earn a minimum of 18 credits in the department regardless of the number of courses for which they have petitioned equivalents from other institutions.

Language Requirements—Coursework in a foreign language may be used as outside coursework for those students who plan research in comparative sociology.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor requires four courses in sociology, at least one of which is 8xxx. Course choices are subject to the approval of the director of graduate studies.

Software Engineering

Contact Information—Software Engineering Graduate Program, Center for the Development of Technological Leadership, University of Minnesota, 510 West Bank Office Building, 1300 S. Second Street, Minneapolis, MN 55454-1082 (612-624-5747; fax 612-624-7510; e-mail degrees@cdtl.umn.edu; <www.cdtl.umn.edu>).

Professor
Shashi Shekhar, AM
Jaideep Srivastava, AM

Associate Professor
John V. Carlis, AM
Mats P. E. Heimdahl, AM
Joseph A. Konstan, AM

Assistant Professor
Richard M. Voyles, AM

Instructor
Neil A. Bitzenhofer, AM
Michael Calvo, AM
John E. Collins, AM
Paul B. Dokas, AM
Jesse D. Freese, AM
Richard Hedger, AM
Stephen Kan, AM
John Kruse, AM
Elizabeth M. Sisley, AM
Michael W. Wold, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The master of science in software engineering (M.S.S.E.) provides a thorough understanding of the fundamental issues related to software development and the software development process. It fosters an awareness of the problems and opportunities associated with software-intensive systems, and explains the methods for quickly evaluating, adopting, and taking advantage of emerging technologies. This program introduces emerging technologies and their applications and lays the foundation for lifelong learning and professional development in a rapidly changing field. The M.S.S.E. is an interdisciplinary program administered jointly by the Institute of Technology's Center for the Development of Technological Leadership and the Department of Computer Science and Engineering.

The program is offered in a format designed for full-time working professionals. Students take courses one day per week (mostly on alternating Fridays and Saturdays) and move through the curriculum as a cohort, taking all classes together for the first three semesters.

Prerequisites for Admission—Prospective students should have an undergraduate degree in computer science or a closely related field and a minimum of one year of professional experience working in the software industry. Students with degrees in other fields may be considered for admission based on extensive industrial experience.

Use of 4xxx Courses—Use of 4xxx courses toward degree requirements is subject to adviser and/or director of graduate studies approval.

Courses—Please refer to Software Engineering (SEng) in the course section of this catalog for courses pertaining to the program.

M.S.S.E. Plan B Degree Requirements

The M.S.S.E. requires 30 credits, including 27 credits of regular coursework and 3 credits for the Plan B project. Students take seven core courses, two or three industrial seminar courses, two or three elective courses, and a capstone course (Plan B project) where students undertake a challenging project.

Language Requirements—None.

Final Exam—The final exam is oral.

Soil Science

Contact Information—Director of Graduate Studies, Department of Soil, Water, and Climate, University of Minnesota, 439 Borlaug Hall, 1991 Upper Buford Circle, St. Paul, MN 55108 (612-625-1244; fax 612-625-2208; e-mail dgs@soils.umn.edu; <www.soils.umn.edu/).

Professor

Deborah L. Allan, FM
James L. Anderson, FM
Paul R. Bloom, FM
H.H. Cheng, FM
Terrence H. Cooper, FM
Peter H. Graham, FM
Satish C. Gupta, FM
Thomas Halbach, AM
John A. Lamb, FM
Gary L. Malzer, FM
Jean-Alex E. Molina, FM
John F. Moncrief, FM
David J. Mulla, FM
Edward A. Nater, FM
Gyles W. Randall, FM
George W. Rehm, FM
Pierre C. Robert, FM
Carl J. Rosen, FM
Michael J. Sadowsky, FM
Michael A. Schmitt, FM
Mark W. Seeley, FM

Adjunct Professor

John M. Baker, FM
Charles E. Clapp, FM
Robert H. Dowdy, FM
William C. Koskinen, FM
Donald C. Reicosky, AM
Michael P. Russelle, FM

Associate Professor

James C. Bell, FM
Albert L. Sims, AM

Adjunct Associate Professor

Dennis R. Linden, FM
Brenton S. Sharratt, AM

Assistant Professor

Neal S. Eash, AM
Neil Hansen, FM
Jeffrey S. Strock, AM
Dong Wang, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The program offers two concentrations: soil science and climatology. This multidisciplinary program encompasses aspects of chemistry, physics, biology, atmospheric sciences, and geology. The discipline is divided into five subdisciplines: climatology, soil chemistry/fertility, soil classification/genesis, soil microbiology/biochemistry, and soil physics. The soil science concentration focuses on the study of soil as it applies to environmental and agricultural issues. The climatology concentration focuses on the interdisciplinary study of earth-atmosphere interactions as well as climate variability as it applies to environmental and agricultural issues. This concentration requires competence in both atmospheric sciences and related areas of soil science. The minor, supporting, or related fields area is usually selected from some allied field such as agronomy, botany, chemistry, microbiology, biochemistry, physics, geology, economics, forestry, agricultural engineering, or atmospheric science.

Prerequisites for Admission—The academic background normally required includes standard courses in college physics, chemistry, geology, microbiology, and mathematics, including one course in calculus, and an introductory course in soil science. For agricultural climatology, additional courses in mathematics, physics, meteorology, and engineering may be substituted. Candidates for the Ph.D. degree are normally required to have completed an acceptable master's degree thesis.

Special Application Requirements—A statement of career goals and three letters of recommendation evaluating the applicant's potential for graduate study should accompany applications to both the M.S. and Ph.D. programs. Submission of GRE scores is required of all native English speakers and is strongly recommended for nonnative speakers (in addition to the TOEFL requirement); students whose native language is not English are expected to have ranked in the top 20 percent of their class. Students may be admitted in any semester.

Program-specific requirements and procedures for electronic application for admittance to the soil science graduate program are listed and updated on the department's Web site at <www.soils.umn.edu>.

Use of 4xxx Courses—Use of 4xxx courses is permitted toward degree requirements per adviser and/or director of graduate studies approval.

Courses—Please refer to Soil Science (Soil) in the course section of this catalog for courses pertaining to the program or at the departmental Web site for an updated list of courses.

M.S. Degree Requirements

All M.S. students must complete a minimum of 30 credits: 14 credits in the major area, one seminar (1 credit) teaching experience, and a minimum of 6 credits in a minor or related field. Plan A students must take a minimum of 10 thesis credits; Plan B students must complete a Plan B paper and fulfill the 30 credit minimum by taking 10 credits of coursework or a special project to replace the 10 thesis credits.

Plan A students in the soil science concentration must take three out of the four core courses in soil science. Plan A students in the climatology concentration must take two or more courses in climatology or atmospheric sciences (approved by the student's advisory committee) and two of the four core courses in soil science. Plan B students in the soil science concentration must take all four core courses in soil science. Plan B students in the climatology concentration must take three or more courses in climatology or atmospheric sciences (approved by the student's advisory committee) and two of the four core courses in soil science.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—Students may minor in soil science with the approval of the director of graduate studies and under the direction of a soil science graduate faculty member serving as the minor adviser. The master's minor requires completion of a minimum of two of the four core area courses in soil science and a seminar.

Ph.D. Degree Requirements

Students must take two seminars (1 credit each), 2 credits of teaching experience, a minimum of 12 credits in a minor or supporting program, and 24 thesis credits.

Students in the soil science concentration must take all four core area courses in soil science.

Students in the climatology concentration must take a minimum of two courses in climatology or atmospheric sciences (approved by the student's advisory committee) and two of the four core area courses in soil science.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—Students may minor in soil science with the approval of the director of graduate studies and under the direction of a soil science graduate faculty member serving as the minor adviser. The doctoral minor requires a minimum of 12 credits in soil science, including a minimum of three of the four core area courses in soil science, a seminar, and teaching experience.

South Asian Languages

See Asian Languages and Literatures.

Spanish

See Hispanic and Luso-Brazilian Literatures and Linguistics.

Special Education

See Educational Psychology.

Speech-Communication

Contact Information—Department of Speech-Communication, University of Minnesota, 225 Ford Hall, 224 Church Street S.E., Minneapolis, MN 55455 (612-624-5800; <www.comm.umn.edu>).

Professor
Donald R. Browne, FM
Karlyn K. Campbell, FM
Alan G. Gross, FM
Dean E. Hewes, FM
Mary M. Lay, FM
Edward Schiappa, FM
Robert L. Scott (emeritus), FM
Amy L. Sheldon, FM
Michael Sunnafrank, Communication, Duluth, AM

Associate Professor
Rosita D. Albert, FM
Laura J. Gurak, FM
David L. Rarick, FM
Arthur E. Walzer, FM

Assistant Professor
Terry A. Kinney, AM
Ascan F. Koerner, AM
Mary D. Vavrus, AM
Kirt H. Wilson, AM

Lecturer
Patricia Kovel-Jarboe, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Speech-communication involves the study of communicative dimensions of human experience using humanistic and social scientific methods. This program prepares students to become researchers and teachers, offering two concentrations: communication theory and rhetorical studies.

Coursework in communication theory has a social scientific orientation. Most students focus on a subarea such as small group, organizational, intercultural, electronic media, interpersonal communication, or problems (e.g., decision making, conflict resolution, information diffusion). Coursework outside the department is usually concentrated in one or more of the behavioral sciences. Students are expected to develop a command of research techniques and a thorough knowledge of statistics. Interdisciplinary programs are encouraged.

Coursework in rhetoric and public address emphasizes humanistic methods and includes argumentation and persuasion, media studies, ethics, rhetorical theory and criticism, and American public address. Students may also pursue special interests in rhetorical philosophies, movements and campaigns, popular culture, or historical and contemporary political speaking. The program should be supplemented by coursework outside the department. An understanding of history, political science, sociology, or other social sciences is recommended.

Prerequisites for Admission—All applicants must have completed at least 15 undergraduate credits in speech or communication courses related to their proposed area of emphasis in the department. A brochure detailing prerequisite requirements is available from the department. All prerequisites must be completed before admission.

Special Application Requirements—Applicants must submit scores from the GRE General Test, transcripts of all post-secondary academic work, and a written statement of academic and occupational objectives. Three letters of recommendation are required of all applicants for assistantships or fellowships. A deadline of January 15 is recommended for students applying for teaching assistantships or University fellowships for the following academic year.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval. Such courses must be taught by graduate faculty and usually no more than two 4xxx courses are allowed on a degree program form.

Courses—Please refer to the Speech-Communication (Spch) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements

The degree is offered under Plan A (thesis) and Plan B (nonthesis). Both plans require a minimum of 15 course credits in speech-communication, including Spch 5421 and 5615, and a minimum of 6 course credits in a minor or related fields. Plan A also requires 10 thesis credits, and Plan B requires a Plan B paper and 6 additional course credits in speech-communication.

Language Requirements—None.

Ph.D. Degree Requirements

The program requires no set number of course credits, but students are urged to submit programs consisting of at least 60 course credits (which may include 30 credits from the M.A. and an additional 30 credits of doctoral coursework); 24 thesis credits are required. The program should include about 12 credits in research tools relevant for completing the degree and continuing a scholarly career. Under certain circumstances, foreign language courses may be used to satisfy this requirement. Twelve credits is a guide indicating extent, rather than a specific count.

Language Requirements—None.

Statistics

Contact Information—School of Statistics, University of Minnesota, 313 Ford Hall, 224 Church Street S.E., Minneapolis, MN 55455 (612-625-8046; fax 612-624-8868; e-mail info@stat.umn.edu).

Professor
Christopher Bingham, FM
Kathryn M. Chaloner, FM
R. Dennis Cook, FM
James M. Dickey, FM
Morris L. Eaton, FM
Seymour Geisser, FM
Charles J. Geyer, FM
Douglas M. Hawkins, FM
Glen D. Meeden, FM
Christopher J. Nachtsheim, Operations and Management Science, AM
Gary W. Oehlert, FM
Ronald R. Regal, Mathematics and Statistics, Duluth, FM
William D. Sudderth, FM
Luke Jon Tierney, FM
Richard L. Tweedie, Biostatistics, FM
Sanford Weisberg, FM

Associate Professor
Birgit Grund, FM
Frank B. Martin, FM
Ronald C. Pruitt, FM

Assistant Professor
Subhashis Ghosal, AM
Tiefeng Jiang, AM
Peihua Qiu, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The School of Statistics is the primary venue at the University for research teaching and dissemination of the theory, methodology, and applications of statistical procedures. Students may specialize in any area of statistics or probability. The core program for all students has strong components of both theoretical and applied statistics.

Prerequisites for Admission—For admission to the master's program, familiarity with basic statistical concepts and methods, and mathematics through multivariable calculus and linear algebra, are required. For admission to the doctoral program, in addition to the above, knowledge of the elements of real analysis is required.

Special Application Requirements—Two letters of recommendation are required. Applicants are strongly encouraged to submit scores from the General (Aptitude) Test (and from the mathematics Subject Test for mathematics majors) of the GRE. A

minimum TOEFL score of 213 is required of applicants whose native language is not English. A minimum TOEFL score of 250 is required of those applicants wishing to be considered for an assistantship. Applicants can be considered for admission at any time; however, financial support is usually available only to those beginning fall semester, on the basis of applications received by the preceding February 1 (January 10 for fellowships). It is strongly recommended that all new students begin their coursework in the fall semester.

Use of 4xxx Courses—Certain 4xxx courses from other departments may be used to meet degree requirements with the approval of the director of graduate studies.

Courses—Please refer to Statistics (Stat) in the course section of this catalog for courses pertaining to the program.

M.S. Plan B Degree Requirements

The program prepares students for Ph.D.-level study and for jobs in industry and the public sector.

During the first year, students take a two-semester theory sequence and a two-semester applied sequence. In addition, they usually take two courses from other departments.

During the second year, students take an additional 9 credits of approved 5xxx or 8xxx statistics courses; some of this requirement can be satisfied by taking approved courses with heavy statistical content from other departments. Students also take a 1-credit statistical consulting course and complete their Plan B project. A total of 30 course credits is required.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master's minor requires at least 9 credits of 5xxx or 8xxx statistics courses. Stat 4101-4102 may be used to satisfy this requirement.

Ph.D. Degree Requirements

Students entering the program with a bachelor's degree must take 60 course credits; students entering with a master's degree must take 43; 24 thesis credits are also required. Students take 41 credits in core courses (27 in statistics, 14 in mathematics), an additional 18 credits of approved 8xxx statistics courses (some of which can be satisfied by taking approved courses with heavy statistical content from other departments), and a 2-credit statistical consulting course.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor requires a theory sequence (Stat 4101-4102 or Stat 5101-5102) and familiarity with various statistical methods. Typical programs include 14 to 18 credits of graduate-level statistical courses. Please note: Stat 4101 and 4102 are available to graduate students from other programs, but not to statistics majors.

Studies in Africa and the African Diaspora

Contact Information—Department of Afro-American and African Studies, University of Minnesota, 808 Social Sciences Building, 267 19th Avenue S., Minneapolis, MN 55455 (612-624-9847; fax 612-624-9383).

Regents' Professor

Joanne B. Eicher, Design, Housing, and Apparel, E
Allen F. Isaacman, History, E

Professor

Ronald C. McCurdy, Music, E
August H. Nimtz, Jr., Political Science, E
Earl P. Scott, Geography, E

Associate Professor

Keletso E. Atkins, Afro-American and African Studies, E
Louis R. Bellamy, Theatre Arts, E
Rose M. Brewer, Afro-American and African Studies, E
Angelita D. Reyes, Afro-American and African Studies, E
Abdi I. Samatar, Geography, E
John S. Wright, English, E

Assistant Professor

Victoria B. Coifman, Afro-American and African Studies, E
Charles Ben Pike, Afro-American and African Studies, E

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—This interdisciplinary graduate minor is administered through the Department of Afro-American and African Studies. The minor program gives students from a variety of disciplines a structured graduate curriculum that offers a systematic understanding of the contemporary and historical experiences of peoples of Africa and of African descent. It is organized around a group of core seminars and focuses on two broad areas; the humanities and the arts, and the social and behavioral sciences.

Prerequisites for Admission—Admission is contingent upon prior admission to a master's or doctoral degree-granting program within the Graduate School.

Special Application Requirements—Students must complete an application form by the end of fall semester to be considered for acceptance for the following academic year. It is expected that no more than 15 students will be admitted to this minor each year. An undergraduate major or minor in Afro-American and/or African studies is not required for admission to the program, but students are expected to have had sufficient background to begin graduate level study.

Use of 4xxx Courses—Use of 4xxx courses towards degree requirements is subject to adviser and/or director of graduate studies approval.

Courses—Please refer to Afro-American Studies (Afro) in the course section of this catalog for courses pertaining to the program.

Freestanding Minor Requirements

Students develop their program in consultation with the director of graduate studies in Studies in Africa and the African diaspora and in their major. All courses must be outside the student's major field of study.

The master's minor requires a minimum of 9 graduate credits, including the seminar Afro 8101—Studies in Africa and the African Diaspora. Remaining courses are selected from one of the following two areas: 1) humanities and the arts or 2) behavioral and social sciences.

The doctoral minor requires a minimum of 15 graduate credits, including the seminar Afro 8101—Studies in Africa and the African Diaspora. Students take one additional seminar that focuses on the study of Africa and peoples of African descent. Remaining courses are selected from one of the two areas listed above.

Studies of Science and Technology

Contact Information—Director of Graduate Studies, Studies of Science and Technology, University of Minnesota, 746 Heller Hall, 271 19th Ave. S., Minneapolis, MN 55455; (612-625-6635; fax 612-626-8380; e-mail mcps@umn.edu; <www.sst.umn.edu/>).

Professor

John H. Beatty, Ecology, Evolution, and Behavior, E
John M. Eyler, History of Medicine, E
Ronald N. Giere, Philosophy, E
Keith Gunderson, Philosophy, E
William H. Hanson, Philosophy, E
Geoffrey Hellman, Philosophy, E
Sally G. Kohlstedt, Geology and Geophysics, E
Helen E. Longino, Women's Studies and Philosophy, E
Arthur L. Norberg, Computer Science, E
C. Wade Savage, Philosophy, E
Robert W. Seidel, Charles Babbage Institute, E
Alan E. Shapiro, Physics, E

Associate Professor

C. Kenneth Waters, Philosophy, E

Assistant Professor

Jennifer K. Alexander, Mechanical Engineering, E
Michael H. Janssen, History of Science and Technology, E

Curriculum—Studies of science and technology (SST) deals with a rapidly expanding field that seeks to understand the conceptual foundations, historical development, and social context of science and technology. SST faculty are drawn from five research or teaching units dedicated in whole or in part to the history and philosophy of science and technology: the Departments of Philosophy, History of Science and Technology, History of Medicine; the Center for Philosophy of Science; and the Charles Babbage Institute for the History of Information Processing. The SST minor is

for students from any major who want to gain a deeper understanding of the nature and development of science and technology.

The SST minor provides introductory core courses in historiography and philosophy of science, followed by research seminars and other elective courses in four main research areas: models, theories, and reality; physical science; biological and biomedical sciences; and science, technology, and society. Seminar topics vary yearly depending on faculty and student interest.

Prerequisites for Admission—Admission is contingent upon prior admission to a master's or doctoral degree-granting program within the Graduate School and is by permission of the director of graduate studies in SST.

Special Application Requirements—Prospective students should contact director of graduate studies.

Use of 4xxx Courses—Use of 4xxx courses is not permitted toward minor requirements.

Courses—Please refer to Studies of Science and Technology (SST) in the course section of this catalog for courses pertaining to the program.

Freestanding Minor Requirements

A master's minor requires 7 graduate credits and a doctoral minor requires 12 graduate credits. Both minors must include HSci 8111; one of either Phil 8601, 8602, or 8605; and SST 8000 Colloquium (one semester for master's, two for doctoral students). Doctoral students must also take one of the SST seminars (SST 8100, 8200, 8300, 8400, or 8420) in an area primarily outside the student's major.

Language Requirements—None specific to the minor.

Studio Arts

See Art.

Surgery

Contact Information—Department of Surgery, University of Minnesota, 420 Delaware Street S.E., MMC 195, Minneapolis, MN 55455 (612-626-2590; e-mail surgwww@umn.edu).

Professor

Roderick A. Barke, FM
R. Morton Bolman, FM
Henry Buchwald, FM
Michael D. Caldwell, FM
Frank B. Cerra, FM
Bruce L. Cunningham, AM
John P. Delaney, FM
David L. Dunn, FM
William C. Engeland, FM
John E. Foker, FM
Robert L. Goodale, FM
Rainer W. G. Gruessner, AM
James T. Lee, Jr., AM
Arthur J. Matas, FM
Donald G. McQuarrie, FM
J. Ernesto Molina, AM
William D. Payne, AM
David G. Reynolds, FM
David A. Rothenberger, AM
Sara J. Shumway, AM
David E. R. Sutherland, FM
Herbert B. Ward, AM
John A. Weigelt, AM

Clinical Professor

Arnold S. Leonard, FM
John S. Najarian, FM

Associate Professor

Jerome H. Abrams, AM
Gregory J. Beilman, AM
Michael A. Maddaus, AM
Steven M. Santilli, AM

Assistant Professor

Timothy D. Sielaff, AM

Clinical Associate Professor

Julio E. Garcia-Aguilar, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The general surgery program trains medical doctors for the practice of surgery and for academic positions. See the Medical School for professional degree requirements; see below for academic degree requirements. Trainees spend two to three years in laboratory research, either in a basic science or in surgery, after which they begin their senior residency and chief residency training. The Medical School's laboratory departments offer many graduate courses closely related to surgery (see the graduate programs in anatomy; biochemistry, molecular biology and biophysics; cellular and integrative physiology; microbiology, immunology, and molecular pathobiology; and pharmacology). These fields also offer opportunities for research work. The Department of Surgery offers supervised work in its experimental research laboratories, as well as in its hospital and outpatient departments, in the areas of surgical diagnosis and operative surgery and in some surgical specialties (such as colon and rectal surgery, transplantation, thoracic and cardiovascular surgery, and pediatric surgery).

Prerequisites for Admission—Prospective students must be in the general surgery training program and have 2-3 clinical years of training completed.

Use of 4xxx Courses—Use of 4xxx courses is not permitted toward degree requirements.

Courses—Please refer to Surgery (Surg) in the course section of this catalog for courses pertaining to the program.

M.S. Surg. Plan A Degree Requirements

The M.S.Surg. is offered Plan A only. Students spend two to three years in the Medical School's general surgery program. A minimum of 53 course credits (47 in the major plus 6 in the minor or related fields) plus 10 thesis credits are required for a total of 63 credits.

Final Exam—The final exam is oral.

Language Requirements—None.

Ph.D. Surg. Degree Requirements

Students spend two to three years in the Medical School's general surgery program. A minimum of 79 course credits (67 in the major plus 12 to 16 in the minor or supporting program) is required; 24 thesis credits are also required.

Language Requirements—None.

Sustainable Agriculture Systems

Contact Information—Director of Graduate Studies, Sustainable Agriculture Systems Minor, Minnesota Institute for Sustainable Agriculture, University of Minnesota, 411 Borlaug Hall, 1991 Upper Buford Circle, St. Paul, MN 55108 (612-625-8235; fax 612-625-1268; e-mail jorda020@umn.edu).

Professor

David D. Biesboer, Plant Biology, E
Vernon B. Cardwell, Agronomy and Plant Genetics, E
Iris D. Charvat, Plant Biology, E
Sharon M. Danes, Family Social Science, E
Peter H. Graham, Soil, Water, and Climate, E
Emily E. Hoover, Horticultural Science, E
Robert Philip King, Applied Economics, E
Richard A. Levins, Applied Economics, E
Albert H. Markhart III, Horticultural Science, E
Jean-Alex E. Molina, Soil, Water, and Climate, E
Roger D. Moon, Entomology, E
David J. Mulla, Soil, Water and Climate, E
James H. Orf, Agronomy and Plant Genetics, E
Edward B. Radcliffe, Entomology, E
Paul C. Rosenblatt, Family Social Science, E
Craig C. Sheaffer, Agronomy and Plant Genetics, E
Steve R. Simmons, Agronomy and Plant Genetics, E

Associate Professor

Deborah L. Allan, Soil, Water, and Climate, E
David A. Andow, Entomology, E
Jeffrey Lynn Gunsolus, Agronomy and Plant Genetics, E
Craig A. Hassel, Food Science and Nutrition, E
Nicholas R. Jordan, Agronomy and Plant Genetics, E
Kent D. Olson, Applied Economics, E
John M. Shutske, Biosystems and Agricultural Engineering, E
William F. Wilcke, Biosystems and Agricultural Engineering, E

Assistant Professor

Susan M. Galatowitsch, Horticultural Science, E
Jeffrey H. Gillman, Horticultural Science, E
Cheryl Smith, Food Science and Nutrition, E
Marla Spivak, Entomology, E

Adjunct Assistant Professor

Helene Murray, Agronomy and Plant Genetics, E

Curriculum—The minor in sustainable agriculture systems offers master's (M.A. and M.S.) and doctoral students an interdisciplinary curriculum that considers the biological, sociological, and economic aspects of agriculture. The minor emphasizes a holistic perspective to designing farming and food systems and solving problems in agriculture. The importance of yield and profitability are balanced by considerations of the environment and the health and social well-being of producers, consumers, and communities. The minor complements major programs in ecology, conservation biology, forestry, sociology, geography, political

science, and public affairs, as well as majors in the College of Agricultural, Food, and Environmental Sciences.

Prerequisites for Admission—Admission is contingent upon prior admission to a master's or doctoral degree-granting program within the Graduate School.

Special Application Requirements—Contact the director of graduate studies in sustainable agriculture systems for an *Intent to Enroll* form. Students are admitted each semester.

Use of 4xxx Courses—4xxx courses are permitted toward minor requirements based on director of graduate studies approval.

Courses—Please refer to Sustainable Agriculture Systems (SAgr) in the course section of this catalog for courses pertaining to the program.

Freestanding Minor Requirements

The master's minor requires 6 graduate credits from the core curriculum; the doctoral minor requires 12 graduate credits. All students must take SAgr 8010 and 8020. The other core course is Agri 5321—Ecology of Agriculture (cross listed with Ent 5321). A unique component of the minor is an on-site internship with growers, grassroots organizations, or public agencies working in sustainable agriculture.

Theatre Arts

Contact Information—Department of Theatre Arts and Dance, University of Minnesota, 580 Rarig Center, 330 21st Avenue S., Minneapolis, MN 55455 (612-625-5029; fax 612-625-6334; e-mail theatre@umn.edu; <http://cla.umn.edu/theater>).

Professor
C. Lance Brockman, AM
Michal Kobialka, FM
Charles M. Nolte (emeritus), FM
Barbara Reid, AM

Associate Professor
Louis R. Bellamy, AM
Maria Cheng, AM
Martin B. Gwinup, AM
Stephen C. Kanee, AM
Margaret L. Maddux, AM
Jean A. Montgomery, AM
Elizabeth H. Nash, AM
James Norwood, FM
Joan A. Smith, AM

Assistant Professor
Ananya Chatterjea, AM
Sonja Kuftinec, AM
Mathew J. LeFebvre, AM
Tamara L. Underiner, AM
Aleksandra Wolska, AM

Education Specialist
Pamela Knourek, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Theatre arts programs provide practical and theoretical education for the performer, artist, educator, scholar, and audience member. Training the historian, theorist, artist, and craftsperson is linked to and centered in the laboratory experience of live performance as well as in the academic classroom. The programs serve the dual roles of examining the various historical and contextual relationships of past and present theatre while educating audiences and theatre artisans/educators of tomorrow. The programs prepare students for careers in professional or academic theatre and related artistic fields.

Prerequisites for Admission—Students are admitted for fall semester only. The M.A./Ph.D. program and the M.F.A. design/technology program admit every year. The M.F.A. directing program admits every three years (next class will be admitted for fall 2003). Prerequisites for the initial screening phase of admission include a U.S. bachelor's degree or comparable foreign degree from a recognized college or university, a minimum of 18 undergraduate credits or the equivalent in theatre arts, and a 3.00 grade point average. Applicants for all degree programs must submit scores from the GRE by February 1. International students' TOEFL scores must be submitted by January 15 (a paper score of 550 is considered the minimum for acceptance or 213 on the computer test).

The master's degree is a prerequisite for admission to the Ph.D. program. Students without a master's degree will be admitted to the Ph.D. with the intention that the M.A. will be attained in route to the Ph.D. For admission to the M.A./Ph.D. or Ph.D. program, students must have a working knowledge/reading proficiency of at least one foreign language (or a sign language). [A computer language will not satisfy this requirement.]

Special Application Requirements—The application deadline for all degree programs is January 15. Applications received after that date will be considered only if there is an opening in the particular program. M.A./Ph.D. students wishing to have materials reviewed for the Graduate School Fellowship (for support of first-year students) must have materials submitted by January 5. All programs require a current résumé, statement of purpose/intent, and three letters of recommendation to accompany the departmental application.

The *M.F.A. directing program* requires an audition by invitation in Minneapolis in early March after an initial screening of application files. The directing program does NOT interview with U/RTA.

The *M.F.A. design and technology program* requires a portfolio review either through the Chicago U/RTA or by submitting materials to be received by February 1. The program also interviews by pre-arrangement during USITT.

The *M.A./Ph.D. program* requires a submitted sample of research writing.

Use of 4xxx Courses—Inclusion of 4xxx theatre and dance courses on degree program forms is subject to approval by the director of graduate study. Students from other programs may include these courses with their own program's approval.

Courses—Please refer to Theatre Arts (Th) and Dance (Dnce) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements

The M.A. degree emphasizes academic pursuits and is considered a prerequisite for the Ph.D. The formal areas of study for the M.A./Ph.D. are theatre history and dramatic literature, dramatic theory, design and technical production, and directing (including management). Any of these four may serve as a concentration of study, although the Ph.D. ordinarily focuses on the first two. Candidates must complete coursework in both academic and performance areas.

For both Plan A and B: three of the six sequence courses (8111-8116) plus 8102, totaling 12 credits; 8 credits from acting, design, directing, playwriting, and/or practicum; 6 credits from outside the department; and 4 elective credits (30 credits total). For Plan A, 10 additional thesis credits and an oral defense of the thesis are required. For Plan B, three papers are required.

There is an 8-credit limit on the number of credits in practicum and performance courses that may be used to satisfy M.A. degree requirements.

Language Requirements—The M.A. leads to the Ph.D.; therefore, language requirements for the Ph.D. apply.

Final Exam—For Plan A, the final exam is written and oral. For Plan B, the final exam is written; an oral exam typically is not required, but one may be requested by the M.A. committee.

Minor Requirements for Students Majoring in Other Fields—A master's minor requires a minimum of 9 credits as approved by the director of graduate studies.

M.F.A. Degree Requirements

The three-year, performance-oriented M.F.A. degree offers two areas of specialization: directing, and design and technical production. The *M.F.A. in directing* focuses on developing intellectual and artistic skills and leadership talent through an intensive course of study with an emphasis on performance. For the *M.F.A. in design and technology*, all areas of design are studied in order to increase understanding in specialization areas, and technology is studied as an essential part of design. Students are expected to achieve proficiency in at least two areas of any combination of design and technology (scenery/properties, costuming, lighting, sound) and a level of expertise in at least one of these areas.

Program faculty will work with students to identify the final areas for the degree. The M.F.A. degree is considered a terminal degree in these areas of theatre arts.

The M.F.A. requires 60 graduate credits, although a particular program's requirements may exceed this minimum. The degree requires 6 credits of dramatic literature or theatre history, which may be fulfilled by Th 4177 and 4178; and a minimum of 6 credits from outside the department (at least 3 credits of which must be a University course that contributes substantially to the degree program). Each program requires a final performance practicum and written record of it. For specific program requirements, contact the director of graduate studies.

Language Requirements—None.

Final Exam—Students must take a final oral exam related to the final creative project and must submit a written record of the project and the research related to it.

Ph.D. Degree Requirements

The Ph.D. certifies the mastery of a body of knowledge in the history, theory, and literature of theatre arts and the facility for applying and communicating that knowledge. The formal areas of study for the M.A./Ph.D. are theatre history and dramatic literature, dramatic theory, design and technical production, and directing (including management). Any of these four may serve as a concentration of study, although the Ph.D. ordinarily focuses on the first two. Candidates must complete coursework in both academic and performance areas.

Students must take seven core courses: six consecutive courses in history, theory, and literature of theatre and one course in theatre historiography (21 credits); coursework in a supporting program or a minor (12 credits); and 24 thesis credits, for a minimum total of 57 credits beyond the B.A. Various seminars support the core courses. Students must also demonstrate a research technique appropriate to the thesis. This could take the form of the foreign language or a discipline research methodology.

There is a 16-credit limit on the number of credits in practicum and performance courses that may be used to satisfy Ph.D. requirements.

Language Requirements—Ph.D. students are expected to demonstrate proficiency in at least one foreign language as certified by the adviser or program faculty in the language. The language may serve as the research technique for the dissertation, if appropriate. In some cases a disciplinary research methodology is more appropriate than a language. Options may include statistics, psychology, women's studies, economics, political history, or anthropology. Note: research technique credits are not the same as supporting program or minor credits.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor requires a minimum of 12 credits as approved by the director of graduate studies.

Theriogenology

See Veterinary Medicine.

Toxicology

Contact Information—Director of Graduate Studies, Toxicology Graduate Program, Veterinary Diagnostic Laboratory, 1333 Gortner Avenue, St. Paul, MN 55108 (612-625-8236; fax 612-624-8707; e-mail murph005@umn.edu).

Professor

Yusuf J. Abul-Hajj, Medicinal Chemistry, Pharmacognosy, FM
David R. Brown, Veterinary Pathobiology, FM
Robert M. Carlson, Chemistry, Duluth, FM
Joseph DiSalvo, Physiology, FM
Lester R. Drewes, School of Medicine, Duluth, FM
Vincent F. Garry, Laboratory Medicine and Pathology, FM
Patrick E. Hanna, Medicinal Chemistry, Pharmacognosy, FM
Gerald J. Niemi, Biology, Duluth, FM
Joseph R. Prohaska, School of Medicine, Duluth, FM
Jean F. L. Regal, School of Medicine, Duluth, FM
W. Thomas Shier, Medicinal Chemistry, Pharmacognosy, FM
Sheldon B. Sparber, Pharmacology, FM
Kendall B. Wallace, School of Medicine, Duluth, FM

Adjunct Professor

Gerald T. Ankley, Duluth, AM
Herbert T. Nagasawa, Medicinal Chemistry, Pharmacognosy, FM
John W. Nichols, Duluth, AM
Robert R. Roy, Veterinary Diagnostic Medicine, AM
Andrew M. Seacat, Veterinary Diagnostic Medicine, AM
Robert S. Skoglund, Veterinary Diagnostic Medicine, AM

Associate Professor

Cecilia Giuliui, Chemistry, Duluth, FM
Randall E. Hicks, Biology, Duluth, AM
Richard G. Hoffman, School of Medicine, Duluth, AM
Michael J. Murphy, Veterinary Diagnostic Medicine, FM
Mark S. Rutherford, Veterinary Pathobiology, FM
Ashok K. Singh, Veterinary Diagnostic Medicine, FM

Assistant Professor

Subhash C. Basak, School of Medicine, Duluth, AM
Lisa A. Peterson, School of Public Health, FM
Elizabeth V. Wattenberg, School of Public Health, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—This University-wide program provides comprehensive training in the broad scope of toxicology. Toxicology, the science of poisons, is devoted to identifying and quantifying potential noxious agents in our environment. Although most chemical agents at sufficiently large doses may be toxic, not all present a significant risk to human health, environmental organisms, or ecosystems. Accordingly, the essence of the science of toxicology is defining the line that distinguishes a risk from a residue. This requires scientific expertise in analytical and environmental chemistry, biology, and mathematics. Advanced courses and research are also available in subdisciplines such as human health risk assessment; epidemiology; environmental chemistry and engineering; ecotoxicology; food additives and nutritional toxicology; biochemical and physiological mechanisms; histopathology; diagnostic and analytical toxicology; drug metabolism; chemical carcinogenesis; behavioral toxicology; veterinary toxicology; and the toxicity of noxious agents to various organ systems (e.g., nervous, heart, liver, kidneys).

Prerequisites for Admission—A B.S. in basic science is required. All applicants should have completed a full year of biology, chemistry, and physics, and have completed mathematics through calculus. The M.S. is not a terminal degree and students are not admitted to it. Applicants are evaluated for admission only to the Ph.D. program.

Special Application Requirements—Applicants must submit scores from the General (Aptitude) Test of the GRE, three letters of recommendation from college-level faculty or equivalent persons who are familiar with the applicant's scholarship and research potential, a complete set of official transcripts, and a clearly written statement of career interests, goals, and objectives. Graduate study in the program begins in fall semester. The application deadline is January 1. All applications are evaluated once each year in early February.

Use of 4xxx Courses—Use of 4xxx courses toward degree requirements is permitted with director of graduate studies approval.

Courses—Please refer to Toxicology (Txcl) in the course section of this catalog for courses pertaining to the program.

M.S. Degree requirements

The M.S. is offered under plan A and Plan B. Plan A requires 22 course credits and 10 thesis credits. Plan B requires 30 course credits. A core curriculum of 8 credits in toxicology (Txcl 8012, 8013 and 8100) is required for both plans. Additional courses are arranged on an individual basis.

Language Requirements—None.

Final Exam—The final exam is written and oral.

Ph.D. Degree Requirements

The Ph.D. requires core courses in physiology, biochemistry, statistics, and toxicology. Students must also complete 12 credits in a minor or supporting program and 24 thesis credits. Because the program spans the Duluth and Twin Cities campuses, the required course numbers differ on each campus.

Additional advanced courses in toxicology or related fields may be specified by the adviser. Students must complete and defend an original research project.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A minor is available at the doctoral level and requires 12 credits: 8 credits of core course and 4 credits of advanced toxicology courses.

Transportation Studies

Contact Information—Center for Transportation Studies, University of Minnesota, 511 Washington Ave. S.E., Minneapolis, MN 55455 (612-626-1077; fax 612-625-6381; e-mail cts@umn.edu; <www.cts.umn.edu>).

Professor
John Adams, Geography, E

Assistant Professor
David Levinson, Civil Engineering, E

Instructor
Karen Chapple, Humphrey Institute of Public Affairs, E

Curriculum—The transportation studies program allows students to gain advanced interdisciplinary knowledge of transportation by taking a set of core courses along with a series of focused electives. Students must complete two courses in transportation policy and planning and a one-credit intelligent transportation technology seminar. In addition to this foundation, students acquire further expertise in a specific area related to transportation by taking at least 9 graduate credits in a field chosen by the student and approved by the director of graduate studies. These credits may consist of any combination of courses that will further the student's knowledge of a specific transportation-related subject area or areas.
A broad array of topical areas and course offerings are available including advanced traffic engineering and related mathematical disciplines; transportation pavements or structures; management, logistics, regional planning, or human factors; historical, political, or economic analysis.

Prerequisites for Admission—Admission requires a B.S. or B.A. from an accredited U.S. institution or its foreign counterpart. The degree must be in a field related to transportation. Applicants who hold a degree in an unrelated field must demonstrate familiarity with the transportation-related issues through work experience, community involvement, political leadership, or other activity.

A 3.00 minimum GPA is required for admission. International students must score 550 on the TOEFL exam. Exceptions may be made in cases where applicants have slightly lower than the minimum requirements but have demonstrated their abilities through substantial professional experience. The GRE is not required.

Special Application Requirements—Prospective students who do not meet the minimum 3.00 GPA must submit a statement explaining how their work experience, community involvement, political leadership, or other activity has prepared them for the program. Prospective students may supplement this statement with letters of recommendation from employers, community leaders, etc., if appropriate.

Use of 4xxx Courses—Use of 4xxx courses toward requirements is subject to director of graduate studies approval.

Courses—The four core courses are PA 5202/Geog 5372, PA 8202, CE 5212, and 5214. CE 5214 covers the systems approach and its application to transportation engineering and planning. Topics include prediction of flows and level of service, production functions and cost optimization, utility theory and demand modeling, transportation network analysis and equilibrium assignment, decision analysis, and multidimensional evaluation of transportation projects. This is a new course currently in the proposal stage. It is expected to be in place for the 2001-2002 academic year.

Postbaccalaureate Certificate Requirements

Completion of two of the four core courses along with the Transportation Technology Seminar, three or more cognate elective courses chosen by the student in consultation with the director of graduate studies, and at least 16 graduate level credits. In addition to completing two of the above courses, students will be required to complete ME 8773/8774.

Urban and Regional Planning

Contact Information—Director of Admissions, Hubert H. Humphrey Institute of Public Affairs, University of Minnesota, 301 19th Avenue South, Minneapolis, MN 55455 (612-624-3800; fax 612-625-3513; e-mail admissions@hhh.umn.edu; <www.hhh.umn.edu>).

Regents' Professor
G. Edward Schuh, AM

Professor
Dean E. Abrahamson, AM
John S. Adams, AM
Sandra Archibald, AM
John E. Brandl, AM
John M. Bryson, AM
Nancy N. Eustis, AM
Katherine Fennelly, AM
Stephen A. Hoenack, AM
Ethan B. Kapstein, AM
Anne R. D. Kapuscinski, Fisheries and Wildlife, AM
Kenneth H. Keller, AM
Sally J. Kenney, AM
Morris M. Kleiner, AM
Robert T. Kudrle, AM
Ann R. Markusen, AM
Judith A. Martin, Geography, AM
William R. Morrish, Architecture, AM
Samuel L. Myers, AM
Lance M. Neckar, Landscape Architecture, AM
David G. Pitt, Landscape Architecture, AM
Carlisle F. Runge, Applied Economics, AM
Esther Wattenberg, Social Work, AM

Associate Professor
Ragui A. Assaad, AM
Edward G. Goetz, AM
Maria J. Hanratty, AM
Deborah Levison, AM

Assistant Professor
Karen Chapple, AM
Kenneth A. Kriz, AM

Other
Zbigniew M. Bochniarz, AM
Harry C. Boyte, AM
Barbara C. Crosby, AM
William A. Diaz, AM
Marsha A. Freeman, AM
Thomas F. Luce, AM
Barbara L. Lukermann, AM
Lee W. Munnich, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The master of urban and regional planning (M.U.R.P.) degree is an interdisciplinary program that prepares students to analyze, forecast, design, and implement plans for regions, communities, and neighborhoods. Students develop a comprehensive understanding of the built environment (land use, transportation, housing, regional economies) and the ability to mediate among competing interests. They are prepared for jobs in public, nonprofit, and private sectors. Students can generally complete the M.U.R.P. degree in two years of full-time study.

Prerequisites for Admission—Students are expected to have completed the equivalent of an introductory course in microeconomics.

Special Application Requirements—In addition to the materials submitted to the Graduate School, applicants must submit to the Humphrey Institute a photocopy of their Graduate School application, the Humphrey Institute Applicant Data Form, copies of all academic transcripts, a statement of purpose, at least three letters of recommendation, and a GRE official score report. Students who wish to be considered for financial aid should apply no later than January 15 of the preceding academic year. Entry is for fall semester.

Use of 4xxx Courses—Use of 4xxx courses toward degree requirements is permitted with instructor's and adviser's permission.

Courses—Please refer to Public Affairs (PA) in the course section of this catalog for courses pertaining to the program.

M.U.R.P. Plan B Degree Requirements

The M.U.R.P. requires 48 credits including Humphrey Institute core courses (12 to 13 credits), planning core courses (12.5 credits), specialization electives (9 credits), and 10.5 to 11.5 credits of free electives. Each student completes an internship in a public or private planning agency usually during the summer after the first year of the program. Students also take a capstone seminar or workshop (3 credits) that constitutes a final professional-level project and complete a professional paper. Specializations for the M.U.R.P. degree include housing and community development; regional, economic, and workforce development; transportation planning; land use/urban design planning; and environmental planning.

Language Requirements—None.

Final Exam—The final exam is oral.

Veterinary Medicine

Contact Information—Director of Graduate Studies, Veterinary Medicine, 385 Animal Science/Veterinary Medicine, 1988 Fitch Avenue, St. Paul, MN 55108 (612-624-0750; fax 612-624-3233; e-mail vmedgrad@umn.edu; <www.cvm.umn.edu/graduate>).

Professor

Trevor R. Ames, Clinical and Population Sciences, FM
P. Jane Armstrong, Small Animal Clinical Sciences, FM
Russell F. Bey, Veterinary Pathobiology, FM
Stephen Bistner, Small Animal Clinical Sciences, FM
Thomas G. Blaha, Clinical and Population Sciences, FM
David R. Brown, Veterinary Pathobiology, FM
Cathy S. Carlson, Veterinary Diagnostic Medicine, FM
James E. Collins, Veterinary Diagnostic Medicine, AM
Melvyn L. Fahning, Clinical and Population Sciences, FM
Ralph J. Farnsworth, Clinical and Population Sciences, FM
Daniel A. Feeney, Small Animal Clinical Sciences, FM
John Fetrow, Clinical and Population Sciences, FM
Sandra M. Godden, Clinical and Population Sciences, AM
Sagar M. Goyal, Veterinary Diagnostic Medicine, FM
David A. Halvorson, Veterinary Pathobiology, FM
Robert M. Hardy, Small Animal Clinical Sciences, FM
David W. Hayden, Veterinary Diagnostic Medicine, FM
Thomas H. Hostetter, Medicine, AM
Alan G. Hunter, Animal Science, FM
Carl R. Jessen, Small Animal Clinical Sciences, AM
Han S. Joo, Clinical and Population Sciences, FM
Mathur S. Kannan, Veterinary Pathobiology, FM
Jeffrey S. Klausner, Small Animal Clinical Sciences, FM
Harold J. Kurtz, Veterinary Diagnostic Medicine, E
Alan Lipowitz, Small Animal Clinical Sciences, FM
Samuel K. Maheswaran, Veterinary Pathobiology, FM
Thomas W. Molitor, Clinical and Population Sciences, FM
Roger D. Moon, Entomology, FM
Robert B. Morrison, Clinical and Population Sciences, FM
Michael P. Murtaugh, Veterinary Pathobiology, FM
Kakambi V. Nagaraja, Veterinary Pathobiology, FM
Moses K. Njenga, Veterinary Pathobiology, AM
Timothy D. O'Brien, Veterinary Diagnostic Medicine, AM
Carl A. Osborne, Small Animal Clinical Sciences, FM
Phillip K. Peterson, Medicine, AM
Carlos Pijoan, Clinical and Population Sciences, FM
David J. Polzin, Small Animal Clinical Sciences, FM
Michael Pullen, Clinical and Population Sciences, AM
Patrick T. Redig, Small Animal Clinical Sciences, AM
Jeffrey K. Reneau, Animal Science, AM
Bradley E. Seguin II, Clinical and Population Sciences, FM
Jagdev M. Sharma, Veterinary Pathobiology, FM
Bert E. Stromberg, Veterinary Pathobiology, FM
Tracy A. Turner, Clinical and Population Sciences, FM
Larry J. Wallace, Small Animal Clinical Sciences, FM
Mary M. Walser, Veterinary Diagnostic Medicine, FM
Douglas J. Weiss, Veterinary Pathobiology, FM
Jonathan E. Wheaton, Animal Science, FM

Associate Professor

Scott A. Dee, Clinical and Population Sciences, FM
John Deen, Clinical and Population Sciences, FM
Melissa Hower-Moritz, Equine Science, E
Vivek Kapur, Veterinary Pathobiology, FM
Jody P. Lulich, Small Animal Clinical Sciences, FM
Michael, G. O'Sullivan, Veterinary Pathobiology, FM
William G. Olson, Clinical and Population Sciences, FM
Elaine P. Robinson, Small Animal Clinical Sciences, FM
Kurt D. Rossow, Veterinary Diagnostic Medicine, AM
Mark S. Rutherford, Veterinary Pathobiology, FM
Daniel P. Shaw, Veterinary Diagnostic Medicine, AM
Ashok K. Singh, Veterinary Diagnostic Medicine, FM
Ava M. Trent, Clinical and Population Sciences, AM
Mats H. T. Troedsson, Clinical and Population Sciences, FM
Stephanie J. Valberg, Clinical and Population Sciences, FM
Patricia A. Walter, Small Animal Clinical Sciences, AM

Assistant Professor

Jeff B. Bender, Clinical and Population Sciences, AM
Sheila M. F. Torres, Small Animal Clinical Sciences, AM
Scott J. Wells, Clinical and Population Sciences, AM

Associate Clinical Specialist

Paula K. Hendrix, Small Animal Clinical Sciences, AM

Assistant Clinical Specialist

Erin D. Malone, Clinical and Population Sciences, AM
Margaret V. Root Kustritz, Small Animal Clinical Sciences, AM
Abby M. Sage, Clinical and Population Sciences, E

Research Associate

Connie J. Gebhardt, Veterinary Pathobiology, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Emphases in the major are large, small, comparative, and food animal medicine. Emphasis can further be directed toward specific systems or population medicine.

The veterinary medicine graduate program encompasses all the clinical and applied graduate education of the College of Veterinary Medicine. The program is divided into five specialty tracks: internal medicine; population medicine; infectious disease; surgery, radiology, and anesthesiology; and theriogenology. Program faculty are drawn from all the departments of the college as well as from other colleges within the University.

The program emphasizes quality clinical training with state-of-the-art research in areas of animal disease at the individual and population levels. All species of domestic animals are the subject of both teaching and research, the program being particularly strong in population-based medicine and epidemiology. Other areas of strength include feline and canine urology, radiology, pain, molecular epidemiology in food animals, microbiology, and immunology. The program also has quality research and teaching in the area of theriogenology.

Prerequisites for Admission—Applicants must meet the stated requirements of the Graduate School, including a minimum undergraduate GPA of 3.00 and a minimum TOEFL score of 550 or a minimum computer-based TOEFL score of 213.

The majority of applicants have a D.V.M. degree or its equivalent. Applicants lacking a D.V.M. degree, including those currently enrolled in a D.V.M. degree program, can be accepted upon approval by the director of graduate studies.

Applicants are requested but not required to take the GRE prior to consideration for admission.

Special Application Requirement—Applicants must submit a letter of intent stating career goals and defining the specialty of graduate study selected (e.g., subdiscipline or animal species). Also required are three letters of recommendation from individuals knowledgeable about the applicant's academic performance. These letters must be sent directly to the director of graduate studies or the program coordinator.

Research Facilities—Research facilities available to the veterinary medicine graduate student include the Advanced Genetic Analysis Center, the Clinical Investigation Center, the Raptor Center, the Swine Center, the Swine Disease Eradication Center, and the Avian Disease Research Center.

Use of 4xxx Courses—Use of 4xxx courses to meet degree requirements is subject to director of graduate studies approval.

Courses—Please refer to Veterinary Medicine (VMed) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements

The M.S. is offered under Plan A and Plan B. Plan A requires 20 credits; a minimum of 14 credits in the major, 6 credits in a minor or related field, and in addition10 thesis credits. Plan B requires 30 course credits, 14 of which must be in the major and 16 in a minor or related field, in consultation with the adviser. Three papers are also required (e.g., a case report, a research project, and a literature review).

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master's minor requires 6 course credits taken from recommended courses in the veterinary medicine major.

Ph. D. Degree Requirements

There are no minimum requirements but students usually take 24 to 30 credits in the major field and 12 credits minimum for official minor or supporting program. In addition, 24 thesis credits are required.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor requires 12 course credits taken from recommended courses in the veterinary medicine major.

Vocational Education

See Work, Community, and Family Education.

Water Resources Science

Contact Information—Director of Graduate Studies-Twin Cities, Water Resources Science, University of Minnesota, 173 McNeal Hall, 1985 Buford Avenue, St. Paul, MN 55108 (612-624-9282; fax 612-625-1263; e-mail juerg001@umn.edu); and Director of Graduate Studies-Duluth, Water Resources Science, 213 RLB, University of Minnesota, Duluth, MN 55812 (218-726-8891; fax 218-726-6979).

Professor

E. Calvin Alexander, Jr., Geology and Geophysics, FM
James L. Anderson, Soil, Water, and Climate, FM
Sandra O. Archibald, Public Affairs, FM
Roger E. A. Arndt, Civil Engineering, FM
Franklin H. Barnwell, Ecology, Evolution, and Behavior, FM
Marvin Bauer, Forest Resources, FM
David D. Biesboer, Plant Biology, FM
Paul R. Bloom, Soil, Water, and Climate, FM
Patrick L. Brezonik, Civil Engineering, FM
Kenneth N. Brooks, Forest Resources, FM
Dwight A. Brown, Geography, FM
Robert M. Carlson, Chemistry, Duluth, FM
Iris D. Charvat, Plant Biology, FM
H. H. Cheng, Soil, Water, and Climate, FM
Yosef Cohen, Fisheries and Wildlife, FM
Charles J. Clanton, Biosystems and Agricultural Engineering, FM
Dianne Dorland, Chemical Engineering, Duluth, AM
K. William Easter, Applied Economics, FM
Efi Foufoula, Civil Engineering, FM
Philip J. Gersmehl, Geography, FM
Florence K. Gleason, Plant Biology, FM
Sagar M. Goyal, Veterinary Diagnostic Medicine, FM
John S. Gulliver, Civil Engineering, FM
Satish C. Gupta, Soil, Water, and Climate, FM
Richard S. Hanson, Microbiology, FM
Ralph W. Holzenthal, Entomology, FM
Thomas C. Johnson, Geological Sciences, Duluth, FM
Andrew R. Klemer, Biology, Duluth, FM
Richard W. Lichty, Economics, Duluth, FM
Robert O. Megard, Ecology, Evolution, and Behavior, FM
John F. Moncrief, Soil, Water, and Climate, FM
David J. Mulla, Soil, Water, and Climate, FM
Edward A. Nater, Soil, Water, and Climate, FM
John L. Nieber, Biosystems and Agricultural Engineering, FM
Christopher Paola, Geology and Geophysics, FM
Gary Parker, Civil Engineering, FM
John Pastor, Biology, Duluth, FM
James A. Perry, Forest Resources, FM
Mark A. Person, Geology and Geophysics, FM
Hans-Olaf Pfannkuch, Geology and Geophysics, FM
Carl Richards, Minnesota Sea Grant, Duluth, FM
C. Ford Runge, Applied Economics, FM
Mark W. Seeley, Soil, Water, and Climate, FM
Michael J. Semmens, Civil Engineering, FM
Richard H. Skaggs, Geography, FM
Heinz G. Stefan, Civil Engineering, FM
Robert W. Sterner, Ecology, Evolution, and Behavior, FM
Otto D. L. Strack, Civil Engineering, FM
Deborah L. Swackhamer, Environmental and Occupational Health, FM
Michael Sydor, Physics, Duluth, FM
G. David Tilman, Ecology, Evolution, and Behavior, FM

Adjunct Professor

Dan Hornbach, Fisheries and Wildlife, AM
Carol A. Johnston, Geological Sciences, Duluth, FM

Associate Professor

Randal J. Barnes, Civil Engineering, FM
James C. Bell, Soil, Water, and Climate, FM
Erik T. Brown, Geological Sciences, Duluth, FM
James B. Cotner, Ecology, Evolution, and Behavior, AM
Susan M. Galatowitsch, Horticultural Science, FM
Randall E. Hicks, Biology, Duluth, FM
Frances R. Homans, Applied Economics, AM
Katherine Klink, Geography, AM
Howard D. Mooers, Geological Sciences, Duluth, FM
Raymond M. Newman, Fisheries and Wildlife, FM
Steven J. Taff, Applied Economics, FM
Bruce N. Wilson, Biosystems and Agricultural Engineering, FM

Adjunct Associate Professor

Bruce C. Vondracek, Fisheries and Wildlife, FM

Assistant Professor

Paul D. Capel, Civil Engineering, AM
Raymond N. Hozalski, Civil Engineering, AM
Neil C. Hansen, Soil, Water, and Climate, AM
James McManus, Large Lakes Observatory, Duluth, AM
Kristen C. Nelson, Forest Resources/Fisheries and Wildlife, AM
Paige J. Novak, Civil Engineering, AM
Elsie A. Ralph, Physics, Duluth, AM
Gary R. Sands, Biosystems and Agricultural Engineering, AM
Dong Wang, Soil, Water, and Climate, AM
Meng Zhou, Physics, Duluth, AM
Tongxin Zhu, Geography, Duluth, AM

Adjunct Assistant Professor

Mary Renwick, Applied Economics, AM

Research Associate

Richard P. Axler, Natural Resources Research Institute, Duluth, AM
Prasanna Gowda, Soil, Water, and Climate, AM
Lucinda B. Johnson, Natural Resources Research Institute, Duluth, AM
John C. Kingston, Natural Resources Research Institute, Duluth, FM

Other

Elon S. Verry, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—This University-wide program provides comprehensive training in water resources science, with integration across scientific disciplines. A structured interdisciplinary graduate curriculum is offered. The program includes a set of core courses plus electives in the following areas of specialization at the M.S. and Ph.D. levels: aquatic biology, aquatic chemistry, hydrologic science, limnology, water economics, water management technology, water policy, water quality, and watershed management. Approximately 80 courses offered within 15 other graduate programs are available to students majoring in water resources science.

This interdisciplinary program produces scientists with strong technical skills in disciplines relevant to water resources science and promotes a broad understanding of 1) the hydrologic cycle and associated ecosystems, 2) the interconnectedness of the sciences involved in managing aquatic resources, and 3) the interplay between the biophysical sciences and social sciences in developing and implementing public policies related to water.

The program involves the Twin Cities campus Departments of Applied Economics; Biosystems and Agricultural Engineering; Civil Engineering; Ecology, Evolution, and Behavior; Entomology; Environmental and Occupational Health; Fisheries and Wildlife; Forest Resources; Geography; Horticultural Science; Geology and Geophysics; Microbiology, Plant Biology; and Soil, Water, and Climate; and the Humphrey Institute of Public Affairs. It also involves the Duluth campus Departments of Biology, Chemical Engineering, Chemistry, Economics, Geography, Geological Sciences, Physics, and Political Science as well as the Large Lakes Observatory and the NRRI.

Prerequisites for Admission—The program is flexible enough to accommodate students from a variety of backgrounds. Normally students have a bachelor's degree in physical or biological science or engineering. Recommended academic preparation includes one year (or two semesters) each of calculus, physics, and chemistry and one biology course. Further preparation may be expected from students wishing to specialize in certain areas of the program.

Special Application Requirements—Applicants must submit three letters of recommendation to the director of graduate studies. These letters should be from professors qualified to estimate applicants' class rank and evaluate their ability to complete a program of graduate study, or from persons who can assess their professional potential. These letters also may be used in applying for financial aid. Applicants must also submit a résumé of their academic history and professional experience and a statement of purpose, including the proposed area of emphasis. Applicants are strongly encouraged to submit results of the GRE. Those who have not taken the GRE are at a disadvantage in competing for financial aid. Students may be admitted any semester but are strongly encouraged to begin fall semester and to submit their application by January 1 in the year they expect to begin their studies.

Use of 4xxx Courses—Use of 4xxx courses is permitted for degree requirements based on director of graduate studies approval.

Courses—Please refer to Water Resources Science (WRS) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements

Students may choose Plan A, which requires a thesis, or Plan B, which requires additional coursework and a major project. Both plans incorporate courses offered on the Twin Cities and Duluth campuses.

Students must complete courses in four core areas: 1) hydrology (surface and/or ground water); 2) environmental/water chemistry; 3) limnology; and 4) water resources policy, economics and management and at least three electives in emphasis areas such as aquatic biology, hydrologic science, watershed management, and water quality engineering. One elective must be from an approved list of technical courses dealing with water quality science/management; two electives must be in the student's focus area within aquatic science. A minimum of two supporting courses (at least 6 credits) outside of aquatic science also are required.

A minimum of 20 course credits (plus 10 thesis credits) are required for Plan A and a minimum of 30 credits are required for Plan B (up to 3 credits of independent study may be used for the Plan B project). Students who had classes equivalent to those in the WRS core as undergraduates may substitute other classes to meet the Graduate School minimum requirement of 20 credits.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master's minor requires 6 credits, including WRS 5101 (3 credits) and a core course from one of the program's emphasis areas. In aquatic biology and limnology, on the Twin Cities campus, the core course is EEB 4601/Geo 4601; in hydrological science, watershed management, and water engineering, the core course is in hydrology.

Ph.D. Degree Requirements

Coursework is tailored to student interests, and many areas of specialization are possible. Core courses are offered on both the Twin Cities and Duluth.

Students complete coursework equivalent to that of an M.S. in water resources science, with additional coursework in an area of specialization. There are no specific credit requirements in the major, but Ph.D. programs normally include at least 40 course credits beyond the B.S. level, including relevant coursework taken for a master's degree and a required minimum of 12 credits in a minor or supporting program.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—Doctoral students must complete 12 credits, including WRS 5101 (3 credits), a core course from one of the program's emphasis areas, and two electives within one field of specialization. In aquatic biology and limnology, on the Twin Cities campus, the core course is EEB 4601/Geo 4601; in hydrological science, watershed management, and water engineering, the core course is in hydrology.

Wildlife Conservation

Contact Information—Kathleen Walter, College of Natural Resources, University of Minnesota, 135 Natural Resources Administration Building, 2003 Upper Buford Circle, St. Paul, MN 55108-6146 (612-624-2748; fax 612-624-6282; e-mail walter@forestry.umn.edu; <www.fw.umn.edu>).

Professor

Yosef Cohen, FM
Francesca J. Cuthbert, FM
Gary E. Duke, Veterinary Pathobiology, FM
Ralph J. Rocky Gutiérrez, FM
John Pastor, Biology, Duluth, FM
Donald B. Siniff, Ecology, Evolution, and Behavior, FM
J. L. David Smith, FM
Anthony M. Starfield, Ecology, Evolution, and Behavior, FM

Adjunct Professor

David E. Andersen, FM
L. David Mech, FM

Associate Professor

James A. Cooper, FM
Peter A. Jordan, FM

Adjunct Associate Professor

Alfred H. Berner, E
Glenn D. DelGiudice, FM
David L. Garshelis, AM
Richard O. Kimmel, E

Adjunct Assistant Professor

David C. Fulton, AM
Edward B. Swain, AM

Other

Thomas D. Drummer, E

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—This program, administered within the Department of Fisheries, Wildlife, and Conservation Biology, is an applied program emphasizing resource-management applications. For the M.S. degree, emphasis is on wildlife biology and related areas in ecology, animal behavior, and physiology as these relate to resource management and conservation problem solving. For many students, the M.S. is a terminal degree leading to employment with government resource-management agencies. For the Ph.D. program, emphasis is on basic biology and ecology with concentrated work in independent, original research generally relating basic science to management/conservation challenges.

This program combines basic biology and ecology with other academic areas and with applied problem solving in natural resource management and conservation areas such as animal behavior, population modeling, habitat management, integrated resource management, and animal physiology.

Prerequisites for Admission—For the M.S., a bachelor's degree with a biological sciences background is required, preferably with emphasis on terrestrial or wetland vertebrates, and with a natural-resource management orientation. A strong background in physical sciences and mathematics is expected; familiarity with statistics and computer use is desirable. For the Ph.D., a master's degree in wildlife science or a closely related field is normally required.

Special Application Requirements—Three letters of recommendation are required from persons able to evaluate the applicant's scholarship and professional experience. Also required are scores from the GRE General Test. Applicants taking the examination should list the wildlife management major field code (0115). Applications are accepted at any time; however, because the faculty reviews most applications in late January for admission the following fall, applications should be sent before January 1.

Use of 4xxx Courses—Use of 4xxx courses toward degree requirements is subject to adviser and director of graduate studies approval. Students from other majors may include such courses subject to their own program's approval.

Courses—Please refer to Fisheries and Wildlife (FW) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements

Plan A is recommended; Plan B is available under special circumstances. Students must become familiar with factors underlying wildlife population and habitat ecology, management techniques, and how management agencies function. Academic work includes coursework in animal ecology, wildlife management, and statistics. The Plan A thesis should involve at least one field season, but generally two. Plan B students complete one to three projects involving field, laboratory, or planning work.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master's minor requires a minimum of 6 credits as approved by the director of graduate studies.

Ph.D. Degree Requirements

Degree programs include basic wildlife biology, development of analytical skills, and one or more areas of specialization.

Language Requirements—A foreign language is required only when the advisory committee determines that a language is needed to support the student's research objectives. Symbolic language (computer programming) is recommended for all students.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor requires a minimum of 12 credits as approved by the director of graduate studies.

Work, Community, and Family Education

Contact Information—Gary Leske, Director of Graduate Studies, Department of Work, Community, and Family Education, University of Minnesota, R-350 Vocational and Technical Education Building, 1954 Buford Avenue, St. Paul, MN 55108 (612-624-1221; fax 612-625-8041; e-mail wcfe@umn.edu; <www.wcfe.coled.umn.edu>).

Professor
James M. Brown, FM
Judith J. Lambrecht, FM
Theodore Lewis, FM
Gary N. McLean, FM
Roland L. Peterson, FM
David J. Pucel, FM
Richard A. Swanson, FM
Ruth G. Thomas, FM

Adjunct Professor
Richard A. Krueger, FM

Associate Professor
Gary W. Leske, FM
Jerry H. McClelland, FM
Rosemarie J. Park, FM
Jane E. Plihal, FM
Marilyn A. M. Rossmann, FM
James R. Stone III, FM

Assistant Professor
Kenneth R. Bartlett, AM
Richard M. Joerger, AM
Shari L. Peterson, FM
Shelia K. Ruhland, AM

Lecturer
Robert D. Shumer, AM
John R. Vreyens, AM

Other
Jeanette R. Daines, AM
James C. Kielsmeier, AM
Marie J. Maher, AM
Tom Peacock, Education, Duluth, AM
Jerome Stein, AM
Joyce Walker, AM
Barbara A. Warren, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The Ed.D. offers specializations in adult education; agriculture, food, and environmental education; business and industry education; family education; human resource development; and comprehensive work, community, and family education. Students combine study and related experiences to develop, apply, analyze, synthesize, and evaluate knowledge of the purposes, practices, issues, and problems of work, community, and family education; social, economic, historical, political, cultural, educational, technological, and psychological contexts within which work, community, and family education exist; and types of research that contribute to or apply that knowledge to the specialization.

See also Education—Work, Community, and Family Education for information about the M.A. and Ph.D. degrees.

Prerequisites for Admission—Prospective master's degree students generally have completed an undergraduate degree or extensive coursework in the specialization area. Prospective doctoral degree students should have academic background and experience in at least one specialization area.

Special Application Requirements—Scores from the GRE general test are required for applicants with a bachelor's degree from a U.S. institution. Applicants should designate the specific specialization to which they seek admission in their goal statement. A current resume is required. Students are admitted each term.

Courses—Please refer to Adult Education (AdEd), Agricultural, Food, and Environmental Education (AFEE), Business and Industry Education (BIE), Family Education (FE), Human Resource Development (HRD), and Work, Community, and Family Education (WCFE) in the course section of this catalog for courses pertaining to the program.

Use of 4xxx Courses—A maximum of 15 credits from 4xxx courses may be used in the supporting program. Students are responsible for determining that the course was available for graduate credit and the offering department criteria for graduate credit were satisfied. Degree programs must include rationale for the use of 4xxx course credits.

Ed.D. Degree Requirements

The Ed.D. requires 60 course credits and 24 field study credits (thesis credits). Course credits include a minimum of 12 credits in general aspects, a minimum of 10 credits in research, and a minimum of 28 credits in the specialization, 4 of which must be internship credits. Course credits must also include 12 credits from outside the department, which may overlap with those in general aspects, research, and the specialization.

Language Requirements—None.

Final Exam—A written preliminary exam in each of the program areas (general aspects, research, and specialization) and a final oral exam are required.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor requires a minimum of 12 credits in one of the specializations, approved by the director of graduate studies

Courses Contents

Accounting (Acct)

Department of Accounting
Curtis L. Carlson School of Management

Acct 5100. Corporate Financial Reporting. (4 cr; QP–Mgmt student, non-accounting major; SP–Mgmt student, non-accounting major; A-F only)
Overview of asset/liability valuation and income measurement. Focus on how economic events are reported in the financial statements. Examines accounting theory and the accounting standard-setting process.

Acct 5101. Asset Valuation and Income Determination. (4 cr; QP–Grade of at least B- in 1050, [mgmt major or mgmt grad student]; SP–Grade of at least B- in 2050, [mgmt major or mgmt grad student]; A-F only)
Valuation, measurement, and reporting issues related to selected assets/liabilities of a firm. Theory underlying accounting issues. Applying accounting principles.

Acct 5102. Liability Valuation and Income Determination. (4 cr; QP–3101 or 5101; mgmt or grad mgmt student; SP–5101; mgmt or grad mgmt student; A-F only)
Extends understanding of the basic valuation problems encountered in financial reporting, focusing on the valuation of liabilities. Covers accounting for leases, pensions, deferred taxes. Introduces consolidated financial statements.

Acct 5125. Auditing Principles and Procedures. (4 cr; QP–[3101 or 5101], accounting major; SP–[3101/5101 or 5100/6100], [accounting major or grad mgmt student]; A-F only)
Auditing financial information systems. Independent audits and internal auditing. Ethics. Legal responsibilities.

Acct 5126. Internal Auditing. (2 cr; QP–3101 or 5101; SP–[3101/5101 or 5100/6100], 3001; A-F only)
Financial and operational auditing. Standards. Managing the function.

Acct 5135. Fundamentals of Federal Income Tax. (4 cr; QP–1050 or 8030 or 8130, [mgmt or grad student]; SP–2050 or 8030 or 8130, [mgmt or grad mgmt student]; A-F only)
Introduction to the U.S. federal system of taxation. Concepts of gross income, deductions, and credits. Analysis of the structure of the Internal Revenue Code and its provisions with respect to specific areas of the law. Examination of the interrelationships between legislative, judicial and administrative authority. Introduces the various methods, tools and techniques to conduct tax research.

Acct 5150. Current Financial Accounting Issues. (2 cr; QP–M.B.T. student; 1050; SP–M.B.T. student; 2050; A-F only)
Accounting principles and practices underlying preparation of financial statements and additional disclosures. Includes recent pronouncement on financial accounting.

Acct 5160. Financial Statement Analysis. (2 cr; QP–[3101 or 5100 or 5101], [accounting or finance major]; SP–[5100/6100 or 3101/5101], [accounting or finance major]; A-F only)
Interpretation/analysis of financial statements. Introduces basic techniques of financial statement analysis and applies them in different settings (e.g., in investment/credit decisions).

Acct 5180. Consolidations and Advanced Reporting. (2 cr; QP–5102, mgmt or mgmt grad student; SP–5102, mgmt or mgmt grad student; A-F only)
Theory underlying the preparation of consolidated financial statements, as well as the mechanical computations needed to prepare the statements themselves.

Acct 5200. Tax Accounting Methods and Periods. (4 cr; QP–M.B.T. student; 5135; SP–M.B.T. student; 5135; A-F only)
Rules affecting timing of income and deductions for tax purposes. Examination of cash and accrual accounting methods on an overall basis and with respect to individual items of income and deductions; rules for changing accounting methods and periods; annual accounting and transactional concepts, including the claim of right doctrine, the Arrowsmith doctrine, and the tax benefit rule.

Acct 5220. Tax Research, Communication, and Practice. (4 cr; QP–M.B.T. student; 5135; SP–M.B.T. student; 5135; A-F only)
In-depth treatment of tax research methodology including tax questions, locating potential authority, assessing potential authority, and communicating research results. Substantive material on dealing with the IRS including sources of IRS policy; processing returns, auditing returns; rulings and determination letters; closing agreements; assessments and collections.

Acct 5230. Corporate Taxation I. (2 cr; QP–MBT student; 5135; SP–M.B.T. student; 5135; A-F only)
Federal income taxation of corporations and shareholders. Organization of a corporation; establishment of its capital structure; determination of its tax liability; dividends and other nonliquidating distributions; stock redemptions, and liquidations.

Acct 5236. Introduction to Taxation of Business. (2 cr; QP–5135, acct major; SP–5135, acct major; A-F only)
Introduction to the income tax laws governing the taxation of corporations, partnerships, limited liability companies, limited liability partnerships, and S corporations. Students will also increase their knowledge and skills related to tax research by writing research memorandums.

Acct 5271. Accounting Information Systems. (2 cr; SP–3101/5101 or 5100/6100)
Applications of electronic data processing systems in accounting, including modeling, financial planning, auditing, and data security. Analysis/design of accounting information systems.

Acct 5281. Special Topics in Financial Reporting. (2 cr; QP–5102, mgmt or grad mgmt student; SP–5102, mgmt or grad mgmt student; A-F only)
Covers areas of financial reporting frequently covered on the CPA exam, including partnerships, foreign operations, and accounting for government and nonprofit organizations.

Acct 5310. International Accounting. (2 cr; QP–1050, mgmt student; SP–2050, mgmt student; A-F only)
Review of macroeconomic concepts of international economics, including trade, international markets for capital, and the role of accounting. Survey of different accounting policies and approaches among nations. Reading and understanding financial statements produced in countries other than the United States.

Acct 5320. Current Topics in Accounting. (2 cr; QP–5102, acct major; SP–5102, acct major; A-F only)
Topics vary.

Acct 5325. Advanced Tax Principles. (2 cr; QP–5135, M.B.T. student; SP–5135, M.B.T. student; A-F only)
In-depth coverage of issues affecting all tax entities, focusing on topics pertaining to individuals and partnerships: at-risk provisions, passive activity loss rules, Alternative Minimum Tax/AMT credit for individuals, tax benefit rule and claim of right doctrine, like-kind exchanges of personal property, net operating losses, hobby losses, and business/rental use of residences.

Acct 5330. Taxation of Corporations II. (2 cr; SP–5230, M.B.T. student; A-F only)
Corporate readjustments related to multiple corporations and consolidated returns.

Acct 5333. Tax Aspects of Consolidated Returns. (2 cr; SP–5230, M.B.T. student; A-F only)
Covers aspects of filing consolidated federal income tax returns. Includes determining affiliated groups; election and filing requirements; intercompany transactions, limitations on certain loss and credit carryforwards; allocation of federal income tax liability; E&P and investment basis adjustments; loss allowance rules; and excess loss accounts.

Acct 5335. Taxation of the Small Business Corporation. (2 cr; SP–5230, M.B.T. student; A-F only)
Federal income taxation of S corporations. Election eligibility; termination of status; treatment of income and deduction items; distributions, basis of stock and debt. Compensation arrangements in closely held corporations; fiscal year issues; personal service corporations; advantages of C corporations vs. S corporations; corporation liquidation and redemption rules; S corporation's built-in gains tax.

Acct 5340. Taxation of Partners and Partnerships. (2 cr; QP–5135, M.B.T. student; SP–5135, M.B.T. student; A-F only)
Reviews tax consequences associated with formation, operation, and dissolution of a partnership.

Acct 5350. Taxation of Estates and Gifts. (2 cr; QP–5135, M.B.T. student; SP–5135, M.B.T. student; A-F only)
Taxation of transfers under federal estate and gift tax laws. Includes property owned by the decedent; retained life estates; transfers taking effect at death; revocable transfers; joint interest; powers of appointment; valuation problems; expenses, debts and taxes; charitable bequests, marital deduction, taxable inter vivos gifts, splitting and credits.

Acct 5351. Estate Planning. (2 cr; QP–5135, M.B.T.student; SP–5135, M.B.T. student; A-F only)
Addresses various topics related to planning the transfer of property during lifetime and at death.

Acct 5353. Income Taxation of Fiduciaries. (2 cr; QP–5135, M.B.T. student; SP–5135, M.B.T. student; A-F only)
Simple, complex, and revocable trusts; estates; accumulation distributions, income in respect of decedents; trust accounting income and principal; distributable net income; terminations; and excess distributions.

Acct 5356. Taxation of Compensation Arrangements. (2 cr; QP–5135, M.B.T. student; SP–5135, M.B.T. student; A-F only)
Federal income taxation of corporate deferred compensation and fringe benefits with emphasis on pension plans, profit sharing plans, stock option plans, individual retirement accounts, annuities and insurance, medical related compensation benefits, and reporting requirements.

Acct 5360. State and Local Taxation. (2 cr; QP–5135, M.B.T. student; SP–5135, M.B.T. student; A-F only)
Examines state levying of individual income, corporate income, property, sales, and excise taxes. Tax problems of businesses with multistate operations.

Acct 5370. Taxation of Property Transactions. (2 cr; QP–5135, M.B.T. student; SP–5135, M.B.T. student; A-F only)
Determining realized gain or loss and recognized gain or loss, and tax treatment of that gain or loss on property dispositions. Consequences of property transactions including depreciation, depletion, basis, and capital gains problems.

Acct 5380. Tax Aspects of International Business I. (2 cr; SP–5230, M.B.T. student; A-F only)
Multinational business operations and transactions involving foreign income. Tax consequences of transactions with foreign organizations and by related foreign companies.

Acct 5381. Tax Aspects of International Business II. (2 cr; SP–5380, M.B.T. student; A-F only)
Foreign tax credit and Subpart F planning opportunities, international structuring (including joint ventures and use of the new entity classification regulations), transfer pricing, and foreign currency. Recent legislative, regulatory, and judicial developments in the international tax area, and the challenges and opportunities presented by these developments.

Acct 5390. Topics in Taxation. (1-4 cr; QP–M.B.T. student; SP–M.B.T. student)
Current tax legislation and problems. Topics may vary. S-N grading allowed with MBT program approval.

Acct 5500. Business, Government, and Economic Tax Policy. (4 cr; QP–5135, M.B.T. student; SP–5135, M.B.T. student)
Modern macroeconomics and its effects on taxation and public finance including government expenditures. History of taxation and the institution and individuals affecting tax policy. Goals of an effective tax system and various proposed major tax reforms.

Acct 8801. Empirical Research in Capital Markets. (4 cr; SP–Business admin Ph.D. student or #; offered alt yrs)
Econometric studies of information contained in accounting numbers; volume and price reactions to accounting disclosure; earnings management; accounting based valuation; market microstructure.

Acct 8802. Emerging Issues in Accounting. (4 cr [max 8 cr]; SP–Business admin Ph.D. student or #; offered alt yrs)
Topics vary.

Acct 8811. Information Economics I. (4 cr; SP–Business admin Ph.D. student or #; offered alt yrs)
Asymmetric information, incentives, and contracts. Moral hazard, adverse selection, reputation, and signaling phenomena. Applications to accounting such as transfer pricing, budgeting, cost allocations, performance measurement, audit pricing.

Acct 8812. Information Economics II. (4 cr; SP–Business admin Ph.D. student or #; offered alt yrs)
Information in capital markets; asset pricing with asymmetric information; economics of disclosure and information acquisition.

Acct 8821. Experimental Economics. (4 cr; SP–Business admin Ph.D. student or #; offered alt yrs)
Auction markets; price formation in experimental asset markets; experimental studies of information transfer and capital market efficiency; experimental tests of strategic behavior, trust, and reciprocity.

Acct 8822. Behavioral Research in Accounting. (4 cr; SP–Business admin Ph.D. student or #; offered alt yrs)
Heuristics and biases in information processing, auditor judgment, mental accounting, and decision aids.

Acct 8892. Readings in Accounting. (1-8 cr [max 16 cr]; SP–Business admin Ph.D. student or #)
Readings appropriate to an individual student's program or objectives that are not available in regular courses.

Acct 8894. Research in Accounting. (1-8 cr [max 16 cr]; SP–Business admin Ph.D. student or #)
Individual research on an approved topic appropriate to student's program and objectives.

Adult Education (AdEd)

Department of Work, Community, and Family Education

College of Education and Human Development

AdEd 5001W. Survey: Human Resource Development and Adult Education. (3 cr)
Overview of fields of human resource development and adult education. Includes societal context, systems theory, processes, definitions, philosophies, goals, sponsoring agencies, professional roles, participants, and resources. Emphasis on the unique characteristics and ways the fields overlap and enhance one another.

AdEd 5101. Strategies for Teaching Adults. (3 cr; A-F only)
Psychological theories of adult learning; learning styles and personality types; teaching styles; group and team learning; moderating and study circles; teaching technologies and distance learning; gender, race, and cultural communication. Applications of strategies.

AdEd 5102. Perspectives of Adult Learning and Development. (3 cr)
Emphasis on major adult development theorists, theories, and current applications. Transformative learning, self-directed learning, experiential learning, and cooperative learning provide theoretical framework for exploring physiological, psychological, sociological, and cultural aspects of adult development through the life span.

AdEd 5103. Designing the Adult Education Program. (3 cr; A-F only)
Designing and implementing educational programs for adults. Application of concepts, theories, and models in different adult learning situations.

AdEd 5196. Field Experience in Adult Education. (3-6 cr [max 6 cr]; S-N only)
Supervised fieldwork and practice. Presentations and evaluations of adult education practices.

AdEd 5201. Introduction to Adult Literacy. (3 cr)
Definitions of literacy: workplace, community and family. Issues: poverty, welfare, ethnicity, cultural diversity, social class, language and learning, immigrants. Review of literacy programs, funding, and professionalization. Reaching and recruiting undereducated adults. The role of the family and schools; community, state and local government. New social action approaches required for licensure.

AdEd 5202. Assessment of Adult Literacy. (3 cr)
Assessment of adult literacy problems as they affect work, family and community. Setting educational goals; formal versus informal assessment; case studies; educational planning.

AdEd 5203. Methods of Teaching Adult Literacy. (3 cr)
Approaches to teaching reading, writing, and mathematics to adults. Technology as a teaching tool. Teaching students with disabilities. Cultural and gender differences. English as a second language. Evaluation of commercial materials and software.

AdEd 5301. Survey of Distance Education. (3 cr)
Survey of distance education concepts, theory, history, present practice, delivery systems, course design, major issues, and future directions.

AdEd 5302. Continuing Education for Professionals. (3 cr)
Analysis of philosophies, issues, policies, trends, professional needs and statutory requirements in continuing professional education programs. Role of the program director and organization.

AdEd 5303. Working with Volunteers in Community Settings. (3 cr)
Uses collaborative, experiential methods to address fundamental issues and practices in volunteer development. Explore personal philosophies, staffing, and key issues and trends in the administration of volunteer programs.

AdEd 5611. Futurism in Human Resource Development and Adult Education. (3 cr)
Implications of future developments in areas of theory/practice in human resource development and adult education.

AdEd 5612. Managing and Consulting in Human Resource Development and Adult Education. (3 cr; SP–HRD 5001)
Theory of managing and consulting in human resource development and adult education. Assessment of role requirements and experimentation with practical management and consultation processes and techniques.

AdEd 5700. Special Topics in Adult Education. (1-8 cr [max 12 cr])
Exploration of issues, methods, and knowledge in areas of adult education. Content varies.

AdEd 8001. Advanced Theory in Human Resource Development and Adult Education. (3 cr; SP–5001 or HRD 5001; A-F only)
Theoretical understanding of individuals and organizations as adaptive entities; roles of human resource development and adult education in mediating complex demands.

Adult Psychiatry (AdPy)

Department of Psychiatry

Medical School

AdPy 5515. Neuropsychology: University Hospitals. (3-9 cr)

AdPy 8205. Special Assignments . (1-16 cr)

AdPy 8206. Research . (1-16 cr)

AdPy 8249. Clinical Neuropsychopharmacology. (1-15 cr; SP–Resident status or 3rd- or 4th-yr med student or 8248 for grad students)
The course is designed for a two-day presentation, four hours one afternoon, followed by eight hours the next day, to include the following subject matter: introduction to neurotransmitter theory and mechanism of action of psychotropic drugs; evaluation of anxiety states and use of antianxiety agents; clinical picture of depression, use of antidepressants, and principles of drug combinations; schizophrenia diagnosis, use of antipsychotic drugs, antiparkinson medication, parkinson side effects of neuroleptics, and tardive dyskinesia; clinical evaluation of epilepsy and use of anticonvulsants; neurophysiology of sleep, prescription of hypnotics and sedatives, and significance of over-the-counter sleep aids; use of anorexiants, over-the-counter appetite suppressants, and opiate analgesics; geriatric psychopharmacology; classification of drug side effects and principles of drug interaction; abused drugs; and ethnopsychopharmacology.

AdPy 8970. Directed Studies. (1-24 cr)

Aerospace Engineering and Mechanics (AEM)

Department of Aerospace Engineering and Mechanics

Institute of Technology

AEM 5401. Intermediate Dynamics. (3 cr; QP–IT upper div or grad, 3036, Math 3261; SP–IT upper div or grad, 2012, Math 2243)
Three-dimensional Newtonian mechanics, kinematics of rigid bodies, dynamics of rigid bodies, generalized coordinates, holonomic constraints, Lagrange equations, applications.

AEM 5501. Continuum Mechanics. (3 cr; QP–IT upper div or grad, AEM 3016, Math 3261, or #; SP–IT upper div or grad, 3031, Math 2243 or equiv or #)
Concepts common to all continuous media; elements of tensor analysis; motion, deformation, vorticity; material derivatives; mass, continuity equation; balance of linear, angular momentum; geometric characterization of stress; constitutive equations.

AEM 5503. Theory of Elasticity. (3 cr; QP–IT upper div or grad, 5515 or equiv, Math 3252 or #; SP–4501 or equiv, Math 2263 or equiv or #; A-F only)
Introduction to the theory of elasticity, with emphasis on linear elasticity. Linear and nonlinear strain measures, boundary-value problem for linear elasticity, plane problems in linear elasticity, three dimensional problems in linear elasticity. Topics from nonlinear elasticity, micromechanics, contact problems, fracture mechanics.

AEM 8000. Seminar: Aerospace Engineering and Mechanics. (1 cr [max 4 cr]; SP–DGS consent; S-N only)

AEM 8201. Fluid Mechanics I. (3 cr; QP–5200 or equiv, Math 3252 or equiv; SP–4201 or equiv, Math 2263 or equiv)
Mathematical and physical principles governing the motion of fluids. Kinematic, dynamic, and thermodynamic properties of fluids; stress and deformation; equations of motion; analysis of rotational and irrotational inviscid incompressible flow; two-dimensional and three-dimensional potential flow.

AEM 8202. Fluid Mechanics II. (3 cr; QP–8201; SP–8201)
Analysis of incompressible viscous flow; creeping flows; boundary layer flow.

AEM 8203. Fluid Mechanics III. (3 cr; SP–8202)
Analysis of compressible flow and shock waves; method of characteristics for one-dimensional unsteady flow and for two-dimensional steady flow.

AEM 8207. Hydrodynamic Stability. (4 cr; SP–8201)
Theory of hydrodynamic stability. Stability of shear flows, rotating flows, boundary layer, two fluid flows, fingering flows, Rayleigh-Taylor instability, Kelvin Helmholtz instability, capillary instability, convective/absolute stability. Methods of linear stability, normal modes, energy theory of stability, nonlinear perturbation, bifurcation theory, transition to turbulence.

AEM 8211. Theory of Turbulence I. (3 cr; QP–8202; SP–8202)
Reynolds equations, methods of averaging, elements of stability theory and vortex dynamics; description of large vortical structures in mixing layers and boundary layers; horseshoe vortices; flow visualization.

AEM 8212. Theory of Turbulence II. (3 cr; QP–8216; SP–8211)
Prandtl's mixing length theory applied to classical boundary layer, pipe, jet, and wake flows; prediction methods used at Stanford Conference; law of wall; law of wake; K-epsilon method.

AEM 8213. Turbulent Shear Flows. (3 cr; QP–8201, 8202; SP–8201, 8202; A-F only)
Equations of motion for turbulent flow. Isotropic/homogeneous turbulence. Free shear flows. Wall turbulence, elements of vortex dynamics.

AEM 8221. Rheological Fluid Mechanics. (3 cr; QP–8201, 8510; SP–8201 or 5501 or #)
Methods of solution for flows of simple fluids with general constitutive equations. Topics from viscometric flow, extensional flow, perturbations of the rest state with steady and unsteady flow, secondary flow.

AEM 8231. Physical Gas Dynamics. (3 cr; QP–5200 or equiv, 5204 or equiv, ME 3301 or equiv; SP–4201 or equiv, 4203 or equiv, ME 3324 or equiv)
Molecular and chemical effects in gas flows. Use of collision theory to determine mean free path, velocity distributions; statistical mechanics; partition function; Maxwellian and Bolzmann distributions; nonequilibrium flows; applications in rarefied and hypersonic flows.

AEM 8241. Perturbation Methods in Fluid Mechanics. (3 cr; QP–8202; SP–8202 or #)
Method of matched asymptotic expansions presented through simple examples and applied to viscous flows at high and low Reynolds numbers and other problems in fluid mechanics and applied mathematics.

AEM 8251. Finite-Volume Methods in Computational Fluid Dynamics. (3 cr; QP–5200 or 8201, CSci 3101 or equiv; SP–4201 or 8201 or equiv, CSci 1107 or equiv)
Development of finite-volume computational methods for solution of compressible Navier-Stokes equations. Accuracy, consistency, and stability of numerical methods; high-resolution upwind shock-capturing schemes; treatment of boundary conditions; explicit and implicit formulations; considerations for high performance computers; recent developments and advanced topics.

AEM 8261. Nonlinear Waves in Mechanics. (3 cr; QP–8510; SP–5501 or #)
Theory of kinematic, hyperbolic, and dispersive waves, with application to traffic flow, gas dynamics, and water waves.

AEM 8271. Experimental Methods in Fluid Mechanics. (3 cr; QP–5200, #; SP–4201, #)
Overview of computer organization, including external communications and A/D, D/A conversion. Measurement techniques, such as pressure measurements and hot-wire and laser Doppler anemometry. Signal processing and uncertainty; computer control of experiments.

AEM 8295. Selected Topics in Fluid Mechanics. (1-4 cr [max 8 cr]; SP–Δ)
Includes individual student projects completed under guidance of a faculty sponsor.

AEM 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

AEM 8400. Seminar: Dynamical Systems and Controls. (1 cr [max 4 cr]; S-N only)
Developing program of research in dynamical systems/controls. Discussions of current research/topics of interest.

AEM 8401. Modern Feedback Control. (3 cr; QP–5321; SP–4311 or #)
State space theory for multiple-input-multiple-output (MIMO) aerospace systems. Singular value decomposition (SVD) technique and its applications to performance and robustness. Linear quadratic gaussian (LQG) and eigenstructure assignment design methodologies. Topics in H∞. Applications.

AEM 8411. Advanced Dynamics. (3 cr; QP–5438; SP–5401 or equiv or #)
Lagrange's equations; calculus of variations and Lagrange multipliers, kinematics and dynamics of rigid bodies, and Hamilton's principle; applications to discrete and continuous systems.

AEM 8412. Nonlinear Systems. (3 cr; QP–8410; SP–8411)
Introduction to nonlinear dynamical systems. Method of averaging and its applications; Liapunov stability, center manifold, and normal form theories; bifurcation analysis; introduction to chaotic phenomena.

AEM 8413. Advanced Nonlinear Systems. (3 cr; QP–8412; SP–8412 or #)
Dynamical systems with emphasis on higher dimensional (more than three) systems and global and chaotic phenomena. Bifurcation analysis with codimension greater than one, Melnikov method, and Silnikov phenomena. Concepts of symmetry. Application to problems modeled by partial differential equations.

AEM 8421. Robust Multivariable Control Design. (3 cr; QP–8410; SP–8411 or equiv)
Application of robust control theory to aerospace systems. Role of model uncertainty/modeling errors in design process. Control analysis and synthesis, including H_2 and H∞ optimal control design and structural singular value m techniques.

AEM 8426. Optimization and System Sciences. (3 cr; SP–8401, IT grad student; A-F only)
Applications of modern finite dimensional optimization techniques in system/control theory. Linear/nonlinear programming, duality, complexity theory, interior point methods, matrix inequalities, convex optimization over cones, bilinear matrix inequalities, rank-constrained problems.

AEM 8431. Trajectory Optimization. (3 cr; QP–5321; SP–4311 or equiv or #)
Parameter optimization problems. Topics in calculus of variations; necessary conditions of nonlinear optimal control problems; classification of trajectory optimization algorithms; steady-state aircraft flight; minimum-time climb aircraft trajectory; aero-assisted orbital transfer trajectories; optimal space trajectories.

AEM 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

AEM 8495. Selected Topics in Dynamical Systems and Controls. (1-4 cr [max 8 cr]; SP–Δ)
Includes individual student projects completed under guidance of a faculty sponsor.

AEM 8500. Research Seminar in Mechanics of Materials. (1-3 cr [max 12 cr]; SP–#; A-F only)
Seminars given by students, faculty, and visitors on topics drawn from current research.

AEM 8511. Advanced Topics in Continuum Mechanics. (3 cr [max 6 cr]; QP–8512; SP–5501 or #; A-F only)
Constitutive equations; invariance and thermodynamic restrictions. Nonlinear elasticity theory; exact solutions, minimization, stability. Non-Newtonian fluids; viscometric flows, viscometric functions, normal stress. Other topics may include reactive and/or nonreactive mixtures, nonlinear plasticity, and deformable electromagnetic continua.

AEM 8521. Advanced Topics in Elasticity. (3 cr; QP–8594; SP–5503; A-F only)
Contact stresses, finite deformations, and other topics.

AEM 8523. Elastodynamics. (3 cr; QP–5580 or 8510; SP–4581 or 5501 or #; A-F only)
Waves and vibrations in rods, beams, and plates; dispersion; volume and surface waves; reflection; energy theorems; vibrations of bounded media and relation to technical theories; elements of nonlinear waves, inelastic waves, and stability of motion of elastic systems.

AEM 8531. Fracture Mechanics. (3 cr; QP–8594; SP–5503 or #; A-F only)
Theories of mechanical breakdown. Kinetic rate theories and instability considerations; formation of equilibrium cracks and circular crack propagation under pulses; statistical aspects of strength and fracture of micromolecular systems; time and temperature dependency in fracture problems and instability of compressed material systems.

AEM 8533. Theory of Plasticity. (3 cr; QP–8594; SP–5203 or #)
Theory of permanent deformation of ductile metals; bi-linear material models, Drucker's three bar truss, and other examples; 3-D continuum formulation, yield surfaces, hardening rules, and material stability; slip line theory, Prandtl punch solution; single crystal plasticity.

AEM 8541. Mechanics of Crystalline Solids. (3 cr; QP–8510; SP–5501 or #)
Atomic theory of crystals and origins of stress in crystals. Relation between atomic and continuum description; phase transformations and analysis of microstructure; effects of shear stress, pressure, temperature, electromagnetic fields, and composition on transformation temperatures and microstructure; interfacial energy in solids.

AEM 8595. Selected Topics in Mechanics and Materials. (1-4 cr [max 8 cr]; SP–Δ)
Includes individual student projects completed under guidance of a faculty sponsor.

AEM 8601. Finite Element Methods in Computational Mechanics. (3 cr; SP–Δ)
Fundamental concepts and techniques of finite element analysis. Variational equations and Galerkin's method; weak formulations for problems with nonsymmetric differential operators; Petrov-Galerkin methods; examples from solid and fluid mechanics; properties of standard finite element families, implementation.

AEM 8602. Finite Element Methods in Computational Fluid Mechanics. (3 cr; QP–8601; SP–8601)
Finite element methods for time-dependent problems. Stability, convergence, and accuracy concepts; analysis and applications of Petrov-Galerkin formulations for convection-diffusion equations; incompressible Navier-Stokes equations; vorticity-stream function formulation and velocity-pressure formulation; hyperbolic systems, compressible Euler equations.

AEM 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

AEM 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

AEM 8880. Plan B Project. (1-3 cr [max 3 cr]; SP–Grad aerospace engineering or mechanics major, Δ)
Satisfies project requirement for Plan B Master's degree. May appear on M.S. program but does not count toward 20-credit minimum in the major field. Topic arranged by student and advisor; written report required.

AEM 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Afro-American Studies (Afro)

Department of Afro-American Studies

College of Liberal Arts

Afro 5072. Racism: Social and Psychological Consequences for Black Americans. (3 cr)
Racism and its effects on African Americans; definitions, determinants, and dynamics. Examined in an experiential context to reflect individual and institutional racism.

Afro 5143. Geography of West Africa. (3 cr)
West Africa from Senegal to Cameroon. Social geography of resource use, population, settlement, economic development, and international relations.

Afro 5145. Development in Africa. (3 cr)
Economic, political, and social development in Africa from independence to the present, emphasizing the reordering of colonial landscapes, bases for North-South relations, big power interventions, and participation in the world economy.

Afro 5181. Blacks in American Theater. (3 cr)
Historical survey of significant events in the development of American black theater traditions. Essays, plays, playwrights, and theaters from early colonial references to the Black Arts Movement.

Afro 5182. Contemporary Black Theater: 1960 to Present. (3 cr)
Essays, plays, playwrights, and theaters that have contributed significantly to contemporary black theater. From the beginning of the Black Arts movement to the present.

Afro 5191. Seminar: The African American Experience in South Africa. (3 cr; SP–§Hist 5438)
Ideological, political, religious, and cultural ties that have informed African American and black South African relations from late 18th century to present.

Afro 5301. The African Novel. (3 cr; SP–Grad or #)
The novel in contemporary Africa in English, French and African languages. Non-English language works in translation.

Afro 5352. Black Families in Comparative Perspective. (3 cr)
Cross-cultural perspectives of family formation, social structure, and gender patterns of families of African descent.

Afro 5401. Field Studies in Afro-American and African Studies. (1-6 cr; SP–Major or minor, #)
Supervised field study/internship focused on Afro-American and/or African culture(s), language(s), and development.

Afro 5551. Methods: Use of Oral Traditions as Resources for History. (3 cr)
Use of spoken information through time as a source for writing history. Use of canons of history to analyze and critique oral traditions and integrate them into written history.

Afro 5593. The Afro-American Novel. (3 cr)
Contextual readings of 19th- and 20th-century black novelists including Chesnut, Hurston, Wright, Baldwin, Petry, Morrison, and Reed.

Afro 5597. Seminar: Harlem Renaissance. (3 cr)
A multidisciplinary review of the Jazz Age's Harlem Renaissance: literature, popular culture, visual arts, political journalism, and major black and white figures.

Afro 5598. Seminar: Black Arts Renaissance, 1960s and 1970s. (3 cr)
Multidisciplinary perspectives on the 1960s and 1970s Black Power "renaissance" of African American art and politics.

Afro 5655. African American Cinema. (3 cr)
Exploration of African American cinematic achievements, from the silent films of Oscar Micheaux through contemporary Hollywood and independent films, using class screenings and critical readings.

Afro 5701. Proseminar: Classic Works in Afro-American Studies. (3 cr)
Exploration of classic works in Afro-American studies; conceptual frameworks; multidisciplinary focus.

Afro 5702. Proseminar: Major Figures in Afro-American Studies. (3 cr)
In-depth examination of major figures from various fields in Afro-American studies; bio-critical focus.

Afro 5741. Minorities and the Mass Media. (3 cr; QP–Jour major or minor, Jour 3004, Δ; SP–Jour major or minor, Jour 3004, Δ; A-F only)
Analysis of relationships between mass media and communities of color in the United States. Focuses on issues of content and control.

Afro 5864. Proseminar: African-American History. (3-4 cr; SP–#)
Examination of issues including slavery, Reconstruction, the Great Depression, and civil rights movement using cultural and intellectual history and autobiography/biography. Focuses on dynamics of race, gender, class, region, sexuality, and religion.

Afro 5865. Proseminar: African-American History. (3-4 cr; SP–#)
Construction of a detailed research agenda, locating appropriate depositories of primary materials and secondary sources, and developing appropriate methodologies and frameworks.

Afro 5876. Proseminar: Approaches to African Development. (3 cr)
Study, critical analysis, and comparison of primary documents relevant to African development.

Afro 5910. Topics in Afro-American and African Studies. (3 cr [max 9 cr])
Topics specified in *Class Schedule.*

Afro 5993. Directed Study. (1-3 cr; SP–#)
Guided individual reading/study for qualified seniors and graduate students.

Afro 8101. Seminar: Studies in Africa and the African Diaspora. (3 cr; SP–#)
Comparatist frameworks, related theories, and pivotal texts.

Afro 8202. Seminar: Intellectual History of Race. (3 cr)
Shifting and contested meanings of "race" from the "Age of Conquest" to the present. Starting from the proposition that race is not a fixed or stable category of social thought or being, the seminar seeks to ascertain how and why Western ideas about race have changed.

Afro 8554. Seminar: Gender, Race, Nation, and Policy—Perspectives from Within the African Diaspora. (3 cr; SP–#)
Interdisciplinary analysis of U.S. domestic and foreign policies as they affect Africans and peoples of African descent in the diaspora. Intersections of gender, race, nation, and class.

Afro 8590. Figures in Contemporary Black Fiction. (3 cr)
Each term focuses on works of an individual writer, such as Toni Morrison, Paule Marshall, and Jamaica Kincaid. Critical studies.

Afro 8802. Seminar: Orientalism. (3 cr)
Recent arguments related to Orientalism as a trend in modern literary and cultural criticism.

Afro 8910. Topics in Studies of Africa and the African Diaspora. (3 cr [max 9 cr])
Topics specified in *Class Schedule.*

Agricultural, Food, and Environmental Education (AFEE)

Department of Work, Community, and Family Education

College of Education and Human Development

AFEE 5111. Agricultural Education: Methods of Teaching. (4 cr)
Use of teaching resources; principles of teaching and learning; problem-solving techniques, lesson plan construction for large group, small group and individual investigations; student management; and assessment.

AFEE 5112. Agricultural Education Program Organization and Curriculum for Youth. (4 cr)
Development of community school program in agriculture, agribusiness, and environmental science that meet graduation outcomes and determine student needs. Use classroom, FFA, and supervised agricultural experiences to develop activities.

AFEE 5113. Adult Agricultural Education Program Development and Technology. (3 cr; A-F only)
Organization and implementation of education programs for farmers, farm managers, and agribusiness personnel using community and environmental resources, agricultural and instructional technology, and management information systems to attain family and business goals.

AFEE 5114. Agricultural Education Teaching Seminar. (1 cr)
Reflective learning on teacher preparation experience; identify issues and problems facing the discipline; needs for continual preparation and program adjustment.

AFEE 5220. Special Topics in Agriculture Education and Extension. (1-3 cr [max 12 cr])
Content varies by offering.

AFEE 5231. Agricultural Education Curriculum K-12. (2 cr; A-F only)
Philosophy, organization, and administration of instruction in agricultural education programs at the elementary, middle, and high school levels.

AFEE 5233. Advanced Procedures in Teaching Agricultural Education. (2 cr; A-F only)
New developments in methodology; assessment of innovations and procedures; consideration of various levels of instruction.

AFEE 5235. Advanced Supervised Agricultural Experience Programs. (2 cr)
The organization and administration of agricultural experience programs for middle and secondary level students: career exploration, improvement projects, experiments, placement in production/business/community settings, entrepreneurship. Current state and national programs and resource material.

AFEE 5237. Mentorship for Supervising Agricultural Education Teachers. (2 cr)
Professional development training for experienced teachers to serve as mentors for beginning and student teachers of agricultural education. Emphasis on

supervision and assessment of teaching performance. Focus on critical period of induction into the teaching profession.

AFEE 5239. Program Organization and Management in Agricultural Education. (2 cr)
Analysis of organization, management, and assessment of agricultural education programs at the middle, high school, and adult levels.

AFEE 5280. Current Issues for the Beginning Agricultural Education Teacher. (1-3 cr [max 3 cr])
Reflection, analysis on current problems and issues confronting beginning teachers of agricultural education. Issues in teaching methods, classroom and program management, discipline, curriculum, FFA and SAE development, school-to-work relationships.

AFEE 5290. Seminar: Current Issues in Agricultural Education and Extension. (1-3 cr [max 6 cr])
Exploration of current issues in agricultural education and extension, strategies of response, implications of response actions, and related leadership roles.

AFEE 5296. Professional Experience Practicum in Agricultural Education and Extension. (1-4 cr)
Observation, study, and experience in agricultural business and industry; identification of educational problems observed in the agricultural industry; evaluation of personal experience.

AFEE 5331. History, Philosophy, and Systems of Extension. (3 cr; A-F only)
History and philosophy of extension; modification and adaptation to worldwide methods and approved practices; extension methodologies; innovative approaches; systems appropriate to development environments.

AFEE 5341. Global Program Delivery Techniques and Technology of Extension. (2 cr; A-F only)
Educational activities, teaching, and communications methods and techniques, from outreach to extension services, with an emphasis on youth and adult education programs in different global settings.

AFEE 5351. Methods for Change in Developing Countries. (3 cr; A-F only)
Strategies and methodologies promoting change in developing countries. Examination of sociological and cultural parameters of improved practices in rural, community, and agricultural development. Project planning, implementation, and evaluation related to change in developing countries.

AFEE 5361. World Development Problems. (3 cr; A-F only)
Introduction to development problems throughout the world. Development in Third World countries. Examples of First World development problems. Interdisciplinary focus on population, health and disease, education, agriculture, industry, finance, politics, and human rights.

AFEE 5371. Farming Systems Research and Extension. (3 cr; A-F only)
Introduction to the theory and practice of linking farming systems, research, and extension. An interdisciplinary and holistic approach to rural development for individuals and communities throughout the world.

AFEE 5993. Directed Study in Agricultural Education and Extension. (1-9 cr)
Topics may be chosen to permit study of areas within education or to supplement areas of inquiry not provided in the regular course structure.

AFEE 5995. Integrating Paper—Master of Education: Agricultural and Extension Education. (1-4 cr; A-F only)
Students prepare paper dealing with issues in agricultural education applied to professional responsibilities.

AFEE 8090. Seminar: Agricultural Education and Extension. (1-3 cr [max 6 cr]; SP–Ag ed grad student)
Topics on various aspects of agricultural education. Prepare, present, and critique a report.

AFEE 8094. Research in Agricultural Education and Extension. (1-6 cr [max 6 cr]; SP–Ag ed student doing Plan B research, Δ; A-F only)
Select problems, prepare bibliographies, analyze and interpret data, and prepare manuscripts on studies.

Agricultural Engineering Technology (AgET)

Department of Biosystems and Agricultural Engineering

College of Agricultural, Food, and Environmental Sciences

AgET 5095. Special Problems in Biosystems and Agricultural Engineering. (1-5 cr; QP–#; SP–#)
Individual study project in biosystems and agricultural engineering at advanced level. Application of engineering principles to a specific problem.

AgET 5203. Environmental Impacts of Food Production. (3 cr)
Topics include crop production intensity, animal raising options, food processing waste alternatives, and pest control.

AgET 5212. Safety and Health Issues in Agricultural Work Environments. (2 cr; QP–Jr or sr or grad in IT or COAFES or PubH or other major with interest in occupational and environmental health and safety; SP–Jr or sr or grad in IT or COAFES or PubH or other major with interest in occupational and environmental health and safety)
Examine emerging agricultural occupational safety and health issues including injury, work-related disease, pesticide exposure, pollution, biotechnology, and social implications of changing demographics and technologies.

AgET 5999. Special Workshop in Biosystems and Agricultural Engineering. (1-4 cr; QP–#; SP–#)
Workshops on a variety of biosystems and agricultural engineering topics offered at locations other than the Twin Cities campus. See *Class Schedule* or department for current offerings.

Agronomy and Plant Genetics (Agro)

Department of Agronomy and Plant Genetics

College of Agricultural, Food, and Environmental Sciences

Agro 5021. Introduction to Plant Breeding. (3 cr; QP–[GCB 3022 or equiv], background in plant science; SP–[GCB 3022 or equiv], background in plant science)
For majors not specializing in plant breeding. How genetics is applied to plant improvement. Emphasizes sustainable-production scenarios.

Agro 5310. Research Methods in Crop Improvement and Production. (1 cr; QP–Agro or Hort or PlBr grad; SP–Applied plant sciences grad; S-N only)
Demonstrations and discussions of techniques in crop improvement and/or production research. Presentations integrate biotechnology with traditional breeding methods; production sessions emphasize ecologically sound cropping systems.

Agro 5321. Ecology of Agricultural Systems. (3 cr; QP–§Ent 5321; [3xxx or above] course in [Agro or AnSc or Ent or Hort or PlPa or Soil] or #; SP–§Ent 5321; [3xxx or above] course in [Agro or AnSc or Ent or Hort or PlPa or Soil] or #; A-F only)
Ecological approach to problems in agricultural systems. Formal methodologies of systems inquiry are developed/applied.

Agro 5999. Special Topics/Workshop in Agronomy. (1-4 cr; QP–Jr or sr; SP–Jr or sr)
Workshops on a variety of topics in Agro offered at locations other than the Twin Cities campus. Presenters/faculty may include guest lecturers/experts. Topics specified in *Class Schedule*.

Agro 8005. Supervised Classroom or Extension Teaching Experience. (2 cr; SP–#; S-N only)
Classroom or extension teaching experience in one of the following departments: Agronomy and Plant Genetics; Biosystems and Agricultural Engineering; Horticultural Science; Plant Pathology; or Soil, Water, and Climate. Participation in discussions about effective teaching to strengthen skills and develop personal teaching philosophy.

Agro 8201. Plant Breeding Principles I. (3 cr; QP–Stat 5301 or equiv; SP–Stat 5301 or equiv; A-F only)
Principles and current methods involved in breeding agronomic and horticultural crops. Use of genotype/environment data to increase genetic gain, population improvement, parent building, alternative selection strategies, breeding for special traits, and new approaches.

Agro 8202. Plant Breeding Principles II. (4 cr; QP–8201, Stat 5301, GCB 5042 or #; SP–8201, Stat 5301, EEB 5033 or #)
Breeding principles and methods; population concepts, constructing source populations, and varietal development. Use of quantitative genetics in decision making in plant breeding, emphasizing covariance of relatives, genotype by environment interactions, stability analysis, statistical methods of analysis, selection theory and application.

Agro 8231. Cytogenetics. (4 cr; QP–GCB 5034; SP–GCB 5034 or #)
Genetic principles in relation to the eukaryotic chromosome. Molecular cytogenetics of chromosome structure, replication, pairing, and crossing over. Behavior of deficiencies, duplications, inversions, interchanges. Aneuploidy, autopolyploidy, allopolyploidy, and uses of cytogenetic stocks in molecular and classical genetics and plant breeding.

Agro 8241. Molecular and Cellular Genetics of Plant Improvement. (3 cr; QP–GCB 5034 or equiv; SP–GCB 5034 or equiv or #)
Principles of genetic modification of higher plants by application of molecular and cellular biotechnology approaches. Gene isolation and transfer, tissue culture manipulations, organelle genetics, molecular markers and mapping, and discussions and lab demonstrations of current research on genetic mechanisms related to crop improvement.

Agro 8270. Graduate Seminar. (1 cr; SP–Grad major in agro or applied plnt sciences or ent or hort or plnt brdg or plnt path or soil or #)
Reports and discussions of problems and investigational work.

Agro 8280. Current Topics in Applied Plant Sciences. (1 cr; SP–Grad major in agro or applied plnt sciences or ent or hort or plnt brdg or plnt path or soil or #)
Topics presented by faculty or visiting scientists.

Agro 8305. Physiological Ecology of Plants in Natural and Managed Ecosystems. (4 cr; QP–BioC 3021, Biol 1009 or [Biol 1201 or 1202]; SP–BioC 3021, [Biol 1001 or Biol 1002], Biol 1009; A-F only)
Introduction to plants and their reactions and responses in managed and natural ecosystems, including carbon and nitrogen allocation, root biology, microbial interaction, secondary metabolism, and plant response to biotic and abiotic stress.

Agro 8505. Advanced Perspectives in Weed Science. (2 cr; SP–Grad major in agro or applied plnt sciences or ent or hort or plnt brdg or plnt path or soil or #; A-F only)
Topics concerning the biochemistry and sustainability of chemical and biological weed control methods. Lecture and student-directed discussion.

Agro 8605. Advanced Management of Agroecosystems. (3 cr; QP–5050; SP–4605 or #)
Problem-based learning approach to developing a holistic approach to agroecosystem-based crop management. Field trips combined with classroom discussion and decision-focused case studies. Students conduct research and develop a decision case.

Agro 8900. Advanced Discussions. (1-3 cr [max 12 cr]; SP–#)
Special workshops or courses in applied plant sciences.

Akkadian (Akka)

Department of Classical and Near Eastern Studies

College of Liberal Arts

Akka 5011. Elementary Akkadian I. (3 cr; SP–Adv undergrads with # or grads)
Introduction to cuneiform script. Basics of Old Babylonian morphology and syntax. Written drills, readings from Hammurabi laws, foundation inscriptions, annals, religious and epic literature.

Akka 5012. Elementary Akkadian II. (3 cr; SP–5011)
Continuation of 5011. Readings include The Gilgamesh Epic, The Descent of Ishtar, Mari Letters, Annals of Sennacherib and Essarhaddon, Sargon II.

Akka 5300. Readings in Akkadian. (3 cr [max 18 cr]; SP–5011, 5022)
Survey of Akkadian literature, including literary, legal, historiographical, and sacred texts. Topics specified in *Class Schedule.*

American Indian Studies (AmIn)

Department of American Indian Studies

College of Liberal Arts

AmIn 5890. Problems in American Indian History. (3 cr; SP–#)
Intensive consideration of topics in American Indian history. Possible topics include social history, Indian history of particular regions, political systems, education, and American Indian policy.

AmIn 5920. Topics in American Indian Studies. (2-4 cr [max 4 cr]; A-F only)
Intensive examination of a particular topic (e.g., American Indian education, American Indians of the Great Lakes, American Indians of the Southwest, American Indians and the Federal government).

American Sign Language (ASL)

Department of Educational Psychology

College of Education and Human Development

ASL 5642. Classroom Communication Through ASL. (1-2 cr [max 5 cr]; QP–Fluency in ASL or #; SP–Fluency in ASL, #; S-N only)
American Sign Language (ASL) form/function, vocabulary production, grammatical features needed by professionals working with children, storytelling strategies, technical sign language for classroom teachers. Content progresses in repeated segments.

American Studies (AmSt)

Department of American Studies

College of Liberal Arts

AmSt 5101. Religion and American Culture. (3 cr; A-F only)
Role of religion in shaping contemporary American cultural pluralism. Institutions and processes, intellectual frameworks, aesthetic and symbol systems that form religious communities and contribute to religious conflicts in U.S. society and culture.

AmSt 5202. Thought and Practice of American Religions. (4 cr; SP–#)
Holidays, festivals, religious arts, organizations, spirituality, ethics, and systems of thought of "civil religion," "women's religion," indigenous American religions, American versions of Christianity, Judaism, Islam, Buddhism, and other world faiths, and their interactions in the United States and worldwide.

AmSt 5920. Topics in American Studies. (3-4 cr [max 9 cr])
Topics specified in *Class Schedule.*

AmSt 8201. Historical Foundations of American Studies. (3 cr; SP–Grad AmSt major)
Exposition of American studies as a field of inquiry, including its history, major theoretical framework, and interdisciplinary methodologies.

AmSt 8202. Theoretical Foundations and Current Practice in American Studies. (3 cr; SP–Grad AmSt major or # or Δ; A-F only)
Analysis of central theoretical work in the field and survey of key methodologies.

AmSt 8239. Gender, Race, Class, Ethnicity, and Sexuality in the United States: Research Strategies. (3 cr; A-F only)
Social, cultural, and artistic modes of self-expression. Intellectual analysis of people in the United States identified as female or male or as members of groups defined by race, ethnicity, class, or sexual orientation.

AmSt 8240. Gender, Race, Class, Ethnicity, and Sexuality in the United States: Topical Development. (3 cr [max 9 cr]; SP–#; A-F only)
Social, cultural, and artistic modes of self-expression and intellectual analysis of people in the United States identified as female or male and/or as members of group defined by race, ethnicity, class, or sexual orientation.

AmSt 8249. Popular Culture: Research Strategies. (3 cr; SP–#; A-F only)
Study of the popular arts in their political and social context. Focuses on issues of race, gender, class, and nationalism.

AmSt 8250. Popular Culture: Topical Development. (3 cr [max 9 cr]; SP–#; A-F only)
Study of the popular arts in their political and social context. Focuses on issues of race, gender, class, and nationalism.

AmSt 8259. Literature, History, and Culture: Research Strategies. (3 cr; SP–#)
Interdisciplinary study of connections between literary expression and history, particularly as they articulate themes in American culture.

AmSt 8260. Literature, History, and Culture: Topical Development. (3 cr; SP–#)
Interdisciplinary study of connections between literary expression and history, particularly as they articulate themes in American culture.

AmSt 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

AmSt 8401. Practicum in American Studies. (3 cr; SP–#; A-F only)
Training in teaching undergraduate courses in American studies.

AmSt 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

AmSt 8520. Seminar: American Art and Material Culture. (3 cr [max 12 cr]; SP–#)
Selected topics in American art, popular art, and material culture, with emphasis on methods and techniques of inquiry: creation and use of archives, oral history, sources for pictorial evidence, and current approaches to interpreting both traditional and non-traditional data.

AmSt 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

AmSt 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

AmSt 8801. Dissertation Seminar. (3 cr; SP–AmSt doctoral student beginning dissertation work; S-N only)
Conceptualizing the research problem for the dissertation and structuring the process of writing a chapter of it.

AmSt 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

AmSt 8970. Independent Study in American Studies. (1-9 cr [max 9 cr]; SP–#, Δ)
Independent study of interdisciplinary aspects of American civilization under guidance of faculty members of various departments.

Ancient Near Eastern (ANE)

Department of Classical and Near Eastern Studies

College of Liberal Arts

ANE 5501. Ancient Israel: The Origins of Israel in Biblical Traditions. (3 cr; SP–Knowledge of Hebrew not required)
The foundation of the Hebrew people; traditions of the patriarchal period, development of Israelite religious and legal institutions; Ancient Near Eastern context of Israel's origins.

ANE 5502. Ancient Israel: From Conquest to Exile. (3 cr; SP–§3502, §RelA 3502, §RelA5502; Hebrew not required; 5501 recommended)
Israelite history in context of what is known from Egyptian, Canaanite, and Mesopotamian sources. Focus on issues raised by archaeological data related to Israelite conquest of Canaan.

ANE 5503. History and Development of Israelite Religion I. (3 cr)
Survey of the evolution of Israelite religion. Cultic practices, law and religion, prophecy, religion, and historiography. Relationship to surrounding religious systems. Knowledge of Hebrew not required.

ANE 5504. History and Development of Israelite Religion II. (3 cr)
Ancient Judaism from the Persian restoration (520 B.C.E.) to Roman times (2nd century C.E.). Religious, cultural, and historical developments are examined to understand Jewish life, work, and worship under a succession of foreign empires: Persian, Greek, and Roman.

ANE 5701. Studies in Semitic Linguistics and Inscriptions. (3 cr; SP–Adv Hebrew or adv Arabic or #)
Survey of comparative Semitic linguistics with emphasis on Northwest Semitic. Reading of Phonecian, Moabite, and Judean inscriptions.

ANE 5713. Introduction to Ugaritic. (3 cr; SP–Adv Hebrew, previous study of biblical texts or #)
Ugaritic alphabetic cuneiform script, morphology, and syntax. Reading of representative samples of Ugaritic literature. Attention to linguistic and cultural issues and links to biblical and other Ancient Near Eastern texts.

ANE 5993. Directed Studies. (1-4 cr; SP–#, Δ, ❑)
Guided individual reading or study.

Anesthesiology (Anes)

Department of Anesthesiology

Medical School

Anes 5587. Advanced Clinical Physiology I for Nurse Anesthetists. (3 cr [max 3 cr]; A-F only)
Cellular mechanisms underlying systems physiology. Cellular physiology, physiology of excitable tissues, renal physiology, cardiovascular physiology, hemostasis.

Anes 5588. Advanced Clinical Physiology II for Nurse Anesthetists. (3 cr [max 3 cr]; SP–Advanced Clinical Physiology I for Nurse Anesthetists; A-F only)
Respiratory physiology, acid-base physiology, gastrointestinal physiology, metabolism, endocrinology, reproductive physiology, physiology of pregnancy/labor.

Anes 5686. Chemistry and Physics for Nurse Anesthetists. (3 cr; SP–General chemistry or #; A-F only)
Chemical equilibrium, organic chemistry, physics of fluids/gases, anesthetic applications.

Anes 8265. General Anesthesia. (8 cr)

Anes 8266. Regional Anesthesia. (3 cr)

Anes 8267. Pre and Postanesthetic Evaluation. (1 cr)

Anes 8268. Seminar. (1 cr)

Anes 8269. Research in Anesthesia. (1 cr)

Animal Science (AnSc)

Department of Animal Science

College of Agricultural, Food, and Environmental Sciences

AnSc 5099. Special Workshop in Animal Science. (1-6 cr [max 12 cr]; SP–#; A-F only)
Topics vary. See *Class Schedule* or department. Topics may use guest lectures/experts.

AnSc 5200. Introductory Statistical Genetics and Genomics. (4 cr; QP–[Stat 3091 or equiv], [GCB 3022 or Biol 4004 or equiv]; SP–[2211 or Stat 3011 or equiv], [GCB 3022 or Biol 4003 or equiv]; A-F only)
Statistical issues in genomics. Gene detection, including statistical analysis/designs for linkage study and for mapping quantitative trait loci. Linkage analysis using pedigree data for codominant/dominant markers. Using radiation hybrid mapping/single cell typing. Design issues in linkage analysis, parentage testing, marker polymorphism.

AnSc 8111. Genetic Improvement of Animals. (3 cr; SP–#)
Application of population genetics to livestock breeding; selection index theory and practice; basis of relationships and covariances among relatives; and selection based on multiple sources of information.

AnSc 8121. Linear Model Methods. (3 cr; QP–Stat 5021; GCB 5033, Math 3142 recommended; SP–Stat 5021)
Techniques and statistical tools for analysis of data. Matrix manipulation, least-squares procedures, correction for environmental factors, estimation of components of variance, and standard errors of estimates.

AnSc 8131. Molecular Biology Techniques in Animal Science. (3 cr; QP–BioC 3021, Biol 5003 or equiv; SP–BioC 4332, Biol 4003; A-F only)
Basic theory and current methodologies of molecular biology and recombinant DNA technology. Lab work includes DNA and RNA hybridization, gene transfer, and polymerase chain reaction techniques. Primarily for students with limited exposure to molecular biology.

AnSc 8194. Research in Animal Genetics. (1-3 cr; SP–#)
Research in quantitative genetics, cytogenetics, molecular genetics, and other areas related to animal breeding.

AnSc 8211. Animal Growth and Development. (3 cr; SP–#)
Whole body growth of animals, bone, and adipose tissue; structure, function, differentiation, and development of tissues; mode of action of hormones, growth factors, and growth promoters.

AnSc 8294. Research in Muscle Chemistry and Physiology. (1-3 cr; SP–#)
Research in selected areas.

AnSc 8311. Animal Bioenergetics. (3 cr; QP–BioC 5331 recommended; SP–#; BioC 4331 recommended; A-F only)
Integrated systems approach to energy metabolism of animals. Application of classical techniques of calorimetry and comparative slaughter, development of systems for expressing energy content of feeds, and techniques for measuring whole body and organ metabolism of specific nutrients. Offered alternate years.

AnSc 8320. Concepts and Developments in Nutritional Physiology. (2 cr [max 4 cr]; SP–#; A-F only)
Review and critical evaluation of pertinent scientific literature.

AnSc 8330. Concepts and Developments in Ruminant Nutrition. (1 cr [max 2 cr]; SP–#; A-F only)
Review and critical evaluation of recent research reports.

AnSc 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

AnSc 8340. Concepts and Developments in Swine Nutrition. (1 cr [max 2 cr]; SP–#; A-F only)
Review and critical evaluation of scientific literature.

AnSc 8394. Research in Animal Nutrition. (1-3 cr; SP–#)
Research in selected areas: topics and animal species determined by consultation.

AnSc 8411. Physiology of Reproduction. (3 cr; QP–6 cr systemic physiology or equiv; SP–3305 or equiv; A-F only)
Emphasis is on gametogenesis, conception, and implantation.

AnSc 8421. Physiology of Fertilization and Gestation. (3 cr; QP–5322; SP–3305 or #)
Physiological events occurring during gametogenesis; capacitation and fertilization; period of the embryo; period of the fetus; and parturition.

AnSc 8431. Immunoreproduction. (3 cr; QP–5322; SP–3305 or #)
Blood groups and polymorphic proteins affecting reproduction; immunoglobulin formation; antigens of semen, ova, and genital secretions; immunopathology; maternal-fetal incompatibility; and antibodies to hormones.

AnSc 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

AnSc 8451. Reproductive Endocrinology. (2 cr; QP–BioC 3021; SP–3305 or 3327 or equiv, BioC 3021; A-F only)
Hormonal regulation of mammalian reproductive cycles and seasonal patterns; nutritional and stress effects on reproductive endocrinology; mechanism of hormone action.

AnSc 8494. Research in Animal Physiology. (1-3 cr; SP–#)
Individual research under faculty direction. Topic determined by consultation: a specialized aspect of a thesis problem or an independent problem of mutual interest to graduate student and adviser.

AnSc 8510. Graduate Seminar. (1 cr [max 2 cr]; SP–#)
Student presentations of literature, proposals, and research results; instructional guidelines and performance evaluation; preparation of visual material.

AnSc 8594. Research in Animal Science. (1-3 cr; SP–#)
Research including experimental studies in disciplines associated with animal production and research, with emphasis on interdisciplinary studies.

AnSc 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

AnSc 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

AnSc 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Anthropology (Anth)

Department of Anthropology

College of Liberal Arts

Anth 5025W. Cultural Semantics. (3 cr)
Understanding cultures and cognitive classification systems through lexical semantics.

Anth 5027W. Origins of European Civilization. (3 cr; SP–§3027)
Early development of European society, from Old Stone Age to Roman period. Principle transformations of European culture with introduction of agriculture, development of metallurgy and trade, and emergence of towns and cities.

Anth 5029. Philosophical Anthropology. (3 cr; SP–Sr or grad or #; A-F only)
Advanced survey of traditional problems associated with broad-ranging views on human nature and culture. Specific arguments of relativists, behaviorists, phenomenologists, and others in relation to social life. Structuralist and post-structuralist approaches.

Anth 5033. Feminist Anthropology. (3 cr; SP–3047 or grad or #)
Advanced introduction to the development of feminist theory in anthropology. Theoretical and methodological shifts in feminist anthropology and ethnography. Feminist ethnography within the discipline as a whole; current debates concerning the reading and writing of ethnography.

Anth 5041. Ecological Anthropology. (3 cr; SP–§3041, §8213; grad or #)
Concepts, theories, and methods of ecological anthropology (cultural ecology) show how humans interact with the biophysical environment. Compare biological and cultural interactions with the environment; examine adaptive strategies cross-culturally.

Anth 5045. Urban Anthropology. (3 cr; SP–4003 or grad or #)
Anthropological approaches to urban life in Western and non-Western settings. Topics include social networks and voluntary organizations; class, ethnicity, gender and power; migration and immigration; urban labor and economics; and urban "problems."

Anth 5059. Anthropology of Religion. (3 cr; SP–1003 or #)
Comparative study of myths, religious beliefs and rituals cross-culturally. Analysis of how religion and social relations are integrated. Careful examination of landmark cases and conceptual approaches in the anthropology of religion.

Anth 5128. Anthropology of Learning. (3 cr)
Cross-cultural perspectives in examining educational patterns, and the implicit and explicit cultural assumptions underlying them; methods and approaches to cross-cultural studies in education.

Anth 5980. Topics in Anthropology. (3 cr [max 3 cr])
Topics specified in *Class Schedule*.

Anth 8001. Foundations of Social and Cultural Anthropology. (3 cr; SP–Grad anth major or #; A-F only)
Introduction to foundational concepts, methods, and ethnographic work in the field. Emphasis on theories that have shaped 20th-century thinking in cultural anthropology; explores connection of these theories to fieldwork and contemporary issues.

Anth 8002. Foundations of Social and Cultural Anthropology. (3 cr; SP–8001; A-F only)
Further introduction to important concepts and perspectives in anthropology, with emphasis on past and contemporary American cultural anthropology. Includes recent work in semiotic, psychological, and feminist anthropology.

Anth 8003. Foundations of Social and Cultural Anthropology. (3 cr; SP–8001, 8002; A-F only)
Builds on theoretical perspectives analyzed in 8001 and 8002; focuses on politics of culture and politics of ethnographic practice and writing.

Anth 8004. Foundations of Anthropological Archaeology. (3 cr; SP–8001, 8002)
Theoretical foundations of anthropological archaeology in historical and contemporary perspective.

Anth 8120. Problems in Culture Change and Applied Anthropology. (3-6 cr [max 6 cr])
Comparative studies of change in cultural systems. Impact of global processes on local cultures. Roles of anthropology and anthropologists in policy, planning, implementation, and evaluation.

Anth 8203. Research Methods in Social and Cultural Anthropology. (3 cr; SP–Grad anth major or #)
Classic and current issues in research methodology, including positivist, interpretivist, feminist, and postmodernist frameworks. Methodology, in the broadest sense of the concept, is evaluated. Students conduct three research exercises and set up an ethnographic research project.

Anth 8205. Economic Anthropology. (3 cr; SP–§4053)
Theoretical foundations of economic anthropology examined through critical readings of traditional, classical, and contemporary authors. Ethnographic puzzles of material life and issues of ecological degradation, development, market expansion, gender, and transglobal processes.

Anth 8207. Political and Social Anthropology. (3 cr)
Western concepts of politics, power, authority, society, state, and law. Cross-cultural approaches to these concepts in historical perspective. Major theoretical frameworks and current problems and positions in social and political anthropology. Ethnographic classics and new directions.

Anth 8209. Psychological Anthropology. (3 cr; SP–§4021)
Self, emotion, cognitive processes, and child development in cross-cultural perspective.

Anth 8211. Symbolic Anthropology. (3 cr; SP–§4019)
Advanced introduction to semiotic, structuralist, and interpretive approaches in anthropology. Reviews classic foundations and recent developments.

Anth 8213. Ecological Anthropology. (3 cr; SP–§5041)
Seminar on method, theory, and key problems in ecological anthropology and human ecology. Examines approaches in light of human practices, interactions between culture and the environment, global environmental change, and our understanding of human dimensions of ecosystem-based management.

Anth 8215. Anthropology of Gender. (3 cr; SP–Grad anth major or #)
Comparative, cross-cultural approach to gender. Focuses on various theories (e.g., feminist, postmodernist, psychoanalytic) of power, gender, authority, and femininity and masculinity. Gender ambiguity and issues of sexuality.

Anth 8217. Pedagogy. (3 cr)
Introduction to role of teaching in academic culture, active learning and critical thinking styles, learning style differences among students, and development of writing assignments, discussion groups, exams, and lectures that help students develop critical, observational, and integrative abilities most crucial to anthropology.

Anth 8219. Grant Writing. (2 cr; SP–Grad anth majors preparing to submit research grant proposals next academic yr)
Students draft a research proposal in their area of interest. Seminar involves reading and evaluating proposals, learning about funding and process of submitting proposals, nuts of bolts of composing a proposal, and ethics of research in anthropology.

Anth 8220. Archaeology Field School. (3-9 cr [max 9 cr]; SP–Grad anth major)
Advanced archaeological field excavation, survey, and research. Intensive training in excavation techniques, recordation, analysis, and interpretation of archaeological materials.

Anth 8230. Development and Management of Anthropological Research Projects. (1 cr [max 4 cr]; SP–Anth grad student or #; A-F only)
Training seminar on research development, coordination, grant management, field/laboratory research management, and fundraising.

Anth 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Anth 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

Anth 8510. Topics in Archaeology. (3-9 cr [max 9 cr])
Seminar examines particular aspects of archaeological methods and/or theory. Topics vary according to student and faculty interests.

Anth 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Anth 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Anth 8810. Topics in Sociocultural Anthropology. (3-9 cr [max 9 cr])
Seminar examines particular aspects of method and/or theory. Topics vary according to student and faculty interests.

Anth 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Anth 8991. Independent Study. (1-18 cr; SP–#)
Under special circumstances and with instructor approval, qualified students may register for a listed course on a tutorial basis.

Anth 8992. Directed Reading. (1-18 cr; SP–#)

Anth 8993. Directed Study. (1-18 cr; SP–#)

Anth 8994. Directed Research. (1-18 cr; SP–#)

Applied Economics (ApEc)

Department of Applied Economics

College of Agricultural, Food, and Environmental Sciences

ApEc 5031. Methods of Economic Data Analysis. (3 cr; QP–Math 1271, Stat 5021, knowledge of matrix algebra; SP–Math 1271, Stat 5021, knowledge of matrix algebra)
Statistical and econometrics techniques for applied economists. Theory and application of multivariate regression model using data sets from published economic studies. Emphasis on use of statistical technique to understand market behavior.

ApEc 5151. Applied Microeconomics: Firm and Household. (2 cr; QP–Econ 5151 or #; SP–¶Econ 5151 or #)
Quantitative techniques for analysis of economic problems of firms and households. Links between quantitative tools and economic analysis developed to understand economic theory and develop research skills. Quantitative tools include regression analysis, mathematical programming, and present value analysis.

ApEc 5152. Applied Macroeconomics: Income and Employment. (2 cr; SP–¶Econ 5152 or #)
Static general equilibrium open economy models and simple business cycle models examine economic growth, business cycles, and fiscal and monetary policy. Input-output analysis and large scale econometric models. Sources and properties of economy and sector-wide data, and empirical applications.

ApEc 5321. Regional Economic Analysis. (3 cr; QP–3006 or Econ 3102 or #; SP–3006 or Econ 3102 or #)
Regional development patterns and role of resources, transportation, and institutional constraints. Trade, migration, and investments in regional growth and change. Regional economic information in investment and location decisions. Evaluation of economic development policies and tools. Economic impact analysis.

ApEc 5341. State and Local Public Services and Finance. (3 cr; QP–3001 or equiv; SP–3001 or equiv; A-F only)
The organization, delivery, economic analysis and finance of state and local public services and functions.

ApEc 5401. Price Analysis, Futures, and Options Markets. (3 cr; QP–[3001 or equiv], [Math 1142 or equiv]; SP–[3001 or equiv], [Math 1142 or equiv])
Development/application of price models. Unique market institutions in agriculture that have been developed in response to marketing/pricing problems. Futures/options trading. Hedging, speculative uses of futures/options contracts. Price efficiency, market performance/regulations.

ApEc 5511. Labor Economics. (3 cr; QP–3101 or Econ 3101 or equiv or #; SP–3101 or Econ 3101 or equiv or #)
Theoretical foundations of labor markets, including intertemporal/household labor supply. Demand for labor, efficiency wages. Human capital theory, unemployment, migration decisions. Analysis of econometric research applied to labor policy issues such as minimum wage, tax policy, social insurance, education.

ApEc 5551. Food Marketing Economics. (3 cr; QP–§FScN 5474, §5550; 3001 or Econ 3101; SP–§4451, §FScN 4451; 3001 or Econ 3101; A-F only)
Economics of food marketing in the United States. Food consumption trends. Consumer food behavior, expenditure, data collection. Consumer utility models, demand forecasting. Food distribution system. Changes in supply chain, industry structure that serves retail food outlets. Individual/group projects.

ApEc 5581. Human Capital and Household Economics. (3 cr; SP–3001 or Econ 3101 or #)
Household economics and investment in human capital (e.g., children, education, health and nutrition); labor force participation, lifetime earnings, and nonmarket work; time allocation and substitution of capital for labor in the household in the western and third world.

ApEc 5611. Land and Water Economics. (3 cr; QP–3001 or Econ 3101 or #; SP–3001 or Econ 3101 or #)
Land as an economic and cultural resource. Property rights concepts, valuation of resources, and policy analysis. Materials drawn from economics, forestry, public finance, planning, and agriculture.

ApEc 5637. Agricultural Law. (3 cr; QP–Sr or grad or #; SP–Sr or grad or #)
Economic regulation of agriculture. Industrial organization and market structure in agribusiness, public lands and water law, agricultural cooperatives, farm labor, farm finance, crop insurance and disaster assistance, agricultural biotechnology, food and drug law, price and income regulations, and international agricultural marketing.

ApEc 5651. Economics of Natural Resource and Environmental Policy. (3 cr; QP–3001, 5610 or Econ 3101; SP–3001, 4611 or Econ 3101)
Economic analyses including project evaluation of current natural resource and environmental issues. Emphasis on intertemporal use of natural resources,

natural resource scarcity or adequacy, environmental quality and mechanisms for pollution control, and their implications for public policy.

ApEc 5711. U.S. Agricultural and Environmental Policy. (3 cr; QP–3001 or Econ 3101; SP–3001 or Econ 3101)
U.S. agricultural policy in an open world economy; role of private markets and government in regulating supply and demand; income vs. price support, supply controls, environmental constraints, and export protectionism; functioning of markets; roles of public interest groups and future of American agricultural policy.

ApEc 5721. World Agriculture: Problems, Policies, and Sustainability. (3 cr; QP–3001 or Econ 3101; SP–3001 or Econ 3101)
Comparative agricultural systems and policies, issues of development and protection, resource use and sustainability in major production regions, international policy conflicts, international organizations and assistance, technological change, production and consumption balances.

ApEc 5731. Economic Growth and International Development. (3 cr; QP–[3101, 3102] or equiv or #; SP–[3101, 3102] or equiv or #)
Economics of research/development. Technical change, productivity growth. Impact of technology on institutions. Science/technology policy.

ApEc 5751. Agricultural Trade and Trade Policy: Issues and Analysis. (3 cr; QP–3001 or Econ 3101; SP–3001 or Econ 3101)
Trade policies of import and export nations, gains from trade, trade negotiations and agreements, free trade and common market areas, exchange rate impacts, primary commodities and market instability, current trade issues.

ApEc 5811. Cooperative Organization. (3 cr; QP–3001, 3002 or #; SP–3001, 3002 or #)
Application of economic analysis to the cooperative form of organization. Producer and consumer cooperatives used to examine economic issues such as changing market organization, financing, management incentives, taxation, and antitrust regulations. Cooperatives as a tool for economic development included.

ApEc 5861. Economics of Agricultural Production. (3 cr; SP–5151 or Econ 5151 or #)
Production economics applied to agriculture, profitable combination of production factors; comparative advantage and location of production.

ApEc 5891. Independent Study: Advanced Topics in Farm and Agribusiness Management. (1-4 cr; QP–#; SP–#)
Special topics or individual work suited to the needs of particular groups of students.

ApEc 5991. Special Topics and Independent Study in Applied Economics. (1-4 cr [max 12 cr]; QP–#; SP–#)
Special classes, independent study, and supervised reading and research on subjects and problems not covered in regularly offered courses.

ApEc 8202. Mathematical Optimization in Applied Economics. (3 cr; SP–[5151, Econ 5151] or equiv or #)
Economic foundations and applications of mathematical and dynamic programming and optimal control. Mathematical optimization concepts; structures and economic interpretations of various models of the firm, consumer, household, sector, and economy. Model building and solution techniques.

ApEc 8203. Applied Welfare Economics and Public Policy. (3 cr; SP–Calculus, intermediate econ theory)
Basic concepts underlying measurement of welfare change, problems of market failure and externalities, social welfare functions, and distribution within and across generations. Application of concepts, based on case studies of the environment, returns to research, technical change, and agricultural policy.

ApEc 8204. Applied Financial Economics. (3 cr; QP–Econ 5151; SP–Econ 5151 or [Econ 8101, 8102]; A-F only)
Introduction to major theories of asset pricing under competitive markets, symmetric information. Equilibrium/arbitrage models of financial markets, option pricing models. Applications of asset pricing theory: agricultural markets, financial derivatives, interest rates, agricultural credit.

ApEc 8211. Econometric Analysis I. (4 cr; QP–[Math 1261 or equiv, [Stat 5122 or 5133], Ph.D. student] or #; SP–[Math 1272 or equiv, [Stat 4102 or 5102], Ph.D. student] or #)
Topics include classical multiple linear regression, stochastic regressors, heteroscedasticity, autocorrelated disturbances, panel data and discrete dependent variables.

ApEc 8212. Econometric Analysis II. (4 cr; SP–8211 or equiv or #)
Second semester of econometrics for Ph.D. students. Specification tests, instrumental variables, heteroscedasticity, panel data, simultaneous equations, bootstrap methods, limited dependent variable models, semiparametric estimation, econometrics of program evaluation, general method of moments, time series, hazard models.

ApEc 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

ApEc 8401. Consumption Economics. (3 cr; SP–[5151, Econ 5151] or equiv, ApEc 8230 or #)
Analytic treatments of consumers' economic behavior. Theory applied to explain household consumption, choices under uncertainty, and shifts in demand and welfare due to changes in private information or public policy. Demand models and value of nonpriced characteristics are estimated.

ApEc 8402. Marketing Economics. (3 cr; SP–[5151, Econ 5151] or equiv, ApEc 8220, 8230 or #)
Advanced theoretical and empirical issues in marketing economics and price analysis. Analysis of market structure, conduct, and performance for perfectly/imperfectly competitive markets. Market dimensions of vertical, spatial, temporal, and quality interdependencies. Applied game theory, contract design, and pricing under asymmetric information.

ApEc 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

ApEc 8601. Natural Resource Economics. (3 cr; SP–[5151, 8202, [Econ 5151 or equiv]] or #)
Economic analysis of resource use/management. Capital theory, dynamic resource allocation. Applications to renewable/nonrenewable resources. Empirical studies, policy issues.

ApEc 8602. Economics of the Environment. (3 cr; SP–Econ 8004 or 8104 or #)
Economic analysis of environmental management, emphasizing environmental policy. Application of microeconomic theory to problems of market failure, market-based pollution control policies, contingent valuation, hedonic models, option value, and other topics.

ApEc 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

ApEc 8701. International Economic Development, Growth, and Trade. (3 cr; SP–Econ 8002 or 8102 or #)
Development, growth, and trade of developing nations and emerging market economies. Course links stylized characteristics of economic development, economic policy, and political economy using modern economic theory and empirical methods of analysis.

ApEc 8702. Economic and Trade Policy: Sectoral and Institutional Issues. (3 cr; SP–8230, Econ 8002 or 8102 or #)
Sectoral economic activity in the United States; emphasizes changing role of agriculture. Role of macroeconomic forces and trade policy since World War II. Economic and institutional development in the international economy, including the World Trade Organization, regional trade agreements such as NAFTA, and the European Union.

ApEc 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

ApEc 8793. Master's Paper: Plan B Project. (1-6 cr [max 6 cr]; SP–Ag and applied econ M.S. student; S-N only)

ApEc 8801. Production Functions and Supply Analysis. (3 cr; SP–[5151, Econ 5151] or equiv, ApEc 5030 or equiv or #)
Cost minimizing and profit maximizing conditions; substitution elasticities; specification and estimation of production, supply, and input demand functions; specification bias; labor and capital markets; technical change; productivity analysis; human capital.

ApEc 8802. Managerial Economics. (3 cr; SP–[5151, Econ 5151] or equiv, ApEc 8220 or #)
Analysis of managerial decisions by individual entrepreneurs and organizations. Theories of decision making under uncertainty, assessment of risk and risk preferences, application of expected utility theory to investment and resource allocation decisions, boundaries of the firm, mechanisms for vertical coordination, and organizational design.

ApEc 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

ApEc 8901. Graduate Seminar: M.S. Program. (1 cr; SP–Ag and applied econ M.S. student; S-N only)
Writing, critiquing, and oral presentation skills for M.S. students. Oral presentation of research proposal for thesis or Plan B project critiqued by peers and committee members.

ApEc 8902. Graduate Seminar: Ph.D. Program. (1 cr; SP–Ag and applied econ Ph.D. student; S-N only)
Faculty, students, and outside speakers present research ideas and results, which participants critique. Topics vary according to interests of the speakers.

ApEc 8991. Advanced Topics in Applied Economics. (1-6 cr)
Special seminars or individual work on subjects suited to needs of students.

Applied Plant Sciences (APSc)

Graduate School

APSc 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

APSc 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

APSc 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

APSc 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

APSc 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Arabic (Arab)

Department of Afro-American Studies
College of Liberal Arts

Arab 5001. Research Methods in Arabic Studies. (3 cr)
Skills and techniques required to deal with medieval and modern works in Arabic literature and Islam. A survey of the most important research bibliographies in Arabic and Islamic studies. Bibliographic references in English and, when appropriate, Arabic.

Arab 5011. Islam in Africa. (3 cr)
Ideological, doctrinal, and ritual aspects of continental African Islam. Emphasis on various religious brotherhoods and Sufi orders from different African countries in the 20th century. No knowledge of Arabic required.

Arab 5036. Islam: Religion and Culture. (3 cr; SP–§Afro 3036)
Religion of Islam, faith, practices, sectarian splintering, expansion outside original home to status of world religion, institutions, status in world societies—Asia, Europe, Americas.

Arab 5101. Advanced Arabic I. (4 cr; SP–3102 or equiv or #)
Advanced readings in classical and modern Arabic. Compositions based on texts.

Arab 5102. Advanced Arabic II. (4 cr; SP–5101 or #)
Readings of Arabic texts. Writing compositions based on texts. Continuation of 5101.

Arab 5491. Classical Islamic Civilization. (3 cr; SP–§Afro 3036)
Islamic legacy in the classical age (800-1400), including medical/natural sciences, mathematics, philosophy, literature, and their transmission to Europe.

Arab 5501. Modern Arabic Poetry in Translation. (3 cr)
Free verse movement and its major trends: post-romantic, social realist, symbolist, resistance, prose poem. Emphasizes leading poets such as al-Mala'ika, al-Sayyab, al-Bayati, and Adunis. Theoretical/critical essays. All readings in English.

Arab 5502. Arabic Novel in Translation. (3 cr)
The novel as a new genre in Arabic literature. Trends: realist, psychological, existentialist, feminist, post-modernist, fantastic, experimentalist. Emphasizes major writers such as Mahfouz, Ghanem, Salih, Jabra, El Sa'dawi, Munif, and Khouri. Theoretical/critical essays. Cultural /historical context.

Arab 5503. Arabic Drama in Translation. (3 cr)
Emergence and development of drama as a European-inspired genre in Arabic literature. Emphasizes major trends and playwrights. All readings in English.

Arab 5505. Survey of the Middle East. (3 cr; SP–§Arab 3505, §Hist 3505, §MELC 3505)
Peoples, lands, and cultures of the Middle East. Historical survey from earliest civilizations to the present.

Arab 5541. Islam in the Catholic Age: Arab Phase 600 A.D. to 900 A.D.. (3 cr; SP–§Arab 3541)
The rise of Islam in its Arabian setting. Roles of the prophet, the Orthodox and Umayyad Caliphs. Development of the Islamic state and empire. Status of Muslims and non-Muslims.

Arab 5542. Medieval Islam. (3 cr; SP–§Arab 3542)
Islamic dynasties, Mamluks and Mongols, and Crusaders and Assassins. Abbasid Caliphate's disintegration and rise of Seljuk Turks.

Arab 5543. Arabs Under Mamluks and Ottomans: 1300-1920. (3 cr; SP–§Arab 3543)
Struggle against Crusaders and Mongols. Disintegration and reemergence under Muhammad Ali of Egypt; dynastic struggles in Syria; rise of Young Turks; Arab revolt.

Arab 5544. Arab World: 1920 to the Present. (3 cr; SP–§Arab 3544)
Struggle in the Arab world for independence and its course since independence. Emphasis on development, political stability and unity; political structures; the Arab-Israeli conflict.

Arab 5678. Seminar: African-Arabic Fiction in Translation. (3 cr)
African fiction in Arabic, including works of Barrada, Idris, Mahrouz, al-Matwi, El-Saadawi, and el-Zayat. Emphasizes twentieth century. Tests discussed in historical/cultural context. Theoretical/critical essays. All readings in English.

Arab 5900. Topics in Arabic Literature and Culture. (3 cr [max 9 cr]; SP–5102 or #)
Readings and discussion of selected works in Arabic. Topics specified in *Class Schedule*.

Arab 5992. Directed Readings. (1-3 cr; SP–#)
Individual research and readings for advanced students.

Arab 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Aramaic (Arm)

Department of Classical and Near Eastern Studies
College of Liberal Arts

Arm 5011. Biblical Aramaic and Old Aramaic Inscriptions. (3 cr; SP–1 yr Hebrew or Arabic or #)
Biblical Aramaic—grammar, fluency in reading Biblical Aramaic and Old Aramaic inscriptions.

Arm 5012. Syriac. (3 cr; SP–1 yr Hebrew or Arabic or #)
Emphasis on fundamentals of grammar and reading Syriac texts fluently.

Architecture (Arch)

Department of Architecture
College of Architecture and Landscape Architecture

Arch 5123. Architectural Thesis. (8 cr; SP–5122, 5241, B.A.Arch. major; students must submit thesis plan in semester before writing thesis; A-F only)
Student's choice, study and solution of an architectural problem to demonstrate proficiency in all phases of design.

Arch 5241. Principles of Design Programming. (3 cr; QP–For undergrads 5122, B.Arch. major; for grads 8257, M.Arch. major or #; SP–For undergrads 5122, B.A.Arch. major; for grads 8255, M.Arch. major or #; A-F only)
Concepts and techniques of architectural programming, including space and activity analysis, site selection, precedent study, code review, appropriate technology identification, hypothesis formulation and evaluation. Emphasis on conceptual development, research, and analytic drawing.

Arch 5281. Undergraduate Architecture Studio I. (6 cr; SP–[[3411 or 3412], Arch major] or #; A-F only)
Architectural questions in settlement patterns, architectural elements in their formal organization. Mapping techniques, orthographic projections, analytic drawing, models.

Arch 5282. Undergraduate Architecture Studio II. (6 cr; SP–5281, Arch major or #; A-F only)
Exploration of human response to the natural forces of gravity, light, and air and their influence on the organization of material form to create places of human habitation.

Arch 5283. Undergraduate Architecture Studio III. (6 cr; SP–[5281, 5282, Arch] or #; A-F only)
Exploration of selected design issue or topic, its influence on organization of material form to create places of human habitation.

Arch 5284. Undergraduate Architecture Studio IV. (4 cr; SP–[5283, B.S.Arch. major] or Δ; A-F only)
Design studio.

Arch 5291. Accelerated Undergraduate Architecture Studio I. (6 cr; SP–#; A-F only)
Selected architectural problems developed by faculty to deepen/enrich ideas introduced in required architectural studio sequence.

Arch 5292. Accelerated Undergraduate Architecture Studio II. (6 cr; SP–[5291, accelerated status] or #; A-F only)
Architectural problems. Emphasizes development of structures as integral part of design, site planning, design process.

Arch 5311. Theory of Architectural Representation. (3 cr; SP–5371, 5372, Arch grad or #; A-F only)
Integration of emerging computer graphics with photography and architectural graphic conventions. Explores historical, theoretical, and critical issues of representation and the influence of visual media on the architectural field.

Arch 5313. Visual Communication Techniques in Architecture. (3 cr; QP–For undergrads 3311, B.A.Arch. or B.E.D. major; for grads M.Arch. major or #; SP–For undergrads 3301, B.A.Arch. or B.E.D. major; for grads M.Arch. major or #; A-F only)
Exploration of delineation, presentation, and design techniques, using various visual media and methods of investigation.

Arch 5321. Architecture in Watercolor. (3 cr; QP–[3311, [Arch or B.E.D.]] or M.Arch. grad student or #; SP–[3301, [Arch or B.E.D.]] or M.Arch. grad student or #; A-F only)
Watercolor as a tool in the design process. Survey of foundation principles, techniques, medium, tools, and materials. Exploration of color relationships, mixing, composition, and applications to design.

Arch 5350. Topics in Architectural Representation. (1-3 cr [max 9 cr]; SP–Arch major or M. Arch. major or #; A-F only)
Selected topics in architectural representation.

Arch 5351. AutoCAD I. (3 cr; SP–For undergrads 5281, arch major; for grads M.Arch. major or #; no grad credit)
Basic concepts, tools, and techniques of computer-aided drawing with current AutoCAD Release. Strategies and techniques for producing dimensioned and annotated drawings suitable for plotting and an introduction to 3-D drawing capabilities. Use of dimension variables, attributes, blocks, symbols, and the creation of customized menus.

Arch 5352. AutoCAD II. (3 cr; SP–For undergrads 5351, arch major; for grads M.Arch. major or #; no grad credit)
Intermediate concepts, tools, and techniques of computer-aided drawing with current AutoCAD Release. Strategies and techniques for producing dimensioned and annotated drawing suitable for plotting. Use of dimension variables, attributes, blocks, symbols, and the creation of customized menus.

Arch 5361. Topics in Architectural Representation: 3-D Architectural Modeling and Design. (3 cr; SP–For undergrads 5281 or 5351, arch major; for grads M.Arch. major or #; A-F only)
Introduction to 3-D studio for architectural modeling, rendering, and animation. Video recording and editing.

Arch 5371. Computer Methods I. (1 cr; SP–¶8251, M.Arch. major or #; S-N only)
Introduction to current techniques, computer programs, and their application to architectural computing.

Arch 5372. Computer Methods II. (1 cr; SP–5371, ¶8252 and M.Arch. major or #)
Current techniques, computer programs, and their application to architectural computing and design.

Arch 5373. Computer Methods III. (1 cr; SP–5372, ¶8253, M.Arch. major or #; S-N only)
Advanced techniques, computer programs, and their application to architectural computing in design, theory, and technology.

Arch 5374. Computer Methods IV. (1 cr; SP–5373, ¶8254, M.Arch. major or #)
Advanced architectural computing applications in design, history, theory, representation, and technology.

Arch 5381. Introduction to Computer Aided Architectural Design. (3 cr; SP–Arch or B.E.D. or M.Arch. or grad student in LA or #; A-F only)
2-D drawing, 3-D modeling/animation, printing, plotting. Electronic networking/communications, database management, spreadsheet analysis, land-use analysis, project management.

Arch 5382. Computer Aided Architectural Design. (3 cr; SP–[5381, undergrad, [B.A.Arch. major or B.E.D. major]] or M.Arch. major or graduate LA major or #; A-F only)
2-D/3-D CAD, image manipulation. Advanced multimedia visualization techniques for design, including solid modeling, photo-/realistic imaging, animation, video-editing/recording.

Arch 5410. Topics in Architectural History. (3 cr [max 12 cr]; SP–For undergrads 3412, arch major; for grads M.Arch. major or #; A-F only)
Advanced study in architectural history. Readings, research, and seminar reports.

Arch 5411. Principles of Design Theory. (3 cr; SP–M.Arch. major or #; A-F only)
Principles of design and their instrumentation. How and why architecture theory is generated. Types and significance of formal analysis. Theoretical positions and modes of criticism.

Arch 5423. Gothic Architecture. (3 cr; SP–For undergrads 3411, arch major; for grads M.Arch. major or #; A-F only)
History of development of architecture and urban design in Western Europe from 1150 to 1400.

Arch 5424. Renaissance Architecture. (3 cr; SP–For undergrads 3411, arch major; for grads M.Arch. major or #; A-F only)
History of architecture and urban design in Italy from 1400 to 1600. Emphasis on major figures (Brunelleschi, Alberti, Bramante, Palladio) and the evolution of major cities (Rome, Florence, Venice).

Arch 5425. Baroque Architecture. (3 cr; SP–For undergrads 3411, arch major; for grads M.Arch. major or #; A-F only)
Architecture and urban design in Italy from 1600 to 1750. Emphasis on major figures (Bernini, Borromini, Cortona, Guarini) and the evolution of major cities (Rome, Turin).

Arch 5426. Architecture and Nature: 1500-1750. (3 cr; SP–For undergrads 3411, 3412, arch major; for grads M.Arch. major or #)
History of the interaction of architecture and nature in Italy, England, and France in the 16th and 17th centuries. Major monuments, their relationship to theories of architecture and gardening, urban and rural life.

Arch 5431. 18th-Century Architecture and the Enlightenment. (3 cr; SP–For undergrads 3412, arch major; for grads M.Arch. major or #; A-F only)
Architecture, urban planning, and garden design in Europe from 1700 to 1850.

Arch 5432. Modern Architecture. (3 cr; SP–For undergrads 3412, arch major; for grads M.Arch. major or #; A-F only)
Architecture and urban design in Europe and the United States from the early 19th century to World War II.

Arch 5434. Contemporary Architecture. (3 cr; SP–For undergrads 3412, arch major; for grads M.Arch. major or #; A-F only)
Developments, theories, movements, and trends in architecture and urban design from World War II to the present.

Arch 5439. History of Architectural Theory. (3 cr; SP–For undergrads 3412, arch major; for grads M.Arch. major or #; A-F only)
History of architectural theory from antiquity to the 20th century.

Arch 5450. Topics in Architectural Theory. (1-3 cr [max 9 cr]; SP–Arch major or M.Arch. major or #; A-F only)
Selected topics in architectural theory and criticism.

Arch 5451. Architecture: Defining the Discipline. (3 cr; SP–M.Arch. major or #; A-F only)
Architecture as a discipline: its nature, role, purpose, and meaning discussed within a general, philosophical, and theoretical framework. Investigation and discussion of paradigms defining architectural theory and practice.

Arch 5452. Architecture: Design, Form, Order, and Meaning. (3 cr; SP–M.Arch. major or #; A-F only)
Architecture and the issue of meaning. Explores fundamental and constituent elements of architectural form and order; their inherent tectonic, phenomenal, experiential, and symbolic characteristics; their potential and implications for the creation and structure of meaningful human places.

Arch 5454. Semiotics and Deconstruction in Architecture. (3 cr; QP–5401, M.Arch. major or #; SP–5411, M.Arch. major or #; A-F only)
Expressive and cultural dimensions of architecture, especially those related to linguistic analogies, knowledge production, and contemporary philosophy. Broad critical perspective of architectural discussion and argumentation addressing current issues.

Arch 5455. Typology and Architecture: Theories of Analysis and Synthesis. (3 cr; QP–5401, M.Arch. major or #; SP–5411, M.Arch. major or #; A-F only)
Theoretical traditions and development of typology's role in architecture. Investigates works of Laugier, Quatremere de Quincy, Viollet-Le Duc, Ledoux, Durand, Camillo Sitte, and Le Corbusier. Recent developments and theoretical positions of neo-rational and contextual arguments for contemporary applications of the idea of type.

Arch 5458. Architecture and Culture. (3 cr; SP–3412, arch major or grad student or #; A-F only)
Architecture as a cultural medium. Relationships among architecture, people, and culture; research findings and design; vernacular and high style architecture. Physiological and symbolic messages; reception theory in architecture; cultural critique and change; implications for architectural practice.

Arch 5459. Gender and Architecture. (3 cr; SP–Arch or WoSt major or M.Arch. major or #)
Examination of ideas related to gender and architecture, gendered and non-gendered places and practices, and their relations to cultural norms and change.

Arch 5461. North American Indian Architecture. (3 cr; SP–For undergrads 3412, arch or AmIn major; for grads M.Arch. major or #)
Historic and contemporary principles and theories of North American Indian architecture. Study of the culture, technology, environment, art and craft of North American Indians in their settlements and architecture.

Arch 5501. Environmental and Material Forces in Architecture. (4 cr; QP–3501, 5281, arch major or #; SP–5281, LA 3501, arch major or #; A-F only)
Exploration of relationship between architectural form, human experience, and building technologies. Design principles and concepts of environmental technology (microclimate, thermal, aural, luminous design) and building technology (materials, methods of construction, structure). Impact of ecological issues, construction materials, and structural systems on architectural design.

Arch 5511. Construction Materials in Architecture. (3 cr; SP–M.Arch. major or #; A-F only)
Study and analysis of building materials, assemblies, and construction operations shaping building designs. Examination of material properties for design and detailing of building systems, elements, and components, and their implications in design applications. Modeling and hands-on building experiences.

Arch 5512. Building Methods in Architecture. (3 cr; SP–5511, M.Arch. major or #; A-F only)
Analysis of architectural materials, building systems, and construction operations related to enclosure systems design, building infrastructure, and detailing. Application of legal constraints and regulations (e.g., ADA, building codes, life-safety issues) in preparation of drawings, specifications, and construction documents for building design.

Arch 5513. Environmental Technology I: Thermal Design in Architecture. (3 cr; SP–M.Arch. major or #; A-F only)
Thermal and climatic issues in the design of small and mid-size buildings. Investigations in built and mechanical methods to modify climate. Evaluation of the impact of design techniques on energy use, the environment, and architectural meaning.

Arch 5514. Environmental Technology II: Lighting and Acoustic Design. (3 cr; SP–M.Arch. major or #; A-F only)
Principles of daylighting, electric lighting, and acoustic design in architecture. Relationship between luminous and acoustic environments, human comfort and architectural experience. Analytical methods, design process, and modeling of daylighting.

Arch 5525. Design in Masonry. (3 cr; QP–5521, M.Arch. major or #; SP–5512, M.Arch. major or #; A-F only)
Design principles, construction methods, and document production for masonry structures.

Arch 5539. Daylighting and Architecture Design. (3 cr; QP–5531, M.Arch. major or #; SP–5514, M.Arch. major or #; A-F only)
Role of daylighting in architectural design: principles, strategies, energy and environmental issues, psychology of light, color, and integration of electric lighting. Design projects investigate qualitative and quantitative issues through drawing, physical models, and photometric analysis.

Arch 5542. Building Energy Systems. (3 cr; QP–5541, M.Arch. major or #; SP–5513, M.Arch. major or #; A-F only)
Understanding functions of building mechanical systems and their integration with other building components through case studies. Residential and commercial HVAC systems, alternative energy sources, energy efficiency, structural implications of mechanical systems, indoor air quality, and environmental control strategies.

Arch 5550. Topics in Architecture Technology. (1-3 cr [max 6 cr]; SP–Arch or M.Arch. major or #)
Selected topics in architecture technology, including construction, environmental management, energy performance, lighting, or materials.

Arch 5561. Building Production Processes. (3 cr; QP–5283, arch major or B.E.D. major or M.Arch. major or #; SP–5282, 5501, arch major or B.E.D. major or M.Arch. major or #)
Introduction to design-build processes including document production, contract execution, and building project management. Case study and hands-on experiences examine construction industry organization, scheduling, consultant relations, legal and code restraints, contractual stipulations, budget and project resource allocations.

Arch 5571. Architectural Structures I: Wood and Steel Design. (3 cr; SP–M.Arch. major or #; A-F only)
Influence of history and culture on architecture and structure. Fundamentals of structural mechanics, structural analysis, structural form finding, and structural design by experimental, qualitative/intuitive, and quantitative methods. Vector-active and form-active structural systems, funicular structures, bending and compression elements, plates and grids, tensile architecture, shells. Description of traditional construction materials.

Arch 5572. Architectural Structures II: Concrete and Masonry Design. (3 cr; QP–5573, M.Arch. major or #; SP–5571, M.Arch. major or #; A-F only)
Overview of advanced materials: reinforced fiberglass, structural glass, and structural tensile fabrics. Impact of construction technology on architecture and

methods of integrating knowledge of structural materials and construction methods into the design process.

Arch 5611. Design in the Digital Age. (3 cr; QP–Grad student or upper level undergrad student; SP–Grad student or upper level undergrad student; A-F only)
Introduction to design, design process. Developing/understanding ways of seeing, thinking, and acting as a designer. Changes in design being wrought by digital technology. Team design project.

Arch 5621. Professional Practice in Architecture. (3 cr; SP–M.Arch. major or #; A-F only)
Legal, ethical, business, and practical requirements of architectural practice. Contemporary and historical models of contract formation, business principles, accounting, project management, design services, and marketing.

Arch 5631. Legal Contracts in Architecture. (3 cr; SP–M.Arch. major or #; A-F only)
Legal subject matter relevant to the work of architects and design professionals.

Arch 5645. Real Estate Development in Architecture. (3 cr; SP–For undergrads B.A.Arch. major; for grads M.Arch. major or #)
Fundamentals of real estate development and investment building. Processes and rules of specialists in development of investment projects. Topics include pro forma value and depreciation, tax shelter, feasibility, market analysis, appraisal equity financing, design, construction, leasing, and property management.

Arch 5650. Topics in Architectural Practice. (1-3 cr; SP–5621, arch major or 5621, M.Arch. major or #)
Topics in architectural practice, methods of design production, marketing, operation, and relationships among clients, architecture, and society.

Arch 5670. Topics in Historic Preservation. (1-3 cr; SP–Arch or M.Arch. major or #)
Selected topics in the theory, philosophy, research, and methods of architectural historic preservation.

Arch 5671. Historic Preservation. (3 cr; SP–3412 or #)
Philosophy, theory, and origins of historic preservation. Historic archaeology and research, descriptive analysis, and documentation of historic buildings. Government's role in historic preservation, preservation standards and guidelines, preservation and building codes, neighborhood preservation, preservation advocacy, and future directions for historic preservation. Research on architectural and historical aspects of historic sites using primary and secondary resources and on controversial aspects of preservation.

Arch 5672. Historic Building Conservation. (3 cr; QP–3412, 5411 or #; SP–3412, 5671 or #)
Historic building materials, systems, and methods of conservation. Discussion of structural systems, building repair and pathology, introduction of new environmental systems in historic buildings, and conservation of historic interiors. Research on historic building materials and techniques using primary and secondary resources and on documentation of a specific historic site through large-format photography and measured drawings.

Arch 5673. Historic Building Research and Documentation. (3 cr; QP–3412, 5512 or #; SP–3412, 5672 or #)
Philosophy, theory, and methods of historic building research, descriptive analysis of buildings, building documentation, historical archaeology, and architectural taxonomy.

Arch 5711. Design Principles of the Urban Landscape. (3 cr; SP–Arch or B.E.D. major or M.Arch. or LA grad major or #; A-F only)
Art and design of creating city, neighborhood, and development plans. Public policies, planning tools and process, and physical models used by design professionals and private and civic institutions to shape the physical environment.

Arch 5724. Meanings of Place. (3 cr; SP–Arch or B.E.D. or Geog major or M.Arch. or LA grad major or #; A-F only)
Analysis of meanings and messages of surroundings, and examination of links between sense of place and feelings of well-being. Exploration of what present-day environments can reveal about the past. Survey of Twin Cities' central district and selected neighborhoods, and other settings inside and outside Minnesota.

Arch 5750. Topics in Urban Design. (1-3 cr; SP–5711, M.Arch. or LA grad major or #; A-F only)
Special topics in theory and practice of urban design.

Arch 5993. Directed Study. (1-4 cr; SP–# only; A-F only)
Guided individual reading or study.

Arch 8101. Subjects and Methods in Architecture. (2 cr; SP–Grad arch major or #; S-N only)
The discipline of architecture.

Arch 8250. Advanced Topics in Design. (1-6 cr [max 6 cr]; SP–Grad arch major or #; A-F only)

Arch 8251. Graduate Architectural Design I. (6 cr; SP–Grad arch major or #; A-F only)
Fundamental architectural problems involving design as a creative inquiry. Individual and collaborative effort.

Arch 8252. Graduate Architectural Design II. (6 cr; SP–8251, grad arch major or #; A-F only)
Fundamental architectural problems involving design as a creative inquiry. Individual and collaborative effort.

Arch 8253. Graduate Architectural Design III. (6 cr; QP–8253; SP–8252, grad arch major or #; A-F only)
Fundamental architectural problems involving design as a creative inquiry. Individual and collaborative effort.

Arch 8254. Graduate Architectural Design IV. (6 cr; QP–8254; SP–8253, grad arch major or #; A-F only)
Fundamental architectural problems involving design as a creative inquiry. Individual and collaborative effort.

Arch 8255. Graduate Architectural Design V. (8 cr; QP–8256; SP– 8254, grad arch major or #; A-F only)
Fundamental architectural problems involving design as a creative inquiry. Individual and collaborative effort.

Arch 8295. Directed Graduate Architectural Design. (6 cr; SP–8251, grad arch major or #; A-F only)

Arch 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Arch 8350. Advanced Topics in Representation. (1-3 cr; QP–5309; SP–5311, grad arch major or #; A-F only)
Theory and practice of visual representation in architecture.

Arch 8450. Topics in Theory. (1-3 cr; QP–5401; SP–5411, grad arch major or #; A-F only)

Arch 8494. Directed Research in Architectural History. (1-3 cr; SP–Grad arch major or #; A-F only)

Arch 8550. Topics in Technology. (1-3 cr; SP–Grad arch major or #; A-F only)

Arch 8650. Topics in Architectural Practice. (1-3 cr; SP–Grad arch major or #; A-F only)

Arch 8750. Topics in Urban Design. (1-3 cr; SP–Grad arch major or #; A-F only)

Arch 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Art (ArtS)

Department of Art

College of Liberal Arts

ArtS 5104. The Nature of Abstraction. (4 cr; SP–3102 or #)
Exploration of abstraction as concept. Studio practice with attention to developing individual work. Emphasizes understanding topics relevant to abstraction. Approached from discipline of painting, open to various material sensibilities.

ArtS 5105. Advanced Dimensional Painting. (4 cr; SP–3105 or #)
Illusionary space applied to sculptural forms. Practical applications of spatial/painterly concepts. Emphasizes critical/visual judgment. Development of cohesive body of work reflecting interaction of two/three dimensions.

ArtS 5106. Advanced Drawing: Interpreting the Site. (4 cr; SP–3106 or #)
Search for personal content as inspired by site. Field trips (2/3 of course) to draw or paint from various metropolitan area locations. Interpretations enhanced by experimentation with new marks/symbols.

ArtS 5110. Advanced Drawing. (4 cr [max 12 cr]; SP–3101 or 3111 or #)
Developing personal direction in form/content. Various media. Various aesthetic/conceptual approaches.

ArtS 5120. Advanced Painting. (4 cr [max 12 cr]; SP–3102 or #)
Developing personal vision/content through painting. Emphasizes critical thinking, self-evaluation, and independent pursuit of ideas.

ArtS 5130. Advanced Painting: Watercolor. (4 cr [max 12 cr]; SP–3102 or #)
Expressive/technical possibilities of transparent watercolor. Emphasizes pictorial structure, color relationships, visual expression. Work from still life, nature, life model, imagination.

ArtS 5310. Advanced Sculpture: Direct Metal. (4 cr [max 12 cr]; SP–3301 or #)
Direct metal sculpture in steel, other metals. Studio practice, investigation of historical/contemporary methods/concepts. Development of personal sculpture imagery.

ArtS 5320. Advanced Sculpture: Spatial Problems. (4 cr [max 12 cr]; SP–3302 or #)
Sculptural practice outside traditional media/approaches. Installation, theater, public art, architecture as topics for individual investigations into spatial organization.

ArtS 5330. Advanced Sculpture: Metal Casting. (4 cr [max 12 cr]; SP–3303 or #)
Metal casting of sculpture in bronze, iron, aluminum, other metals. Studio practice, investigation of historical/contemporary methods/concepts. Development of personal sculptural imagery.

ArtS 5340. Advanced Sculpture: Carving and Construction. (4 cr [max 12 cr]; SP–3304)
Carving/construction using wood, other materials. Studio practice, investigation of historical/contemporary methods/concepts. Development of personal sculptural imagery.

ArtS 5350. Advanced Sculpture: Kinetics. (4 cr [max 12 cr]; SP–3305 or #)
Studio practice in kinetic sculpture. Historical/contemporary methods/concepts of sculpture produced by motion. Development of personal imagery.

ArtS 5360. Advanced Performance Art and Installation. (4 cr [max 12 cr]; SP–3306 or #)
Studio practice in performance art and installation; investigation of historical and contemporary methods and concepts of interdisciplinary expression. Development of personal imagery.

ArtS 5370. Advanced Sculpture: Traditional Approaches. (4 cr [max 12 cr]; SP–3307 or #)
Clay figure modeling. Mold making using historical/contemporary systems. Casting in semi-permanent materials. Studio practice, traditional sculptural methods/concepts. Development of personal imagery.

ArtS 5400. Seminar: Concepts and Practices in Art. (3 cr [max 6 cr]; SP–1001 or #)
Various ideologies, cultural strategies that influence practice/interpretation of art. Emphasizes diversity of viewpoints. Application of issues in developing final B.F.A. exhibition.

ArtS 5402. Artists' Books. (4 cr; SP–3402 or #)
Advanced projects in creation of unique, handmade books using various structures, media, techniques. Critical, historical, theoretical issues surrounding contemporary book arts.

ArtS 5403. Women's Images and Images of Women. (3 cr; SP–1001 or #)
Women's place in Western art from the artist's perspective. Women as artists and the imagery they have created. Women as the object of imagery and the social and political attitudes those images convey. Survey of women artists from late-Renaissance through contemporary feminism; relevant issues.

ArtS 5405. Visual Narrative Structures. (4 cr; QP–[1401, one 1xxx art course] or #; SP–[1001, one 1xxx art course] or #)
Visual/verbal investigation of structures of visual narratives. Contemporary efforts to integrate cogent images in visual texts. Development of methods for personal visual communication of cultural, spiritual, aesthetic, environmental experiences. Historical/cultural focuses. Studio work.

ArtS 5441. Professional Practices. (3 cr; SP–Grad or #)
Intensive writing seminar provides a context for theoretical issues, business practices, and professional skills required for career management and development in the visual arts.

ArtS 5490. Workshop in Art. (1-4 cr [max 12 cr])
Selected topics and intensive studio activity. Topics vary yearly.

ArtS 5510. Advanced Printmaking: Intaglio and Screen. (4 cr [max 12 cr]; SP–3501 or #)
In-depth research of intaglio, screen printing. Historical/contemporary applications. Development of imagery using color, photo-mechanical, digital processes. Cross-media approaches.

ArtS 5520. Advanced Printmaking: Relief and Lithography. (4 cr [max 12 cr]; SP–3502 or #)
Relief printing, lithography for creative expression. Studio practice with stone, metal, wood. Developing personal visual language/aesthetics. Historical/contemporary awareness, evolving technologies/strategies.

ArtS 5550. Advanced Papermaking. (4 cr [max 12 cr]; SP–3505 or #)
Distinct expressive qualities of handmade paper, its versatility as contemporary art form. Independent research pursued in consultation with instructor.

ArtS 5610. Advanced Interactive Media. (4 cr [max 12 cr]; SP–3601 or #)
Web-/screen-based and installation/performance projects in consultation with instructor. Focuses on individual expression, role of artists/audience, and synthesis of artistic form/content using interactive digital technologies.

ArtS 5620. Advanced Digital Video. (4 cr [max 12 cr]; SP–3602; A-F only)
Individual projects exploring elements of time, cinematic space, narrative, and montage through experimental, documentary, or installation-based video art. Articulation of relationships between conceptual, aesthetic, and artistic process.

ArtS 5710. Advanced Photography. (4 cr [max 12 cr]; SP–Two sem of 3xxx photography or #)
Design/implementation of individual advanced projects. Demonstrations, lectures, critique. Reading, writing, discussion of related articles/exhibitions.

ArtS 5810. Advanced Ceramics. (4 cr [max 12 cr]; SP–3801, 3802 or #)
Critical discourse of aesthetics, history, and contemporary issues in clay and criticism. Independent, advanced projects.

ArtS 5821. Ceramic Materials Analysis. (4 cr; SP–3801 or 3802 or #)
Ceramic materials, their interrelationships. Advanced investigation of glazes, slip formulation, clay bodies in high/low temperature ranges. Individual interests related to students' aesthetic needs.

ArtS 5830. Advanced Ceramics: Mold Making. (4 cr [max 12 cr]; SP–3803 or #)
Advanced mold making for ceramics. Plaster mold fabrication, ceramic production, contemporary methods/concepts. Development of personal visual expression.

ArtS 5840. Advanced Neon. (4 cr [max 12 cr]; SP–3804 or #)
Emphasis on the development of personal sculptural sensibility. Studio practice with neon glass tubing and electrical components. A mixed media approach is encouraged.

ArtS 5990. Independent Study in Art. (1-4 cr [max 12 cr]; SP–major, #)
Independent study project designed by student in consultation with instructor.

ArtS 8100. Drawing and Painting: Theory and Practice. (3 cr [max 12 cr]; SP–Art M.F.A. student)
Tutorial in drawing and/or painting.

ArtS 8300. Sculpture: Theory and Analysis. (3 cr [max 6 cr])
Theoretical issues of sculpture as understood by practicing sculptors. Research on and discussion of current sculpture in light of historical precedent; personal work relative to contemporary practice.

ArtS 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

ArtS 8400. Theoretical Constructions in Contemporary Art. (3 cr [max 6 cr])
Structure for examining and understanding current critical practice. Evaluation and questions about assumptions of theory in context of current artistic production.

ArtS 8401. Studio and Pedagogy: Philosophy and Practice. (3 cr [max 6 cr])
Orientation to establishing studio practice, introduction of department and community resources, and preparation for teaching. Studio visits and critiques; development of teaching strategies. Required of drawing and painting students.

ArtS 8500. Printmaking: Theory and Practice. (3 cr [max 12 cr])
Focus on the complexities and multi-disciplinary activities of printmaking. Development of concepts and personally significant imagery leading to thesis work.

ArtS 8600. Electronic Art: Theory and Practice. (3 cr [max 12 cr])
Tutorial. Issues related to creative visual work using the computer and other technologies. Interactivity, robotics, digitally based conceptual art, and time-based art.

ArtS 8700. Photography: Theory and Practice. (3 cr [max 12 cr])
Contemporary issues in the production of photographic images.

ArtS 8800. Ceramics: Theory and Practice. (3 cr [max 12 cr]; A-F only)
Tutorial emphasizing individual goals and directions. Discussion of aesthetics, history, theory, contemporary issues in clay, and criticism.

ArtS 8990. M.F.A. Creative Thesis. (1-9 cr [max 18 cr]; SP–Art M.F.A. candidate, passed oral/written prelim, #)
Research/studio work in preparation for thesis exhibition and supporting paper.

Art History (ArtH)

Department of Art History

College of Liberal Arts

ArtH 5101. Myths in Art: Cross-Cultural Comparison. (3 cr; A-F only)
Relationships of text/image, efficacy of each in conveying meaning. Properties of visual/verbal communication. Ways in which artists convey mythological meanings, how much these ways differ according to place/time. Students prepare/critique visual presentations through Web pages.

ArtH 5103. Hellenistic and Early Roman Art and Archaeology. (3 cr; SP–Clas/ArtH 3008, jr or #)
Sculpture, architecture, painting, and topography in developing centers of Hellenistic culture in the eastern Mediterranean, and in Etruscan and Roman towns from 400 B.C. to the beginnings of the Roman Empire.

ArtH 5108. Greek Architecture. (3 cr; SP–ArtH/Clas 3008, jr or sr or grad, or #)
Geometric through classical examples of religious and secular architecture and their setting at archaeological sites in Greece, Asia Minor, and Italy.

ArtH 5111. Prehistoric Art and Archaeology of Greece. (3 cr; SP–Jr or sr or grad, Greek art/archaeology course or #)
Artistic and architectural forms of Neolithic period in Aegean area and Cycladic, Minoan, and Mycenaean cultures. Aims and methods of modern field archaeology; the record of human habitation in the Aegean area. Archaeological evidence as a basis for historical reconstruction.

ArtH 5112. Archaic and Classical Greek Art. (3 cr; SP–Jr or sr or grad or #)
Sculpture, painting, architecture, and minor arts in Greek lands from the 9th through 5th centuries B.C. Examination of material remains of Greek culture; archaeological problems such as identifying and dating buildings; analysis of methods and techniques.

ArtH 5120. Field Research in Archaeology. (3-6 cr [max 6 cr]; SP–#)
Field excavation, survey, and research at archaeological sites in the Mediterranean area. Techniques of excavation and exploration; interpretation of archaeological materials.

ArtH 5172. House, Villa, Tomb: Roman Art in the Private Sphere. (3 cr; SP–Intro art history course or #)
The architecture, painting, and sculpture of urban houses, country estates, and tombs in the Roman World. Relationships between public and private spheres, and literary and physical evidence; usefulness of physical evidence in illuminating gender roles.

ArtH 5182. Art and the State: Public Art in the Roman Empire. (3 cr; SP–Intro art history course or #)
Origins of Roman public art; use in maintaining community; exploitation by the first Emperor, Augustus; development and diffusion through the later Empire; varying capabilities to adjust to the demands of a Christian Empire.

ArtH 5234. Gothic Sculpture. (3 cr; SP–Jr or sr or grad or #)
The origin, character, and development of Gothic sculpture in France, the German empire, and the Netherlands, 1150-1400. Emphasis on French sculpture of the cathedral age and the emergence of a court style in Paris and elsewhere in Europe (e.g. London, Prague).

ArtH 5252. History of Early Christian Art in Context. (3-4 cr; SP–3xxx ArtH course or #)
The role played by art in the formation of early Christian and Byzantine communities, and in establishing their relationships with the Pagan world and early Islam.

ArtH 5323. Art of the Italian Renaissance: 14th-16th Centuries. (3 cr)
Chronological/thematic study of painting, sculpture, and architecture. Emphasizes major artists/commissions, but lesser schools/followers also considered.

ArtH 5324. 15th-Century Painting in Northern Europe. (3 cr; SP–Jr or sr or grad or #)
The origin, character, and development of painting in France, the Netherlandish area, and the German Empire during the years 1350 to 1500. Emphasis on the Flemish school (e.g., Van Eyck brothers, Campin, Van der Weyden) and its influences.

ArtH 5346. 17th- and 18th-Century Art of Southern Europe. (3 cr; SP–3011 or grad or #)
17th-century painting in Spain (e.g., Ribera, Velazquez, Murillo); 17th- and 18th-century architecture, sculpture, and painting in Italy (e.g., Caravaggio, Carracci, Bernini, Algardi, Borromini, Piranesi).

ArtH 5347. 17th- and 18th-Century Art of Northern Europe. (3 cr; SP–3011 or grad student or #)
Seventeenth-century painting in Holland/Belgium (e.g., Rembrandt, Rubens). Seventeenth- and eighteenth-century French architecture, sculpture, and painting (e.g., Versailles, Poussin, Watteau).

ArtH 5417. Twentieth Century Theory and Criticism. (3 cr; SP–3464 or #)
Trends in 20th-century art theory, historical methodology, criticism. Key philosophical ideas of modernism/postmodernism: formalism, semiotics, poststructuralism, feminism, Marxism, psychoanalysis, deconstruction.

ArtH 5431. Age of Revolution: French Painting 1789 to 1870. (3 cr)
Major issues and movements in France and leading practitioners: neo-classicism-David; romanticism-Corot, Gericault, Delacroix; landscape and peasant painting-the Barbizon group; realism-Courbet; pre-Impressionism-Monet, Manet, Pissarro. Movements linked with historical changes emphasizing contextualization of monuments.

ArtH 5454. Design Reform in the Era of Art Nouveau. (3 cr)
History of art nouveau in France, Belgium, England, Germany, Austria, Scotland, United States. Innovations in architecture, graphics, decorative arts; continental variants of the style. Major promoters and pioneers of modern design. Critical issues of design reform; texts integrated with principal monuments.

ArtH 5463. Early 20th-Century Painting and Sculpture. (3 cr)
Primary movements of early 20th century: fauvism, German expressionism, cubism, futurism, dadaism, surrealism, non-objective painting, constructivism, Orphism, early abstraction. Framed against postimpressionism and internationalism at turn of century.

ArtH 5465. American Sculpture: The Public Monument. (3 cr)
Case studies in American public sculpture of the l9th and 20th centuries including the l893 Chicago Fair, the Iwo Jima and Vietnam Veterans Memorials, the Washington Monument, the Lincoln Memorial; careers of Daniel Chester French and Augustus St. Gaudens.

ArtH 5466. Contemporary Art. (3 cr; SP–3464 or #)
Survey of the art and important critical literature of the period after 1970. Origins and full development of postmodern and subsequent aesthetic philosophies.

ArtH 5521. Modernism and Modernity in American Painting: 1876 to 1945. (3 cr)
Relationship between modernity and "modernism" in the visual arts between the Centennial Exposition of 1876 and World War II. Artists addressed include the Ash Can School and the Regionalists.

ArtH 5535. Style, Tradition, and Social Content in American Painting: Colonial Era to 1876. (3 cr)
America's colonial, Revolutionary era, and 19th-century painters' responses to the influence of European aesthetics. Key American painting types: portraiture, rural genre, and landscape from Copley and Gilbert Stuart to the Hudson River School and the chroniclers of the Western frontier.

ArtH 5536. Topical Studies in American Art. (3 cr)
Course description varies from year to year, depending on the current research interests of the instructor and the needs and interests of advanced undergraduate and graduate students in modern and American art.

ArtH 5546. American Architecture: 1840 to 1914. (3 cr)
American architecture from 1840 to 1914, examined in relation to European precedents and American sociohistorical conditions. Critical attention to problems of style, the architectural profession, vernacular vs. "high" architecture, technology, economics, urbanism, and social reform.

ArtH 5725. Ceramics in the Far East. (3 cr)
Selective examination of representative pottery and ceramic wares produced in China, Korea, and Japan from the Neolithic era to modern times. Nearly every major ceramic type is represented.

ArtH 5765. Early Chinese Art. (3 cr)
Develop a more effective way to understand the unique qualities of an individual work of art. Concentration is on accessible works of art in local private and museum collections.

ArtH 5766. Chinese Painting. (3 cr)
Major works from the late bronze age to the modern era that illustrate the development of Chinese landscape painting and associated literary traditions.

ArtH 5767. Japanese Painting. (3 cr)
Japanese pictorial arts from the late tomb period to the modern era; special attention to the development of indigenous traditions.

ArtH 5769. Connoisseurship in Asian Art. (3 cr)
A selective examination of representative works of art produced in China from the Neolithic era to the Han Dynasty. Major archaeological sites and examples of art in local collections.

ArtH 5775. Formation of Indian Art: 2500 B.C.E. to 300 C.E.. (3 cr; SP–Art history course or #)
Sculpture and architecture from the Indus Valley civilization through the Kushana period.

ArtH 5776. Redefining Tradition: Indian Art 400 to 1300. (3 cr; SP–Art history course or #)
An examination of India's art and architecture from the time of the earliest free-standing temples through the 13th century, focusing on temples and their associated sculpture, mural painting, and the beginnings of Islamic architecture in India.

ArtH 5777. The Diversity of Traditions: Indian Art 1200 to Present. (3 cr; SP–Art history course or #)
Issues presented by sculpture, architecture and painting in India from the prehistoric Indus Valley civilization to the present day.

ArtH 5781. Age of Empire: The Mughals, Safavids, and Ottomans. (3 cr)
Artistic developments under the three most powerful Islamic empires of the 16th through 19th centuries: Ottomans of Turkey; Safavids of Iran; Mughals of India. Roles of religion and state will be considered to understand their artistic production.

ArtH 5785. Art of Islamic Iran. (3 cr)
Architecture, painting, and related arts in Iran from the inception of Islam (7th century) through the 20th century. Understanding the nature of Islam in Persianate cultural settings and how artistic production here compares to the Islamic world.

ArtH 5925. History of Photography as Art. (3 cr)
Origins and development of photography, with attention to technology and cultural impact. Major aesthetic achievements in photography from its beginning to present.

ArtH 5927. Documentary Cinema. (4 cr; A-F only)
History of nonfiction filmmaking, from early forms of reportage and birth of documentary to emergence of "film-verite" and "guerrilla television" and work by independents (e.g., Errol Morris, Michael Moore).

ArtH 5940. Topics: Art of the Film. (3 cr)
Topics in film history including individual directors (e.g., Hitchcock, Welles), genres (e.g., westerns, musicals), and other topics (e.g., American independent filmmaking, film noir).

ArtH 5950. Topics: Art History. (3-4 cr)
Topics specified in *Class Schedule*.

ArtH 5960. Topics: Art History. (3 cr [max 6 cr])
Topics specified in *Class Schedule*.

ArtH 5993. Directed Study. (1-4 cr [max 12 cr]; SP–#; A-F only)

ArtH 5994. Directed Research. (1-4 cr [max 12 cr]; SP–#; A-F only)

ArtH 8190. Seminar: Issues in Ancient Art and Archaeology. (3 cr [max 12 cr]; SP–#)
Selected topics, with special attention to current scholarly disputes. Topics specified in *Class Schedule*.

ArtH 8200. Seminar: Medieval Art. (3 cr [max 12 cr])
Focus on a major art historical theme, artist, period, or genre.

ArtH 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

ArtH 8340. Seminar: Baroque Art. (3 cr [max 12 cr]; SP–#)
Topics vary.

ArtH 8400. Seminar: Issues in l9th-Century Art. (3 cr [max 12 cr]; SP–#)
Typical seminars have included symbolism, role of the academy and the avant-garde, surrealism in art and theory, and Franco-American relationships at the turn of the 20th century.

ArtH 8440. Seminar: Issues in Contemporary Art. (3 cr [max 12 cr]; QP–#; SP–#; A-F only)
Identity politics in contemporary art. Theories of performance/performativity. Nationalism/sexuality in art since 1980s. Discourses of death in postmodernism. Body at turn of 21st century.

ArtH 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

ArtH 8520. Seminar: American Art and Material Culture. (3 cr [max 12 cr]; SP–#)
Topics in American art, popular art, and material culture, emphasizing methods and techniques of inquiry: creation and use of archives, oral history, sources for pictorial evidence, and current approaches to interpreting traditional and non-traditional data.

ArtH 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

ArtH 8710. Seminar: Islamic Art. (3 cr [max 12 cr]; SP–#)
Focus depends on current research interests of the professor and needs and interests of graduate students in Islamic and Asian art history.

ArtH 8720. Seminar: East Asian Art. (3 cr [max 12 cr]; SP–#)
Research focuses on closely defined topic, such as a short period of Chinese art, a restricted subject, or role of a single artist. A substantive research paper is required and participation in the seminar dialogue is expected.

ArtH 8770. Seminar: Art of India. (3 cr [max 12 cr]; SP–3 cr art hist, #)
Selected problems and issues in history of South Asian art. Topic varies by offering.

ArtH 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

ArtH 8920. Seminar: Film History and Criticism. (3 cr [max 12 cr]; SP–#)
Selected topics in film history and theory, including specific directors, genres, movements, periods, and critical issues (e.g., violence).

ArtH 8950. Seminar: Issues in the History of Art. (3 cr [max 12 cr]; SP–3 cr art hist, #)
Theoretical or topical issues; topic varies.

ArtH 8970. Directed Studies. (1-3 cr [max 12 cr]; SP–#)

Astronomy (Ast)

Department of Astronomy

Institute of Technology

Ast 5012. The Interstellar Medium. (4 cr; QP–3051, Phys 3513 or #; SP–2001, Phys 2601 or #)
Survey of physical processes in the interstellar medium. Dynamic processes, excitation processes, emission and absorption by gas and dust. Hot bubbles, HII regions, molecular clouds.

Ast 5022. Relativity, Cosmology, and the Universe. (4 cr; QP–3051, Phys 3513 or #; SP–2001, Phys 2601 or #)
Large-scale structure and history of the universe. Introduction to Newtonian and relativistic world models. Physics of early universe, cosmological tests, formation of galaxies.

Ast 5201. Methods of Experimental Astrophysics. (4 cr; QP–3051, Phys 3512; SP–Upper div IT or grad or #)
Contemporary astronomical techniques and instrumentation. Emphasizes data reduction and analysis, including image processing. Students make astronomical observations at O'Brien Observatory and use department's computing facilities for data analysis. Image processing packages include IRAF, AIPS, IDL, MIRA.

Ast 8001. Radiative Processes in Astrophysics. (4 cr; SP–#)
Introduction to classical/quantum physics of electromagnetic radiation as it applies to astro-physics. Emphasizes radiative processes (e.g., emission, absorption, scattering) in astrophysical contexts (e.g., ordinary stars, ISM, neutron stars, active galaxies).

Ast 8011. High Energy Astrophysics. (4 cr; SP–#)
Energetic phenomena in the universe. Radiative processes in high energy regimes; supernovae, pulsars, and X-ray binaries; radio galaxies, quasars, and active galactic nuclei.

Ast 8021. Stellar Astrophysics. (4 cr; SP–#)
Stellar structure, evolution, and star formation. Emphasizes contemporary research.

Ast 8031. Astrophysical Fluid Dynamics. (4 cr; SP–#)
Contemporary topics. Numerical techniques for modeling astrophysical fluids and plasmas. Supernovae shocks, convection, astrophysical jets, and cloud dynamics.

Ast 8041. Comparative Planetology. (4 cr; SP–#)
Overview of current knowledge of the solar system. Formation history of protostellar nebula, physical properties of major planetary bodies/moons. Sun and fossils of epoch of planetary system formation: comets, asteroids, minor bodies.

Ast 8051. Galactic Astronomy. (4 cr; SP–#)
Content, structure, evolution, and dynamics of Milky Way Galaxy. Emphasizes recent observations from space-/ground-based telescopes.

Ast 8061. Radio Astronomy. (4 cr; SP–#)
Techniques/applications of radio astronomy. Basics of signal-to-noise ratios. Sensitivities/applications of Fourier transform and power spectra. Aperture synthesis, single dish applications. Observing of continuum emission and spectral line emission/absorption, astrophysical examples.

Ast 8071. Infrared Astronomy. (4 cr; SP–#)
Techniques/applications of infrared astronomy. Basics of signal-to-noise ratios/sensitivities, challenges of developing infrared instrumentation. Observations of continuum emission (blackbody, free-free, synchrotron). Spectral line emission/absorption, infrared polarization. Astrophysical examples.

Ast 8081. Cosmology. (4 cr; SP–#)
Role of gravity in cosmology. Background, recent research advances.

Ast 8110. Topics in Astrophysics. (2-4 cr; SP–#)

Ast 8120. Topics in Astrophysics. (2-4 cr; SP–#)

Ast 8200. Astrophysics Seminar. (1-3 cr; SP–#)

Ast 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Ast 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

Ast 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Ast 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Ast 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Ast 8990. Research in Astronomy and Astrophysics. (1-4 cr; SP–#)
Research under supervision of a graduate faculty member.

Biochemistry (BioC)

Department of Biochemistry, Molecular Biology, and Biophysics

College of Biological Sciences and the Medical School

BioC 5309. Biocatalysis and Biodegradation. (3 cr; QP–§MicE 5309; chem through organic chem; knowledge of word processing, e-mail, access to Web, access to college-level science library recommended; SP–§MicE 5309; chem through organic chem; knowledge of word processing, e-mail, access to Web, access to college-level science library recommended)
Assess validity of information on biocatalysis and biodegradation; learn fundamentals of microbial catabolic metabolism as it pertains to biodegradation of environmental pollutants; biocatalysis for specialty chemical synthesis; display of this information on the Web.

BioC 5352. Applied Microbial Biochemistry. (3 cr; QP–§MicB 5352; BioC 3021 or BioC 5331 or MicB 5321, Biol 5013 or #; SP–§MicB 5352; Biol/BioC 3021 or BioC 4331 or MicB 4111, MicB 3301 or Biol 3301 or #)
Biochemistry of microorganisms and enzymes of industrial interest. Heterologous peptide overproduction by microorganisms and yeasts; polymer, antibiotic, organic acid, and amino acid production; genetics of industrially useful microorganisms; biological systems useful for biotransformation and environmental remediation; introduction to fermentation technology.

BioC 5361. Microbial Genomics. (3 cr; SP–College-level courses in [organic chemistry, biochemistry, microbiology])
Introduction to genomics. Emphasizes microbial genomics. Sequencing methods, sequence analysis, genomics databases, genome mapping, prokaryotic horizontal gene transfer, genomics in biotechnology, intellectual property issues.

BioC 5401W. Advanced Metabolism and Its Regulation. (3 cr; QP–3021 or 5331; SP–3021 or 4331 or Biol 3021)
Underlying principles that determine metabolism of common/unusual compounds in plants, animals, microorganisms. Regulation of carbon, energy flow in whole organisms.

BioC 5444. Muscle. (3 cr; QP–3021 or 5331 or Phsl 3052 or #; SP–§Phsl 5444; Biol/BioC 3021 or BioC 4331 or Phsl 3061 or #)
Muscle structure/function: molecular mechanism by which force is generated.

BioC 5446. Membrane Biochemistry. (2 cr; QP–3021 or 5331 or #; SP–3021 or 4331 or Biol 3021 or #)
Membrane structure. Mechanisms and physiological roles of channels, pumps, and membrane enzymes.

BioC 5527. Physical Biochemistry: Macromolecular Structure, Energetics, and Dynamics in Biological Systems. (4 cr; QP–§MdBc/Chem 5527; intro physical chem or equiv; intro biochemistry recommended; SP–[intro biochemistry, intro physics] or physical chem or #)
Introduction to diffraction methods used to obtain macromolecular structures. Principles underlying structural biology and structure/function relationships. Thermodynamic principles in protein and nucleic acid folding, structure, and dynamics.

BioC 5528. Physical Biochemistry: Spectroscopy. (4 cr; QP–§Chem 5528, §MdBc 5528; intro physical chem or equiv; intro biochemistry recommended; SP–Intro physical chem or equiv; intro biochemistry recommended)
Application of NMR, electron spin resonance, optical, infrared, and circular dichroism spectroscopies to proteins, nucleic acids, and membranes.

BioC 5530. Selected Topics in Molecular Biophysics. (1-3 cr [max 9 cr]; QP–§Chem 5530, §MdBc 5530; 5525 or MdBc 5525 or Chem 5525 or 5526 or 5527 or 5528 or equiv; SP–5527 or 5528 or equiv)
Topics from current literature on biophysics of proteins, nucleic acids, muscle, membranes. Content/instructors vary from one offering to another, on an approximately every other year rotation.

BioC 5531. Macromolecular Crystallography I: Fundamentals and Techniques. (1 cr; QP–[[One organic chem or biochemistry course], [two calculus or college physics courses]] or #; SP–[[One organic chem or biochemistry course], [two calculus or college physics courses]] or #; S-N only)
Macromolecular crystallography for protein structure determination/engineering. Determining macromolecule structure by diffraction.

BioC 5532. Macromolecular Crystallography II: Techniques and Applications. (1 cr; QP–5531; SP–5531; S-N only)
Determining structure of macromolecule by diffraction. Using software in macromolecular crystallography.

BioC 8001. Advanced Biochemistry I: Protein Structure, Function, and Metabolism. (4-5 cr; QP–§MdBc 8001, one qtr biochem, three qtrs organic chem, two qtrs physical chem; SP–[One sem biochem, two sems organic chem, one sem physical chem] or #)
Protein structure, methods to determine structure, protein folding, forces stabilizing macromolecular structure, protein engineering, design. Dynamic properties of proteins/enzymes, enzyme substrate complexes, mechanism of enzyme catalysis. Enzymology of metabolic regulation and cell signaling.

BioC 8002. Advanced Biochemistry II: Molecular Biology and Regulation of Biological Processes. (4-5 cr; QP–§MdBc 8002, BioC/MdBc 8001; SP–8001 or #)
Structure/stability of nucleic acids, genome organization. Chromosome mechanics, including DNA replication, recombination, and transposable elements. Mechanism/regulation of gene expression, including transcription, processing, and translation. Genetic/enzymatic controls. Cell cycle controls. Regulation of development.

BioC 8007. Cell Biology and Biochemistry of the Extracellular Matrix. (3 cr; SP–§MIMP 8007; 8002 or MIMP 8002 or 8004 or #; A-F only)
Concepts in cell adhesion/tissue composition. Importance of cell adhesion in tissue function/disease. Structure/function/assembly of tissue components. Cellular adhesion mechanisms.

BioC 8084. Research and Literature Reports. (1 cr [max 5 cr]; SP–Grad BMBB major or #; S-N only)
Current developments.

BioC 8184. Graduate Seminar. (1 cr [max 5 cr]; SP–Grad BMBB major or DGS consent; S-N only)
Reports on recent developments in the field and on research projects in the department.

BioC 8213. Selected Topics in Molecular Biology. (4 cr; QP–8002 or MdBc 8002; SP–§GCD 8213; 8002 or #)
Current topics such as DNA replication, recombination and gene conversion, regulation of gene expression, chromatin structure and transcription, developmental gene regulation, organellar gene expression, RNA splicing, initiation/control of translation, animal viruses, transposable elements, somatic recombination, oncogenes.

BioC 8216. Signal Transduction and Gene Expression. (4 cr; QP–8003; SP–8002 or #)
Cell signaling, metabolic regulation in development. Procaryotic/eucaryotic systems used as models for discussion. Literature-based course.

BioC 8290. Current Research Techniques. (3 cr [max 9 cr]; SP–Grad BMBB major; S-N only)
Research project carried out in laboratory of a staff member.

BioC 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

BioC 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

BioC 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)
BioC 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

BioC 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Biology (Biol)

College of Biological Sciences

Biol 5407. Ecology. (3 cr; QP–§3407; [[1009 or 1201 or equiv], [Math 1142 or Math 1251 or equiv], grad] or #; SP–§3407; [[1001 or 1009 or equiv], [Math 1142 or Math 1271 or equiv], grad] or #)
Principles of population growth/interactions and ecosystem function applied to ecological issues, including regulation of human populations, dynamics/impacts of disease, invasions by exotic organisms, habitat fragmentation, and biodiversity. Lab.

Biol 5409. Evolution. (3 cr; QP–§3409; [[1009 or 1202], grad] or #; SP–§3409; [[1001 or 1009], grad] or #)
Diversity of forms in fossil record and in presently existing biology. Genetic mechanisms of evolution. Examples of ongoing evolution in wild/domesticated populations and in disease-causing organisms. Lab.

Biol 5501. Biological Collections: Curation and Management. (1 cr; QP–1103 or 1106 or 3011 or 3012; SP–2012 or 2022 or 3007 or 3211)
Roles and value of biological collections in terms of biodiversity; natural history museum management and philosophy; conservation of museum specimens; data access and ethics. Students participate in various curatorial activities.

Biol 5511. Teaching the Biological Sciences. (3 cr; QP–9 cr in the life sciences; SP–6 cr in the life sciences; A-F only)
Methods and teaching styles used by outstanding university teachers including reviews and critiques from research on teaching. Opportunities for students to practice and evaluate teaching strategies.

Biol 5910. Special Topics in Biology for Teachers. (1-4 cr [max 12 cr]; QP–B.A. or B.S. in science or science ed or elementary ed or K-12 licensed teacher; SP–B.A. or B.S. in science or science ed or elementary ed or K-12 licensed teacher)
Courses developed for K-12 teachers depending on topics or subtopics which might include any of the following: plant biology, animal biology, genetics, cell biology, biochemistry, microbiology.

Biol 5913. Biology for Teachers: Monarchs in the Classroom. (3 cr; SP–[[Elementary or middle school or high school or preservice] teacher or #], application)
Two-week summer workshop. Week one focuses on monarch butterfly biology taught through fieldwork, labs, lecture, and research projects. A 2- to 3-week break follows, when students raise monarchs, conduct simple experiments. Week two focuses on designing classroom activities/projects based on monarch biology. Follow-up meetings held during academic year.

Biomedical Engineering (BMEn)

Biomedical Engineering
Institute of Technology

BMEn 5001. Advanced Biomaterials. (3 cr; SP–1st yr grad BMEn major; [general chem, organic chem, biochem, polymer sci] recommended; A-F only)
Commonly used biomaterials. Chemical/physical aspects. Practical examples from such areas as cardiovascular/orthopedic applications, drug delivery, and cell encapsulation. Methods used for chemical analysis and for physical characterization of biomaterials. Effect of additives, stabilizers, processing conditions, and sterilization methods.

BMEn 5041. Tissue Engineering. (3 cr; SP–IT upper div or grad student or med student or #)
Fundamentals of wound healing and tissue repair; characterization of cell-matrix interactions; case study of engineered tissues, including skin, bone marrow, liver, vessel, and cartilage; regulation of biomaterials and engineered tissues.

BMEn 5101. Advanced Bioelectricity/Instrumentation. (3 cr; SP–Phsl 5440, calculus, college physics)
Instrumentation, computer systems, and processing requirements for clinical physiological signals. Electrode characteristics, signal processing, and interpretation of physiological events by ECG, EEG, and EMG. Measurement of respiration and blood volume/flow.

BMEn 5102. Bioelectric Measurements and Therapeutic Devices II. (3 cr; SP–5101)
Theory and application of electrical stimulation in areas of therapeutic and functional neuromuscular stimulation and pain control, cardiac pacing, defibrillation, tissue healing, and electrotherapy. Safety of electric fields. Electrical tissue impedance measurements.

BMEn 5150. Biomedical MEMS. (4 cr; SP–Analog circuit principles, basic electromagnetic theory; A-F only)
Survey of solid-state biomed transducers. Physical principles of operation and technology implementation of microsensors/microactuators. Physical, chemical, and biomed sensors. Actuators for surgery. Other precision positioning applications, materials, and fabrications. Emphasizes recent advances in biomed microelectromechanical systems.

BMEn 5201. Advanced Biomechanics. (3-4 cr; SP–[[IT upper div or grad student], AEM [statics, deformable media]] or #)
Introduction to biomechanics of musculoskeletal system. Anatomy, tissue material properties. Kinematics, dynamics, and control of joint/limb movement. Analysis of forces/motions within joints. Application to injury, disease. Treatment of specific joints, design of orthopedic devices/implants.

BMEn 5311. Advanced Biomedical Transport Processes. (3-4 cr; SP–IT upper div or grad student or #; [ChEn 5103 or ME 5342] recommended; A-F only)
Introduction to biological fluid, mass, and heat transport. Mass transfer across membranes. Fluid flow in vessels/interstitium. Heat transfer in cells, tissues, and body. Applications to blood oxygenation, respiration, drug delivery, and tissue engineering.

BMEn 5350. Cell Engineering. (3 cr; QP–Cell biol or equiv; SP–5301 or equiv, 5310 or equiv, 5201 or equiv, IT upper div or grad student or #)
Survey of engineering approaches to cell-related phenomena important to cell and tissue engineering: receptor/ligand binding, trafficking and signaling processes; applications to cell proliferation, adhesion, and motility; cell-matrix interactions.

BMEn 5371. Biomedical Applications of Heat Transfer in Humans. (3-4 cr; QP–Phsl 3053, 3056, 5441; SP–Phsl 3053, 3056, 5441)
Overview of physiology underlying thermoregulation in humans, clinical applications of heat transfer in humans, and framework for a design project.

BMEn 5501. Biology for Biomedical Engineers. (3-4 cr; SP–Engineering upper div or grad student)
Concepts of cell/tissue structure/function. Basic principles of cell biology. Tissue engineering, artificial organs.

BMEn 5502. Pathobiology of Medical Devices. (3 cr; QP–IT upper division or grad student; SP–IT upper division or grad student; A-F only)
Biological response to biomaterials presented in context of fundamental principles of cell injury, adaptation, repair, or death. Diversity of medical uses of biomaterials, by organ system. Unique features of specific biological systems in which medical devices are used.

BMEn 5910. Special Topics in Biomedical Engineering. (1-4 cr)
Special topics.

BMEn 5920. Special Topics in Biomedical Engineering. (2-4 cr)

BMEn 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

BMEn 8401. New Product Design and Business Development. (4 cr; QP–[IT grad student or CSOM grad student], some design experience; 8401, 8402 must be taken same yr; SP–[IT grad student or CSOM grad student], some design experience; 8401, 8402 must be taken same yr; A-F only)
Student teams work with IT and CSOM faculty and company representatives to develop a product concept for sponsoring company. Assignments include concept/detail design, manufacturing, marketing, introduction strategy, profit forecasting, production of product prototype.

BMEn 8402. New Product Design and Business Development. (4 cr; QP–8401; SP–8401; A-F only)
Student teams work with IT and CSOM faculty and company representatives to develop a product concept for sponsoring company. Assignments include concept/detail design, manufacturing, marketing, introduction strategy, profit forecasting, production of product prototype.

BMEn 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

BMEn 8601. Biomedical Engineering Seminar. (1 cr; S-N only)
Lectures and demonstrations of university and industry research introducing students and faculty to methods and goals of biomedical engineering.

BMEn 8602. Biomedical Engineering Seminar. (1 cr; S-N only)
Lectures and demonstrations of university and industry research introducing students and faculty to methods and goals of biomedical engineering.

BMEn 8630. Biomedical Engineering Graduate Student Seminar. (1 cr [max 3 cr]; SP–Grad BMEn major; S-N only)
Student presentations of current thesis research or other areas of biomedical engineering.

BMEn 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

BMEn 8710. Directed Research. (1-3 cr)

BMEn 8720. Internship in Biomedical Engineering. (3 cr [max 3 cr]; SP–Grad BMEn major; S-N only)
Supervised lab or industrial experience unrelated to student's normal academic or employment experience.

BMEn 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

BMEn 8820. Plan B Project. (3 cr [max 3 cr]; SP–BMEn M.S. student)
Project chosen by student and adviser to satisfy M.S. Plan B project requirement. Written report required.

BMEn 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

BMEn 8900. Special Topics in Biomedical Engineering. (1-4 cr; A-F only)
Topics in biomedical engineering.

BMEn 8910. Independent Study. (1-3 cr [max 3 cr]; SP–Grad BMEn major)
Research or study of a topic determined by interests of student in consultation with faculty supervisor. Requires approval by faculty supervisor and director of graduate studies.

Biomedical Science (BMSc)

Graduate School

BMSc 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

BMSc 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

BMSc 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

BMSc 8990. Research: Biomedical Sciences. (1-7 cr [max 42 cr]; SP–Enrollment in M.D./Ph.D. program; S-N only).
Content determined by interest of student in consultation with staff.

Biophysical Sciences (BPhy)

School of Physics and Astronomy
Institute of Technology and the Medical School

BPhy 5138. Research Seminar. (1 cr [max 4 cr]; S-N only)
Topics introduce techniques/goals of biophysical sciences and medical physics. Lectures/demonstrations.

BPhy 5139. Seminar and Journal Club. (1 cr [max 2 cr]; S-N only)
Current research/topics related to goals/methods of biophysical sciences and medical physics. Lectures/discussions.

BPhy 5170. Basic Radiological Physics. (3 cr; QP–#; SP–#)
Theoretical/experimental aspects of radiological physics. Physical properties of various ionizing radiations, interactions of ionizing radiations with matter, methods of radiation dose measurement.

BPhy 5171. Medical and Health Physics of Imaging I. (3 cr; QP–5170 or #; SP–5170 or #)
Physics of diagnostic imaging: specification/quantification of image quality, X-ray production, image receptors, magnetic resonance imaging, radiation exposure and protection. Special imaging techniques, including mammography, computed tomography, and direct digital image capture.

BPhy 5172. Radiation Biology. (3 cr; QP–5170 or #; SP–5170 or #)
Effects of ionizing radiation on cells, tissues, and organisms. Biochemical/physiological bases of radiation effects. Biological rationale for radiation therapy practices.

BPhy 5173. Medical and Health Physics of Radiation Therapy. (3 cr; QP–5170 or #; SP–5170 or #)
Measurements of radiation quality, output, and depth dose distributions for clinical use. Treatment parameter calculation. Beam modification and shaping. Treatment planning for fixed field and rotational therapy in external beam, intracavitary, and interstitial therapy. Computer applications in treatment planning. Principles/criteria for radiation protection.

BPhy 5174. Medical and Health Physics of Imaging II. (3 cr; QP–5170 or #; SP–5170 or #)
Physics of diagnostic imaging. Ultrasound, theoretical/experimental applications of radionuclides in medicine and biology. Counting statistics and imaging systems associated with radiopharmaceuticals, radiation dosimetry, and safety in nuclear medicine.

BPhy 8147. Advanced Physics of Magnetic Resonance Imaging (MRI). (3 cr; QP–5174 or #; SP–5174 or #)
NMR (nuclear magnetic resonance) and MRI physics, spatial selection and encoding, imaging hardware and system engineering. Imaging sequences, associated contrast/resolution. Recent developments in MRI.

BPhy 8148. Advanced Digital Imaging Science. (3 cr; QP–5174 or #; SP–5171 or #)
Role of digital image science in medical imaging. Measurement of image quality, digital radiography. Image reconstruction for CT, SPECT, PET, and MRI. 3D image processing, image registration/visualization. Picture archiving, communications systems.

BPhy 8293. Directed Study in Biophysical Sciences and Medical Physics. (1-12 cr [max 12 cr]; QP–#; SP–#)
Individualized study under faculty direction.

BPhy 8294. Directed Research in Biophysical Sciences and Medical Physics. (1-12 cr [max 12 cr]; QP–#; SP–#)
Individualized research under faculty direction.

BPhy 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

BPhy 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

BPhy 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

BPhy 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

BPhy 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Biosystems and Agricultural Engineering (BAE)

Institute of Technology and College of Agricultural, Food, and Environmental Sciences

BAE 5095. Special Problems. (1-5 cr; QP–#; SP–#)
Advanced individual-study project. Application of engineering principles to specific problem.

BAE 5513. Watershed Engineering. (3 cr; QP–Upper div IT or grad, 3052 or CE 3300, CE 3400; SP–3023, upper div IT)
Application of engineering principles to managing surface runoff from agricultural, range, and urban watersheds. Design of facilities and selection of land use practices for controlling surface runoff to mitigate problems of flooding and degradation of surface-water quality.

BAE 8001. Seminar. (1 cr; SP–#; S-N only)
Presentation and discussions on current research topics, research philosophy and principles, proposal writing, and professional presentations.

BAE 8002. Research Seminar I. (1 cr [max 2 cr]; QP–8100 or equiv; SP–8001 or ¶8001 or equiv; S-N only)
Organization/critique of seminars on new developments in biosystems and agricultural engineering.

BAE 8003. Research Seminar II. (1 cr [max 2 cr]; SP–8002 or equiv; S-N only)
Moderate and critique seminars in biosystems and agricultural engineering.

BAE 8005. Supervised Classroom or Extension Teaching Experience. (2 cr; QP–§Agro 8000, §Hort 8000, §PlPa 8000, §Soil 8000; SP–§Agro 8005, §Hort 8005, §PlPa 8005, §Soil 8000, #; S-N only)
Teaching experience is offered in the following departments: Biosystems and Agricultural Engineering; Agronomy and Plant Genetics; Horticultural Science; Soil, Water, and Climate; Plant Pathology. Discussions about effective teaching to strengthen skills and develop a personal teaching philosophy.

BAE 8013. Parameter Estimation in Biosystems and Agricultural Engineering. (3 cr; QP–Stat 3091 or equiv, computer programming course; SP–Stat 3021 or equiv, computer programming course; A-F only)
Procedures for estimating parameter values and parameter uncertainty from experimental data. Values and interpretation of linear and nonlinear models using ordinary and weighted least-square methods. Design of experiments. Application to biosystems and agricultural engineering problems.

BAE 8094. Advanced Problems and Research. (2-6 cr; QP–5191, 5192; SP–5095)

BAE 8303. Machinery Modeling. (3 cr; QP–AEM 3036, CE 3400; SP–AEM 2021, CE 3502)
Machinery systems modeling using multibody dynamics simulation software (MBS). Students review models presented in the literature and report on limitations of modeling approaches used. Models are developed in the students' areas of interest.

BAE 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

BAE 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

BAE 8513. Hydrologic Modeling of Small Watersheds. (3 cr; QP–CE 5405 or equiv, computer programming course; SP–CE 3502, hydrology course)
Study and representation of hydrologic processes by mathematical models: stochastic meteorological variables, infiltration, overland flow, return flow, evapotranspiration, and channel flows. Approaches for model calibration and evaluation.

BAE 8523. Coupled Heat, Moisture, and Chemical Transport in Porous Media. (3 cr; QP–Math 3261, Soil 5232; SP–CSci 5301 or equiv, Math 5512-5513 or equiv, Soil 5232 or equiv, computer programming; A-F only)
Series of five projects to develop computer programs to solve governing equations.

BAE 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

BAE 8703. Managing Water in Food and Biological Systems. (3 cr; QP–Chem 5501 or FScN 5314 or MatS 5011; SP–Chem 3501 or FScN 5451 or MatS 3011 or #)
Qualitative and quantitative analysis of water in foods and biological materials using NMR and MRI. Water and chemical reactivity, microbial activity, physiochemical properties and changes, and structural properties and changes in foods and biological materials.

BAE 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required (Plan A only).)

BAE 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Business Administration (BA)

Curtis L. Carlson School of Management

BA 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

BA 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

BA 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Business and Industry Education (BIE)

Department of Work, Community, and Family Education

College of Education and Human Development

BIE 5001. Teaching Marketing Promotion. (3 cr; A-F only)
Materials, methods, and approaches to teaching marketing promotion. Covers the basic elements of the marketing mix: advertising, promotion, public relations, direct selling, visual merchandising, and direct marketing.

BIE 5011. Introduction to Microcomputer Applications. (3 cr)
Instructional uses of microcomputers and representative business and marketing education applications, including word processing, databases, spreadsheets, and graphics.

BIE 5012. Advanced Word Processing. (3 cr; SP–5011 or equiv)
Develop and apply solution methods for office problems using word-processing software, including advanced editing, printing and desktop publishing capabilities.

BIE 5013. Spreadsheet Analysis Using Microcomputers. (3 cr; SP–5011 or equiv)
Develop expertise in using spreadsheets to analyze data, monitor business records, and create models.

BIE 5014. Database Microcomputer Applications. (3 cr; SP–5011 or equiv)
Examination of business needs requiring computerized databases. Using microcomputer database software to develop, maintain, and prepare reports.

BIE 5015. Integrated Microcomputer Applications in Business and Marketing Education. (3 cr; SP–5011, 5012, 5013, 5014 or equiv)
Use of realistic business microcomputer problems requiring the integration of two or more application packages. Pedagogical issues of learning advanced microcomputer application capabilities and teaching similar applications to designated groups of learners.

BIE 5080. Special Topics in Business and Industry Education. (1-4 cr [max 4 cr])
Content varies by offering.

BIE 5101. Technological Problem Solving. (3 cr; SP–3111, 3112, 3121, 3122; A-F only)
Capstone technology education course in which students research problems relative to various technological systems and develop solution(s) to the identified problems.

BIE 5151. Technical Development: Specialized. (1-12 cr [max 12 cr]; A-F only)
Students select and study technical processes and principles based on the particular subject matter areas they plan to teach. Experiences allow students to integrate specialized technical instruction in advanced and emerging areas.

BIE 5321. Vocational Guidance in Business and Industry Education. (2 cr; A-F only)
Self assessment, use of occupational and labor market information, job seeking skills, work and work satisfaction. For industrial teachers and trainers in school and industry settings.

BIE 5325. Foundations of Industrial Education. (3 cr)
Social, economic, psychological, philosophical, legislative, and pedagogical foundations of industrial education in the United States. Comparison with selected foreign countries. Analysis of contemporary trends against backdrop of early foundations.

BIE 5344. Facilities Management in Business and Industry. (3 cr; SP–3112; A-F only)
Planning, evaluating, and managing industrial education shop and lab facilities.

BIE 5365. Curriculum Development in Technology Education. (3 cr)
Conceptualization and derivation of content for the K-12 technology curriculum. Comparison of U.S. approaches to technology curriculum with selected countries.

BIE 5401. Introduction to Business and Marketing Education. (3 cr)
Conceptual models of business and marketing education useful in the design and delivery of business and marketing education programs in secondary and post secondary schools, adult education settings, and business and industry.

BIE 5440. Business and Industry Observation and Seminar. (1-3 cr [max 6 cr])
Current operating practices and career opportunities in business and industry. Planned experiences in work environments and related seminars.

BIE 5452. Methods of Teaching Business Concepts. (3 cr)
Recent research and developments in teaching business concepts related to economics, business organization and management, business law, entrepreneurship, marketing, international business, information systems, accounting, risk management, and personal finance.

BIE 5457. Methods of Teaching for Business Employment. (3 cr)
Recent research and developments in teaching for business employment, including administrative support positions, accounting and information processing, marketing, sales, computer operations, and other occupations using desktop computing.

BIE 5463. Methods in Teaching Keyboarding and Word Processing. (2 cr; A-F only)
Implementing keyboarding and word processing; effective teaching strategies; expected learner outcomes; evaluation methods; selecting hardware; instructional materials (including print, software, Internet); organizing and managing labs.

BIE 5475. Curriculum Development for Business and Marketing Education. (2 cr; A-F only)
How to prepare programs of instruction, identify/make decisions regarding course content for business/marketing courses at secondary/postsecondary level.

BIE 5596. Occupational Experience in Business and Industry. (1-10 cr [max 10 cr]; S-N only)
Observation and employment in business and industry to developing technical or occupational competencies; 100 clock hours of supervised work experience per credit.

BIE 5597. Internship: Business and Industry Education. (1-8 cr [max 12 cr]; SP–#; S-N only)
Practical experience in business or industry as a professional educator or supervisor. Requires an integrative paper.

BIE 5601. Student and Trainee Assessment. (2 cr; A-F only)
Development of tests of knowledge; effect and processes for programs focused on instruction of skills associated with business and industry; development of learning progress reporting systems; evaluation of instructional effectiveness.

BIE 5605. Critical Issues in Business and Industry. (3 cr)
Identification and analysis of major current issues in business and industry education.

BIE 5624. Sales Training. (3 cr; A-F only)
Training competent customer service employees as part of a marketing strategy. Explore training strategies using the appropriate instructional methods for different settings and situations.

BIE 5625. Technical Skills Training. (3 cr)
Analyze technical skills and training practices in business and industry; systems and process analysis; trouble-shooting of work behavior; design methods and developing training materials.

BIE 5626. Customer Service Training. (3 cr; A-F only)
Overview of customer service strategies used by successful organizations and training practices used to develop customer-oriented personnel.

BIE 5627. Management and Supervisory Development. (3 cr)
Problems, practices, programs, and methodologies relating to the training and development of managers and supervisors, including needed competencies, needs assessment, delivery modes, and evaluation.

BIE 5628. Multimedia Presentations in Business. (3 cr; SP–5011 or equiv)
Designing, creating, and presenting information using multimedia resources in business settings.

BIE 5629. Course Development for Business and Industry. (2 cr; A-F only)
Identifying content, objectives, sequencing, planning lessons, methods, and media for instruction, evaluation, and feedback.

BIE 5661. Instructional Methods for Business and Industry Education. (2 cr)
Basic instructional strategies and techniques in instructional settings, from schools and colleges to business and industry.

BIE 5662. Computer Training in School and Industry Settings. (3 cr; SP–5011 or equiv)
Alternative teaching practices for business applications software: word processors, spreadsheets, graphics, desktop publishing, databases, and communications; public school and industry settings.

BIE 5796. Field Based Projects in Business and Industry. (1-4 cr [max 4 cr]; S-N only)
Curricular, instructional, developmental, or evaluative problems and projects applicable to local school or business and industry situations.

BIE 5993. Directed Study in Business and Industry. (1-4 cr [max 4 cr])
In-depth individual inquiry in the content areas related to business and industry.

BIE 8995. Research Problems: Business and Industry. (3-6 cr [max 6 cr]; SP–Adviser approval; S-N only)
Individual research in business and industry education.

Business, Government and Society (BGS)

Department of Strategic Management and Organization

Curtis L. Carlson School of Management

BGS 8841. Seminar: Theory and Methods of Measurement. (4 cr; QP–MBA 8045 or MBA 8210 or equiv; SP–MBA 6210 or equiv, business admin Ph.D. student or #; offered alt yrs)
Validity and reliability of measures developed as key indicators of constructs in a behavioral context. Methods for evaluating measures, such as indicators of reliability, Multi-Trait Multi-Method analysis, exploratory factor analysis, and confirmatory factor analysis using Lisrel.

Business Law (BLaw)

Department of Accounting

Curtis L. Carlson School of Management

BLaw 5078. Partnerships and Corporations. (2 cr)
Partnership and corporate forms of business entities, including methods of creating the relationships and the study of law used to regulate and control these organizations and their members.

BLaw 5088. Law of Personal Property, Real Property, and Commercial Paper. (2 cr)
Basic concepts of personal property, including rights of possessors, bailees, and finders and holders of security interests. Real property law. Transfers of ownership, control of and encumbering such interests. The law of paper (negotiable instruments).

Center For Spirituality and Healing (CSpH)

Health Sciences

CSpH 5000. Explorations in Complementary Therapies and Healing Practices. (1-4 cr [max 12 cr])
Research/practice, delivery of complementary therapies, regulatory issues.

CSpH 5100. Introduction to Complementary Healing Practices. (3 cr)
Cultural contexts of healing traditions. Complementary therapies presented by practitioners, including traditional Chinese medicine, meditation, mind-body healing, spiritual practices, energy healing, naturopathy, herbalism, movement therapies, homeopathy, manual therapies, and nutrition.

CSpH 5110. Ways of Thinking About Health. (2 cr)
Diverse healing traditions of selected cultures. Use of herbal medicines as essential component of social structure. Links between nature, humans, and indigenous healers. Use of foods as healing medicines in India, China, and ancient Greece. Connection between spirituality and healing powers in indigenous/modern cultures. Rise of scientific traditions, their influence on ways of thinking about healing.

CSpH 5200. Art of Healing: Self as Healer. (1 cr)
Introduction to individual transformational journey as part of health science education. Students become aware of their responsibility/resources to facilitate development of the self. Research data, experience of self that is part psychoneuroimmunology, mind-body-spirit approaches. Lecture, scientific literature, meditation, imagery, drawing, group interaction.

CSpH 5201. Spirituality and Resilience. (2 cr)
Links between resilience and spirituality. Applications of resilience/health realization model to students' personal/professional lives. Review of literature, theory, and research.

CSpH 5210. Peacemaking and Spirituality: A Journey Toward Healing and Strength. (2 cr; A-F only)
Influence of spirituality on resolving conflict, making peace in intense interpersonal/intrapersonal conflicts in multiple health care, social work settings.

CSpH 5300. Cultures, Faith Traditions, and Health Care. (2 cr; A-F only)
Culturally/spiritually based health care practices of selected native/immigrant populations in Minnesota. Clinical implications. Personal/professional conflicts for delivery of competent care to culturally diverse groups by those trained in Western health care.

CSpH 5310. Introduction to Traditional Chinese Medicine. (2 cr; A-F only)
Philosophical roots of Shamanism, Confucianism, Taoism, and Buddhism. Influence of these philosophies on Chinese medicine. Evolution of concepts of the tao, Yin-Yang, microcosm, macrocosm. Development of herbal medicine, Tui Na, Qi Gong, acupuncture, moxibustion. Traditional Chinese medicine etiology of disease, physiology, diagnosis, therapy, disease prevention, ethics, psychology, cosmology.

CSpH 5321. Introduction to International Health. (2 cr)
Primary public health problems, priorities, and interventions in developing countries. Issues related to culture/indigenous health systems and of concern to health care providers who work abroad or with refugee communities in countries of resettlement.

CSpH 5400. Dietary Supplements: Regulatory, Scientific, and Cultural Perspectives. (3 cr)
Concepts/principles of dietary supplements, RDA, dose-response, risk assessment. Laws/regulations concerning dietary supplements. Vitamin/mineral supplements. Philosophy/use of botanicals/nutraceuticals and common herbal supplements in western medicine. Use of supplements and evidence-based recommendations as influenced by culture.

CSpH 5401. Introduction to Ethnopharmacology. (3 cr)
Investigation of biologically active substances used in traditional cultures. Ethnopharmacology's past, current, and potential contributions to human knowledge. Concrete examples.

CSpH 5501. Clinical Aromatherapy I. (2 cr)
Controlled use of essential plant oils for specific, measurable physiological/psychological therapeutic outcomes. History, scientific basis, practice issues, use of 19 essential oils in clinical practice.

CSpH 5502. Clinical Aromatherapy II. (2 cr)
Additional applications of clinical aromatherapy, including chemical basis for therapeutic effects, clinical use of 14 essential oils.

CSpH 5601. Music in the Healthcare Environment. (2 cr)
Music therapy, music medicine, music psychotherapy. Techniques/interventions. Hypotheses/rationale related to interventions. Related research.

CSpH 8100. Special Topics in Complementary Therapy and Healing Practices. (1-6 cr [max 12 cr])
Critiquing research on complementary therapies (e.g., design, outcome measures). Synthesizing research findings for a therapy. Hypothesizing future directions for research on complementary therapies.

CSpH 8191. Independent Study in Complementary Therapies and Healing Practices. (1-6 cr; SP–Grad student in CSpH minor or #)
Students propose area for individual study with faculty guidance. Students write proposal, which includes outcome objectives and work plan. Faculty member directs student's work and evaluates project.

Central Asian Studies (CAS)

Institute of Linguistics, ESL, and Slavic Languages and Literatures

College of Liberal Arts

CAS 5311. Medieval Sages. (3 cr; SP–§MELC 5311; background in Iranian, Central Asian, or Islamic studies recommended)
Study and discussion of the intellectual life of the region from the rise of the Ghaznavids (A.D. 1000) to the fall of the Timurids (A.D. 1500). Ibn Sina (Avicenna), al-Biruni, al-Ghazali, Rumi, Sa'di, and Firdowsi are among the sages whose lives are examined.

CAS 5526. Islam and Communism. (3 cr; SP–§3526, §MELC 5526)
Development of medieval Islamic culture in Transoxiana; formation of Sufi orders; rise and development of Communist ideology; introduction of socialist principles into Central Asia; clash of Islamic principles with Communist dicta; Pan-Islamism; Pan-Turkism.

CAS 5532. Russia and Central Asia. (3 cr; SP–§3532, §MELC 5532)
Rise and fall of the Mongol Empire, formation of the Chaghatai Khanate and the Golden Horde. Russian expansion into Central Asia and rivalry with Britain. Russia and the Central Asian republics during and after the Soviet period.

CAS 5601. Fiction of Iran and Central Asia in Translation. (3 cr; SP–§3601, §MELC 5601)
Social, political, and religious thought of Iranian and (Soviet) Central Asian writers of fiction since the early years of the 20th century, emphasizing themes of tradition, modernization (Westernization and Sovietization), women's rights, and secularization.

CAS 5602. Persian Poetry in Translation. (3 cr; SP–§3602, §MELC 5602)
Major poetic works of Iran dealing with life at the medieval courts, Sufic poetry, and "new" poetry are studied. Rudaki, Khayyam, Rumi, Hafiz, Yushij, and Farrukhzad are among the poets whose works are examined.

CAS 5994. Directed Research. (1-10 cr; SP–#, Δ, ❑)

Chemical Engineering (ChEn)

Department of Chemical Engineering and Materials Science

Institute of Technology

ChEn 5103. Porous Media. (3 cr; QP–ChEn 5103, 5202; SP–§MatS 8219, ChEn 4003, 4102; A-F only)
Geometry and topology of porous materials. Fundamentals of flow, transport, and deformation. One-phase and two-phase Darcy flows, convective dispersion in microporous materials. Relations of macroscopic properties and behavior to underlying microscopic structures and mechanisms. Nanoporous materials. Examples from nature and technology.

ChEn 5104. Coating Process Fundamentals. (3 cr; QP–ChEn 5103, 5202; SP–ChEn 4003, 4102; A-F only)
Basic process functions; viscous flow and rheology, capillarity, wetting; electrostatic effects; phase change, colloidal transformations, mass/heat transfer in drying; kinetics in curing; stress and property development in solidification. Illustrations drawn from theoretical modeling, flow visualization, and stopped-process microscopy.

ChEn 5302. Chemical Reaction Engineering and Catalysis. (3 cr; QP–ChEn 5301; SP–ChEn 4102; A-F only)
Continuous and batch reactors, heat management, catalytic reactions and reactors, nonideal flow in reactors, polymerization, solids processing, multiphase reactors. Fundamentals and mechanisms of catalytic reactions. Industrial examples in petroleum/chemical industries.

ChEn 5595. Special Topics. (1-4 cr; QP–#; SP–#)
New or experimental special topics.

ChEn 5751. Biochemical Engineering. (3 cr; QP–ChEn 5103 or #; SP–ChEn 4002; A-F only)
Chemical engineering principles applied to analysis and design of complex cellular and enzyme processes. Quantitative framework for design of cells for production of proteins, synthesis of antibodies with mammalian cells, or degradation of toxic compounds in contaminated soil.

ChEn 5752. Quantitative Biology for Engineers. (3 cr; SP–Engineering background, #; A-F only)
Biological fundamentals of biotechnology. Structural basis of biological systems. Communication between cells/environment. Gene expression. Proteins and their functional classes. Metabolic pathways and their reactions. From gene/genome to physiology. Genomics/proteomics as technologies. Biotechnology and society: ethics, law, public policy. Biotechnology-based commercial enterprises.

ChEn 5753. (Biological) Biomedical Transport Processes. (3 cr; QP–ChEn senior or #; SP–§ME 5381, §BMEn 5310; ChEn 4003 or ME 3322)
Introduction to fluid, mass, and heat transport in biological systems. Mass transfer across membranes, fluid flow in capillaries, interstitium, veins and arteries. Heat transfer in single cells and tissues. Whole organ and body heat transfer issues. Blood flow and oxygenation. Heat and mass transfer in respiratory system. Biotransport issues in artificial organs, membrane oxygenators, and drug delivery applications.

ChEn 5754. Food Processing Technology. (3 cr; QP–ChEn 5103; SP–ChEn 4002; A-F only)
Introduction to food processing as it interfaces with engineering. Case studies. Engineering economics and practical design problems in food processing. Heat transfer; freezing, conduction (unsteady state); thermal processing; extruder design; protein processing; order-of-magnitude estimating; and economic concepts such as ROI, discounted cash flow, and capital estimating.

ChEn 5759. Principles of Mass Transfer in Engineering and Biological Engineering. (2 cr; QP–ChEn 5103 or #; SP–ChEn 4002; A-F only)
Principles of mass transfer in gases, liquids, biological and macromolecular solutions, gels, solids, membranes, and capillaries. Porous solids interaction between mass transfer and chemical reaction. Applications in biological, environmental, mineral, and chemical engineering systems.

ChEn 5771. Colloids and Dispersions. (3 cr; SP–Physical chemistry; A-F only)
Preparation, stability, coagulation kinetics or colloidal solutions. DLVO theory, electrokinetic phenomena. Properties of micelles, other microstructures.

ChEn 8101. Fluid Mechanics I: Change, Deformation, Equations of Flow. (3 cr; QP–5103; SP–4002 or #; A-F only)
Equations of change of mass, momentum, angular momentum, etc. Kinematics of deformation and convective transport. Applications to fluid statics and dynamics of Newtonian fluids. Examples of exact solutions of Navier-Stokes equations and useful simplifications.

ChEn 8102. Principles and Applications of Rheology. (3 cr; QP–8181; SP–8101; A-F only)
Deformation and flow of non-Newtonian and viscoelastic fluids, plastic materials, and perfectly elastic solids. Phenomenological and molecular interpretation of rheology of elastomers, polymer melts and polymer solutions, application of rheology to polymer processing.

ChEn 8103. Fluid Mechanics III: Porous Media. (3 cr; SP–§MatS 8219; A-F only)
Geometry and topology of porous materials. Fundamentals of flow, transport, and deformation. One- and two-phase Darcy flows, convective dispersion in microporous materials. Relations of macroscopic properties and behavior to underlying microscopic structures and mechanisms. Nanoporous materials.

ChEn 8104. Coating Process Fundamentals. (3 cr; SP–#; A-F only)
Basic process functions; viscous flow and rheology, capillarity, and wetting; electrostatic effects; phase change, colloidal transformations, mass and heat transfer in drying; kinetics in curing; stress and property development in solidification. Requires independent study and a report.

ChEn 8201. Applied Mathematics I: Linear Analysis. (3 cr; SP–#; A-F only)
Integrated approach to solving linear mathematical problems (linear algebraic equations and linear ordinary and partial differential equations) using theoretical and numerical analysis based on linear operator theory. Appropriate for first-year engineering graduate students.

ChEn 8202. Applied Mathematics II: Nonlinear Analysis. (3 cr; SP–#; A-F only)
Nonlinear mathematical problems (nonlinear ordinary and partial differential equations) using theoretical and numerical analysis. Appropriate for students who have had a graduate-level course in linear analysis.

ChEn 8301. Physical Rate Processes I: Transport. (3 cr; QP–5103, #; SP–#; A-F only)
Survey of mass transfer, dilute and concentrated diffusion, Brownian motion. Diffusion coefficients in polymers, of electrolytes, and at critical points. Multicomponent diffusion. Mass transfer correlations and predictions. Mass transfer coupled with chemical reaction.

ChEn 8302. Physical Rate Processes II: Mass Transfer. (3 cr; QP–8004, #; SP–8301, #; A-F only)
Applications of mass transfer. Membranes, including gas separation and reverse osmosis; controlled drug release; dispersion, including examples of pollution modeling; adsorption and chromatography; coupled heat and mass transfer, including cooling towers; double-diffusive effects.

ChEn 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

ChEn 8401. Physical and Chemical Thermodynamics. (3 cr; QP–5202; SP–#; A-F only)
Principles of classical thermodynamics and an introduction to nonequilibrium thermodynamics, with applications in chemical engineering and materials science. Background should include undergraduate engineering or chemistry courses in thermodynamics.

ChEn 8402. Statistical Thermodynamics and Kinetics. (3 cr; SP–Physical chem or statistical mechanics course; A-F only)
Introduction to statistical mechanical description of equilibrium and non-equilibrium properties of matter, emphasizing fluids and classical statistical mechanics.

ChEn 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

ChEn 8501. Chemical Rate Processes: Analysis of Chemical Reactors. (3 cr; SP–#; A-F only)
Design of reactors for heat management and with catalytic processes through detailed analysis of steady state and transient behavior. Polymerization, combustion, solids processing, and environmental modeling; design of multiphase reactors. Primarily for graduate students who have had a course in chemical reactor engineering.

ChEn 8502. Process Control. (3 cr; QP–5301; SP–4601 or equiv; A-F only)
For linear systems: stability, controllability, observability, pole-placement via state feedback state observers, output feedback, and robustness of control systems. For nonlinear systems: solution properties, stability analysis, singular perturbations, feedback linearization via state feedback, and direct synthesis via output feedback.

ChEn 8503. Chemical Rate Processes: Homogeneous Reactions. (3 cr; SP–Chemical rate processes course; A-F only)
Description and characterization of chemically reacting systems. Theories of elementary reactions. Experimental methods for investigating elementary reactions. Applications of chemical kinetics to complex reactions, such as combustion, flames, and the atmosphere.

ChEn 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

ChEn 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

ChEn 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

ChEn 8900. Seminar. (1 cr; S-N only)
Presentation and discussion of papers concerning newer developments in chemical engineering, materials science, and related fields.

ChEn 8901. Seminar. (1 cr [max 9 cr])
Presentation and discussion of papers concerning the newer developments in chemical engineering.

ChEn 8902. Seminar on Finite Element Methods of Computer-Aided Analysis. (1 cr; A-F only)
Survey of the fundamentals of the finite element method as applied mathematics. Develop ability to construct basic finite element codes and put them into successful operation.

ChEn 8993. Directed Study. (1-12 cr)

ChEn 8994. Directed Research. (1-12 cr)

ChEn 8995. Special Topics. (1-4 cr)
New or experimental courses offered by department or visiting faculty.

Chemical Physics (ChPh)

Graduate School

ChPh 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

ChPh 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

ChPh 8602. Chemical Physics Seminar. (1 cr; SP–Grad chem physics major or #)
Weekly seminar series on modern chemical physics and related topics.

ChPh 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

ChPh 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

ChPh 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Chemistry (Chem)

Department of Chemistry
Institute of Technology

Chem 5011. Mechanisms of Chemical Reactions. (3 cr; QP–3303 or equiv; SP–2302 or equiv)
Reaction mechanisms and methods of study. Mechanistic concepts. Gas phase reactions. "Electron pushing" mechanisms in organic and enzymatic reactions. Kinetic schemes and other strategies.

Chem 5021. Computational Chemistry. (3 cr; QP–Chem grad or #; SP–3502 or equiv)
Theoretical methods for study of molecular structure, bonding, and reactivity. Ab initio and semi-empirical calculations of molecular electronic structure. Theoretical determination of molecular electronic structure and spectra; relation to experimental techniques. Molecular mechanics. Structure determination for large systems. Molecular properties and reactivity. Computational tools. Critical assessment of methods and theoretical work in the literature. Lab.

Chem 5201. Materials Chemistry. (4 cr; QP–[3301, [5501 or 5534]] or #; SP–3501 or equiv or #)
Crystal systems/unit cells, phase diagrams, defects/interfaces, optical/ dielectric properties, electrical/thermal conductivity, X-ray diffraction, thin film analysis, electronic structure, polarons/phonons, solid state chemistry, liquid/molecular crystals, polymers, magnetic/optical materials, porous materials, ceramics, piezoelectric materials, biomedical materials, catalysts.

Chem 5210. Materials Characterization. (4 cr; QP–#; SP–Graduate student or #; A-F only)
Modern tools/techniques for both bulk- and thin-film characterization. Topics may include ion-solid interactions, Rutherford back scattering, secondary ion mass spectrometry, solid-state NMR, X-ray photoelectron spectroscopy, small-angle X-ray/neutron scattering, transmission/scanning electron/probe microscopy, near-field scanning optical microscopy, porosimetry, adsorption techniques, and ellipsometry.

Chem 5221. Introduction to Polymer Chemistry. (4 cr; QP–[3302, 5502] or #; SP–§MatS 5221; [2302, 3501] or #)
Condensation, radical, ionic, emulsion, ring-opening, metal-catalyzed polymerizations. Chain conformation, solution thermodynamics, molecular weight characterization, physical properties.

Chem 5223W. Polymer Laboratory. (2 cr; QP–5610 or #; SP–§MatS 5223; [5221 or 8211] or #)
Synthesis, characterization, and physical properties of polymers. Free radical, condensation, emulsion, anionic polymerization. Infrared spectroscopy/gel permeation chromatography. Viscoelasticity, rubber elasticity, crystallization.

Chem 5311. Chemistry of Industry. (3 cr; QP–Chem sr or grad or #; SP–Chem sr or grad student or #)
Industrial and polymer chemistry technology. Relation of basic properties to industrial utility. Economics, social problems, industrial environment.

Chem 5321. Organic Synthesis. (3 cr; QP–3302 or equiv; SP–[2302 or equiv], #)
Fundamental concepts, reactions, reagents, structural/stereochemical issues, and mechanistic skills for organic chemistry.

Chem 5322. Advanced Organic Chemistry. (3 cr; QP–3302 or equiv; SP–2302 or equiv)
Topics vary, including natural products, heterocycles, asymmetric synthesis, organometallic chemistry, and polymer chemistry. (See instructor for details.)

Chem 5352. Physical Organic Chemistry. (3 cr; QP–3302; SP–2302, [5011 or 8011])
Fundamental concepts and mechanistic tools for analysis of organic reaction mechanisms. Solvation, reactive intermediates, gas phase chemistry, photochemistry or strained-ring chemistry or both.

Chem 5361. Interpretation of Organic Spectra. (3 cr; QP–3302 or equiv; SP–2302 or equiv)
Application of nuclear magnetic resonance, mass, ultraviolet, and infrared spectral analyses to organic structural problems.

Chem 5411. Bioorganic Chemistry. (3 cr; QP–3302 or equiv; SP–2302 or equiv)
Chemistry of amino acids, peptides, proteins, lipids, carbohydrates, and nucleic acids. Structure, nomenclature, synthesis, and reactivity. Techniques to characterize biomolecules.

Chem 5412. Enzyme Mechanisms. (3 cr; QP–3302 or equiv; SP–2302 or equiv)
Enzyme classification with examples from current literature; strategies to decipher enzyme mechanisms; chemical approaches to control enzyme catalysis.

Chem 5413. Nucleic Acids. (3 cr; QP–3302 or equiv; SP–2302 or equiv)
Chemistry and biology of nucleic acids. Structure, thermodynamics, reactivity, DNA repair, chemical oligonucleotide synthesis, antisense approaches, ribozymes, techniques for nucleic acid research, interactions with small molecules and proteins.

Chem 5715. Physical Inorganic Chemistry. (3 cr; QP–5702 or equiv, chem major or #; SP–4701 or equiv, chem major or #)
Physical methods (e.g., IR, UV-VIS, ESR, Mossbauer and mass spectroscopy, magnetic measurements, X-ray diffraction) and concepts applied to inorganic and organometallic systems.

Chem 5725. Organometallic Chemistry. (3 cr; QP–5702 or equiv, chem major or #; SP–4701 or equiv, chem major or #)
Synthesis, reactions, structures, and other properties of main group and transition metal organometallic compounds; electronic and structural theory, emphasizing their use as stoichiometric and homogeneous catalytic reagents in organic and inorganic systems.

Chem 5735. Bioinorganic Chemistry. (3 cr; QP–5702 or equiv, chem grad or #; SP–4701 or equiv, chem grad or #)
Role of metal ions in biology. Emphasizes structure, function, and spectroscopy of metalloproteins and their synthetic analogs.

Chem 5745. Advanced Inorganic Chemistry. (3 cr; QP–5702, chem major, #; SP–4701, chem major, #)
Topics in main group and transition metal chemistry. Emphasizes synthesis, structure, physical properties, and chemical reactivity.

Chem 5755. X-Ray Crystallography . (4 cr; QP–Chem grad student or #; SP–Chem grad student or #; A-F only)
Essentials of crystallography as applied to modern, single crystal X-ray diffraction methods. Practical training in use of instrumentation in X-ray crystallography facility in Department of Chemistry. Date collection, correction/refinement, structure solutions, generation of publication materials, use of Cambridge Crystallographic Structure Database.

Chem 8011. Mechanisms of Chemical Reactions. (4 cr; QP–3302 or equiv; SP–2302 or equiv)
Reaction mechanisms and methods of study. Mechanistic concepts in chemistry. Gas phase reactions to mechanisms, "electron pushing" mechanisms in organic reactions, mechanism of enzymatic reactions. Kinetic schemes and other strategies to investigate mechanisms.

Chem 8021. Computational Chemistry. (4 cr; SP–3502 or equiv)
Modern theoretical (classical and quantum) methods used in study of molecular structure, bonding, and reactivity. Concepts and practical applications. Determination of spectra; relationship to experimental techniques. Molecular mechanics. Critical assessment of reliability of methods with emphasis on understanding the literature.

Chem 8066. Professional Conduct of Chemical Research. (1 cr; SP–Chem grad student; S-N only)
Builds sensitivity to ethical issues in chemical research. Readings/case studies, small-group/large-group discussion, summarizing comments from instructors/guests/panels having special expertise. Weekly seminar.

Chem 8081. M.S. Plan B Project I. (1-4 cr; SP–Grad chem major; A-F only)
Satisfies project requirement for Plan B master's degree. May appear on M.S. degree program, but does not count toward 14-credit minimum in major field. Topic arranged by student adviser; written report required. 8081 required; 8082 optional.

Chem 8082. M.S. Plan B Project II. (1-4 cr; SP–Grad chem major; A-F only)
Satisfies project requirement for Plan B master's degree. May appear on M.S. degree program, but does not count toward 14-credit minimum in major field. Topic arranged by student adviser; written report required. 8081 required; 8082 optional.

Chem 8151. Advanced Analytical Chemistry I. (4 cr; SP–#)
Advanced treatment of principles of analytical chemistry, chemical equilibria, and dynamics. Chromotographic and other modern analytical scale separation techniques discussed in detail. Column dynamics and retention mechanisms emphasized.

Chem 8152. Advanced Analytical Chemistry II. (4 cr; SP–Grad chem major or #)
Survey of analytical spectroscopic methods. Design and application of spectroscopic instruments, including signal generation, acquisition, and interpretation. May include nuclear magnetic resonance, electron paramagnetic resonance, infrared and ultraviolet/visible spectroscopy, and mass spectrometry.

Chem 8153. Advanced Analytical Chemistry III. (5 cr; QP–5133 or equiv, differential equations course; SP–4101 or equiv, differential equations course; A-F only)
Use of analog and digital electronics and computational methods in experiments. Passive circuits, operational amplifiers, filters, oscillators and Laplace transform techniques in analysis, domain conversion for data acquisition and control, statistics, experimental design. Introduction to chemometrics, Fourier analysis, convolution/deconvolution, curve fitting.

Chem 8155. Advanced Electroanalytical Chemistry. (2 cr; QP–5122; SP–8151)
Polarography, galvanostatic and potentiostatic methodology, coulometry, linear scan and cyclic voltammetry and pulse methods.

Chem 8157. Bioanalytical Chemistry. (2 cr; QP–5133 or equiv, BioC 5001 or equiv; SP–4101 or equiv, BioC 3021 or equiv; A-F only)
Theory and practical aspects of analytical methods used in determination and characterization of biologically important materials. Enzymatic and kinetic methods in study of proteins, carbohydrates, lipids, and nucleic acids.

Chem 8159. Nuclear Magnetic Resonance Spectroscopy. (2 cr; QP–Sem of organic chem; SP–Sem of organic chem)
Detailed understanding of relaxation processes, chemical exchange, quadrupolar effects, NOW, 2D NMR, NMR hardware, and solid state NMR. NMR imaging and Pulsed Field Gradient (PFG) NMR are discussed.

Chem 8180. Special Topics in Analytical Chemistry. (2-4 cr; SP–Grad chem major or #)
Topics (and availability) vary by year depending on instructor and development of the field.

Chem 8211. Physical Chemistry of Polymers. (4 cr; QP–undergrad physical chem course; SP–§Mats 8211, undergrad physical chem course or #)
Introduction to polymer physical chemistry. Chain conformations; thermodynamics of polymer solutions, blends, and copolymers; light, neutron, and X-ray

scattering; dynamics in dilute solution and polymer characterization; dynamics of melts and viscoelasticity; rubber elasticity, networks, and gels; glass transition; crystallization.

Chem 8280. Special Topics in Materials Chemistry. (2-4 cr; SP–Grad chem major or #)
Topics (and availability) vary by year depending on instructor and development of the field.

Chem 8321. Organic Synthesis. (4 cr; QP–3302 or equiv; SP–2302 or equiv)
Core course; fundamental concepts, reactions, reagents, structural and stereochemical issues, and mechanistic skills necessary for understanding organic chemistry.

Chem 8322. Advanced Organic Chemistry. (4 cr; QP–3302 or equiv; SP–2302 or equiv)
Modern studies. Topics, which vary by year, include natural products, heterocycles, asymmetric synthesis, organometallic chemistry, and polymer chemistry.

Chem 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Chem 8352. Physical Organic Chemistry. (4 cr; QP–8002 or 3302 or equiv, #; SP–5011/8011 or 2302 or equiv, #)
Fundamental concepts and mechanistic tools for understanding and critical analysis of organic reaction mechanisms. Solvation, reactive intermediates, gas phase chemistry, photochemistry, and/or strained-ring chemistry.

Chem 8361. Interpretation of Organic Spectra. (4 cr; QP–3302 or equiv; SP–2302 or equiv)
Practical application of nuclear magnetic resonance, mass, ultraviolet, and infrared spectral analyses to solution of organic structural problems.

Chem 8380. Special Topics in Organic Chemistry. (2-4 cr; SP–Grad chem major or #)
Topics (and availability) vary by year depending on instructor and development of the field.

Chem 8411. Bioorganic Chemistry. (4 cr; QP–3302 or equiv; SP–2302 or equiv)
Chemistry of amino acids, peptides, proteins, lipids, carbohydrates, and nucleic acids; structure, nomenclature, synthesis, and reactivity; an overview of techniques used to characterize these biomolecules.

Chem 8412. Enzyme Mechanisms. (4 cr; QP–3302 or equiv; SP–2302 or equiv)
Enzyme classification with representative examples from current literature; strategies used to decipher enzyme mechanisms; chemical approaches for control of enzyme catalysis.

Chem 8413. Nucleic Acids. (4 cr; QP–3302 or equiv; SP–2302 or equiv)
Chemistry and biology of nucleic acids: structure, thermodynamics, reactivity, DNA repair, chemical oligonucleotide synthesis, antisense approaches, ribozymes, overview of techniques used in nucleic acid research, interactions with small molecules and proteins.

Chem 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

Chem 8480. Special Topics in Biological Chemistry. (2-4 cr; SP–Grad chem major or #)
Topics (and availability) vary by year depending on instructor and development of the field.

Chem 8551. Quantum Mechanics I. (4 cr; QP–Undergrad physical chem course; SP–Undergrad physical chem course)
Two-part sequence: eigenvalues and eigenfunctions. Soluble bound state and continuum state problems. Approximation techniques for bound and scattering states. Spin and identical particles. Atoms and molecules in time-dependent electric and magnetic fields. Three lecture hours per week.

Chem 8552. Quantum Mechanics II. (4 cr; QP–8532; SP–8551)
Two-part sequence: eigenvalues and eigenfunctions. Soluble bound state and continuum state problems. Approximation techniques for bound and scattering states. Spin and identical particles. Atoms and molecules in time-dependent electric and magnetic fields.

Chem 8561. Thermodynamics, Statistical Mechanics, and Dynamics I. (4 cr; QP–Undergrad physical chem course; SP–Undergrad physical chem course)
Two-part sequence covering thermodynamics, equilibrium statistical mechanics, ensemble theory, partition functions. Applications include ideal gases and crystals. Theories of simple liquids, Monte Carlo, and molecular dynamics simulations. Reaction dynamics from a microscopic viewpoint.

Chem 8562. Thermodynamics, Statistical Mechanics, and Dynamics II. (4 cr; SP–8561)
Two-part sequence covering thermodynamics, equilibrium statistical mechanics, ensemble theory, partition functions. Applications include ideal gases and crystals. Theories of simple liquids, Monte Carlo, and molecular dynamics simulations. Reaction dynamics from a microscopic viewpoint.

Chem 8580. Special Topics in Physical Chemistry. (2-4 cr; SP–Grad chem major or #)
Topics (and availability) vary depending on instructor and development of the field.

Chem 8601. Seminar: Modern Problems in Chemistry. (1 cr; SP–Grad chem major or #; S-N only)
Weekly seminar series on modern chemical topics.

Chem 8602. Seminar Presentation: Modern Problems in Chemistry. (1 cr; SP–Grad chem major or #; A-F only)
Weekly seminar series on modern chemical topics presented by students.

Chem 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Chem 8715. Physical Inorganic Chemistry. (4 cr; QP–5702 or equiv; SP–4701 or equiv, grad chem major or #)
Physical methods and concepts applied to inorganic and organometallic systems, including many of the following methods: NMR, IR, UV-VIS, ESR, Mössbauer and mass spectroscopy, magnetic measurements, X-ray diffraction.

Chem 8725. Organometallic Chemistry. (4 cr; QP–5702 or equiv; SP–4701 or equiv, grad chem major or #)
Synthesis, reactions, structures, and other important properties of main group and transition metal organometallic compounds; treatment in terms of modern electronic and structural theory; emphasis on their use as stoichiometric and homogeneous catalytic reagents in organic and inorganic systems.

Chem 8735. Bioinorganic Chemistry. (4 cr; QP–5702 or equiv; SP–4701 or equiv, grad chem major or #)
Survey of role of metal ions in biology; emphasizes structure, function, and spectroscopy of metalloproteins and their synthetic analogs.

Chem 8745. Advanced Inorganic Chemistry. (4 cr; QP–8751; SP–8715, grad chem major or #)
Survey of topics in main group and transition metal chemistry; emphasizes synthesis, structure, physical properties, and chemical reactivity.

Chem 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Chem 8780. Special Topics in Inorganic Chemistry. (2-4 cr; SP–Grad chem major or #)
Topics (and availability) vary by year depending on instructor and development of the field.

Chem 8880. Special Topics in Chemistry. (2-4 cr; SP–Grad chem major or #)
Topics (and availability) vary depending on instructor and development of the field.

Chem 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Chicano Studies (Chic)

Department of Chicano Studies

College of Liberal Arts

Chic 5114. International Perspectives: U.S.-Mexico Border Cultures. (3 cr; SP–§ 3114; Grad)
The relations of Mexico and the United States from an international perspective with central focus on the cultural interchange in the borderlands between them; using both literary and historical materials.

Chic 5310. Chicanas/os and the Law. (3 cr)
Surveys the status of Chicanas and Chicanos in the law. A wide realm of case law and articles introduce key issues. Examines history, inequality, education, employment, affirmative action, criminal law, immigration, housing, and environmental racism.

Chic 5402. Chicanas: Women and Work. (3 cr; SP–Sr, #)
Chicanas and their various relationships to family and community; local, national, and global work forces. Exploration of larger questions and issues related to the growing integration of the world's systems of production.

Chic 5403. Chicana/Latina Feminisms. (3 cr; SP–Sr, #)
The historical and social development of Chicana and Latina feminisms in general and their various specific types. Includes women activists who do not self-identify as "feminists," but are fighting for equality.

Chic 5505. Indigenous Women and Land Issues. (3 cr)
Legal experience of indigenous women defending their land and property interests. Encompasses a social ecology approach to their land struggles, including cultural and legal histories of Native Americans, Mexicanas, and Chicanas.

Chic 5601. Migrant and Seasonal Agricultural Labor. (2 cr)
Surveys the agricultural workforce with a focus on legal theory. While its approach is interdisciplinary, its emphasis is on the legal construct. A wide realm of case law and articles address several key issues confronting agricultural laborers.

Chic 5701. History of Ancient Mexico. (3 cr)

Chic 5702. Literature of Ancient and Colonial Mexico. (3 cr; SP–Chicano studies sr, #)
Analysis and contextualization of ancient and colonial Mexican literature such as Popol Vuh, Rabinal Achi, Chilam Balam, Codex Mendoza, Juan Ruiz de Alarcon, and Sor Juana Ines de la Cruz.

Chic 5901. Chicana(o) Studies: Theory and Methodology. (3 cr)
Focus on theory and methodology of Chicano studies scholarship in social sciences and humanity.

Chic 5920. Topics in Chicana(o) Studies. (3 cr; SP–Sr or grad student, #)
Multidisciplinary themes in Chicano studies. Examine and analyze issues of current interest.

Chic 5921. Chicano Studies Topics: Women and the Law. (3 cr)
Surveys the status of women in the law. Wide realm of legal issues impacting women, with primary focus on Chicanas and Native American women. Historical, political, economic, social, and legal issues affecting women.

Chic 5993. Directed Studies. (1-3 cr [max 16 cr]; SP–#)
Guided individual reading, research, and study for completion of the requirements for a senior paper or honors thesis.

Child and Adolescent Psychiatry (CAPy)

Department of Psychiatry

Medical School

CAPy 5620. Disruptive Behavioral Disorders I: Attention Deficit Hyperactivity Disorder Throughout the Life Span. (1 cr)

CAPy 5621. Workshop: Eating Disorders in Children and Adolescents. (1 cr)

CAPy 5623. Treatment Interventions With Anxiety and Depression in Children and Adolescents. (1 cr)
Characteristics of depression and suicidal behavior in children/adolescents. Methods of crisis intervention, treatment, and prevention.

CAPy 5624. Eating Disorders in Children and Adolescents: Medical and Psychological Perspectives. (1 cr; A-F only)
Clinical characteristics of anorexia, bulimia nervosa in children/adolescents. Etiological factors, multidimensional treatment approaches.

CAPy 5627. Workshop: Disruptive Behavioral Disorders II. (1 cr)

CAPy 5628. Workshop: Developmental Disorders: Perspectives on Etiology, Assessment and Treatment. (1 cr)

CAPy 5629. Disruptive Behavioral Disorders IV: Medication and Behavioral Therapies. (1 cr)

CAPy 5630. Workshop: Psychotherapy in Children and Adolescents. (1 cr)

CAPy 5631. Workshop: Developmental Neuropsychiatry. (1 cr)

CAPy 5632. Workshop: Competence Enhancement Training Programs for Children with Disruptive Behavior. (1 cr)

CAPy 5633. Assessment of Anxiety and Depressive Disorders in Children and Adolescents. (1 cr)
Various manifestations of anxiety in children. Separation anxiety, obsessive-compulsive disorders, specific phobias, generalized anxiety. Developmental patterns of childhood fears/anxiety. Cognitive-behavioral and psychosocial interventions.

CAPy 5634. Workshop: Developmental Dyslexia: Theory, Research, and Clinical Differentiation. (1 cr)

CAPy 5635. Workshop: Disruptive Behavioral Disorders V. (1 cr)
Theoretical basis, therapy outcome research literature related to CBT. Problem-solving techniques, verbal self-instruction training, attributional retaining, stress inoculation procedures. Procedures applied to common problems experienced by disruptive children/adolescents. Anger/frustration management, conflict resolution, interpersonal problem-solving, self-esteem enhancement, negative thought/feeling management.

CAPy 5636. Workshop: Disruptive Behavioral Disorders III. (1 cr)

CAPy 5638. Workshop: Prevention Science II. (1 cr)

CAPy 5639. Workshop: Behavior Problems in Preschool Children. (1 cr)

CAPy 5641. Workshop: Prevention Science I—Risk Factors, Protective Factors, and Models of Disorder. (1 cr)

CAPy 5643. Workshop: Multicultural Issues in Assessment and Treatment of Children With Psychiatric Problems. (1 cr)

CAPy 5644. Workshop: Child Abuse/Neglect and Childhood Psychopathology—Implications for Assessment/Treatment. (1 cr)

CAPy 5645. Workshop: Innovative Methods in Psychotherapy. (1 cr)

CAPy 5646. Workshop: Methods of Measurement and Assessment in Psychopathology. (1 cr)

CAPy 5647. Workshop: Prevention Science III. (1 cr)
Behaviors/mechanisms related to peer rejection. Social skills interventions for promoting positive relationships and for building meaningful friendships.

CAPy 5648. Workshop: Prevention Science IV. (1 cr)

CAPy 5649. Workshop: Personality and Social Development. (3 cr)

CAPy 5650. Disruptive Behavioral Disorders VI: Behavioral Management Interventions . (1 cr)
Applied behavioral analysis and its application in treating children's aggressive, hyperactive, and oppositional behavior. Contingency management techniques for home/school. Behavior treatment augmentations to improve parent psychological well-being.

CAPy 5652. Summer Practicum on Cognitive-Behavioral Therapies for Children and Adolescents. (1 cr; SP–#; A-F only)
Problem-solving techniques, verbal self-instruction training, attributional retraining. Stress inoculation procedures applied to common problems experienced by disruptive children/adolescents. Anger/frustration management, conflict resolution, interpersonal problem-solving, self-esteem enhancement, negative feeling/thought management. Lectures, readings, supervised field experience. Take-home exam.

CAPy 5653. Introduction to Play Therapy. (1 cr)
Play explored from normal developmental perspective. Play as powerful modality in treatment of mental health problems in children and in families. Play Therapy with adults. Case Studies, group participation.

CAPy 5654. Summer Practicum in Prevention Science II: Building Friendships and Peer Relationship Skills. (1 cr; SP–#; A-F only)
Behaviors/mechanisms related to peer rejection. Social skills interventions for promoting positive relationships and building meaningful friendships. Assignment worked out with instructor. Final exam.

CAPy 5660. ADHD Throughout the Life Span: Current Perspectives on Diagnosis, Assessment, and Treatment. (1 cr)
Attention Deficit Hyperactivity Disorder reviewed from its beginnings in toddler years to its later adult manifestations. Description of diagnostic criteria. Other disorders that commonly coexist with ADHD. Assessment methods. Medication, behavioral treatment approaches. School-based interventions.

CAPy 5661. Aggression, Disruption, and Oppositional Behavior in Children and Adolescents. (1 cr; A-F only)
Principles of applied behavioral analysis. Specific behavioral programs adapted for treatment of children's aggressive, disruptive, and oppositional behavior. Applications to home/school settings.

CAPy 5662. Development and Prevention of Antisocial and Delinquent Behavior in Children and Adolescents. (1 cr; A-F only)
Description/epidemiology of aggressive/antisocial behavior in juveniles. Theoretical models of development of antisocial behavior. Selected interventions for preventing antisocial behavior and drug abuse.

CAPy 5663. Building Friendships and Peer Relationship Skills: Interventions for Socially Rejected Children. (1 cr)
Basic milestones in social development. Behaviors/mechanisms leading to peer acceptance/rejection during childhood. Strategies for promoting social skill acquisition. Behavioral, social-cognitive, and emotional-regulation intervention approaches.

CAPy 5665. Principles and Profiles of Child and Adolescent Psychopathology. (1 cr)
Normal/abnormal development in children/adolescents.

CAPy 5666. Aggression and Conduct Problems in Children and Adolescents. (1 cr)
Characteristics, developmental course, and associated risk factors in children with aggression/conduct problems. Developmental pathways of aggression/conduct problems. Biological, parent/family, social/peer, and contextual (e.g., neighborhood, school, societal) causes/correlates. Development of resilience in children who face risk factors. Developmentally-focused, multi-systemic model of intervention.

CAPy 5667. Child-Focused Interventions for Aggression and Conduct Problems in Children and Adolescents. (1 cr)
Practices of intervention for practitioners who work in school, community, clinical, and other service delivery sectors where children with aggression/conduct problems end up being served. Overview of problems. Three areas of child-focused interventions.

CAPy 5668. Parent and Family Interventions for Aggression and Conduct Problems in Children and Adolescents. (1 cr)
Practices/intervention for school, community, clinical, and service delivery sectors where children with aggression/conduct problems are served. Overview of problems. Five areas of parent/family and contextually-focused interventions. Strategies for engaging families in intervention. Ideas for reducing barriers and making interventions culturally compatible.

Child Psychology (CPsy)

Institute of Child Development

College of Education and Human Development

CPsy 8301. Developmental Psychology: Cognitive Processes. (4 cr; SP–Doctoral student or #)
Perceptual, motor, cognitive and language development, and biological bases of each. Conceptual framework of research issues.

CPsy 8302. Developmental Psychology: Social and Emotional Processes. (4 cr; SP–Doctoral student or #)
Normative issues and individual differences in social development from infancy through adolescence, with special reference to developmental psychopathology; life span considerations.

CPsy 8304. Research Methods in Child Psychology. (3 cr; SP–Doctoral student or #)
Review of principal research methods and designs in developmental psychology and consideration of special issues concerning research, including scientific integrity.

CPsy 8311. Seminar: History of Child Development. (2 cr; SP–Doctoral student or #; S-N only)
History of developmental psychology and child development movement in context of classic studies. Presentations by students/instructor.

CPsy 8321. Seminar: Current Issues in Teaching Developmental Psychology. (1 cr; SP–Doctoral student or #)
Problems and issues in teaching introductory child psychology course.

CPsy 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

CPsy 8360. Seminar: Developmental Psychology. (1-3 cr [max 21 cr]; SP–Doctoral student)
Intensive study in the following topics. Section 1: ethology of child behavior. Section 2: language development. Section 3: perceptual development. Section 4: social development. Section 5: cognitive development. Section 6: developmental neuropsychobiology. Section 7: applied child development.

CPsy 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

CPsy 8606. Advanced Developmental Psychopathology. (3 cr; SP–Doctoral student or #)
Alternative formulation of childhood disorders, emphasizing competency training rather than medical nosology.

CPsy 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

CPsy 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

CPsy 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

CPsy 8980. Research Seminar in Child Psychology. (1-3 cr [max 15 cr]; SP–Doctoral student)
Participation in organized research group in developmental psychology.

CPsy 8993. Directed Study in Child Psychology. (1-4 cr; SP–Doctoral student or #)

CPsy 8994. Research Problems in Child Psychology. (1-6 cr [max 15 cr]; SP–Doctoral student or #)
Individual empirical investigation.

CPsy 8996. Directed Field Experiences in Child Psychology. (1-6 cr [max 6 cr]; SP–Doctoral student, #; S-N only)
Emphasizes field experiences focusing on intellectual and/or social development of children as individuals or members of groups; may include interactions with children in natural settings, or research on applied topics or with atypical populations.

Chinese (Chn)

Department of Asian Languages and Literatures
College of Liberal Arts

Chn 5011. Research Methods. (4 cr; SP–3032 or 3112)
Introduction to the sources and approaches of research in language and literature.

Chn 5015. Chinese Philosophical/Historical Texts. (4 cr; SP–3112)
Readings from major texts in Chinese philosophical and historical traditions.

Chn 5018. Chinese Religious Texts. (4 cr; SP–3112)
Traditional Chinese religious systems through selected texts.

Chn 5120. Topics in Chinese Linguistics. (4 cr [max 8 cr]; SP–4121 or 4125)
Studies of the structure and change in the Chinese language.

Chn 5230. Topics in 20th-Century Chinese Literature. (4 cr [max 8 cr]; SP–3032)
Studies of representative literary works from May 4, 1919 to the present.

Chn 5240. Topics in Chinese Poetry. (4 cr [max 8 cr]; SP–3112)
Selected major Chinese poets and poetic forms.

Chn 5242W. Chinese Classical Drama and Theatre. (4 cr)
A multimedia course on traditional Chinese theatre.

Chn 5250. Topics in Chinese Fiction. (4 cr [max 8 cr]; SP–3032 or 3112)
Studies of traditional and modern Chinese fiction.

Chn 5260. Topics in Pre-modern Chinese Prose. (4 cr [max 8 cr]; SP–3112)
Studies of representative Chinese prose writings of the pre-modern period.

Chn 5393. Directed Study. (1-5 cr [max 18 cr]; SP–#, Δ, ❑)
Guided individual reading or study.

Chn 8320. Seminar in Chinese Linguistics. (4 cr; SP–5120 or #)
Emphasizes examining relevant theoretical models for selected issues in analysis of structure and history of Chinese language.

Chn 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Chn 8430. Seminar in 20th-Century Chinese Literature. (4 cr; SP–#)
In-depth study of life, time, and works of one major 20th-century author, or conceptualization and critical examination of one central issue that engaged the passion of 20th-century Chinese writers, as presented in their works.

Chn 8440. Seminar in Chinese Poetry and Poetics. (4 cr; SP–#)
In-depth study of life, time, works, and poetic tradition of one major Chinese poet, or theory and development of one poetic genre.

Chn 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

Chn 8450. Seminar in Chinese Fiction and Narrative Theory. (4 cr; SP–5105 or equiv or #; A-F only)
Important issues in Chinese narrative theory; complex relationship between development of Chinese fiction and that of Chinese narrative theory.

Chn 8494. Directed Research. (1-5 cr [max 16 cr])

Chn 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Chn 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Chn 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Civil Engineering (CE)

Department of Civil Engineering
Institute of Technology

CE 5170. Internet Based Study. (1-5 cr [max 15 cr]; SP–Upper div IT; A-F only)
Internet based teaching with bi-weekly exercises on topic of concern.

CE 5211. Traffic Engineering. (3 cr; QP–IT or grad, 3200; SP–3201, Stat 3021 or equiv)
Principles of vehicle and driver performance as they apply to the safe and efficient operation of highways. Design and use of traffic control devices. Capacity and level of service. Trip generation and traffic impact analysis. Safety and traffic studies.

CE 5212. Urban Transportation Planning. (3 cr; QP–IT or grad, 3200, #; SP–3201 or equiv)
Techniques of analysis and planning for transportation services; demand-supply interactions; evaluating transportation alternatives; travel demand forecasting; integrated model systems; citizen participation in decision-making.

CE 5214. Transportation Systems Analysis. (3 cr; SP–3201)
Systems approach, its application to transportation engineering/planning. Prediction of flows and level of service. Production functions, cost optimization, utility theory, demand modeling, transportation network analysis, equilibrium assignment, decision analysis, multidimensional evaluation of transportation projects.

CE 5231. Pavement Management and Rehabilitation. (3 cr; QP–Upper div IT or grad, 5603; SP–Upper div IT or grad, CE 4231 or #)
Concepts and practices in monitoring, maintaining, and rehabilitating flexible and rigid pavement systems. Manual and automated means of pavement assessment, structural and functional definitions of pavement performance, decision-making processes, and optimization.

CE 5232. Advanced Portland Cement Concrete. (3 cr; SP–Upper div IT or Grad, CE 4232 or #)
Advanced topics in cement chemistry and selection of materials for and design of portland cement concrete mixtures. Lab assignments pertaining to mixture design and short-term and long-term behavior. Use of admixtures and fiber reinforcement. Effects of proportionment of standard materials.

CE 5233. Advanced Bituminous Materials. (3 cr; SP–Upper div IT or grad, CE 3402 or #)
Advanced topics in selection and design of bituminous materials. Asphalt cement, rheology, emulsions, chip seals, hot-mix asphalt design, viscoelastic characterization. Lab assignments pertaining to rheology, mixture design and viscoelastic behavior.

CE 5311. Experimental Geomechanics. (3 cr; QP–Upper div IT or grad, 5603; SP–Upper div IT or grad, 4301, GeoE 4301 or #; A-F only)
Machine stiffness, closed-loop testing. Small-strain theory. Measurement of deformation: strain gages, LVDTs, accelerometers, and associated circuits. Direct and indirect testing. Material behavior: experiments on anisotropic, damaged, and fluid-filled solids.

CE 5321. Geomechanics. (3 cr; QP–Upper div IT or grad; SP–Upper div IT or grad, 4301 or GeoE 4301; A-F only)
Elasticity theory and solution of elastic boundary value problems. Wave propagation in unbounded elastic media. Elements of fracture mechanics and applications. Elements of poroelasticity and applications.

CE 5331. Geomechanics Modeling. (3 cr; QP–Upper div IT or grad, 3300; SP–Upper div IT or grad, 4301 or #; A-F only)
Soil and rock response in triaxial testing; drained and undrained behavior; elastic and plastic properties. Modeling stresses, strains, and failure in geomechanics problems.

CE 5411. Applied Structural Mechanics. (3 cr; QP–Upper div IT or grad, 5600, AEM 3036; SP–Upper div IT or grad, C or better in 4401 or #; A-F only)
Principal stresses and failure criteria in 3 dimensions. Introduction to plane elasticity, energy methods, torsion of beams, bending of unsymmetrical beams.

CE 5412. Prestressed Concrete Design. (3 cr; QP–IT or grad, 5611, 5612; 5613 recommended; SP–Upper div IT or grad, C or better in 4401 or #; 4412 recommended; A-F only)
Design of prestressed concrete structures. Time dependent effects, behavior, flexure, shear, torsion, deflections, continuous systems.

CE 5413. Masonry Structures. (3 cr; QP–IT or grad, 5600 or #; SP–Upper div IT or grad, C or better in 3401 or #; 4401 recommended; A-F only)
Masonry materials and their production; mortars and grouts; design of unreinforced, reinforced, and prestressed masonry structural systems; walls; columns; lintels; arches. Codes and specifications, testing and inspection.

CE 5431. Wave Methods for Nondestructive Testing. (4 cr; QP–[AEM 3016, 3036] or #; SP–§GeoE 5431; [AEM 2021, 3031] or #; A-F only)
Introduction to contemporary methods for nondestructive characterization of objects of civil infrastructure (e.g., highways, bridges, geotechnical sites). Imaging technologies based on propagation of elastic waves such as ultrasonic/resonant frequency methods, seismic surveys, and acoustic emission monitoring. Lecture, lab.

CE 5541. Environmental Water Chemistry. (3 cr; SP–3501, Chem 1021, 1022; A-F only)
Introduction to water chemistry. Physical chemical principles, geochemical processes controlling chemical composition of waters, behavior of contaminants that affect the suitability of water for beneficial uses.

CE 5542. Experimental Methods in Environmental Engineering. (3 cr; SP–3501, Chem 1021, Chem 1022; A-F only)
Tools necessary to conduct research in environmental engineering and chemistry. Theory of operation of analytical equipment. Sampling and data handling methods, statistical analyses, experimental design, laboratory safety. Lecture, laboratory.

CE 5551. Environmental Microbiology Laboratory. (4 cr; QP–3500, [upper div or grad] student; SP–3501, [upper div or grad] student; A-F only)
Role of microorganisms in environmental bioremediation, pollution control, water/wastewater treatment, biogeochemistry, and human health. Basic microbiological techniques: isolation, identification/enumeration of bacteria, BOD, biodegradation kinetics, disinfection. Lecture, lab.

CE 5581. Water Resources: Individuals and Institutions. (3 cr; A-F only)
Control of water resources by natural system functions, user actions, and influence of social, economic, and political institutions. Water resource policy in the United States. Case studies (e.g., flood/drought management).

CE 5591. Environmental Law for Engineers. (3 cr; QP–upper div IT or grad or #; SP–upper div IT or grad or #; A-F only)
Environmental regulatory law relevant to civil and environmental engineering; specific provisions of federal statutory and regulatory laws such as NEPA, CWA, RCRA, CAA, and CERCLA.

CE 8022. Numerical Methods for Free and Moving Boundary Problems. (3 cr; QP–8605; SP–8401 or #; A-F only)
Examples of free and moving boundary problems: metal solidification, filling, polymer molding, flow in porous media, ground freezing. Solutions: analytical, fixed finite difference, fixed finite element, front tracking schemes, general deforming finite element methods.

CE 8094. Civil Engineering Research. (1-4 cr [max 12 cr]; SP–#)
Research or independent study in concrete, structural steel, soils, hydraulics, hydrology, and municipal, environmental, or transportational problems. Investigations, reports, tests, or designs.

CE 8211. Traffic Flow and Traffic Operations. (4 cr)
Microscopic/macroscopic traffic flow models, measurements, characteristics. Shock waves, statistical distributions of traffic variables. Simulation, modeling. Urban traffic operations, including signal timing/control of large scale networks. Project that includes simulation/control software in practice.

CE 8212. Advanced Travel Demand Modeling and Supply Analysis. (3 cr; QP–Stat 3091; SP–5211 or equiv, Stat 3021)
Application of random utility theory to model travel demand; deterministic and stochastic trip assignment; network design problems; transportation planning software.

CE 8214. Transportation Economics. (3 cr; A-F only)
Application of microeconomic theory to transportation. Demand/demand estimation, cost/cost estimation, pricing/investment, regulation/deregulation. Urban/intercity passenger transportation, freight transportation.

CE 8215. Stochastic Transportation Modeling. (3 cr; QP–8200 or 8210; SP–8210 or 8211, Stat 5021 or equiv)
Random variables and estimation; time-series models, linear systems and Kalman filtering; discrete-time Markov processes and dynamic travel demand models; continuous-time Markov processes and traffic flow.

CE 8231. Advanced Pavement Engineering. (3 cr; QP–5304; SP–4231 or #)
Advanced concepts in pavement analysis and design; computation of stresses and strains in flexible and rigid pavement systems; review of Boussinesq theory, Burmeister model, and Westergaard model; load transfer in rigid pavements; temperature induced stresses; mechanics of drainage.

CE 8300. Seminar: Geomechanics. (1-3 cr [max 4 cr]; SP–#; S-N only)
Presentations on various topics.

CE 8301. Fracture of Geomaterials. (3 cr; SP–IT grad student, 5321, GeoE 5321 or #; A-F only)
Crack tip stress and displacement fields; stress intensity factors. Energy principles of fracture; compliance method. Process zone models. J integral. Mixed-mode fracture. Behavior of cracked solids. Numerical and experimental approaches.

CE 8302. Soil/Rock Plasticity and Limit Analysis. (4 cr; QP–3300; SP–IT grad student, 4301 or #; A-F only)
Plasticity of soils and rocks. Yield conditions, flow rules. Theorems of limit analysis. Static solutions, method of characteristics. Kinematic solutions, hodograph. Energy balance. Applications to soil/rock engineering problems.

CE 8311. Advanced Rock Mechanics. (3 cr; QP–5305; SP–IT grad student, 4311 or GeoE 4311 or #; A-F only)
Stress transformations; principal stresses and directions. Friction and behavior of rock joints; stability of frictional sliding. Elastic waves; acoustic emission and seismic measurements. Fragmentation and rock breakage.

CE 8321. Thermoporoelasticity. (4 cr; QP–AEM 5580; SP–IT grad student, 5321 or GeoE 5321 or #; A-F only)
Micro-mechanical description of porous media. Thermodynamics foundations. Linear theory of thermoporoelasticity: constitutive, transport, and balance laws; field equations. Determination of material constants. Singular solutions. Methods of solution: integral transform, method of singularities, finite and boundary element method.

CE 8322. Storage and Flow of Granular Materials. (3 cr; QP–5301 or 5302; SP–IT grad student, 4301 or #; A-F only)
Plasticity of granular media. Static and dynamic method of slices. Storage and flow of granular materials in bins and hoppers. Stress concentrations, arching, piping. Experiments on granular material properties and flow.

CE 8331. Modeling Geomechanical Processes. (3 cr; QP–5300; SP–IT grad student, 5321 or GeoE 5321; A-F only)
Data-limited nature of problems in geomechanics. Dimensional analysis. Regimes of solution. Similarity of solutions. Elements of fracture mechanics, elastoplasticity, poroelasticity. Applications to stability of underground excavations, fluid flow in fracture, tool-rock interaction, hydraulic fracturing.

CE 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

CE 8336. Boundary Element Methods I. (3 cr; SP–IT grad student; A-F only)
Introduction to boundary element methods for elastostatics; stress discontinuity, displacement discontinuity, and direct boundary integral methods. Derivation of basic mathematical solutions from the theory of elasticity. Applications in geomechanics.

CE 8337. Boundary Element Methods II. (3 cr; SP–8336, GeoE 8336 or #; A-F only)
Transient and nonlinear problems.

CE 8351. Advanced Groundwater Mechanics I. (3 cr; QP–5425; SP–4351 or GeoE 4351, IT grad student or #; A-F only)
Solute transport; shallow flow in leaky aquifers; complex variable methods in groundwater flow. Analytic element method: potentials for line sinks, line doublets, line dipoles, area sinks, and special analytic elements; singular Cauchy integrals; analytic elements in domains with closed boundaries.

CE 8352. Advanced Groundwater Mechanics II. (3 cr; QP–5425; SP–4351, IT grad student or #; A-F only)
Applying complex methods, including conformal mapping, in groundwater mechanics; solving problems with free boundaries using the hodograph method; drains in aquifers with free boundaries; superposition of solutions with drains; singular Cauchy integrals; boundary elements.

CE 8361. Engineering Model Fitting. (3 cr; SP–IT grad student or #; A-F only)
Parameter estimation and inverse modeling for civil and geological engineering. Formulating engineering model fitting problems; comparing and selecting various fit criteria; implementing numerical algorithms; analyzing and interpreting results using both statistical and qualitative tools; designing future measurement plans.

CE 8400. Seminar: Structures. (1 cr [max 3 cr]; S-N only)
Content depends on instructor and student. Sample topics: theory of elasticity, optimization, reliability, wave propagation, soil dynamics, experimental equipment, wind forces on structures, structural failures, modern construction practices.

CE 8401. Fundamentals of Finite Element Method. (3 cr; QP–5601; SP–4411 or #; A-F only)
Elements of calculus of variations; weak and strong formulations of linear continuum and structural problems. Isoparametric elements and numerical integration. Basic concepts of error analysis and convergence. Analysis of plates and shells. Introduction to mixed methods and time dependent problems.

CE 8402. Nonlinear Finite Element Analysis. (3 cr; QP–8605; SP–8401 or #; offered alt yrs; A-F only)
Large strains and work conjugate stresses. Equilibrium and principle of virtual work for nonlinear problems. Nonlinear elasticity and plasticity. Finite element discretization and nonlinear algebraic equations. Linearization and solution algorithms for nonlinear problems. Structural stability.

CE 8411. Plate Structures. (3 cr; SP–5411 or #; offered alt yrs; A-F only)
Analysis of plate structures based on the small-deflection elastic Kirchhoff-Love theory. Classical and numerical analysis methods. Skew and orthotropic plate structures. Elements of large deflection theory and stability of plates.

CE 8412. Shell Structures. (3 cr; SP–#; offered alt yrs; A-F only)
Static analysis of thin elastic shells based on Love's postulates. Membrane and bending theories. Thermal stresses in cylinders. Buckling of shells of revolution.

CE 8421. Structural Dynamics. (3 cr; QP–AEM 3036; SP–AEM 2012 or #; A-F only)
Response of discrete and continuous systems to dynamic loading. Formulation and solution of problems of one or more degrees of freedom; modal analysis. Numerical integration and transform techniques. Response of dynamic systems to base motion using response spectrum methods.

CE 8422. Earthquake Engineering. (3 cr; QP–8620; SP–8421 or #; A-F only)
Introduction to earthquake engineering; response spectra; energy absorption capacity of structures; estimation of damping; earthquake resistant design; seismic design codes; base isolation; soil-structure interaction. Blast resistant design. Wind effects on structures.

CE 8431. Structural Stability. (3 cr; SP–#; offered alt yrs; A-F only)
Classification of discrete and continuous conservative and nonconservative systems. Buckling analysis of, e.g., structural members, frameworks, plates by classical and numerical methods.

CE 8432. Analysis of Thin-Walled Members. (3 cr; QP–5610; SP–5411 or #; offered alt yrs; A-F only)
Analysis of thin-walled structural members based on Vlasov theory and its modifications. Members with open and closed cross sections. Second-order effects and buckling. Influence of inelastic material behavior on buckling.

CE 8441. Plastic Design of Steel Structures. (3 cr; QP–5610; SP–4413 or #; offered alt yrs; A-F only)
Plastic analysis and design of structures with applications to grillages, continuous beams, portal and gable frames. Collapse mechanisms and plastic deformations. Minimum weight design.

CE 8442. Nonlinear Analysis of Structural Systems. (3 cr; QP–5601, 5612, or equiv; SP–4411, 4413 or #; offered alt yrs; A-F only)
Advanced theory and computational techniques for analyzing complex structural building systems. Using comprehensive geometric and material nonlinear analysis for designing steel and composite structures.

CE 8443. Fracture and Fatigue of Steel Structures. (3 cr; SP–IT grad student or #; A-F only)
Fracture mechanics, ductile fracture, ferrous metallurgy, welding, S-N curves of steel structures. Emphasizes design and materials selection, evaluation, and repair of existing structures. Case studies such as fracture of steel structures during earthquakes, fatigue of large vehicle frames, and fatigue of bridge structures.

CE 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

CE 8451. Behavior of Reinforced Concrete Structures. (3 cr; QP–5611, 5613, 5615; SP–4412 or #; A-F only)
Advanced topics; experimental and theoretical background to design code provisions. Moment-curvature analysis of members. Shear; torsion; disturbed regions. Beam column joints; shear walls. Effects of earthquake loading. Limit analysis.

CE 8461. Structural Reliability. (3 cr; QP–5612, 5613 or equiv; SP–#; offered alt yrs; A-F only)
Structural design standards and methods; uncertainties in structural design. Basic probabilistic concepts and statistical distributions. Resistance and load statistics. First- and second-order reliability methods, systems reliability. Development of probability-based design codes.

CE 8490. Special Topics. (1-3 cr [max 3 cr]; SP–#; A-F only)
Topics vary depending on faculty and student interests.

CE 8500. Environmental Seminar. (1 cr [max 3 cr]; SP–Grad CE major or #; S-N only)
Broad coverage of topics in environmental engineering and science. Speakers consist primarily of graduate students in these areas, but presentations may also be given by University faculty and guest speakers.

CE 8501. Environmental Fluid Mechanics I. (4 cr; QP–3400 or #; SP–3502 or equiv or #; A-F only)
Basic laws of mass, energy, and momentum transport in environmental fluid flow. Exact and approximate solutions for viscous flow. Irrotational flow; gravity waves. Similitude and inspectional analysis. Laminar boundary layers and slender flows. Application to engineering and environmental problems.

CE 8502. Environmental Fluid Mechanics II. (4 cr; QP–5435; SP–8501 or #; A-F only)
Reynolds equations. Developed and developing turbulent boundary layers and slender flows, and their interaction with inviscid flow. Jets, plumes, wakes and shear layers. Statistical description of turbulence; data analysis.

CE 8503. Environmental Mass Transport. (4 cr; QP–3400, 3500 or equiv; SP–3502, 3501 or equiv or #; A-F only)
Principles of intraphase and interfacial chemical transport and fate in the environment, specifically the processes of diffusion, dispersion, and convection. Application to surface water and atmospheric mixing, dispersion in groundwater, and transport between these media.

CE 8504. Theory of Unit Operations. (4 cr; QP–5500, 5501, 5506; SP–4541, 4531; A-F only)
Theoretical basis, design, and operation of chemical and physical processes used in treating and controlling water quality, including adsorption, ion exchange, sedimentation, thickening, filtration, gas transfer, coagulation, flocculation, membrane processes, and disinfection.

CE 8505. Biological Processes. (3 cr; QP–5405, 5501; SP–4502, 4501 or #; A-F only)
Theoretical principles underlying chemical and biological wastewater treatment processes, including aerobic and anaerobic treatment for organic carbon and nutrient removal. Mathematical models of microbial growth kinetics and mass transport in suspended growth and attached film applications are developed.

CE 8506. Stochastic Hydrology. (4 cr; QP–Stat 5021; SP–Stat 3021 or equiv or #; A-F only)
Analysis and synthesis of hydrologic series and systems; derived distributions; uncertainty and risk analysis; flood frequency analysis; multivariate time series analysis; correlation and spectral analysis; series of long-range dependence; linear estimation; geostatistics; sampling networks; hydrologic forecasting.

CE 8507. Advanced Methods in Hydrology. (4 cr; QP–8407; SP–8506; A-F only)
Notions of scale-invariance, scaling, and multiscaling in geophysical processes; methods of multiscale analysis; wavelet transforms; time-frequency-scale analysis and fractal analysis. Applications in atmospheric, hydrologic, and geomorphologic processes.

CE 8508. Ecofluid Dynamics. (4 cr; QP–[3400, 3500] or equiv; SP–3502 or equiv; A-F only)
Theoretical principles underlying environmental fluid dynamics of biochemical processes in lakes, rivers, wetlands, coastal ocean. Emphasizes small-scale fluid motion, dominant flux path, growth kinetics, thin layers, microstructure measurements.

CE 8511. Mechanics of Sediment Transport. (3 cr; QP–5410; SP–3502 and 4501 or #; A-F only)
Particle motion in fluids. Criteria for incipient motion. Formulations for bedload and suspended load. Bedform mechanics and hydraulic resistance relations. Channel stability, aggradation and degradation, alluvial stream morphology.

CE 8541. Aquatic Chemistry. (3 cr; QP–5506; SP–4541 or #; A-F only)
Advanced course on water chemistry; physical chemical principles and geochemical processes controlling the chemical composition of natural waters, soil- and sediment-water interactions. Emphasizes behavior of inorganic contaminants in natural waters and engineered systems and dissolved natural organic matter.

CE 8542. Chemistry of Organic Pollutants in Environmental Systems. (3 cr; QP–5506; SP–4541 or #; A-F only)
Structural characteristics and physico-chemical properties of organic contaminants in aquatic systems. Emphasis on PCBs, PAHs, dioxins, insecticides, herbicides, and chlorinated solvents. Factors affecting their transport and transformation. Structure- and property-activity relationships and their use in predicting organic chemical behavior.

CE 8551. Environmental Microbiology: Molecular Theory and Methods. (4 cr; SP–5551 or #; A-F only)
Introduction to microbial genetics and molecular phylogeny. Application of nucleic-acid techniques in environmental microbiology and microbial ecology.

CE 8552. Groundwater Microbiology: Laboratory. (4 cr; SP–Grad CE major or #, exposure to basic environ engr and microbiol; A-F only)
Subsurface microbial ecology, biogeochemical cycling, metabolic classification of subsurface bacteria, modeling bacterial transport, diagnosis of microbial induced fouling (MIF) events, bioremediation of contaminated aquifers. Lectures and four lab hours per week.

CE 8553. Biofilms. (3 cr; SP–4551 or #; A-F only)
Science/engineering concepts to investigate formation/function of biofilms. Properties/composition of biofilms, transport/transformation processes in biofilms, communication in biofilms, mathematical modeling. Applications in environmental engineering.

CE 8561. Analysis and Modeling of Aquatic Environments I. (3 cr; SP–Grad CE major, 1 sem grad work or #; A-F only)
Introduction to hydrologic transport and water quality simulation in natural water systems. Deterministic, process-oriented water quality model development. Mixed cell models, advection, turbulent diffusion and dispersion. Chemical and biological kinetics in water quality models. Application of water quality models to management problems.

CE 8562. Analysis and Modeling of Aquatic Environments II. (3 cr [max 6 cr]; QP–8550; SP–Sem grad work or #)
Models for transport and transformation of pollutants, nutrients, particulates, ecosystems, etc., from recently completed theses, articles, or research in progress. Students review assigned recent papers, make presentations, and analyze a topic of their choice. Workshop format.

CE 8563. Industrial Waste Treatment. (3 cr; QP–3500, 5401, 5405, 5500, 5501 or #; SP–3501, 4501, 4502, or equiv or #; A-F only)
Introduction to industrial waste treatment. Individual industries, emphasizing constituents of the waste-stream and how best to recycle, recover, or reduce wastes. Cost concerns and regulations. Field trips to various industries to gain first-hand knowledge of processes involved in treatment.

CE 8571. Hydraulic Measurements. (3 cr; QP–3400; SP–3502 or #; A-F only)
Lab and field methods and instruments for measuring hydraulic pressure, velocity, and discharge.

CE 8572. Computational Hydrodynamics I. (3 cr; QP–5401; SP–IT grad student or #)
Method of characteristics and finite difference methods and their applications to one-dimensional unsteady flows. Stability, convergence, and consistency of finite difference methods. Navier-Stokes equations and their physical meaning. Finite volume method and its application to two- and three-dimensional flows. Grid generation methods.

CE 8573. Computational Hydrodynamics II. (3 cr; QP–8418; SP–IT grad student or #; A-F only)
Navier-Stokes and Euler equations, their physical meaning and implications to computational approach. Finite difference and finite volume methods. Viscous boundary layer and compressibility boundary layer. Turbulent flow modeling. Applications to industrial and environmental flow problems.

CE 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

CE 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

CE 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Classics (Clas)

Department of Classical and Near Eastern Studies
College of Liberal Arts

Clas 5001. Classical Lyric and Satire. (3 cr; SP–¶3001, two literature courses or #)
Greek and Roman lyric poetry; Roman satire.

Clas 5013. Roman Law and Society. (3 cr)
Survey of Roman law from social and historical perspectives. Basic concepts of Roman private law and legal procedure.

Clas 5070. Topics in Ancient Religion. (3 cr; SP–RelA 3071 or 3072 or 3073 or 5071 or 5072 or 5073 or any RelS course or #)
Study of a specific aspect of religion in Classical and Near Eastern antiquity such as healing cults, magic and divination, Gnosticism, or prophecy and authority. Topics specified in *Class Schedule*.

Clas 5071. Greek and Hellenistic Religions. (3 cr; SP–§3071)
Greek religion from the Bronze Age to Hellenistic times. Sources include literature, art, and archaeology. Homer and Olympian deities; ritual performance; prayer and sacrifice; temple architecture; death and the afterlife; mystery cults; philosophical religion; Near Eastern salvation religions. Meets with 3071.

Clas 5072. The New Testament. (3 cr; SP–§3072)
Early Jesus movement in its cultural and historical setting. Origins in Judaism; traditions about Jesus. Apostle Paul, his controversies and interpreters. Questions of authority, religious practice, and structure; emergence of the canon of scripture. Contemporary methods of New Testament study; biblical writings as history and narrative. Meets with 3072.

Clas 5073. Roman Religion and Early Christianity. (3 cr; SP–§3073)
Etruscan, Republican religion. Appeal of non-Roman cults. Ruler worship. Christians in Asia Minor, Egypt, and the West. Popular piety, Christian and non-Christian. Rabbinic Judaism. Varieties of Christianity in 2nd and 3rd centuries. Influence of Greco-Roman culture on emerging church. Constantine and Julian. Meets with 3073.

Clas 5080. New Testament Proseminar. (3 cr; SP–1082 or 3072 or equiv)
Study of some specific aspect of the New Testament and related literature. The class is organized as a discussion seminar. Topics specified in *Class Schedule*.

Clas 5081. Classical Epic in Translation. (3 cr; SP–¶3081)
Homer's Iliad and Odyssey; Virgil's Aeneid; cultural context of epic; development of the hero; epic style; poetics of epic.

Clas 5082W. Greek Tragedy in Translation. (3 cr; SP–¶3082)
Origins of tragedy; ancient theatres; selected plays of Aeschylus, Sophocles and Euripides.

Clas 5083. Ancient Comedy. (3 cr; SP–§3083)
Greek/Roman comic drama (e.g., Aristophanes, Menander, Plautus, Terence).

Clas 5085. Greek Philosophy: The Pre-Socratics to Plato. (3 cr)
Fragments of the pre-Socratics and Sophists and selected dialogues of Plato.

Clas 5088. Archaeology in Biblical Lands I: Old Testament Period. (3 cr; SP–§3088)
Archaeological data relevant to the Old Testament; major sites in the Holy Land and other areas of the Mediterranean and Near East. Evidence of pottery, inscriptions, manuscripts, and coins. Excavation methods. Archaeology as a tool for study of ancient religions. Meets with 3088.

Clas 5089. Archaeology in Biblical Lands II: New Testament Period. (3 cr; SP–§3089)
Archaeological data relevant to Jewish scriptures and New Testament; major sites in the Holy Land and other areas of the Mediterranean and Near East. Evidence of pottery, inscriptions, manuscripts, and coins. Excavation methods. Archaeology as a tool for study of ancient religions. Meets with 3089.

Clas 5103. Hellenistic and Early Roman Art and Archaeology. (3 cr; SP–Jr, Clas/ArtH 3008 or #)
Sculpture, architecture, painting, and topography in developing centers of Hellenistic culture in eastern Mediterranean and in Etruscan and Roman towns from 400 B.C. to the beginnings of the Roman Empire.

Clas 5108. Greek Architecture. (3 cr; SP–Jr, Clas/ArtH 3008 or #)
Geometric through classical examples of religious and secular architecture and their setting at archaeological sites in Greece, Asia Minor and Italy.

Clas 5111. Prehistoric Art and Archaeology of Greek. (3 cr; SP–Jr, Greek art or archaeology course or #)
Artistic and architectural forms of Neolithic period in Aegean area and Cycladic, Minoan, and Mycenaean cultures. Aims and methods of modern field archaeology; the record of human habitation in the Aegean area. Archaeological evidence as a basis for historical reconstruction.

Clas 5112. Archaic and Classical Greek Art. (3 cr; SP–Jr, Clas/ArtH 5111)
Sculpture, painting, architecture and minor arts in Greek lands from the 9th through 5th centuries B.C. Examination of material remains of Greek culture; archaeological problems such as identifying and dating buildings; analysis of methods and techniques. Emphasis on Periklean Athens.

Clas 5120. Field Research in Archaeology. (3 cr; SP–#)
Field excavation, survey, and research at archaeological sites in the Mediterranean area. Techniques of excavation and exploration; interpretation of archaeological materials.

Clas 5145. Advanced Greek and Roman Mythology. (3 cr; SP–§3145; 1042 or #)
Different theoretical approaches to Greek/Roman mythology.

Clas 5172. House, Villa, Tomb: Roman Art in the Private Sphere. (3 cr; SP–Intro art history course or #)
The architecture, painting, and sculpture of urban houses, country estates, and tombs in the Roman world. Relationships between public and private spheres, and literary and physical evidence; usefulness of the physical evidence in illuminating gender roles.

Clas 5182. Art and the State: Public Art in the Roman Empire. (3 cr; SP–Intro art history course or #)
Origins of Roman public art; use in maintaining community; exploitation by the first emperor, Augustus; development and diffusion through the later empire; varying capabilities to adjust to the demands of a Christian Empire.

Clas 5252. History of Early Christian Art in Context. (3-4 cr; SP–3xxx art history course or #)
Role played by art in the formation of early Christian and Byzantine communities, and in establishing their relationships with the Pagan world and early Islam.

Clas 5340. Practicum in Archaeological Field and Computer Techniques. (3 cr; SP–§3340; ClCv major or ancient art and archaeology course or #)
Methods used for excavation of Old and New World sites. Meets at archaeometry/computer lab for part of the semester and at a selected site in Minnesota for day-long sessions for 9 to 10 weeks. Meets with 3340.

Clas 5794. Introduction to Classical and Near Eastern Studies. (1 cr; SP–Grad major or minor or #; S-N only)
Introduction to core research materials and reference materials in the various disciplines which make up classical studies.

Clas 5940. Topics in Classical Literature. (3 cr [max 9 cr]; SP–§3940; two literature courses or #)
Additional work for graduate credit. Topics specified in *Class Schedule*. Meets with 3940.

Clas 5950. Aspects of Classical Culture. (3 cr; SP–§3950)
Topics specified in *Class Schedule*. Meets with 3950.

Clas 5993. Directed Studies. (1-4 cr; SP–#, Δ, ❑)
Guided individual reading or study.

Clas 5994. Directed Research. (1-12 cr; SP–#, Δ, ❑)

Clas 5996. Directed Instruction. (1-12 cr; SP–#, Δ, ❑)

Clas 8190. Seminar: Issues in Ancient Art and Archaeology. (3 cr [max 12 cr]; SP–#)
Selected issues, with special attention to current scholarly disputes. Topics specified in *Class Schedule*.

Clas 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Clas 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

Clas 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Clas 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Clas 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Clas 8950. Topics in Classical Studies. (3 cr [max 12 cr])
Topics such as slavery, women in antiquity, pagans and Jews, the taboo, and modern study of myth.

Clinical Laboratory Science (CLS)

Department of Laboratory Medicine and Pathology

Medical School

CLS 5064. Introduction to Clinical Immunohematology. (2 cr; SP–#; A-F only)
Principles of blood grouping, antibody identification, compatibility testing, serology, and immunology.

CLS 5065. Introduction to Clinical Immunohematology: Laboratory. (2 cr; SP–#; A-F only)
Exercises illustrating techniques in blood grouping, antibody identification, compatibility testing, and detection of antibodies by serological and immunological methods.

CLS 5090. Special Laboratory Methods. (1-2 cr; SP–#; A-F only)
Assignment on an individual basis to one of a variety of special areas of experience in the clinical lab.

CLS 5100. Virology, Mycology, and Parasitology for Medical Technologists. (2 cr; SP–Microbiology course with lab, biochem course; A-F only)
Lab diagnosis of viral, fungal, and parasitic infections. Lecture.

CLS 5102. Principles of Diagnostic Microbiology. (4 cr; SP–Microbiology course with lab, biochem course; #; A-F only)
Techniques in lab diagnosis of infectious disease. Isolation/identification of bacteria/yeasts. Antimicrobial susceptibility testing. Lecture, lab.

CLS 5120. Seminar: Clinical Laboratory Science. (1 cr [max 3 cr]; SP–#; S-N only)
Current literature. Presentation/discussion of research.

CLS 5121. Journal Presentations. (1 cr [max 2 cr]; SP–1st yr CLS grad student; S-N only)
Critical analysis, evaluation, discussion of current journal articles in student's specialty area.

CLS 5125. Practicum Teaching. (1-2 cr; SP–#; A-F only)
Supervised teaching experience, develop skills using instructional materials, tests, and measurements.

CLS 5127. Introduction to Management and Education I. (1 cr; SP–#; A-F only)

CLS 5128. Introduction to Management and Education II. (1 cr; SP–5127, MedT 4127; A-F only)

CLS 5129. Elements of Laboratory Administration. (2 cr; SP–#; A-F only)
Leadership styles, employee selection and evaluation, communications, motivation, morale, discipline, job descriptions, record keeping, budgets, cost accounting, purchasing, product evaluation, lab safety, labor relations, government regulations.

CLS 5130. Practicum in Laboratory Administration. (2 cr; SP–#; A-F only)
Supervised experience and assignment of specific problems related to lab service and management in health care institutions.

CLS 5135. Advanced Clinical Microbiology. (3 cr; SP–#)
Observation, study, and practice in special problems, advanced techniques, and methodology.

CLS 5140. Techniques for Teaching. (2 cr; SP–#; A-F only)
Developing objectives, classroom activities, and evaluation criteria for medical technology education.

CLS 5155. Advanced Clinical Hematology. (3 cr; SP–#)
Observation, study, and practice in special problems, advanced techniques, and methodology.

CLS 5165. Advanced Clinical Immunohematology. (3 cr; SP–#)
Observation, study, and practice in special problems, advanced techniques, and methodology.

CLS 5175. Advanced Clinical Chemistry. (3 cr; SP–#)
Observation, study, and practice in special problems, advanced techniques, and methodology.

CLS 5251. Hematology I: Basic Techniques. (3 cr; SP–#; A-F only)
Theory and application of basic principles and techniques in clinical hematology and hemostasis. Lecture and lab.

CLS 5252. Hematology II: Morphology and Correlation. (2 cr; SP–5251 or MedT 4251; A-F only)
Fundamentals of blood and bone marrow examination emphasizing microscopic identification of immature and abnormal cells. Clinical correlation of lab findings in hematology and hemostasis. Lecture and lab.

CLS 5253. Hemostasis. (1 cr; SP–5251 or MedT 4251; A-F only)
Theory and application of specific concepts and techniques in hemostasis and coagulation. Lecture and lab.

CLS 5310. Clinical Chemistry I: Lecture. (2 cr; SP–Organic chem course with lab; biochem course, #; A-F only)
Principles and theory of clinical chemistry for assessing renal and metabolic disease/dysfunction, electrolyte balance, and acid-base balance. Principles and processes for quality management in the clinical lab.

CLS 5311. Clinical Chemistry I: Laboratory Applications. (2 cr; SP–One organic chem course with lab; one bio course, #; A-F only)
Application of clinical chemistry principles and laboratory techniques in the analysis of urine, plasma, and body fluids. Emphasis on laboratory tests to evaluate renal function, electrolytes, and acid-base balance. Introduction to principles and processes for managing test quality. Laboratory.

CLS 5320. Clinical Chemistry II: Lecture. (2 cr; SP–Organic chem course with lab, biochem course, 5310 or MedT 4310, #; A-F only)
Principles and theory of clinical chemistry for assessing metabolic disease/dysfunction involving hormones, enzymes, lipids/lipoproteins, cardiac function, liver, and digestive tracts. Emphasis on measurement methods and physiological significance.

CLS 5321. Clinical Chemistry II: Laboratory Applications. (2 cr; SP–Organic chem course with lab, biochem course, 5310 or MedT 4310, #; A-F only)
Application of clinical chemistry principles and lab techniques in analyzing serum, plasma, and urine. Focus on tests to evaluate selected disorders. Developing lab and instrumentation use skills with emphasis on quality control and technique.

CLS 5768. Advanced Hematology. (5-10 cr [max 30 cr]; SP–#)
Practical experience collecting bone marrow from patients. Diagnosing hematological diseases by evaluating and interpreting cells from clinical specimens of bone marrow, peripheral blood, and, if applicable, lymph nodes.

CLS 5864. Research Seminar. (1 cr [max 10 cr]; SP–#; S-N only)
Departmental research seminar series.

CLS 5865. Departmental Seminar. (1 cr [max 10 cr]; SP–#; S-N only)
Departmental clinical lab research seminar series.

CLS 8193. Advanced Topics in Clinical Chemistry. (2 cr; SP–#)
Includes use of molecular approaches to diagnosis and risk assessment of selected diseases.

CLS 8194. Research on Clinical Laboratory Problems. (1-3 cr; SP–#)
Individual research project in a selected area.

CLS 8293. Educational Administration in Medical Technology. (2 cr; SP–#)
Responsibilities of administration to students, faculty, and educational community. Curriculum planning, accreditation, staffing, student selection, finances. Sample administrative problems and decisions used as practice vehicles.

CLS 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

CLS 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Cognitive Science (CgSc)

Graduate School

CGSC 8000. Philosophy of Cognitive Science. (3 cr; SP–Grad cog sci minor or #)
Philosophical framework for analyzing cognitive sciences. Recent developments in metaphysics and epistemology. Nature of scientific theories, methodologies of cognitive sciences, relations among cognitive sciences, relation of cognitive science to epistemology and various philosophical problems.

CGSC 8001. Proseminar in Cognitive Science. (2 cr; SP–Grad cog sci minor or #; S-N only)
Survey of major topics, including theoretical assumptions, methods, and samples of current research.

CGSC 8360. Seminar: Topics in Cognitive Science. (1-3 cr [max 6 cr]; SP–Grad cog sci minor or #)
Lectures and in-depth discussion on a topic.

Communication Disorders (CDis)

Department of Communication Disorders
College of Liberal Arts

CDis 5401. Counseling and Professional Issues. (4 cr; QP–#; SP–4501 or 4601 or 4801 or #)
Basic counseling principles and current professional issues in communication disorders. Application of counseling theory to clinical practice. Analysis of regulation, practice, and future direction of communication disorders.

CDis 5501. Fluency Disorders. (3 cr; QP–#; SP–4501 or #)
Description, nature, and treatment of fluency disorders in children and adults. Involvement in therapeutic and research activities.

CDis 5502. Voice and Resonance Disorders. (3 cr; QP–#; SP–3305, 4301, 4501 or #)
Normal and disordered aspects of voice and resonance. Organic and functional voice disorders, laryngectomy, and cleft palate. Basic information regarding the nature and clinical management of these disorders.

CDis 5503. Motor Speech Disorders. (3 cr; QP–#; SP–3305, 4301, 4501 or #)
Dysarthria, speech-production disorders resulting from neurologic disorders or lesions, and apraxia of speech, a disorder of the volitional control of speech. Nature and management of motor speech disorders in adults and children.

CDis 5504. Dysphagia. (3 cr; QP–5509 or #; SP–3305, 4301, 4501, or #)
Normal and disordered aspects of swallowing. The nature, etiologies, evaluation, and management of swallowing disorders will be covered.

CDis 5602. Phonological Disorders. (3 cr; QP–#; SP–3304, 4601 or #)
Theory and research related to the nature, assessment, and treatment of phonological disorders in children.

CDis 5603. Child Language Disorders: Assessment and Intervention. (4 cr; QP–#; SP–[3303, grad student] or #)
Language assessment, teaching procedures used with children/adolescents. Procedures apply to children who face language disabilities such as developmental delays, autism, learning disabilities.

CDis 5604. Language Assessment and Intervention: School Age Children. (3 cr; QP–#; SP–4601 or #)
Strategies, models and service-delivery options in assessment and intervention for school-age children with language impairments. Emphasis on practical applications for speech-language pathologists.

CDis 5605. Language and Cognitive Disorders in Adults. (3 cr; QP–#; SP–3302, 4301, 4601 or #)
Neurogenic communicative and cognitive disorders in adults, including aphasia, right-hemisphere syndrome, traumatic brain injury, and dementia. Consideration of neurologic substrates, assessment and diagnosis, and clinical intervention.

CDis 5606. Introduction to Augmentative and Alternative Communication. (3 cr; QP–#; SP–4501, 4601 or #)
Description of the range of augmentative and alternative communication applications for persons with developmental and acquired disabilities.

CDis 5607. Electronic Communication Aids. (3 cr; QP–5611 or #; SP–5606 or #)
Operational procedures for dedicated augmentative communication aids and related software applications. Design and implement assessment and intervention strategies relevant to dynamic and fixed display devices. Troubleshoot common technical difficulties encountered by individuals using electronic communication aids.

CDis 5801. Audiologic Assessment I. (3 cr; QP–5701 or #; SP–4801 or #)
Basic audiometric battery including pure tones, speech, masking, and immittance in adults; industrial audiology and otoacoustic emissions.

CDis 5802. Hearing Aids I. (3 cr; QP–5304, 5701 or #; SP–3305, 4801 or #)
Survey of modern hearing aids including history of development, electroacoustic functions, clinic and laboratory measurement techniques, sound field acoustics, techniques for selection.

CDis 5803. Hearing Loss in Children: Diagnosis. (3 cr; QP–5701 or #; SP–4801 or #)
Behavioral, physiological approaches to assessment and identification, development of the auditory mechanism, etiologies of hearing losses in infants, children, selection of sensory aids, principles of case management with children and families.

CDis 5810. Laboratory Module in Audiology. (1 cr; QP–5701 or #; SP–4801 or #)
Intensive study of clinical methods in audiology. Designed to supplement didactic courses in the audiology curriculum; enhance skills through laboratory study individually or in small groups.

CDis 5900. Topics: Communication Disorders. (2 cr)
Topics listed in Communication Disorders office.

CDis 5993. Directed Study. (1-12 cr [max 18 cr]; QP–#; SP–#)
Directed readings and preparation of reports on selected topics.

CDis 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

CDis 8410. Seminar: Research. (3 cr [max 12 cr])
Advanced study exploring application of experimental and quasi-experimental research designs used in single-subject and group research.

CDis 8420. Seminar: Teaching. (3 cr [max 9 cr]; SP–Grad com dis major)
Advanced study to prepare doctoral students for careers in undergraduate and graduate teaching.

CDis 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

CDis 8501. Interdisciplinary Management in Cleft Palate and Craniofacial Disorders. (3 cr; SP–3305, 4501 or #)
Communication problems associated with cleft palate and craniofacial disorders within interdisciplinary context; structural bases for speech problems, and physical and behavioral approaches to speech treatment; interdisciplinary medical and dental concerns and management.

CDis 8530. Seminar: Speech. (3 cr [max 12 cr])
Advanced study and analysis of research in speech science and speech pathology.

CDis 8602. Traumatic Brain Injury. (3 cr; SP–[3302, 4301, 4601] or #)
Survey of communicative/cognitive disorders in adults who have traumatic brain injuries. Demographics, neuropathologic substrates, assessment/diagnosis, clinical applications.

CDis 8630. Seminar: Language. (3 cr [max 12 cr])
Advanced study and analysis of research in language acquisition, language science, and language disorders.

CDis 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

CDis 8720. Clinical Education in Speech-Language Pathology. (1-8 cr [max 24 cr]; SP–Grad com dis major; S-N only)
Clinical experience.

CDis 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

CDis 8801. Audiologic Assessment II. (3 cr; QP–5702; SP–5801 or #)
Auditory brainstem response and balance function in adults. Case studies and development of clinical protocols allowing for integration of topics from both courses in this sequence.

CDis 8802. Hearing Aids II. (3 cr; QP–5706; SP–5802 or #)
Instrumentation and methods for fitting and evaluating personal hearing aids; ear impression techniques and materials; repair and modification of hearing aids.

CDis 8803. Signals and Systems in Audiology. (3 cr; QP–5304, 5306, 5701; SP–3305, 3306, 4801 or #)
Introduction to electronics, digital signal processing, and calibration of instruments used to assess hearing. Lab sessions on such topics as sound-field calibration, earphone calibration, filters, spectra of transient signals, and use of an artificial mastoid.

CDis 8804. Evoked Potentials. (3 cr; SP–8801)
Research and methods used in measurement and application of evoked potentials. Early, middle, and late auditory evoked potentials and electroneurography.

CDis 8820. Clinical Education in Audiology. (1-8 cr [max 24 cr]; SP–Grad com dis major; S-N only)
Clinical experience.

CDis 8830. Seminar: Hearing. (3 cr [max 12 cr])
Advanced study and analysis of research in hearing science and audiology.

CDis 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

CDis 8994. Directed Research. (1-12 cr [max 18 cr]; SP–#)

Comparative Literature (CLit)

Department of Cultural Studies and Comparative Literature

College of Liberal Arts

CLit 5331. Discourse of the Novel. (3 cr; SP–§CSCL 5331)
Comparative study of the novel (eighteenth century to present): its relation to ordinary language practices, emergent reading publics, technologies of cultural dissemination, problems of subjectivity; its role in articulating international cultural relations.

CLit 5555. Introduction to Semiotics. (3 cr; SP–§CSCL 5555)
Problems of the nature of the sign; sign function; sign production; signifying systems as articulated in philosophy, linguistics, anthropology, psychoanalysis, and art theory. Applying semiotics to various signifying practices (e.g., literature, cinema, daily life).

CLit 5751. Basic Concepts of Cinema. (4 cr; SP–§CSCL 5751, §CSDS 5751)
Cinema as object of theoretical/historical analysis. Emphasizes concepts that have transformed scope/aim of film analysis since 1960s. Readings of filmic/theoretical texts.

CLit 5910. Topics in Comparative Literature. (3 cr [max 24 cr])
Topics specified in *Class Schedule*.

CLit 5992. Directed Reading in Comparative Literature. (1-3 cr [max 9 cr]; SP–#)
Guided individual reading and study.

CLit 8001. Basic Seminar in Comparative Literature I. (4 cr)
Key texts, positions, and problematics in field of comparative critical theory. Special attention to historical precursors, influential contemporary debates, and disciplinary genealogies.

CLit 8002. Basic Seminar in Comparative Literature II. (4 cr)
Key texts, positions, and problematics in field of comparative critical theory. Special attention to historical precursors, influential contemporary debates, and disciplinary genealogies.

CLit 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

CLit 8362. Modernity and Its Others. (4 cr)
Dialectical interrogation of Western and non-Western theories of modernity. Reckoning with differences and variations in its history, providing an account of the normative category of modernity (designated as European), and alternative articulations around the globe.

CLit 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

CLit 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

CLit 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

CLit 8901. Pedagogy of Cultural Studies and Comparative Literature. (3 cr; SP–Grad comp lit major)
Prepares graduate majors for teaching. Issues of pedagogy. Preparing syllabi for specific courses that graduate instructors teach. Required for students planning to teach in Department of Cultural Studies and Comparative Literature.

CLit 8910. Advanced Topics in Comparative Literature. (4 cr [max 32 cr])
Practical applications of specific methodologies and theories to a determined area. Topics vary by instructor and semester.

CLit 8920. Advanced Topics in Comparative Literature. (3 cr [max 15 cr])
Practical applications of specific methodologies and theories to a determined area. Topics vary by instructor and semester.

CLit 8992. Directed Reading in Comparative Literature. (1-4 cr [max 12 cr]; SP–#)

CLit 8994. Directed Research in Comparative Literature. (1-4 cr [max 12 cr]; SP–#)

Comparative Studies in Discourse and Society (CSDS)

Department of Cultural Studies and Comparative Literature

College of Liberal Arts

CSDS 5301. Society, Ideology, and the Production of Art. (3 cr; SP–§CSCL 5301)
Recent critical theories of relation of arts to social/ideological forces. Selected artifices from Western culture (e.g., Renaissance to 20th century; high, popular, mass culture). Music, visual art, literature.

CSDS 5302. Aesthetics and the Valuation of Art. (3 cr; SP–§CSCL 5302)
Society, ideology, aesthetic value in light of recent critical theories of visual art, music, literature. Mediations of place, social class, gender, ideology on aesthetic judgment in post-renaissance Western culture.

CSDS 5751. Basic Concepts of Cinema. (4 cr; SP–§CSCL 5751, §CLit 5751)
Cinema as object of theoretical/historical analysis. Emphasizes concepts that have transformed scope/aim of film analysis since 1960s. Readings of filmic/theoretical texts.

CSDS 5910. Topics in Comparative Studies in Discourse and Society. (3 cr [max 24 cr])
Themes in comparative, sociohistorical analysis of discursive practices. Individually or team taught. Topics specified in *Class Schedule*.

CSDS 5993. Directed Study. (1-3 cr [max 9 cr]; SP–#)
Guided individual reading and study.

CSDS 8001. Basic Seminar in Comparative Studies in Discourse and Society I. (4 cr)
Key texts, positions, and problematics in field of comparative critical theory. Special attention to historical precursors, influential contemporary debates, and disciplinary genealogies.

CSDS 8002. Basic Seminar in Comparative Studies in Discourse and Society II. (4 cr)
Key texts, positions, and problematics in field of comparative critical theory. Special attention to historical precursors, influential contemporary debates, and disciplinary genealogies.

CSDS 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

CSDS 8404. International Hierarchy. (4 cr)
Asymmetric structures and processes of international relations; systemic conditions and implications of informal empire and structures of dependency and hegemony.

CSDS 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

CSDS 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

CSDS 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

CSDS 8901. Pedagogy of Cultural Studies and Comparative Literature. (3 cr; SP–Grad CSDS major)
Prepare graduate majors for teaching. Issues of pedagogy. Preparing syllabi for specific courses that graduate instructors teach. Required for students planning to teach in Department of Cultural Studies and Comparative Literature.

CSDS 8910. Advanced Topics in Comparative Studies in Discourse and Society. (4 cr [max 32 cr])
Themes in comparative, sociohistorical analysis of discursive practices. Individually or team taught. Topics vary by instructor and semester.

CSDS 8920. Advanced Topics in Comparative Studies in Discourse and Society. (3 cr)
Practical applications of specific methodologies and theories to a determined area. Topics vary by instructor and semester.

CSDS 8993. Directed Study in Comparative Studies in Discourse and Society. (1-4 cr [max 12 cr]; SP–#)

CSDS 8994. Directed Research in Comparative Studies in Discourse and Society. (1-4 cr; SP–#)

Computer Engineering (CmpE)

Department of Electrical and Computer Engineering

Institute of Technology

CmpE 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

CmpE 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Computer Science (CSci)

Department of Computer Science

Institute of Technology

CSci 5103. Operating Systems. (3 cr; QP–5102; SP–4061 or #)
Conceptual foundation of operating system designs and implementations. Relationships between operating system structures and machine architectures. UNIX implementation mechanisms as examples.

CSci 5106. Programming Languages. (3 cr; QP–3322, 3327; SP–4011 or #)
Design and implementation of high-level languages. Course has two parts: (1) language design principles, concepts, constructs; (2) language paradigms, applications. Note: course does not teach how to program in specific languages.

CSci 5107. Computer Graphics. (3 cr; QP–3322; SP–4041 or #)
Introduction to theory and practice of graphics programming. Graphics programming fundamentals; overview of 2D graphics and algorithms, 3D modeling and rendering techniques, animation, and scientific visualization. Graphics language currently used is OpenGL.

CSci 5108. Computer Graphics II. (3 cr; QP–§5117; 5107 or #; SP–5107 or #)
Advanced modeling/rendering. Curves/surfaces, constructive solid geometry, radiosity, advanced ray tracing, texture, shadows, and other surface detail. Animation. Introduction to scientific visualization. Current topics in computer graphics.

CSci 5115. User Interface Design, Implementation and Evaluation. (3 cr; QP–3322; SP–4041 or #)
Theory, design, programming, and evaluation of interactive application interfaces. Human capabilities and limitations, interface design and engineering, prototyping and interface construction, interface evaluation, and topics such as data visualization and World Wide Web. Course is built around a group project.

CSci 5116. GUI Toolkits and Their Implementation. (3 cr; QP–5107 or 5110; SP–5115 or 5107 or #)
Structure and design of user interface toolkits and frameworks. Aspects of GUI toolkits (e.g., window system protocols, event processing, geometry management, resource management, data management, constraints). Course is built around implementation assignments and case studies of toolkits.

CSci 5131. Internet Programming. (3 cr; QP–5106 or 5211; 5180, 5702 recommended; SP–5106 or 5211 or #; 4081 (or 5801), 5707 recommended)
Issues in internet programming: Java programming, concurrent programming, workflow, distributed databases, security, collaborative computing, object-oriented architecture/design, network publishing, messaging architecture, distributed object computing, internets.

CSci 5161. Introduction to Compilers. (3 cr; QP–5106; SP–4011 or #)
Theories and mechanisms of programming language processing tools. General compiler organization: lexical scanner, syntax parser, symbol table, internal program representation, code generator. Relationship between design and implementation. Run-time memory management mechanism.

CSci 5201. Computer Architecture. (3 cr; QP–3327; SP–2021 or #; §EE 5361)
Introduction to computer architecture. Pipelining, memory hierarchy, and input/output systems. Performance metrics. Examination of each component of a complicated computer system.

CSci 5211. Data Communications and Computer Networks. (3 cr; QP–5102; SP–4061 or #)
Fundamental concepts, principles, protocols, and applications. Layered network architectures, data link protocols, local area networks, routing, transport, congestion/flow control, emerging high-speed networks, network programming interfaces, management, security, and applications. Ethernet, ATM, TCP/IP, HTTP and WWW. Basic knowledge of computer architecture and operating systems is recommended.

CSci 5212. Network Programming and Administration. (3 cr; QP–5211; SP–5211 or #)
Network and distributed programming concepts using C, C++, or Java on UNIX or PC platforms. TCP/IP, sockets, and RPC. Hands on experience with network components. Students plan, configure, install, diagnose, performance tune, operate, and manage state-of-the-art computer networks, internetworking devices, and protocols.

CSci 5283. Computer-Aided Design I. (3 cr; QP–3327; SP–2021 or #)
CAD for digital systems. Emphasizes VLSI. Hardware description languages, synthesis, simulation, test generation.

CSci 5285. Computer-Aided Design of VLSI. (3 cr; QP–3327; SP–2021 or #)
CAD for digital systems. Emphasizes VLSI. Physical design: partitioning, placement/routing, electrical rule checks. Inherent complexity of algorithms. Analysis of best known algorithms.

CSci 5302. Analysis of Numerical Algorithms. (3 cr; QP–5301; SP–5301 (preferred) or 2031 or #)
Additional topics in numerical analysis: interpolation, approximation, extrapolation, numerical integration and differentiation, numerical solutions of ordinary differential equations.

CSci 5304. Computational Aspects of Matrix Theory. (3 cr; QP–5302; SP–5302 or #)
Perturbation theory for linear systems and eigenvalue problems. Direct and iterative solution of large linear systems. Decomposition methods. Computation of eigenvalues and eigenvectors. Singular value decomposition. LAPACK and other software packages. Methods for sparse and large structured matrices.

CSci 5321. Linear and Nonlinear Programming. (4 cr; SP–2031, some programming experience)
Standard form for linear programming (LP), simplex method and geometry of LP, revised simplex method, duality theory and sensitivity, approximation of data by LP, interior methods, affine scaling algorithms, unconstrained optimization.

CSci 5403. Computational Complexity. (3 cr; QP–5400; SP–4041 or #)
Computational models, complexity measures in each model, and related complexity classes.

CSci 5421. Advanced Algorithms and Data Structures. (3 cr; QP–3322; SP–4041 or #)
Fundamental paradigms of algorithm and data structure design. Divide-and-conquer, dynamic programming, greedy method, graph algorithms, amortization, priority queues and variants, search structures, disjoint-set structures. Theoretical underpinnings. Examples from various problem domains.

CSci 5442. Computational Geometry and Applications. (3 cr; QP–5421; SP–5421 or #)
Designing efficient algorithms and data structures for geometric problems; models of computation, convex hulls, geometric duality, multidimensional search, Voronoi diagrams and Delauney triangulations, linear programming in fixed dimensions, lower bound techniques. Applications and advanced topics.

CSci 5451. Introduction to Parallel Computing: Architectures, Algorithms and Programming. (3 cr; QP–3322; SP–4041 or #)
Parallel architectures design, embeddings, routing, examples of parallel computers, fundamental communication operations, performance metrics, parallel algorithms for sorting, matrix problems, graph problems, dynamic load balancing, types of parallelisms, parallel programming paradigms, message passing programming in MPI, data parallel programming in HPF, shared-address space programming in threads.

CSci 5511. Artificial Intelligence I. (3 cr; QP–3311; SP–2011 or #)
Introduction to AI. Problem solving, search, inference techniques. Logic and theorem proving. Knowledge representation, rules, frames, semantic networks. Planning and scheduling. Lisp programming language.

CSci 5512W. Artificial Intelligence II. (3 cr; QP–5511; SP–§5519; 5511 or #)
Advanced topics in AI for solving complex problems. Machine learning (symbolic/neural networks approaches), genetic algorithms, reasoning with uncertainty, utility theory and decision theoretic methods, natural language processing, perception robotics, introduction to Prolog programming language.

CSci 5519. Artificial Intelligence II (non-WI). (3 cr; QP–5511; SP–§5512; 5511 or #)
Advanced topics in AI for solving complex problems. Machine learning (symbolic and neural networks approaches), genetic algorithms, reasoning with uncertainty, utility theory and decision theoretic methods, natural language processing, perception robotics, introduction to Prolog programming language.

CSci 5521. Pattern Recognition. (3 cr; QP–5301, Stat 3091; SP–5301, Stat 3021 or #)
Problems of pattern recognition, feature selection, measurement techniques. Classification methods: statistical decision theory, nonstatistical techniques. Automatic feature selection and data clustering.

Syntactic pattern recognition. Mathematical pattern recognition and artificial intelligence. Applications in information retrieval and WWW data mining.

CSci 5551. Introduction to Intelligent Robotic Systems. (3 cr; QP–5511; SP–5511 or #)
Transformations, kinematics/inverse kinematics, dynamics, control. Sensing (robot vision, force control, tactile sensing), applications of sensor-based robot control, robot programming, mobile robotics, and microrobotics.

CSci 5561. Computer Vision. (3 cr; QP–5511; SP–5511 or #)
Issues in perspective transformations, edge detection, image filtering, image segmentation, and feature tracking. Complex problems in shape recovery, stereo, active vision, autonomous navigation, shadows, and physics-based vision. Applications.

CSci 5707. Principles of Database Systems. (3 cr; QP–3322; SP–4041 or #)
Fundamental concepts. Data Models. Data manipulation languages. Extending data types. Database design. Security and integrity policy. Techniques of using database systems for applications. Application of these concepts in the design and development of database applications.

CSci 5708. Architecture and Implementation of Database Management Systems. (3 cr; QP–5702; SP–5707 or #)
Techniques in commercial and research-oriented database systems. Catalogs. Physical storage techniques. Query processing and optimization. Transaction management. Mechanisms for concurrency control, disaster recovery, distribution, security, integrity, extended data types, triggers, and rules.

CSci 5801. Software Engineering I. (3 cr; QP–5106; SP–2011, 1902 or #; §4081.)
Advanced introduction to software engineering. Reviews and expands on 4081. Software life cycle; development models; software requirements analysis; software design, coding, and maintenance.

CSci 5802. Software Engineering II. (3 cr; QP–5180; SP–5801 or #)
Introduction to software testing, software maturity models, cost specification models, bug estimation, software reliability models, software complexity, quality control, and experience report. Student groups specify, design, implement, and test partial software systems. Application of general software development methods and principles from 5801.

CSci 5980. Special Topics in Computer Science. (1-3 cr [max 9 cr]; QP–#; SP–#)
Lectures and informal discussions on current topics in computer science.

CSci 5991. Independent Study. (1-3 cr [max 9 cr]; QP–#; may be repeated for cr; SP–#; may be repeated for cr)
Independent study arranged with CS faculty member.

CSci 5994. Directed Research. (1-3 cr [max 9 cr]; QP–#; may be repeated for cr; SP–#; may be repeated for cr)
Directed research arranged with faculty member.

CSci 5996. Curricular Practical Training. (1 cr [max 3 cr]; SP–#; may be repeated for cr; S-N only)
Industrial work assignment involving advanced computer technology. Reviewed by faculty member. Grade based on final report covering work assignment.

CSci 8101. Advanced Operating Systems. (3 cr; QP–5103; SP–5103 or #)
Successful research systems and existing theory of systems design. Goal is not merely to catalog systems or learn mathematics, but to develop a sense of elegance of design that leads to successful systems.

CSci 8102. Operating Systems Theory. (3 cr; QP–8101; SP–8101 or #)
Fundamental principles underlying design of distributed and multiprocessor operating systems. Foundations of distributed computing systems; shared multiprocessor systems.

CSci 8115. Human-Computer Interaction and User Interface Technology. (3 cr; QP–5111; SP–5115 or #)
Current research issues in human-computer interaction, user interface toolkits and frameworks, and related areas. Research techniques, model-based development, gesture-based interfaces, constraint-based programming, event processing models, innovative systems, HCI in multimedia systems.

CSci 8161. Advanced Compiler Techniques. (3 cr; QP–5102; SP–4061 or #)
Techniques for uniprocessors and parallel computers. Fundamental program analysis instruments such as data flow analysis and data dependence analysis. Variety of code generation and transformation techniques.

CSci 8203. Advanced Computer Architecture. (3 cr; QP–3327; SP–5201 or #)
Design of high-performance uniprocessors. Advanced pipeline design, dynamic instruction scheduling, branch penalty reduction schemes.

CSci 8205. Parallel Computer Organization. (3 cr; QP–3327; SP–5201 or #)
Parallel machine organization, system design. Difference between parallel, uniprocessor machines. Obtaining good performance. Architectural differences, their influence on programming models. Synchronization/communication. Topologies, message routing strategies.

CSci 8211. Advanced Computer Networks and Their Applications. (3 cr; QP–5211; SP–5211 or #)
Current research issues in traffic and resource management, quality-of-service provisioning for integrated services networks (such as next-generation Internet and ATM networks) and multimedia networking.

CSci 8283. Research Problems in Computer-Aided Design for Electronic Design. (3 cr; QP–5201 or 5283; SP–5201 or 5283 or equiv or #)
Open research problems in contemporary CAD for electronic design, approaches to their solution.

CSci 8314. Iterative Methods for Linear Systems. (3 cr; QP–5304; SP–5304 or #)
Large sparse systems. Sparse systems; methods like Jacobi, Gauss-Seidel, relaxation, and conjugate gradient; preconditioning; and parallel implementation.

CSci 8323. Numerical Solutions of Linear Least Square Problems. (3 cr; QP–5304; SP–5304 or #)
Numerical methods for linear and nonlinear least square problems; designing efficient and accurate algorithms. Sensitivity of least squares problems, modification of decompositions, generalized least squares, special methods for structured problems, and nonlinear least squares.

CSci 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

CSci 8353. Advanced Parallel Numerical Methods. (3 cr; QP–5301, 5151; SP–5301, 5451 or #)
Parallel methods for problems in numerical linear algebra. Review of vector and parallel architectures; programming environments; parallel methods for linear least squares; eigenvalue problems, singular value decomposition, structured matrices, and linear systems.

CSci 8363. Numerical Linear Algebra in Data Exploration. (3 cr; QP–5304; SP–5304 or #)
Computational methods in linear algebra, matrix decompositions for linear equations, least squares, eigenvalue problems, singular value decomposition, conditioning, stability in method for machine learning, large data collections. Principal directions, unsupervised clustering, latent semantic indexing, linear least squares fit. Markov chain models on hyperlink structure.

CSci 8404. Design and Analysis of Approximation Algorithms. (3 cr; QP–5400 or 5421; SP–5403 or 5421 or #)
Because an exact solution is often unfeasible for computationally difficult problems in important applications, approximation algorithms are a significant area of study. Introduces techniques for design of approximation algorithms; theory for evaluating the algorithms' performance.

CSci 8421. Advanced Algorithms and Data Structures II. (3 cr; QP–5421; SP–5421 or #)
Advanced methods for algorithm design. Network flow and matching, advanced dynamic programming, linear programming, cryptography, approximation algorithms, on-line algorithms, and randomized algorithms. Cutting-edge material provides enough background for students to pursue dissertation-level research.

CSci 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

CSci 8481. Parallel Algorithms for Numeric and Non-numeric Problems. (3 cr; QP–3322; SP–4041 or #)
Parallel algorithms for many important problems in computer science and related fields. Parallel algorithms for sorting, selection, graph problems, computational geometry, matrix problems, FFT, combinatorial search algorithms, dynamic programming, and data mining.

CSci 8521. Neural Computing and Neural Networks. (3 cr; QP–5511; SP–5511 or #)
Introduction to Artificial Neural Networks (ANNs). Network architectures and learning rules; design of ANNs.

CSci 8551. Intelligent Agents. (3 cr; QP–5511; SP–5511 or #)
Theories of intelligent agents. Agent architectures; knowledge representation, communication, cooperation, and negotiation among multiple agents; planning and learning; issues in designing agents with a physical body; dealing with sensors and actuators; world modeling.

CSci 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

CSci 8701. Overview of Database Research. (3 cr; QP–5703; SP–5708 or #)
Research papers from journals and conferences on current topics in databases, such as database research methodologies, relational implementation techniques, active databases, storage systems, benchmarking, distributed and parallel databases, new data models, prototype systems, data mining, and future directions.

CSci 8703. Distributed and Parallel Databases. (3 cr; QP–5703; SP–5708 or #)
Distributed database management systems (DBMS) architecture, including client-server, distributed DB design, distributed query optimization and processing; distributed transaction management (concurrency control and recovery); federated/multibases (definition and issues); database machines (concepts, successes, and failures); parallel databases.

CSci 8705. Scientific Databases and Applications. (3 cr; QP–5703; SP–5708 or #)
Application domains of geographical information systems, common data types, queries and analyses, data models, languages to query, query optimization, access methods, clustering methods and file structures, system architectures and design (e.g., parallelism, entensibility), and new trends (e.g., spatial graphs).

CSci 8760. Plan B Project. (3 cr; SP–Comp sci M.S. student, #; may not be applied toward cr minimum in major; S-N only)
Project arranged between student and faculty.

CSci 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

CSci 8801. Advanced Software Engineering. (3 cr; QP–5180; SP–5801 or #)
Software reusability, internet/intranet programming, software reengineering, and software safety.

CSci 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

CSci 8970. Computer Science Colloquium. (1 cr [max 3 cr]; S-N only)
Recent developments in computer science and related disciplines. Students must attend 13 of the 15 lectures.

CSci 8980. Special Advanced Topics in Computer Science. (1-3 cr [max 9 cr]; SP–#)
Lectures and informal discussions.

CSci 8991. Independent Study. (1-3 cr; SP–#)

CSci 8994. Directed Research in Computer Science. (1-3 cr [max 9 cr]; SP–#)

Conservation Biology (CBio)

Graduate School

CBio 8001. Conservation Biology Seminar. (1 cr [max 6 cr]; SP–#; S-N only)
Topics vary.

CBio 8004. Economic and Social Aspects of Conservation Biology. (3 cr; SP–CBio student or #)
Economic/social aspects of conservation biology. Ecological economics, human dimension of conservation biology, values of conserving species/ecosystems.

CBio 8095. Contemporary Problems in Conservation Biology. (1 cr; SP–8004, FW 8452, #; S-N only)
Comprehensive review of conservation biology issue. Written exam.

CBio 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

CBio 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

CBio 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

CBio 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

CBio 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Control Science And Dynamical Systems (CSDy)

Graduate School

CSDy 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

CSDy 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

CSDy 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

CSDy 8899. Seminar in Control Science and Dynamical Systems. (1-3 cr [max 9 cr]; SP–CSDy or IT grad; S-N only)
Current research and advanced topics.

Coptic (Copt)

Department of Classical and Near Eastern Studies
College of Liberal Arts

Copt 5001. Elementary Coptic. (3 cr)
Introduction to Coptic grammar and vocabulary, chiefly in the Sahidic dialect.

Copt 5002. Elementary Coptic. (3 cr; SP–5001 or equiv)
Reading a variety of Coptic literature, such as Gnostic, martyrological, or monastic texts.

Cultural Studies and Comparative Literature (CSCL)

Department of Cultural Studies and Comparative Literature
College of Liberal Arts

CSCL 5147. Teaching as Dialogue. (3 cr)
Teaching and the teacher are the subject. Entering into dialogue is the method. Issues with the politics of teaching, the means of entering into dialogue, questions of judgment, and the idea of self-teaching as the goal of teaching.

CSCL 5154W. Theoretical Constructions of Space. (3 cr)
Inquiry into theories of space drawn from various disciplines including anthropology, architecture, geography, history, landscape design, philosophy, planning, and sociology. Focus on sociopolitical interests that are served and sustained; emphasis on opportunities and implications for personal identity.

CSCL 5256. Suburbia. (3 cr)
Suburbia from origins in 18th-century England to the present. Historical changes and present challenges, especially in America. Ideology, mythology, planning, development, geography, transportation, the family. Specific sites and designs; representations in film, television, popular literature, and music.

CSCL 5301. Society, Ideology, and the Production of Art. (3 cr)
Recent critical theories on the relation of the arts to social and ideological forces; selected artifices from Western culture (Renaissance to 20th century; high, popular, and mass culture). Music, visual art, literature.

CSCL 5302. Aesthetics and the Valuation of Art. (3 cr)
Society, ideology, and aesthetic value considered in light of recent critical theories of visual art, music, and literature. Meditations of place, social class, gender and ideology on aesthetic judgment in post-Renaissance Western culture.

CSCL 5331. The Discourse of the Novel. (3 cr)
Comparative study of the novel, 18th century to present. Its relations to ordinary language practices, emergent reading publics, technologies of cultural dissemination, problems of subjectivity, and its role in articulating international cultural relations.

CSCL 5555. Introduction to Semiotics. (3 cr)
Problems of the nature of the sign; sign function; sign production; signifying systems as articulated in philosophy, linguistics, anthropology, psychoanalysis, and art theory. Application of semiotics to various signifying practices (literature, cinema, daily life).

CSCL 5711. Sociocriticism. (3 cr)
Sustained consideration of the modern tradition of sociological reflection on literature. Early and late Birmingham School, Frankfurt School, Bakhtin circle, and the various French initiatives associated with both Les Temps Modernes and Tel Quel.

CSCL 5751. Basic Concepts of Cinema. (4 cr)
Examination of the cinema as an object of theoretical and historical analysis. Emphasis on the concepts that have emerged to radically transform the scope and aim of film analysis since the 1960s. Readings of filmic and theoretical texts.

CSCL 5771. Basic Concepts of Literary Study. (3 cr)
Examination of literary discourse as an object of theoretical and historical analysis. Emphasis on the concepts that have emerged to radically transform the scope and aim of literary analysis since the 1960s. Readings of literary and theoretical texts.

CSCL 5835. Richard Wagner's "Der Ring des Nibelungen": Music, Myth, and Politics. (3 cr; SP–#)
Literary and musical analysis and historical context of the four works of Wagner's "Ring": *Das Rheingold*, *Die Walküre*, *Siegfried*, *Götterdämmerung.* Critical assessment of Wagner's achievement and influence.

CSCL 5910. Topics in Cultural Studies and Comparative Literature. (3 cr [max 24 cr])
Topics specified in *Class Schedule*.

CSCL 5993. Directed Study. (1-3 cr [max 9 cr])
Guided individual reading or study.

Curriculum and Instruction (CI)

Department of Curriculum and Instruction
College of Education and Human Development

CI 5008. Theory and Practice of Teaching Art in Elementary Schools. (1-2 cr; A-F only)
Art concepts, skills, processes appropriate for elementary school. Methods of art instruction. Children's production of/responses to art.

CI 5045. Advanced Contemporary Crafts. (2 cr; A-F only)
In-depth experiences in craft techniques, including ceramics, fibers, jewelry, and metal design, with emphasis on design analysis, understanding of materials, and mastery of processes.

CI 5049. Art Media Techniques. (1-4 cr; A-F only)
Lectures, demonstrations, studio labs and critique session on creative processes; handling specific media. Topic varies.

CI 5050. Issues in Art Education. (1-4 cr [max 12 cr])
Issues/trends, current practices, recent research.

CI 5052. Introduction to Art Therapy. (2 cr; A-F only)
History, current conceptions, and practices of art therapy.

CI 5055. Postmodern Visual Culture and Global Education. (1-3 cr; SP–Grad students; A-F only)
Representations of knowledge. Postmodern conditions of education and relationships to the influences of visual culture. Introduction to issues concerning the value and importance of visual imagery; influence of computer networking, mass communication, and other image sources.

CI 5065. Improving Art Programs in the Schools. (3 cr; SP–Initial lic students majoring in art ed; A-F only)
Issues of art instruction, including teaching methods and evaluation, philosophical frameworks of pedagogy, and institutional issues concerning art programs in primary and secondary schools; social and cultural structures of schooling, practical issues of teaching art.

CI 5069. Curriculum Innovations in Art Education. (3 cr; A-F only)
Study and analysis of innovations; evaluation of materials for teaching units and projects.

CI 5075. The Social and Historical Foundations of Art Education. (1-3 cr; SP–Grad student; A-F only)
Issues of culture in education; examination of various forms of art as representations of knowledge, belief, and cultural capital. Epistemology, the meaning of

function, and the conceptual location of visual culture in education and general culture. Seminar discussions include problems of cross-cultural and multicultural art education.

CI 5078. Application of Aesthetic Theory in Education. (2 cr; A-F only)
Contemporary theories of art; psychological and philosophical foundations. Open to teachers, supervisors, and administrators concerned with art in general education at all levels.

CI 5096. Art Education: Practicum. (1-6 cr [max 6 cr]; A-F only)
Issues of art instruction, including teaching methods and evaluation, philosophical frameworks of pedagogy, and institutional issues concerning art programs in primary and secondary schools. Practicum requiring students to work in a public school setting.

CI 5097. Student Teaching in Art Education. (8 cr; SP–Licensure student in art ed; S-N only)
Observation of, participation in, and supervisory experiences with various types and levels of art classes.

CI 5111. Introduction to Elementary School Teaching. (3 cr; SP–Foundations of ed major or elem ed initial lic; A-F only)
Curriculum organization, instruction, management, assessment, professional decision making.

CI 5113. Classroom Management in the Elementary School. (3 cr)
For teachers, administrators, and support staff working in elementary school programs. Focus on management of student behavior, instruction as it relates to student behavior, and teacher organizational tasks in the classroom.

CI 5131. Introduction to Curriculum Studies. (3 cr; SP–Grad student; A-F only)
Curriculum theory and practice. Definitions of curriculum, historical and current issues in curriculum, principles and theories of curriculum, and alternative models and methods of design and evaluation.

CI 5133. Curriculum Planning and Design. (3 cr; SP–Grad student; A-F only)
Application of the theoretical and practical bases of disciplinary and interdisciplinary curriculum design to the problem of designing, implementing and evaluating the quality of a course or program of study.

CI 5136. History of the American Curriculum. (3 cr)
Survey of formation of public school subjects and curriculum theory in United States. Social, political, and economic implications of curriculum theory.

CI 5137. Multicultural Gender-Fair Curriculum. (3 cr; SP–Grad student; A-F only)
Issues related to diversity in learning settings and the exploration of culture in educational contexts. Explores rationale for and process of considering a multicultural and gender-fair curriculum; cultural issues inherent in curricular change; language, culture, sexual preference, special needs students, and the conflicts between culture and curriculum.

CI 5138. Multicultural and Moral Perspectives on Classroom Instruction. (3 cr; SP–M.Ed. or Ph.D. student)
Factors leading to effective communication in ethnically diverse classroom, preschool to adult. Communication techniques and classroom structures that have cultural and moral implications.

CI 5139. Moral Education Programs. (3 cr; SP–Social or moral development course)
Review of history, traditions, and efficacy of moral education programs in the schools; current school and district programs. Includes site visits to schools that are implementing social skills programs.

CI 5141. Reflective Teaching and Professional Ethics. (3-4 cr; SP–Teaching license and one yr teaching exper)
Students develop their professional identities as educators by considering their world views and values in relation to their professional role and responsibilities in the context of a diverse society. Encourages reflective practice and critical review of research.

CI 5147. Language, Culture, and Education. (3 cr; SP–M.Ed. or grad student; A-F only)
Applies current sociolinguistic and discourse theory/research to study of relationships between language and culture in educational settings: language curriculum and instruction; classroom language use; borders between school and home/community language use; and educational policies on literacy/second-language instruction.

CI 5149. Issues of Diversity in Schools and Classrooms. (3-4 cr; SP–Grad student or teacher leadership program)
Examination of issues in schools and classrooms that affect people from diverse groups, using historical, communication, value, and intercultural frameworks.

CI 5150. Curriculum Topics. (1-6 cr [max 12 cr])
Special topics, current trends in curriculum. Subject integration, curriculum contexts, development, implementation, evaluation.

CI 5155. Contemporary Approaches to Instruction and Assessment. (3 cr; SP–Grad student; A-F only)
Examination of a variety of contemporary approaches to instruction and assessment, as well as the skills to implement these approaches.

CI 5162. Peer Coaching for Teachers. (1-2 cr; SP–Teaching exper; A-F only)
Teachers coaching teachers; acquiring concepts, skills, and dispositions necessary for observing classroom instruction and providing constructive feedback.

CI 5172. Teaching Students with Learning Difficulties. (3 cr; SP–Elem teaching exper or #; A-F only)
Theory and practice in teaching students with learning difficulties across the curriculum.

CI 5177. Practical Research. (3 cr; SP–CI M.Ed. student, or CI or EdPA teacher leadership M.Ed. student; A-F only)
Preparation for identifying a research and development topic, reviewing the existing knowledge on the topic, planning and carrying out a project, further investigating the topic, and writing a report on the project.

CI 5178. Project in Teacher Leadership. (3-6 cr; SP–CI or EdPA teacher leadership M.Ed. student)
Create, implement, evaluate, and present a leadership project designed to initiate positive change in educational environments. Review related literature, proposal development, project development, implementation/evaluation, critical reflection. Share learning outcomes.

CI 5181. Clinical Experience in Elementary School Teaching. (4-8 cr; SP–Foundations of ed and elem ed init lic only; S-N only)
Students spend full days in the elementary classroom gradually assuming responsibility for teaching the class. Students prepare a portfolio based on criteria given. One seminar per week.

CI 5183. Applying Instructional Methods in the Elementary Classroom. (1-2 cr [max 8 cr]; SP–Foundations of ed major or elem ed init lic only; S-N only)
Supervised experience in elementary classrooms.

CI 5186. School-Related Projects. (1-4 cr; SP–M.Ed. student; A-F only)
Research or evaluation project related to teaching, curriculum, or other aspect of schooling. Approved and supervised by faculty advisor.

CI 5187. Practicum: Improvement of Teaching in Elementary or PreKindergarten Schools. (2-3 cr; SP–M.Ed. student in elem or early childhood ed; S-N only)
Elementary school classroom teaching project designed to improve specific teaching skills. Approved and directed by adviser.

CI 5190. Directed Individual Study in Curriculum and Instruction. (1-6 cr [max 12 cr]; SP–Grad students only)
Directs students to individual studies that focus on producing and evaluating curriculum materials; literature review of issues and problems; and assessing curriculum processes.

CI 5251. Social and Philosophical Foundations of Early Childhood Education. (3 cr; SP–[M.Ed. student in ECE or ECSE] or #; A-F only)
Surveys imagery, history, philosophy, and psychology of early childhood education. Analyzing/interpreting trends in early education, including diversity, special needs, legislation, public policy, and educationally appropriate practice.

CI 5252. Facilitating Social and Physical Learning in Early Childhood Education. (3 cr; SP–M.Ed. student in early childhood ed or in early childhood special ed)
Current theoretical/empirical literature and developmental knowledge as basis for planning, implementing, and evaluating social/physical growth/development of young children. For students obtaining ECE/ECSE licensure.

CI 5253. Facilitating Cognitive and Creative Learning in Early Childhood Education. (3 cr; SP–M.Ed. student in early childhood ed or early childhood special ed; A-F only)
Overview of cognitive, creative, and language characteristics of children ages 0-8 years and of how teachers can plan curriculum to facilitate children's development in these areas.

CI 5281. Student Teaching in Early Childhood Education. (3-6 cr; SP–M.Ed. student in early childhood ed or early childhood special ed; S-N only)
Application of theory/research relating to teaching preschool children. For individuals obtaining ECE licensure.

CI 5330. Topics in Instructional Systems and Technology. (1-3 cr)
Topics related to needs of in-service teachers. Topics, location, credits, and duration are flexible.

CI 5331. Introduction to Instructional Systems and Technology. (3 cr)
Orientation to the field to examination of various issues affecting the use of technology. Advanced students identify research topics for investigation in future courses and identify key literature in the field in preparation for masters and doctoral examinations.

CI 5336. Planning for Multimedia Design and Development. (3 cr)
Theory, research, practice in instructional design. Generic components of instructional design process. Applying principles to design/development of computer-based instructional materials.

CI 5337. Planning for K-12 Technology Design and Integration. (3 cr; SP–Able to use various instructional computing tools)
Applying principles of instructional design to development of technology-enhanced teaching in K-12 schools. Students create proposal for program/course or lesson development, using basic design principles, technology.

CI 5351. Technology Tools for Educators. (3 cr; SP–Basic knowledge of Macintosh operating system and a word processing program; A-F only)
Develop skills in using selected technology applications to support teaching and learning. Internet applications, presentation software, multimedia authoring tools, desktop publishing software, Web page creation. May also include a field-site project.

CI 5361. Teaching Via the Internet. (3 cr)
Examination of the capabilities of the Internet for professional development and instructional use. Use of specific client/server software for accessing the Internet; instructional issues and opportunities; implications for K-12 student involvement and classroom management; and Web page development by teachers and their students. Previous experience with computers desirable.

CI 5362. Introduction to Educational Multimedia. (3 cr; SP–Familiarity with basic computer operations)
Issues influencing design/development of educational multimedia for CD-ROM/Internet delivery. Hardware/software for CD-ROM, Web-based delivery. Design, development, project management.

CI 5363. Introduction to Computer-Based Instructional Design. (3 cr; A-F only)
Learn to design and develop computer-based instructional materials using a state of the art authoring language. Introduction to principles of courseware design; multimedia components in instruction; development of computer courseware using the authoring language; tutorial design.

CI 5364. Computer-Based Instruction: Games and Simulation. (3 cr; SP–5363; A-F only)
Principles and procedures of computer simulation and game design. Types of computer simulation, the components common to simulation design, and the theory underlying educational simulation design.

CI 5367. Interactive Multimedia Instruction. (3 cr; SP–Knowledge of principles and procedures of CBI design and one multimedia authoring system; A-F only)
Principles of effective computer-based design; tools in multimedia development; contemporary issues and skills used in the design, development, and implementation of interactive multimedia instruction. Use multimedia development tools, create a multimedia portfolio, and investigate the issues surrounding their effective use.

CI 5391. Technology in the Postsecondary Development Curriculum. (3 cr)
Examines ways in which use of technology is transforming learning environments, teaching practices, and the curriculum in developmental education for postsecondary students. Course taught on-line.

CI 5401. Literature for the Elementary School. (3 cr; SP–Children's lit course or #; A-F only)
Evaluative survey of books for children; research related to children's reading interests; selection of literature for themed instruction.

CI 5402. Introduction to Special Collections. (2-4 cr; SP–Children's lit course; A-F only)
Special collections of children's literature as research material. Study of manuscripts, original art, and letters. Materials from the Kerlan Collection in Walter Library will be available.

CI 5403. Creative Writing For and By Children. (2-4 cr; SP–Children's lit course or #; S-N only)
Creative aspects of writing and illustrating children's literature and children's own writing. Features authors and illustrators of children's books.

CI 5410. Special Topics in the Teaching of Literacy. (1-3 cr)
Topics related specifically to the needs of in-service teachers. Topics, location, credits, and duration will be highly flexible.

CI 5411. Teaching Reading in the Elementary School. (3 cr; A-F only)
Aids the in-service elementary classroom teacher in the development of knowledge of theory and practice in the teaching of reading.

CI 5412. Reading Difficulties: Instruction and Assessment. (3 cr; SP–5411 or 5451; A-F only)
Causes, diagnosis and assessment, prevention and correction; intervention practices useful to the classroom teacher and special teacher of reading.

CI 5413. Teaching Students with Reading Difficulties. (3 cr; SP–5412; A-F only)
Assessment and tutoring of individual children who have difficulty reading in school.

CI 5415. Literacy Development in the Primary Grades. (3 cr; SP–Elem teaching exper or #; A-F only)
Integration of skill and aesthetic activities in graded and non-graded primary classroom settings. Use national and state language arts standards and statewide assessment protocols to examine elementary literacy curricula.

CI 5416. Literacy Development in the Intermediate Grades. (3 cr; SP–Elem teaching exper or #; A-F only)
Theory and practice of integrated teaching of reading, literature, writing, and language.

CI 5418. Whole Language Teaching and Learning in the Elementary School. (3 cr; SP–M.Ed. or grad student, minimum one yr teaching exper; A-F only)
Theory, research, and politics of whole language teaching. Applications for developing an elementary school whole language curriculum.

CI 5422. Teaching Writing in the Elementary School. (3 cr; SP–Init lic or M.Ed. or grad student; A-F only)
Theory of and research on the writing process. Applications to developing an elementary school writing curriculum.

CI 5424. Reading, Language Arts, and Literature: Primary. (3 cr; SP–Elem ed init lic only; A-F only)
Curricular and methodological issues of reading, language arts, and children's literature. Major topics include emergent literacy, reading process, strategy instruction for word recognition and comprehension, methods of word recognition, authentic assessment strategies, and teaching diverse students.

CI 5441. Teaching Literature in the Secondary School. (2-3 cr; SP–Fall, English init lic only, 2 cr; other sections, 3 cr; A-F only)
Current theories of teaching literature; critical approaches to analyzing literature; theory and research on response to literature; adolescent literature and reading interests; methods for devising response activities and units; incorporating multicultural literature; relating media and literature; linking writing of literature to understanding literature; designing literature curriculum; evaluating and assessing students' growth in literary response.

CI 5442. Literature for Adolescents. (3 cr; A-F only)
Characteristics of literature written for adolescents; rationale for using adolescent literature; adolescents' reading interests and attitudes; analysis of quality and appeal; individualized reading programs; methods of promoting reading; multicultural literature; developing teaching activities.

CI 5451. Teaching Reading in Content Areas. (3 cr; SP–Fall, English init lic only; A-F only)
Methods of accommodating to students' abilities and facilitating reading in regular content classes.

CI 5461. Teaching Composition in the Secondary School and College. (3 cr; SP–Spring, English init lic only; A-F only)
Current theories of composition instruction, methods for teaching various composing processes within social contexts, uses of informal writing, linking reading and writing, describing and evaluating features of student writing, using and modeling conference strategies, using computer-mediated software, teaching writing of fiction and non-fiction, grammar and writing, editing instruction, writing assessment, uses of portfolios.

CI 5462. Evaluating and Assessing Writing. (3 cr; SP–5461; A-F only)
Methods of evaluating writing; identifying rhetorical and linguistic features of and explaining difficulties in writing; strategies for giving descriptive feedback to informal and formal writing; training for peer conferences; strategies for portfolio writing evaluation and assessment; methods for conducting large-scale writing assessments; issues of validity and reliability with writing assessments with particular application to the Minnesota Graduation Standards basic skills writing test.

CI 5472. Teaching Film, Television, and Media Studies. (3 cr; A-F only)
Methods of teaching film, video, and media studies at the secondary and college level; methods for eliciting critical responses; analysis of film/video techniques; analysis of cultural representations and genre characteristics; connecting and comparing film/video and literature; studying documentary and television news; developing media studies units.

CI 5481. Developments in Teaching English and Speech. (2 cr; SP–English init lic; A-F only)
Current theories of English/speech curriculum. Teaching oral language. Organizing curriculum. Linking components of English/speech curriculum. Reflecting on pre-student-teaching experience.

CI 5482. Reading, Language Arts, and Literature: Intermediate. (3 cr; SP–Elem ed init licensure only; A-F only)
Aids the preservice teacher in understanding theory and practice in the teaching of reading to students in the upper elementary grades.

CI 5496. Directed Experiences in Teaching English. (8 cr; SP–M.Ed./init lic students in English ed only; S-N only)
Student teaching/clinical experience for English post-baccalaureate students only.

CI 5500. Special Topics: Outdoor Science Education. (1-8 cr [max 8 cr]; SP–Elem tchg exper)
Classroom and fieldwork activities aimed at increasing the knowledge and interest of students in teaching outdoor in all seasons. Topics include snow and ice ecology, the timber wolf and white-tailed deer, pond ecology, Twin Cities' geology, trees and plants of Minnesota, and stargazing.

CI 5501. Teaching Science and Health in the Elementary School. (2 cr; SP–Elem ed init licensure only; A-F only)
Methods and materials for teaching science and health at the elementary school level.

CI 5504. Elementary School Science: Materials and Resources. (3 cr; SP–Elem tchg exper or #)
Examination of the teacher's role in inquiry teaching; the current science curriculum; and resources for teaching science in the elementary school.

CI 5531. Teaching Middle School Science. (4 cr; SP–Init lic student in science ed; A-F only)
Methods of planning/teaching science to middle school students.

CI 5532. Teaching Secondary School Science. (4 cr; SP–Admission to init lic program in science; A-F only)
Methods of planning and teaching science for secondary school students.

CI 5533. Current Developments in Science Teaching. (3 cr; SP–[M.Ed., init lic, grad student] or #; A-F only)
Using curriculum standards to design science courses.

CI 5534. Studies in Science Education. (3 cr; SP–M.Ed., init lic, or #; A-F only)
Improvement of science teaching through the application of research findings.

CI 5535. Foundations of Science Education. (3 cr; SP–[M.Ed., grad student] or #; A-F only)
Analysis of present science teaching practices in light of historical and philosophical foundations of science education.

CI 5536. Advanced Methods of Teaching and Assessment in Science. (3 cr; SP–[M.Ed. or grad] student or #)
Development/teaching of extended science activities: structured controversies, field-based activities, service learning projects, computer-based investigations. Development of authentic assessments, students' portfolios based on national/state guidelines.

CI 5540. Special Topics: Science Education. (1-8 cr [max 8 cr])
Detailed examination and practice of the teaching of one area of science (e.g. geology, health, physical science) or one method of instruction (e.g. laboratories, demonstrations, Internet, simulations).

CI 5596. Clinical Experience in Middle School Science. (4 cr; SP–Init lic in science ed; A-F only)
Supervised clinical experience in middle school science teaching.

CI 5597. Clinical Experience in Secondary School Science Teaching. (4-8 cr; SP–Init lic or #; S-N only)
Supervised clinical experience in secondary school science teaching.

CI 5619. Teaching Second Languages and Cultures in Elementary Schools. (3 cr)
Methods and materials for ESL and foreign languages; development of oral and written communication in a second language; alternatives in second-language program format; global awareness and cross-cultural

experience; assessment of children's language; children's literature, games, and songs; planning and development of units and lessons.

CI 5631. Second Language Curriculum Development and Assessment. (3 cr; SP–SLC init lic only; A-F only)
Developing skills for selecting, organizing, providing, and assessing effective second language learning opportunities through study, practice, and reflection.

CI 5632. Communication and Comprehension in Second Language Classrooms. (3 cr; SP–SLC init lic only; A-F only)
Comprehension and communication processes in a second language focus on listening, speaking, reading and writing; techniques for initial to advanced literacy instruction; fundamental principles of effective second language instruction; the relationship of culture to proficiency in the four modalities; traditional and alternative approaches to assessing language proficiency; use of technology to enhance instruction.

CI 5634. Content-Based Instruction in Second Language Settings. (3 cr; SP–SLC init lic only; A-F only)
Content-based language instruction: principles, models and methods; learning strategy instruction; developing content-based language curriculum; traditional and alternative approaches to assessing cognitive-academic language proficiency; use of technology to enhance content-based instruction.

CI 5635. Culture and Diversity in Second Language Classrooms. (3 cr; SP–Init lic program only)
Developing skills for teaching a diverse student population in both foreign language and English as a second language instructional settings through study, practice, and reflection.

CI 5642. The Assessment of Learners with Limited English Proficiency. (3 cr; A-F only)
Explores policies, procedures, and instruments in use in assessing the English language proficiency and academic readiness of limited English proficient students in American public schools; academic competence, bilingualism and special needs populations; alternative assessment; preparation of students for mainstream classrooms.

CI 5644. Working with Linguistically and Culturally Diverse Students in the Mainstream Classroom. (1 cr)
Benefits and challenges of working with linguistically and culturally diverse students; instructional practices and strategies; issues related to language learning, cultural considerations, and integration of culturally and linguistically diverse learners in the classroom.

CI 5646. Understanding and Teaching English Grammar. (3 cr; SP–Ling 5001 or #)
English syntax from pedagogical perspective. Grammatical structures that challenge ESL learners. Analyzing learner errors. Issues/activities related to teaching grammar in ESL contexts.

CI 5651. Foundations of Second Languages and Cultures Education. (3 cr; A-F only)
Historical overview of second language teaching and learning in the U.S. Exploration of second language instructional settings across multiple contexts: elementary and secondary options for foreign language, bilingual education, immersion language programs, and English as a second language programs. Theoretical frameworks for language instruction are tied to practice.

CI 5652. Integrating Culture in the Second Language Classroom. (3 cr)
Exploration of culture in second language contexts. Rationale for and process of implementing cultural awareness, culture learning, and the integration of language and culture instruction as integral to effective second language development.

CI 5656. Reading and Writing in a Second Language. (3 cr; A-F only)
Reading comprehension and composing processes in a second language; relationship between first and second language comprehension and composing processes; relationship between reading and writing; relationship of culture to reading comprehension and writing; politics of literacy; assessment of second language reading comprehension and writing proficiency; using technology to enhance literacy instruction.

CI 5657. Speaking and Listening in a Second Language. (3 cr; A-F only)
Theories and methods in teaching language as communication in oral and aural modes; planning student interaction; classroom organization for oral language learning and acquisition; using technology to enhance interaction; assessment of listening comprehension and oral communication.

CI 5658. Second Language Testing and Assessment. (3 cr; A-F only)
Aligning second language classroom instruction and assessment; fundamental concepts in language assessment; traditional and alternative approaches to assessing proficiency in speaking, listening, reading, writing; creation of formative and summative assessments; critique of common assessment instruments.

CI 5660. Special Topics in the Teaching of Second Languages and Cultures. (1-3 cr [max 3 cr])
Topics related specifically to the needs of the in-service teacher. Topics, location, credits, and duration are flexible.

CI 5662. Issues in Second Language Curriculum Design. (3 cr; A-F only)
Historical overview of curriculum development in second language education; contexts that influence curriculum development; models for curriculum development in second language settings; politics of curricular reform; national and state standards and implications for curriculum development; effects of technology on second language curriculum.

CI 5693. Directed Study in Second Languages and Cultures. (1-4 cr; SP–#)
Individual or group work on curricular, instructional, or assessment problems.

CI 5696. Practicum: Teaching World Languages and Cultures in Elementary Schools. (2 cr; SP–5619, adviser approval; credits cannot be counted on a graduate degree program for endorsement candidates)
Teaching and learning experiences in Second Languages and Cultures at the elementary-school level. Requires students to work in a public school setting.

CI 5697. Practicum: ESL in the Elementary School. (2 cr; SP–5619, adviser approval)
Teaching and learning experiences in an English as a Second Language setting at the elementary school level. Requires students to work in a public school setting.

CI 5698. Student Teaching in Second Languages and Cultures. (2 cr; SP–Adviser approval; credits cannot be counted on a graduate degree program)
Student teaching in Second Languages and Cultures at the secondary level for teachers already licensed in another field. Requires students to work in a public school setting.

CI 5699. Clinical Experiences in Second Languages. (6-8 cr; SP–SLC init lic program only; A-F only)
Teaching and learning experiences in elementary and secondary second language instructional settings. Includes a seminar held concurrently to support the student teaching experience.

CI 5701. Teaching Social Studies in the Elementary School. (2 cr; SP–5111 or equiv, elem ed init lic only; A-F only)
Content and organization of elementary social studies programs; programs of understanding, improving the learning situation, and effective use of materials.

CI 5731. Social Studies for the In-Service Elementary/Middle School Teacher. (3 cr; SP–Elem/middle school teaching exper or #; A-F only)
Content and organization of elementary and middle school social studies programs. Understanding and improving the teaching-learning situation through the analysis of current trends and issues in the field. Integration with other subject areas where appropriate.

CI 5741. Introduction to Social Studies Education. (3 cr; SP–Social studies init lic student; A-F only)
Broad issues and themes related to social studies education, including societal context, rationale, and scope and sequence. Analysis and evaluation of selected teaching strategies, methods, and resources.

CI 5742. Advanced Methods of Teaching the Social Studies. (3 cr; SP–Secondary social studies init lic student; A-F only)
Focus on developing a repertoire of instructional methods that support authentic pedagogy and assessment. Enhancing reading comprehension and writing skills in the social studies.

CI 5743. The Social Sciences and the Social Studies. (2 cr; SP–Secondary social studies init lic student; A-F only)
Development of instructional strategies and contexts for exploring the social sciences as disciplines at the secondary level; central concepts and generalizations; tools of inquiry; competing structures and theories; and the relative impact of multicultural and gender-fair perspectives on the nature of history and the social sciences.

CI 5744. Seminar: Reflecting on Professional Development in Social Studies Education. (1 cr; SP–Secondary social studies init lic student; A-F only)
Emphasis on reflecting on the teaching experience, developing a professional identity, and refining teaching skills.

CI 5747. Global and Environmental Education: Content and Practice. (3 cr; A-F only)
Prepares educators for leadership responsibilities in the area of global environmental education. Focus on the knowledge and process skills necessary to carry out a leadership role in the curriculum.

CI 5761. Social Studies Education for the In-service Middle/Secondary Teacher. (3 cr)
Trends and issues in social studies education. Current developments and controversies in social studies pedagogy, curriculum, and assessment.

CI 5762. Developing Civic Discourse in the Social Studies. (3 cr; SP–M.Ed. or grad student; A-F only)
Philosophies, strategies, and research on developing civic discourse in the secondary social studies classroom: selecting issues, developing a democratic classroom climate, relating to social and cultural contexts. Applicable to all of the social sciences.

CI 5765. Teaching About Newspapers in the Classroom. (3 cr)
Use of daily newspaper in the classroom. Instructional strategies, curriculum development techniques, and teaching materials useful in teaching about newspaper in elementary/secondary classrooms.

CI 5782. Clinical Experiences in Teaching Social Studies. (1-8 cr [max 16 cr]; QP–M.Ed./init lic student; SP–Social studies postbac student; S-N only)

CI 5821. Teaching Mathematics in the Elementary School. (2 cr; SP–Elem ed init lic only; A-F only)
Principles of learning pertinent to the modern program of mathematics in elementary grades. Objectives, content, philosophy, instructional materials, and methods of instruction and evaluation.

CI 8075. Seminar: Art Education. (2 cr; SP–Educ grad student or #; A-F only)
Reports, evaluation of problems, and review of recent literature.

CI 8079. Research in Art Education. (3 cr; SP–Educ grad student or #; A-F only)
Current research agenda. Helps students identify research questions and choose appropriate methodologies.

CI 8095. Problems: Art Education. (1-12 cr [max 12 cr]; SP–Grad art educ major or #)
Independent research under faculty guidance; may include advanced studio practice and educational issues requiring a research methodology.

CI 8111. Representations of Knowledge in Curriculum and Culture. (1-3 cr [max 3 cr]; SP–CI grad student or #)
Overview of research and theory on sociology of knowledge and education. Conceptions of knowledge in curriculum; connections between cultural conditions and curriculum design and implementation; influence of national political agendas, population, the mass media, and textbooks on curriculum in diverse educational settings.

CI 8115. Curriculum and Achievement Outcomes in a Diverse Society. (3 cr; SP–Doctoral student; A-F only)
Analysis of American public school experiences for students of African-American, Hispanic, Asian, and American Indian background; social, political, regional, and educational variables that influence student outcomes; perspectives concerning ethnic student achievement; factors influencing school achievement, and prospects for change.

CI 8121. Curriculum Change: Perspectives, Processes, and Participants. (3 cr; SP–CI grad student or #)
Examination of curriculum within educational organizations; educational organization as mediator and transmitter of societal/cultural perspectives; implications of organizational context for curriculum change, change processes, and change participants.

CI 8127. Curriculum Theory and Research: Alternative Paradigms and Research Methods. (3 cr; SP–CI grad student or #)
Traditions of inquiry, exemplary studies, and associated research methods; survey and assessment of topics and methods as applied to curriculum questions; and relationships between theory and research.

CI 8131. Curriculum and Instruction Core: Critical Examination of Curriculum in Context. (3 cr; SP–CI Ph.D. student; A-F only)
Central concepts, ideas, and debates in professional field of curriculum. Critical discussion about curriculum in general education to lay a foundation for student research and innovation in a particular school subject or related field.

CI 8132. Curriculum and Instruction Core: Teaching Theory and Research. (3 cr; SP–CI Ph.D. student; A-F only)
Overview of research on teaching: historical perspective, modern research and findings, and implications for practice and future research.

CI 8133. Research Methods in Curriculum and Instruction. (3 cr; SP–CI Ph.D. student; A-F only)
Survey of educational research methods and comparison of underlying assumptions and procedures.

CI 8148. Conducting Qualitative Studies in Educational Contexts. (3 cr; SP–CI M.A. or Ph.D. student or #)
Introduction to use of qualitative research methods. Ethnography, sociolinguistics, symbolic interactionism. Emphasizes observation.

CI 8161. Planning a Research Experience I. (2 cr; SP–8133, CI Ph.D. student or #)
Designing research questions, initiating literature reviews, and selecting a research methodology.

CI 8162. Planning a Research Experience II. (2 cr; SP–8133, CI Ph.D. student or #)
Development of research methodology, data collection devices, and processes for successful research.

CI 8181. Seminar in Teaching in Colleges of Education. (3 cr; SP–CI Ph.D. student or #)
Goals, instructional strategies, evaluation procedures, and professional considerations.

CI 8195. Problems: Improvement of Instruction. (1-6 cr [max 6 cr]; SP–#)
Independent research in curriculum and instruction.

CI 8196. Practicum in Teaching in Colleges of Education. (1 cr; SP–8181)
Supervised teaching in an education course at the University of Minnesota or other college or university.

CI 8197. Problems: Curriculum Studies. (1-4 cr [max 8 cr]; SP–M.A. student; A-F only)
Directs students to completing Plan B paper for M.A. degree.

CI 8198. Problems: Teacher Education. (1-6 cr [max 12 cr]; SP–#)
Independent research.

CI 8361. Advanced Courseware and Design: Issues. (3 cr; A-F only)
Examination and critique of existing research. Students identify a research topic, write a literature review, plan a study, and present a research proposal.

CI 8391. Instructional Systems Seminar. (1-3 cr [max 6 cr]; SP–CI grad student or #)
Topics related to needs of the in-service teacher; topics, location, credits, and duration are highly flexible.

CI 8395. Problems: Instructional Systems. (1-6 cr [max 12 cr]; SP–#)
Independent research.

CI 8400. Special Topics in Children's and Young Adult Literature. (1-6 cr [max 6 cr]; SP–Grad course in children's or young adult lit)
Overview of research and issues. Study of original manuscripts and artwork for children's books; research in child and young adult response to literature. Topics vary by offering.

CI 8410. Special Topics in Reading Research and Instruction. (1-6 cr [max 6 cr]; SP–#)
Research at all levels; topics vary by offering and may include research designs, trends, and specific studies.

CI 8412. Research in Reading. (3 cr; SP–#)
Significant literacy research; critical analysis of methodology and findings, appraising research methods, population limitations, and educational implications.

CI 8421. Research in Composition. (3 cr; SP–#)
Theories and methods. Research designs: experimental, case study, descriptive, qualitative, ethnographic. Methods for: writing in social contexts, teaching and evaluating writing, and rhetorical, linguistic, and discourse analysis of written texts. Validity and reliability in coding and rating; portfolio and large-scale writing assessments.

CI 8470. Special Topics on Literacy. (1-6 cr [max 6 cr]; SP–CI Ph.D. student or #)
Current theories and research on literacy and literacy development; alternative methods of conducting literacy research; implications for literacy instruction.

CI 8492. Readings in English Education and Reading. (1-2 cr [max 10 cr]; SP–#)

CI 8495. Problems: Teaching English and Reading. (1-6 cr [max 6 cr]; SP–#; A-F only)
Individual research.

CI 8511. Seminar: Research in Science Education. (1 cr [max 6 cr]; SP–CI grad student or #)
Students and faculty present research projects for comment and critique. Special topics may also be considered.

CI 8570. Advanced Topics in Science Education. (1-4 cr [max 4 cr]; SP–CI grad student or #; A-F only)
Examination and critique of current research topics, methods, and issues.

CI 8594. Conducting Research in Science Education. (3 cr; SP–Sci educ research course)
Application of research methodology to a specific science education issue.

CI 8595. Problems: Science Education. (1-6 cr [max 12 cr]; SP–CI grad student or #)
Independent research.

CI 8631. Research Seminar I: Second Languages and Cultures Education. (3 cr; SP–8133; A-F only)
Students explore a research topic through readings, seminar discussions, conducting an actual study, and peer critique of work.

CI 8632. Research Seminar II: Second Languages and Cultures Education. (3 cr; SP–8631; A-F only)
Students complete data analyses and prepare written report on an original study as well as offer peer critique of work.

CI 8650. Seminar: Special Topics in Second Languages and Cultures Research. (1-3 cr [max 3 cr]; SP–CI grad student or #)
Research topics vary.

CI 8691. Readings in Second Languages and Cultures Education. (1-3 cr [max 3 cr]; SP–#)
Independent reading.

CI 8695. Problems: Second Languages and Cultures Education. (1-6 cr [max 12 cr]; SP–#)
Independent research.

CI 8742. Seminar: Research in Social Studies Education. (2 cr; SP–CI grad student or #; A-F only)
Critical review and analysis of seminal research studies; criteria for appraising research findings; educational implications.

CI 8795. Problems: Social Studies Education. (1-6 cr [max 12 cr]; SP–CI grad student or #)
Independent research.

CI 8796. Research Internship in Social Studies Education. (1-6 cr [max 6 cr]; SP–CI grad student; A-F only)
Internship with social studies education faculty member; experience in collecting and analyzing data; drafting and presenting reports; writing for publication.

Dance (Dnce)

Department of Theatre Arts and Dance

College of Liberal Arts

Dnce 5010. Modern Dance Technique 7. (2 cr [max 4 cr]; SP–Δ; audit registration not permitted)
Continuation of technical development. Performance range/style. Students study with various guest artists.

Dnce 5020. Modern Dance Technique 8. (2 cr [max 4 cr]; SP–5010 or Δ; audit registration not permitted)
Continuation 5010. Performance range/style. Students study with various guest artists.

Dnce 5110. Ballet Technique 7. (2 cr [max 4 cr]; SP–Δ; audit registration not permitted)
Continuation of ballet technique. Musicality, performance, stylistic differences. Practical work conducted within context of choreographic/aesthetic development of ballet.

Dnce 5120. Ballet Technique 8. (2 cr [max 4 cr]; SP–5110 or Δ; audit registration not permitted)
Continuation of 5110. Musicality, performance, stylistic differences. Practical work conducted within context of choreographic/aesthetic development of ballet.

Dnce 5210. Jazz Technique 7. (1 cr [max 2 cr]; SP–Δ; audit registration not permitted)
Continuation of jazz technique. Syncopation, performance projection. Specific styles: swing, bebop, lyrical, funk, latin.

Dnce 5220. Jazz Technique 8. (1 cr [max 2 cr]; SP–5210 or Δ; audit registration not permitted)
Continuation of 5210. Syncopation, performance projection. Specific styles: swing, bebop, lyrical, funk, latin.

Dnce 5500. Topics in Dance. (1-2 cr [max 10 cr])
Topics specified in *Class Schedule*.

Dnce 5700. Performance. (2 cr [max 18 cr]; SP–¶technique course, Δ)
Technique, improvisation, choreography, music, design, and technical production as they relate to dance performance.

Dnce 5858. Teaching Dance. (4 cr; SP–1020, Δ or #)
Methods, principles, and techniques of teaching dance.

Dnce 5970. Directed Studies. (1-4 cr [max 10 cr]; SP–#, Δ, ❑)
Guided individual study.

Dentistry (Dent)

School of Dentistry

Dent 8031. Topics and Problems in Dental Education. (1-3 cr)
Independent study in student learning, instructional development, curriculum planning, student testing and evaluation, and academic administration, where these areas and their interfaces are applied directly to professional dental education. Provides opportunity for applying and extending concepts learned in Dent 7033.

Dent 8090. Evidence-based Clinical Pediatric Dentistry. (2 cr; A-F only)
Selected pediatric dentistry topics. In-depth literature review, seminar discussion.

Dent 8091. Interdisciplinary Care of the Cleft Palate Patient. (1 cr; S-N only)
Comprehensive surgical, dental, and speech and hearing evaluation and management of patients with cleft lip and palate.

Dent 8100. Topics in Advanced Periodontology: Literature Review. (2 cr)
State-of-the-art information on a variety of topics concerning risk factors and therapeutic modalities for periodontal disease.

Dent 8101. Dental Implantology: A Multidisciplinary Approach. (2 cr)
Dental implant therapy from perspective of several dental disciplines.

Dent 8120. Advanced Principles and Techniques of TMJ and Orofacial Pain Disorders. (3 cr; SP–Participation in TMJ and orofacial pain advanced education program; A-F only)
Interdisciplinary study of theory, principles, epidemiology, and mechanisms associated with TMJ and craniofacial pain disorders and a basis for scientific understanding of diagnostic and management strategies for them.

Dent 8121. Current Literature in TMJ and Craniofacial Pain. (1 cr; A-F only)
Review of current literature and of how it relates to past literature, theories on pain, and philosophies of management.

Dent 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Dent 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Dermatology (Derm)

Department of Dermatology
Medical School

Derm 8225. Clinical Dermatology. (7 cr)

Derm 8226. Clinical Seminar. (1 cr)

Derm 8227. Histology of the Skin. (1 cr)

Derm 8230. Functional Biology of the Skin. (1 cr)

Derm 8232. Seminar: Dermatologic Histopathology and Mycology. (1 cr)

Design, Housing, and Apparel (DHA)

Department of Design, Housing, and Apparel
College of Human Ecology

DHA 5111. History of Decorative Arts. (4 cr; QP–General art history survey course or #; SP–General art history survey course or #; A-F only)
In depth study of textiles, ceramics, metal, and glass from selected historical periods. Focus on the Goldstein Gallery collections.

DHA 5170. Special Topics in Design, Housing, and Apparel. (1-4 cr [max 8 cr]; QP–Depends on topic, check with dept; SP–Depends on topic, check with dept; A-F only)
In-depth investigation of a single specific topic, announced in advance.

DHA 5193. Directed Study in Design, Housing, and Apparel. (1-4 cr; QP–#; SP–#; A-F only)
Independent study in design, housing, and apparel under tutorial guidance.

DHA 5196. Field Study: National/International. (1-10 cr [max 10 cr]; QP–#; SP–#; A-F only)
Faculty-directed field study in a national or international setting.

DHA 5216. Textile and Apparel Consumer. (3 cr; QP–3216 or #; SP–1201, 2213 or #; A-F only)
Consumer actions concerning textile/clothing products for home (and other physical interiors) and personal use as a part of daily living in different social, economic, and cultural settings, nationally and internationally.

DHA 5381. Digital Illustration. (3 cr; QP–5334, DHA major; SP–4334, [DHA major or grad student]; A-F only)
Integration of design with computer applications. Use of raster-/vector-based programs for illustration.

DHA 5382. Digital Sound and Video. (3 cr; QP–[5334, DHA major] or #; SP–[4334, [DHA major or grad student]] or #; A-F only)
Design solutions involving time-based media. Emphasizes sound/video. Electronic publishing via Internet.

DHA 5383. Modeling and Animation. (3 cr; QP–[5334, DHA major] or #; SP–[4334, [DHA major or grad student]] or #; A-F only)
Three dimensional modeling/animation in electronic design communication.

DHA 5385. Internet-Based Media. (3 cr; QP–[5334, DHA major] or #; SP–[4334, [DHA major or grad student]] or #; A-F only)
Designing interactive presentations (using various operating systems) for Internet/Web. Electronic publishing. Development of internet-based communication.

DHA 5388. Design Planning, Analysis, and Evaluation. (3 cr; QP–[3353, DHA major] or grad or #; SP–[4354, DHA major] or grad or #; A-F only)
Preliminary research, including theoretical, applied, and legal aspects. Planning/developmental models. Design prototyping, testing, and analysis.

DHA 5399W. Theory of Electronic Design. (3 cr; QP–[DHA major, sr] or grad or #; SP–[DHA major, sr] or grad student or #; offered alternate yrs; A-F only)
Theories, methodologies, histories of electronic design, its impact on visual communications. Digital artifacts, processes, paradigms.

DHA 5463. Housing Policy. (3 cr; QP–3463; SP–2401, 2463 or #; A-F only)
Explore the institutional and environmental settings that make up housing policy in the United States. Examine competing ideas about solving the nation's housing problems through public intervention in the market. Federal and local public sector responses to housing problems will be evaluated.

DHA 5467W. Housing and the Social Environment. (3 cr; QP–1400 or #; SP–2401 or #; A-F only)
Housing choices are explored in the context of the social environment with an emphasis on the special needs of the elderly, disabled, minorities, large families, female-headed households, and low-income households.

DHA 5481. Housing for the Elderly and Special Populations. (3 cr; QP–1400 or #; SP–2401 or #; A-F only)
Introduction to the changing housing needs of individuals and families across the life span. Particular emphasis will be on housing needs of children, older adults, and persons with disabilities.

DHA 5484. Rural Housing Issues. (3 cr; QP–3463; SP–2401, 2463 or #; A-F only)
Housing issues in nonmetropolitan areas. The housing concerns of specific rural populations (e.g., low income, elderly persons, American Indians, migrant workers) are identified and comparisons with urban housing issues are made.

DHA 8101. Philosophical Foundations of Design, Housing, and Apparel. (4 cr; A-F only)
The nature of thought underlying and within professional areas of the field.

DHA 8103. Methodological Orientations: Qualitative Research. (3 cr; A-F only)
Assessment of field research methods relevant to research regarding material culture. Relationship of selected research problem (and its theoretical framework) to practical problems of fieldwork. Rationale and plan for appropriate field methods of data collection.

DHA 8111. Analysis of Design Literature. (3 cr; A-F only)
Classic and contemporary literature; visualization, creativity, and design methods literature.

DHA 8112. Design Theory and Criticism. (3 cr; A-F only)
Students establish a framework for criticism by examining various theories used in design disciplines, study existing designed environments to explain the designer's purpose, identify problem-solving processes, and describe interaction between humans and design. Field investigations.

DHA 8113. Education and Evaluation in Design Studios. (3 cr; A-F only)
Educational processes and methods used in design studio courses. Learning styles, team projects, criticism, evaluation, and curriculum development.

DHA 8114. Design Studio. (4 cr; SP–#; A-F only)
Advanced problem analysis, design solution.

DHA 8164. Innovation Theory and Analysis. (3 cr; A-F only)
Theories and factors that influence adoption and diffusion of designed products. Methodologies used in analysis of diffusion process.

DHA 8170. Topics in Design, Housing, and Apparel. (1-3 cr [max 6 cr]; SP–Varies with topic; A-F only)
In-depth investigation of a topic announced in advance.

DHA 8180. Professional Seminar in Design, Housing, and Apparel. (1-2 cr [max 4 cr]; A-F only)
Professional development issues and trends.

DHA 8181. Ethics and Research. (1 cr; SP–Grad student; S-N only)
Overview of ethical concerns/questions in conducting/disseminating research. Mentoring relationships, use of human subjects, data handling, plagiarism, authorship, publishing, research funding, social responsibility of researchers, code of conduct.

DHA 8192. Readings in Design, Housing, and Apparel. (1-3 cr [max 8 cr]; SP–#; A-F only)
Independent study and review of books and periodicals under tutorial guidance.

DHA 8193. Directed Study in Design, Housing, and Apparel. (1-3 cr [max 8 cr]; SP–#; A-F only)

DHA 8222. Plan B Master's Project. (3 cr; QP–DHA master's student; SP–DHA master's student, #; S-N only)
Plan B master's project.

DHA 8262. Writings on Dress: Historical Perspectives. (3 cr; A-F only)
Dress as a significant factor in human interaction prior to 1940. Early social science and philosophical writing, beginning with Montaigne in 1537. These perspectives appraised for relevance to current research and theory.

DHA 8263. Writings on Dress: Contemporary Themes. (3 cr; QP–8101; SP–8101 or #; A-F only)
Current conceptualizations and thematic areas in literature of textiles and apparel.

DHA 8265. Dress: Race, Class, and Gender. (3 cr; SP–4212 or #; A-F only)
Dressing the body as a sociocultural and personal expression of an individual's identity. Gender, race, and class differences in apparel explored to understand the global market, international and niche retailing, as related to clothing practices.

DHA 8266. Aesthetic Concepts Related to Apparel Design. (3 cr; SP–Grad DHA major or #; A-F only)
Aesthetics of dress; application of a framework for visual analysis and evaluation.

DHA 8267. Dress and Culture. (3 cr; SP–4212 or #; A-F only)
Cultural factors of identity expressed through dress. Focuses on issues of cultural diversity through analysis of dress and textiles within a specific world region.

DHA 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

DHA 8361. Color, Design, and Human Perception. (3 cr; QP–Basic color theory course; SP–Basic color theory course or #; A-F only)
Perceptual and psychological aspects of color and design. Human factors of color variables and design strategies that can enhance human experience of, and interaction with, color.

DHA 8362. The Nature of Representation in Visual Communication. (3 cr; SP–Grad DHA major or #; A-F only)
Relationship of images to the design communication process. Aspects of representation and pictorial information modes. Human interaction with images and their role in increasing understanding, enhancing learning, and positively affecting human experience.

DHA 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

DHA 8463. Housing and Community Dynamics. (3 cr; A-F only)
Roles of difference—race, gender, and class—in shaping distribution of housing, particularly in cities. Role of housing in patterns of social differentiation.

DHA 8467. Housing Theory. (3 cr; SP–5467 or #; A-F only)
Investigation/evaluation of theories applied to study of housing. Levels of analysis. Links between theory, research questions, and methodological approaches.

DHA 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

DHA 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

DHA 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

DHA 8990. M.F.A. Creative Thesis. (6 cr [max 12 cr]; SP–Completed coursework requirements for M.F.A. in DHA w/multimedia emphasis, #; A-F only)
M.F.A. project.

Development Studies and Social Change (DSSC)

Graduate School

DSSC 8111. Approaches to Knowledge and Truth: Ways of Knowing in Development Studies and Social Change. (3 cr; SP–Grad DSSC minor or #; S-N only)
Approaches practiced by physical, biological, and social scientists and humanities scholars. "Ways of knowing" in different cultures or in different groups within cultures. Team taught by faculty from biological and social sciences and the humanities.

DSSC 8211. Doctoral Research Workshop in Development Studies and Social Change. (1 cr; SP–Grad DSSC minor or #; S-N only)
Identification of potential funding sources for field research and the writing of grant proposals. Preparing for and conducting field research. Taken during the year before undertaking field research, typically the third year of graduate study.

DSSC 8212. Doctoral Research Workshop in Development Studies and Social Change. (1 cr; SP–Grad DSSC minor or #; S-N only)
Identification of potential funding sources for field research and the writing of grant proposals. Preparing for and conducting field research. Taken during the year before undertaking field research, typically the third year of graduate study.

DSSC 8310. Topics in Development Studies and Social Change. (2-3 cr [max 9 cr]; SP–Grad DSSC minor or #)
Offered in conjunction with MacArthur Program on Peace and International Cooperation workshop series.

Dutch (Dtch)

Department of German, Scandinavian, and Dutch
College of Liberal Arts

Dtch 5490. Topics in Dutch Literature. (3 cr [max 9 cr])
Topic may focus on a specific author, group of authors, genre, period, or subject matter. Topics specified in *Class Schedule*.

Dtch 5741. Medieval and Early Modern Dutch. (3 cr)
Introduction to the linguistic aspects of medieval and early modern Dutch. Reading and analysis of representative literary texts from the Dutch Middle Ages to 1700.

Dtch 5993. Directed Studies. (1-4 cr [max 12 cr]; SP–#, Δ, ❑)
Guided individual reading or study.

East Asian Studies (EAS)

Institute of International Studies
College of Liberal Arts

EAS 5940. Topics in Asian History. (1-4 cr [max 16 cr]; SP–Grad or #)
Selected topics such as cultural, economic, intellectual, political, and social history.

EAS 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

EAS 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Ecology, Evolution, and Behavior (EEB)

Department of Ecology, Evolution, and Behavior
College of Biological Sciences

EEB 5008. Forest Response to Quaternary Climate Change. (2 cr; QP–Biol 5041 or 5841; SP–Biol 3407, EEB 4631 or Geo 4631; ¶EEB 5009; A-F only)
Forest responses to past climate change at the population, community, and ecosystem level. Response to natural and human disturbance, range shifts and invasions. Limitations to the speed of response to rapid climate change.

EEB 5009. Quaternary Vegetation History and Climate. (2 cr; QP–5004 or Geo 5631 or #; SP–4631 or Geo 4631 or #)
Reconstructing and dating changes in vegetation and climate from Quaternary pollen stratigraphy of major world biomes; evidence from other indicators of past environments; comparison with climate models.

EEB 5011. Pollen Morphology. (2 cr; QP–PBio 3201 or #; SP–Biol 3007, PBio 4321 or #)
Morphology and nomenclature of pollen grains and pteridophyte spores, survey of pollen and spores of major plant families, lab techniques.

EEB 5013. Quaternary Plant Macrofossils. (2 cr; QP–PBio 3201 or #; SP–PBio 4321 or 4511 or #)
Morphology of seeds, fruits, and other macroscopic remains likely to occur in Quaternary deposits, survey of fossils of major plant families, lab techniques.

EEB 5033. Population and Quantitative Genetics. (4 cr; QP–[Biol 5003 or GCB 3022], course in biometry or statistics; SP–[[Biol 4003 or GCD 3022], intro statistics] or #)
Genetic basis of variation in populations and of evolutionary change. Allelic frequency dynamics: emphasizes natural selection, additive genetic variance, and heritability. Current topics related to consequences of artificial selection and of inbreeding.

EEB 5051. Analysis of Populations. (3 cr; QP–Intro biology, intro statistics or #; SP–Intro biology, intro statistics or #)
Factors involved in the regulation, growth, and general dynamics of populations. Data needed to describe populations, population growth, population models, and regulatory mechanisms.

EEB 5053. Ecology: Theory and Concepts. (4 cr; QP–Biol 3008; SP–Biol 3407 or #)
Classical and modern mathematical theories of population growth, interspecific interactions, ecosystem dynamics and functioning, with emphasis on underlying assumptions and on effects of added biological reality on robustness of predictions, stability, interspecific interactions, ecosystem structure and functioning.

EEB 5122W. Plant Interactions with Animals and Microbes. (4 cr; QP–Biol 3008, Biol 1106 or 1806 or 3011, Biol 1103 or Biol 3012 or 3812, 10 cr biol sci; SP–Biol 2012 or 3002, 3407 or 3409 ; A-F only)
Ecological and environmental implications of mutualistic and antagonistic interactions between plants, animals and microbes at organismal, population, and community levels.

EEB 5321. Evolution of Social Behavior. (3 cr; QP–3111; SP–Biol 3411 or #; A-F only)
Introduction to theories and concepts relating to behavior evolution, mating systems, and cooperative behavior in animals.

EEB 5323. Neural and Endocrine Mechanisms Underlying Vertebrate Behavior. (2 cr; QP–3111 or Biol 3011; SP–Biol 3411 or Biol 3101 or NSc 3101 or Phsl 3101 or #; A-F only)
Selected aspects of the physiological basis of vertebrate behavior with emphasis on neural and endocrine integration and the effects of evolutionary pressures on it. Hormones and sex behavior, sensory perception, neuroethology of communication.

EEB 5327. Behavioral Ecology. (3 cr; QP–3111; SP–Biol 3411 or #)
Evolutionary principles applied to aggressive competition, mate choice, cooperation, and parental investment. Optimization models used to examine foraging strategies, predator/prey interactions, and territoriality. Evolution of sex, sexual selection, dispersal. Evolutionary game theory.

EEB 5361. Visions of Nature: The Natural World and Political Thought. (4 cr; QP–Advanced studies in history, philosophy, or biology; SP–Advanced studies in history, philosophy, or biology)
Theories about the organization of nature, human nature, and their significance for the development of ethics, religion, political and economic philosophy, civics, and environmentalism in Western and other civilizations. Graduate credit requires paper on conceptual topic on human ecology.

EEB 5371. Principles of Systematics. (3 cr; QP–#; SP–#)
Theoretical and practical procedures of biological systematics. Phylogeny reconstruction, including computer-assisted analyses, morphological and molecular approaches, species concepts and speciation, comparative methods, classification, historical biogeography, nomenclature, and use and value of museums.

EEB 5961. Decision Analysis and Modeling in Conservation Biology. (3 cr; QP–Conservation biology grad; SP–Conservation biology grad or #; A-F only)
Active learning class explores decision analysis techniques and modeling in conservation biology. Introduces techniques, concepts, and software.

EEB 8010. Seminar in Paleoecology. (1 cr [max 4 cr]; SP–#; S-N only)
Reading and discussion of recent literature on Quaternary paleoecology.

EEB 8020. Community Ecology Seminar. (1 cr [max 5 cr]; SP–#; S-N only)
Research topics in selected areas.

EEB 8050. Population Biology Seminar. (1 cr [max 5 cr]; SP–#; S-N only)
Research topics in selected areas.

EEB 8051. Empirical Ecology. (4 cr; QP–Biol 3008, stat or biometry course; SP–Stat or biometry course or #)
Overview of analytical methods in interpreting data collected from observational and experimental studies in ecology and related fields of evolution, behavior, and conservation biology. Univariate, bivariate, and multivariate methods, including computationally intensive methods, ordination, and hypothesis testing.

EEB 8060. Evolutionary Genetics Seminar. (1 cr [max 5 cr]; SP–#; S-N only)
Research topics in selected areas.

EEB 8162. Winter Ecology. (1-2 cr; SP–Physiology and ecol courses, #; S-N only)
Survival options and mechanisms of plants and animals during seasonal cold periods.

EEB 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

EEB 8360. Behavioral Biology Seminar. (1 cr [max 5 cr]; SP–#; S-N only)
Research topics in selected areas.

EEB 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

EEB 8620. Advanced Limnology. (2 cr [max 6 cr]; QP–5601 or Geol 5601 or equiv.; SP–4601 or #; A-F only)
Selected topics, using current and classical literature. Seminar format. Term paper required.

EEB 8641. Spatial Ecology Seminar. (3 cr; SP–[5051, 2 sem calculus] or [3 sem calculus, [course in statistics or probability], #]; S-N only)
Introduction to spatial ecology. Role of space in population dynamics/interspecific interaction. Single species/multispecies models. Deterministic/stochastic theory. Modeling, effects of implicit/explicit space on competition, pattern formation, stability, diversity, and invasion. Reading/discussion of recent literature. Lab.

EEB 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

EEB 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

EEB 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

EEB 8980. Seminar on Current Topics. (1-3 cr [max 6 cr]; SP–[1st yr or 3rd sem] grad student, #; S-N only)
Current research in ecology, evolution, and behavior.

EEB 8990. Graduate Seminar. (1 cr [max 5 cr]; SP–#; S-N only)
Research topics in one or more selected areas.

EEB 8991. Independent Study: Ecology, Evolution, and Behavior. (1-10 cr [max 10 cr]; SP–#; S-N only)
Individual research on a specialized topic.

EEB 8994. Directed Research. (1-5 cr [max 10 cr]; SP–#; S-N only)

Economics (Econ)

Department of Economics
College of Liberal Arts

Econ 5151. Elements of Economic Analysis: Firm and Household. (2 cr; QP–3101 or equiv, qtr calculus, qtr linear algebra, grad or #; SP–3101, 3102, or equiv; Math 1271 or equiv; Math 2243 or equiv, grad or #)
Decision-making by households and firms under conditions of perfect competition, monopoly, and monopolistic competition.

Econ 5152. Elements of Economic Analysis: Income and Employment. (2 cr; QP–3101, 3102 or equiv, qtr calculus, qtr linear algebra, grad or #; SP–3101, 3102 or equiv; Math 1271 or equiv; Math 2243 or equiv; grad or #)
Determinants of national income, employment, and price level; aggregate consumption, investment, and asset holding.

Econ 5312. Growth, Technology, and Development. (3 cr; QP–3101, 3102 or equiv or #; SP–3101, 3102 or equiv or #)
Economics of research and development; technical change and productivity growth; impact of technology on institutions; science and technology policy.

Econ 5821. Public Economics. (3 cr; QP–§3801; 3101, 3103 or equiv; SP–§3801; 3101, 3102 or equiv)
Competing views on the proper role of government in the economy. Effects of tax and spending policies, taking into account private agents' response to government actions and the ways government officials may use their powers; optimal policies. Applications primarily to U.S. government.

Econ 8001. Microeconomic Analysis. (2 cr; QP–5151 or equiv, Math 3252, Math 3261 or equiv; SP–5151 or equiv, Math 2243, Math 2263 or equiv or #)
Theories of consumer demand, producer supply, and market equilibrium; general equilibrium and welfare. Sample topics: externalities, economics of information and uncertainty, and game theory. This seven-week course meets with 4161.

Econ 8002. Microeconomic Analysis. (2 cr; QP–8001; SP–8001)
Theories of consumer demand, producer supply, and market equilibrium; general equilibrium and welfare. Sample topics: externalities, economics of information and uncertainty, and game theory. This seven-week course meets with 4162.

Econ 8003. Microeconomic Analysis. (2 cr; QP–8002; SP–8002)
Theories of consumer demand, producer supply, and market equilibrium; general equilibrium and welfare. Sample topics: externalities, economics of information and uncertainty, and game theory. This seven-week course meets with 4163.

Econ 8004. Microeconomic Analysis. (2 cr; QP–8003; SP–8003)
Theories of consumer demand, producer supply, and market equilibrium; general equilibrium and welfare. Sample topics: externalities, economics of information and uncertainty, and game theory. This seven-week course meets with 4164.

Econ 8101. Microeconomic Theory. (2 cr; QP–5151 or equiv, Math 3261 or equiv, ¶Math 5615; SP–5151 or equiv, Math 2243 or equiv, ¶Math 5615 or ¶Math 8601, grad econ major or #)
Decision problems faced by the household and firm; theories of choice under conditions of certainty and uncertainty. Partial equilibrium analysis of competition and monopoly. General equilibrium analysis. Welfare economics: economic efficiency of alternative market structures, social welfare functions. Dynamics: stability of markets, capital theory. Seven-week course.

Econ 8102. Microeconomic Theory. (2 cr; QP–8101, ¶Math 5615; SP–8101, ¶Math 5615 or ¶Math 8601, grad econ major or #)
Decision problems faced by the household and firm; theories of choice under conditions of certainty and uncertainty. Partial equilibrium analysis of competition and monopoly. General equilibrium analysis. Welfare economics: economic efficiency of alternative market structures, social welfare functions. Dynamics: stability of markets, capital theory. Seven-week course.

Econ 8103. Microeconomic Theory. (2 cr; QP–8101, ¶Math 5616; SP–8102, ¶Math 5616 or ¶Math 8602 or comparable abstract math course, grad econ major or #)
Decision problems faced by the household and firm; theories of choice under conditions of certainty and uncertainty. Partial equilibrium analysis of competition and monopoly. General equilibrium analysis. Welfare economics: economic efficiency of alternative market structures, social welfare functions. Dynamics: stability of markets, capital theory. Seven-week course.

Econ 8104. Microeconomic Theory. (2 cr; QP–8102, ¶Math 5616; SP–8103, ¶Math 5616 or ¶Math 8602 or comparable abstract math course, grad econ major or #)
Decision problems faced by the household and firm; theories of choice under conditions of certainty and uncertainty. Partial equilibrium analysis of competition and monopoly. General equilibrium analysis. Welfare economics: economic efficiency of alternative market structures, social welfare functions. Dynamics: stability of markets, capital theory. Seven-week course.

Econ 8105. Macroeconomic Theory. (2 cr; QP–5152 or equiv, Math 3252, Math 3261 or equiv; SP–5152 or equiv, Math 2243, Math 2263 or equiv or #)
Dynamic general equilibrium models: solving for paths of interest rates, consumption, investment, prices. Models with uncertainty, search, matching, indivisibilities, private information. Implications for measurement and data reporting. Overlapping generations and dynasty models. Variational and recursive methods. This seven-week course meets with 4165.

Econ 8106. Macroeconomic Theory. (2 cr; QP–8104; SP–8105)
Dynamic general equilibrium models: solving for paths of interest rates, consumption, investment, prices. Models with uncertainty, search, matching, indivisibilities, private information. Implications for measurement and data reporting. Overlapping generations and dynasty models. Variational and recursive methods. This seven-week course meets with 4166.

Econ 8107. Macroeconomic Theory. (2 cr; QP–8104; SP–8106)
Dynamic general equilibrium models: solving for paths of interest rates, consumption, investment, prices. Models with uncertainty, search, matching, indivisibilities, private information. Implications for measurement and data reporting. Overlapping generations and dynasty models. Variational and recursive methods. This seven-week course meets with 4167.

Econ 8108. Macroeconomic Theory. (2 cr; QP–8105; SP–8107)
Dynamic general equilibrium models: solving for paths of interest rates, consumption, investment, prices. Models with uncertainty, search, matching, indivisibilities, private information. Implications for measurement and data reporting. Overlapping generations and dynasty models. Variational and recursive methods. This seven-week course meets with 4168.

Econ 8111. Introduction to Mathematical Economics. (2 cr; QP–¶8101, Math 3261 or equiv, Math 5612 or equiv or #; Math 5242 recommended; SP–Math 2243 or equiv, ¶Econ 8101, ¶Math 5615 or equiv or #; Math 4242 recommended)
Use of mathematical models in economic theory.

Econ 8112. Introduction to Mathematical Economics. (2 cr; QP–8111, ¶8102, ¶Math 5613 or comparable abstract math course; SP–8111, ¶8102, ¶Math 5615 or comparable abstract math course)
Use of mathematical models in economic theory. Standard techniques.

Econ 8113. Introduction to Mathematical Economics. (2 cr; QP–8111, Math 5614 or comparable abstract math course, ¶8102; SP–8112, Math 5616 or comparable abstract math course, ¶8103)
Use of mathematical models in economic theory. May include special topics.

Econ 8117. Noncooperative Game Theory. (2 cr; QP–Math 5614 or equiv; SP–Math 5616 or equiv or #)
Solution concepts for noncooperative games in normal form, including Nash and perfect equilibrium and stable sets of equilibria. Extensive form games of perfect and incomplete information, sequential equilibrium, and consequences of stability for extensive form. Applications including bargaining and auctions. Seven-week course.

Econ 8118. Noncooperative Game Theory. (2 cr; QP–8117; SP–8117)
Solution concepts for noncooperative games in normal form, including Nash and perfect equilibrium and stable sets of equilibria. Extensive form games of perfect and incomplete information, sequential equilibrium, and consequences of stability for extensive form. Applications including bargaining and auctions. Seven-week course.

Econ 8119. Cooperative Game Theory. (2 cr; QP–8103, Math 5614 or equiv; SP–8104, Math 5616 or equiv or #)
Basics of cooperative game theory, emphasizing concepts used in economics. Games with and without transferable utility; the core, the value, and other solution concepts. Recent results, including potentials, reduced games, consistency, and noncooperative implementation of cooperative solution concepts. Seven-week course.

Econ 8124. History of Economic Thought. (2 cr; QP–8103, 8106; SP–8104, 8108 or #)
Selected topics, emphasizing development of theoretical topics. Seven-week course.

Econ 8125. History of Economic Thought. (2 cr; QP–8124; SP–8124 or #)
Selected topics, emphasizing development of theoretical topics. Seven-week course.

Econ 8181. Advanced Topics in Microeconomics. (2 cr [max 4 cr]; QP–8103; SP–8104 or #; offered when feasible)
Faculty and student presentations based on recent literature. Seven-week course.

Econ 8182. Advanced Topics in Microeconomics. (2 cr [max 4 cr]; QP–8103; SP–8104 or #; offered when feasible)
Faculty and student presentations based on recent literature. Seven-week course.

Econ 8185. Advanced Topics in Macroeconomics. (2 cr [max 4 cr]; QP–8106; SP–8108 or #; offered when feasible)
Faculty and student presentations based on recent literature. Seven-week course.

Econ 8186. Advanced Topics in Macroeconomics. (2 cr [max 4 cr]; QP–8106; SP–8108 or #)
Faculty and student presentations based on recent literature. Seven-week course.

Econ 8191. Workshop in Mathematical Economics. (1-3 cr [max 10 cr]; QP–8103; SP–8104 or #)

Econ 8192. Workshop in Mathematical Economics. (1-3 cr [max 10 cr]; QP–8103; SP–8104 or #)

Econ 8201. Econometric Analysis. (2 cr; QP–[3101 or equiv], [Math 1261 or equiv], [Stat 5122 or 5133]; SP–[[3101 or equiv], [Math 1272 or equiv], Stat 5102] or #)
Basic linear regression model, its variants. Panel data, censored/truncated regression, discrete choice models. Time series, simultaneous equation models.

Econ 8202. Econometric Analysis. (2 cr; QP–8201; SP–8201)
Basic linear regression model, its variants. Panel data, censored/truncated regression, discrete choice models. Time series, simultaneous equation models.

Econ 8203. Econometric Analysis. (2 cr; QP–8201; SP–8202)
Basic linear regression model, its variants. Panel data, censored/truncated regression, discrete choice models. Time series, simultaneous equation models.

Econ 8204. Econometric Analysis. (2 cr; QP–8202; SP–8203)
Basic linear regression model, its variants. Panel data, censored/truncated regression, discrete choice models. Time series, simultaneous equation models.

Econ 8205. Applied Econometrics. (2 cr; QP–Math 5242 or equiv, ¶Econ 8101, ¶Econ 8105, ¶Stat 5101; SP–Math 4242 or equiv, ¶Econ 8101, ¶Econ 8105, ¶Stat 5101 or #)
Application in research, including classical and Bayesian approaches; formulation, comparison, and use of models and hypotheses; inference and prediction in structural models; simulation methods. Seven-week course.

Econ 8206. Applied Econometrics. (2 cr; QP–8205, ¶8102, ¶8106, ¶Stat 5101; SP–8205, ¶8102, ¶8106, ¶Stat 5101 or #)
Application in research, including classical and Bayesian approaches; formulation, comparison, and use of models and hypotheses; inference and prediction in structural models; simulation methods. Seven-week course.

Econ 8207. Applied Econometrics. (2 cr; QP–8205, ¶8103, ¶8107, ¶Stat 5102; SP–8206, ¶8103, ¶8107, ¶Stat 5102 or #)
Application in research, including classical and Bayesian approaches; formulation, comparison, and use of models and hypotheses; inference and prediction in structural models; simulation methods. Seven-week course.

Econ 8208. Applied Econometrics. (2 cr; QP–8206, ¶8104, ¶8108, ¶Stat 5102; SP–8207, ¶8104, ¶8108, ¶Stat 5102 or #)
Application in research, including classical and Bayesian approaches; formulation, comparison, and use of models and hypotheses; inference and prediction in structural models; simulation methods. Seven-week course.

Econ 8211. Econometrics. (2 cr; QP–5151, 5152, Math 5242 or equiv, Stat 5133; SP–5151, 5152, Math 4242 or equiv, Stat 5102 or #)
Linear regression; general linear hypotheses; Gauss Markov Theorem, generalized least squares and their applications. Decision-theoretic choice among estimators. Simultaneous equations models; identification and estimation. Asymptotic distribution theory. Applications, including multivariate time series models and/or limited dependent variables models. Seven-week course.

Econ 8212. Econometrics. (2 cr; QP–8211; SP–8211)
Linear regression; general linear hypotheses; Gauss Markov Theorem, generalized least squares and their applications. Decision-theoretic choice among estimators. Simultaneous equations models; identification and estimation. Asymptotic distribution theory. Applications, including multivariate time series models and/or limited dependent variables models. Seven-week course.

Econ 8213. Econometrics. (2 cr; QP–8212; SP–8212)
Linear regression; general linear hypotheses; Gauss Markov Theorem, generalized least squares and their applications. Decision-theoretic choice among estimators. Simultaneous equations models; identification and estimation. Asymptotic distribution theory. Applications, including multivariate time series models and/or limited dependent variables models. Seven-week course.

Econ 8281. Advanced Topics in Econometrics. (2 cr [max 4 cr]; QP–8213; SP–8213 or #; offered when feasible)
Faculty and student presentations based on recent literature. This is a 7-week course.

Econ 8282. Advanced Topics in Econometrics. (2 cr [max 4 cr]; QP–8213; SP–8213 or #)
Faculty and student presentations based on recent literature. Seven-week course.

Econ 8291. Workshop in Econometrics. (1-3 cr [max 10 cr]; QP–8213; SP–8213 or #)

Econ 8292. Workshop in Econometrics. (1-3 cr [max 10 cr]; QP–8213; SP–8213 or #)

Econ 8311. Economic Growth and Development. (2 cr; QP–8103, 8105; SP–8104, 8106 or #)
Methods of analyzing dynamical systems; applying methods to new models of growth and development; deriving and evaluating models' quantitative implications in light of growth and development in a number of countries. Seven-week course.

Econ 8312. Economic Growth and Development. (2 cr; QP–8311; SP–8311 or #)
Methods of analyzing dynamical systems; applying methods to new models of growth and development; deriving and evaluating models' quantitative implications in light of growth and development in a number of countries. Seven-week course.

Econ 8313. Economic Growth and Development. (2 cr; QP–8312; SP–8312 or #)
Methods of analyzing dynamical systems; applying methods to new models of growth and development; deriving and evaluating models' quantitative implications in light of growth and development in a number of countries. Seven-week course.

Econ 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Econ 8381. Advanced Topics in Economic Development. (2 cr [max 4 cr]; QP–8312; SP–8312 or #; offered when feasible)
Faculty and student presentations based on recent literature. Seven-week course.

Econ 8382. Advanced Topics in Economic Development. (2 cr [max 4 cr]; QP–8312; SP–8312 or #)
Faculty and student presentations based on recent literature. Seven-week course.

Econ 8391. Workshop in Economic Growth and Development. (1-3 cr [max 10 cr]; SP–#)
Econ 8392. Workshop in Economic Growth and Development. (1-3 cr [max 10 cr]; SP–#)

Econ 8401. International Trade and Payments Theory. (2 cr; QP–8102, 8104; SP–8103, 8105 or #)
Impact of trade on factor rentals. Stolper-Samuelson, Rybczynski, and factor price equalization theorems. Heckscher-Ohlin theorem. Derivation of offer curves and general international equilibrium. Transfer problem. Seven-week course.

Econ 8402. International Trade and Payments Theory. (2 cr; QP–8401; SP–8401 or #)
Tariffs, quotas, and other barriers to trade; gains from trade; trading blocs; increasing returns; growth. This is a seven-week course.

Econ 8403. International Trade and Payments Theory. (2 cr; QP–8402; SP–8402 or #)
International business cycles; exchange rates; capital movements; international liquidity. This is a 7-week course.

Econ 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

Econ 8481. Advanced Topics in International Trade. (2 cr [max 4 cr]; QP–8403; SP–8403 or #; offered when feasible)
Faculty and student presentations based on recent literature. Seven-week course.

Econ 8482. Advanced Topics in International Trade. (2 cr [max 4 cr]; QP–8403; SP–8403 or #; offered when feasible)
Faculty and student presentations based on recent literature. Seven-week course.

Econ 8491. Workshop in Trade and Development. (1-3 cr [max 10 cr]; SP–#)

Econ 8492. Workshop in Trade and Development. (1-3 cr [max 10 cr]; SP–#)

Econ 8501. Wages and Employment. (2 cr; QP–8101, 8104; SP–8102, 8106 or #)
Economic analysis of labor markets and their operation under conditions of both individual and collective bargaining. Implications of labor market operations for resource allocation, wage and price stability, income and employment growth. Wage structures and wage levels. Wage and employment theories and practices. Economic impacts of unions. Seven-week course.

Econ 8502. Wages and Employment. (2 cr; QP–8501; SP–8501 or #)
Economic analysis of labor markets and their operation under conditions of both individual and collective bargaining. Implications of labor market operations for resource allocation, wage and price stability, income and employment growth. Wage structures and wage levels. Wage and employment theories and practices. Economic impacts of unions. Seven-week course.

Econ 8581. Advanced Topics in Labor Economics. (2 cr [max 4 cr]; QP–8502; SP–8502 or #; offered when feasible)
Faculty and student presentations based on recent literature. Seven-week course.

Econ 8582. Advanced Topics in Labor Economics. (2 cr [max 4 cr]; QP–8502; SP–8502 or #; offered when feasible)
Faculty and student presentations based on recent literature. Seven-week course.

Econ 8601. Industrial Organization and Government Regulation. (2 cr; QP–8101; SP–8102 or #)
Behavior of businesses and industries: productivity, firm size distributions, exit-entry dynamics, etc. Theories of the firm, industry structure and performance, invention and innovation, and technology adoption. Positive and normative theories of regulation. Seven-week course.

Econ 8602. Industrial Organization and Government Regulation. (2 cr; QP–8601; SP–8601 or #)
Behavior of businesses and industries: productivity, firm size distributions, exit-entry dynamics, etc. Theories of the firm, industry structure and performance, invention and innovation, and technology adoption. Positive and normative theories of regulation. Seven-week course.

Econ 8603. Industrial Organization and Government Regulation. (2 cr; QP–8602; SP–8602 or #)
Behavior of businesses and industries: productivity, firm size distributions, exit-entry dynamics, etc. Theories of the firm, industry structure and performance, invention and innovation, and technology adoption. Positive and normative theories of regulation. Seven-week course.

Econ 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Econ 8681. Advanced Topics in Industrial Organization. (2 cr [max 4 cr]; QP–8603; SP–8603 or #; offered when feasible)
Faculty and student presentations based on recent literature. Seven-week course.

Econ 8682. Advanced Topics in Industrial Organization. (2 cr [max 4 cr]; QP–8603; SP–8603 or #; offered when feasible)
Faculty and student presentations based on recent literature. Seven-week course.

Econ 8691. Workshop in Applied Microeconomics. (1-3 cr [max 10 cr]; SP–#)

Econ 8692. Workshop in Applied Microeconomics. (1-3 cr [max 10 cr]; SP–#)

Econ 8701. Monetary Economics. (2 cr; QP–8102, 8105; SP–8103, 8106 or #)
Economic role of principal financial institutions. Determinants of value of money. Principal problems of monetary policy. Seven-week course.

Econ 8702. Monetary Economics. (2 cr; QP–8701; SP–8701 or #)
Economic role of principal financial institutions. Determinants of value of money. Principal problems of monetary policy. Seven-week course.

Econ 8703. Monetary Economics. (2 cr; QP–8702; SP–8702 or #)
Economic role of principal financial institutions. Determinants of value of money. Principal problems of monetary policy. Seven-week course.

Econ 8704. Financial Economics. (2 cr; QP–8102, 8105; SP–8103, 8106 or #)
Role of financial institutions in efficient allocation of risk; multiperiod and continuous-time securities markets; theory of firm under uncertainty; financial intermediation; derivation of empirical asset-pricing relationships; tests concerning alternative market structures. Seven-week course.

Econ 8705. Financial Economics. (2 cr; QP–8704; SP–8704 or #)
Role of financial institutions in efficient allocation of risk; multiperiod and continuous-time securities markets; theory of firm under uncertainty; financial intermediation; derivation of empirical asset-pricing relationships; tests concerning alternative market structures. Seven-week course.

Econ 8706. Financial Economics. (2 cr; QP–8705; SP–8705 or #)
Role of financial institutions in efficient allocation of risk; multiperiod and continuous-time securities markets; theory of firm under uncertainty; financial intermediation; derivation of empirical asset-pricing relationships; tests concerning alternative market structures. Seven-week course.

Econ 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Econ 8781. Advanced Topics in Monetary Economics. (2 cr [max 4 cr]; QP–8702; SP–8702 or #; offered when feasible)
Faculty and student presentations based on recent literature. Seven-week course.

Econ 8782. Advanced Topics in Monetary Economics. (2 cr [max 4 cr]; QP–8702; SP–8702 or #; offered when feasible)
Faculty and student presentations based on recent literature. Seven-week course.

Econ 8791. Workshop in Macroeconomics. (1-3 cr [max 10 cr]; SP–#)

Econ 8792. Workshop in Macroeconomics. (1-3 cr [max 10 cr]; SP–#)

Econ 8801. Public Economics. (2 cr; QP–8102, 8105; SP–8103, 8106 or #)
Theories of public choice and role of government in economy. Economic effects of taxes, public debt, and public expenditure. Current problems in economics of public sector, including political economy. Seven-week course.

Econ 8802. Public Economics. (2 cr; QP–8801; SP–8801 or #)
Theories of public choice and role of government in economy. Economic effects of taxes, public debt, and public expenditure. Current problems in economics of public sector, including political economy. Seven-week course.

Econ 8803. Public Economics. (2 cr; QP–8802; SP–8802 or #)
Theories of public choice and role of government in economy. Economic effects of taxes, public debt, and public expenditure. Current problems in economics of public sector, including political economy. Seven-week course.

Econ 8881. Advanced Topics in Public Economics. (2 cr [max 4 cr]; QP–8803; SP–8803 or #; offered when feasible)
Faculty and student presentations based on recent literature. Seven-week course.

Econ 8882. Advanced Topics in Public Economics. (2 cr [max 4 cr]; QP–8803; SP–8803 or #; offered when feasible)
Faculty and student presentations based on recent literature. Seven-week course.

Econ 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Econ 8891. Workshop in Public Economics and Policy. (1-3 cr [max 10 cr]; SP–#)

Econ 8892. Workshop in Public Economics and Policy. (1-3 cr [max 10 cr]; SP–#)

Econ 8990. Individual Graduate Research. (1-7 cr; SP–#)

Education (Educ)

College of Education and Human Development

Educ 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Educ 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

Educ 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Educ 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Educ 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Education and Human Development (EdHD)

College of Education and Human Development

EdHD 5001. Learning, Cognition, and Assessment in the Schools. (3 cr; QP–M.Ed./init lic student or CLA music ed or preteaching major or #; psych course recommended; SP–M.Ed./init lic student or CLA music ed or preteaching major or #; psych course recommended; A-F only)
Principles of learning, cognition, cognitive development, classroom management, motivation, instruction, assessment. Approaches include behaviorism, cognitive and social constructivism, human information processing theory. Topics include intelligence, knowledge acquisition, reasoning skills, scholastic achievement, standardized testing, reliability, validity, student evaluation, performance assessment, portfolios, demonstrations. Applications to instruction and organization of curricular materials.

EdHD 5003. Developmental and Individual Differences in Educational Contexts. (3 cr; QP–M.Ed./init lic or CLA music ed or preteaching major or #; SP–M.Ed./init lic or CLA music ed or preteaching major or #; A-F only)
Overview of developmental and individual differences of children and adolescents in educational contexts; emphasis on a dynamic systems perspective; developmental transitions in childhood and adolescence; interactions between the student, environment, and task; and accommodations and adaptations for students in special education.

EdHD 5005. School and Society. (2 cr; QP–§EdPA 5090; M.Ed./init lic student or CLA music ed major or preteaching major or #; SP–§EdPA 5090; M.Ed./init lic student or CLA music ed major or preteaching major or #; A-F only)
Readings in history, philosophy, social sciences, and law revealing diverse educational values in a pluralistic society. Multiple expectations of schools. Civil liberties, rights, community. Varying cultural backgrounds of students, family circumstances, exceptional needs.

EdHD 5007. Technology for Teaching and Learning. (1.5 cr; QP–§5007 (sem version), §CI 5300; [M.Ed./init lic or CLA music ed major or preteaching major or #], [basic knowledge of Macintosh operating system and of a word processing program]; SP–§5007 (qtr version), §CI 5300; [M.Ed./init lic or CLA music ed major or preteaching major or #], basic computer skills; A-F only)
Diverse educational technology in K-12 classrooms. Effective use of technology. Computer technologies used to stimulate personal productivity/communication and to enhance teaching/learning processes.

EdHD 5009. Human Relations: Applied Skills for School and Society. (1 cr; SP–M.Ed./init lic or CLA music ed or preteaching or #; A-F only)
Issues of prejudice/discrimination in terms of history, power, social perception. Knowledge/skills acquisition in cooperative learning, multicultural education, group dynamics, social influence, leadership, judgment/decision making, prejudice reduction, conflict resolution, teaching in diverse educational settings.

Educational Policy and Administration (EdPA)

Department of Educational Policy and Administration

College of Education and Human Development

EdPA 5001. Formal Organizations in Education. (3 cr)
Classical/current theories of organizations. Applications to education and related fields.

EdPA 5021. Historical Foundations of Modern Education. (3 cr)
Analysis and interpretation of important elements in modern education derived from pre-classical sources: Greeks, Romans, Middle Ages, Renaissance, Reformation, Enlightenment, and Industrial Revolution.

EdPA 5023. History of Western Educational Thought. (3 cr)
Great educational classics of Western civilization: Plato, Aristotle, Quintilian, Montaigne, Milton, Locke, Rousseau, and others.

EdPA 5024. History of Ideas in American Education. (3 cr)
Readings in American cultural development related to education, including: Franklin, Jefferson, Mann, B.T. Washington, W.E.B. DuBois, Dewey. Special reference to the emerging system of public education in changing contexts, agrarian to urban-industrial, moderate pluralism to intense diversity.

EdPA 5028. Education Imagery in Europe and America. (3 cr)
Images and ideas of education expressed in the visual arts of Western civilization (antiquity to 20th century) in relation to concurrent educational thought and practice; symbolism, myth, propaganda, didacticism, genre, caricature.

EdPA 5032. Comparative Philosophies of Education. (3 cr)
Exploration of the principal philosophies in educational thought today, e.g., realism, idealism, pragmatism, and postmodernism. Practice in philosophical critique.

EdPA 5036. Ethics, Morality, and Values in Education. (3 cr)
Application to key issues of professional practice. Moral education, virtues, principles.

EdPA 5041. Sociology of Education. (3 cr)
Structures and processes within educational institutions; linkages between educational organizations and their social contexts, particularly related to educational change.

EdPA 5044. Introduction to the Economics of Education. (3 cr)
Costs and economic benefits of education, with a focus on K-12; educational markets, prices, and production relationships; investment and cost-benefit analysis.

EdPA 5048. Cross-Cultural Perspectives on Leadership. (2 cr)
Introduction to cultural variables of leadership that influence functioning of cross-cultural groups. Lectures, case studies, discussion, problem-solving, simulations. Intensive workshop.

EdPA 5052. Ethnic Groups and Communities: Families, Children, and Youth. (3 cr)
Roles of young people in widely varied North American communities. Comparative aspects of youth commitment to society, economic value of youth, youth-adult conflict, youth roles in family. Well-defined analyses of contextual roles. Complexity of policy for appropriate educational/community development.

EdPA 5056. Case Studies for Policy Research. (3 cr; A-F only)
Qualitative case study research methods and their applications to educational policy and practice. Emphasis on designing studies that employ open-ended interviewing as primary data collection technique.

EdPA 5061. Ethnographic Research Methods. (3 cr)
Practice in aspects of field methodology below the level of full field study; detailed reading; analysis of studies in anthropology and education for methodological content.

EdPA 5064. Divergent Perspectives in Educational Policy and Practice. (3 cr)
Examines fundamental and current issues in the field of education. Participants learn how to approach an issue from multiple perspectives, develop skills to identify and analyze its component parts, and examine personal belief systems to place a given issue within a personal context.

EdPA 5080. Special Topics: Educational Policy and Administration. (1-3 cr [max 24 cr])
Topical issues in educational policy/administration.

EdPA 5087. Seminar: Educational Policy and Administration. (1-3 cr [max 24 cr])
Shared responsibility of students/instructor in presentation of topics.

EdPA 5095. Problems: Educational Policy and Administration. (1-3 cr [max 24 cr])
Course or independent study on specific topic within department program emphasis.

EdPA 5096. Internship: Educational Policy and Administration. (1-9 cr [max 24 cr])
Internship in elementary, secondary, general, or postsecondary administration, or other approved field related setting.

EdPA 5101. International Education and Development. (3 cr)
Introduction to comparative and international development education, contemporary theories regarding the role of education in the economic, political, and sociocultural development of nations; examination of central topics and critical issues in the field.

EdPA 5102. Knowledge Formats and Applications: International Development Education Contexts. (3 cr)
Analyzes the interrelationships of "knowledge capital" (noetic symbolic resources) and culture through intrinsic, cross-, and multicultural perspectives. Distinguishes knowledge from information and data, focusing on national and international developments occurring along basic and applied knowledge paths.

EdPA 5103. Comparative Education. (3 cr)
Examination of systems and philosophies of education globally with emphasis upon African, Asian, European, and North American nations. Foundations of comparative study with selected case studies.

EdPA 5121. Educational Reform in International Context. (3 cr)
Critical policy analysis of educational innovation and reform in selected countries. Use theoretical perspectives and a variety of policy analysis approaches to examine actual educational reforms and their implementation.

EdPA 5124. Critical Issues in International Education and Educational Exchange. (3 cr)
Analysis of comprehensive policy-oriented frameworks for international education; practices of U.S. and other universities; conceptual development of international education and its practical application to programs, to employment choices, and to pedagogy.

EdPA 5128. Anthropology of Learning. (3 cr)
Cross-cultural perspectives in examining educational patterns; the implicit and explicit cultural assumptions underlying them. Methods and approaches to cross-cultural studies in education.

EdPA 5132. Intercultural Education and Training: Theory and Application. (3 cr)
Examination of intercultural education; formal and nonformal education programs intended to teach about cultural diversity, promote intercultural communication and interaction skills, and teach students from diverse background more effectively.

EdPA 5301. Contexts of Learning: Historical, Contemporary, and Projected. (3 cr; A-F only)
Contextual understanding of education as a social institution. Education is studied as one institution among the several that constitute its dynamic context.

EdPA 5302. Educational Policy: Context, Inquiry, and Issues. (3 cr)
Review of social science concepts/research in considering educational policies/issues, process of inquiry that affect policy development, implementation, evaluation. Focus on pre-K-12. Role of educational leaders, administrators.

EdPA 5303. Managing the Learning Organization. (3 cr; A-F only)
Examines schools, colleges, and other human service organizations centered on learning. Focuses on perspectives and skills needed to manage organizations effectively.

EdPA 5304. Educational Leadership for Equity, Opportunity, and Outcome. (3 cr)
Implications of multiple contexts in which leadership occurs. Role of followers. Complexities of collaborative structures and of shared governance.

EdPA 5321. The Principalship. (3 cr)
Role of the principal: qualifications, duties, and problems.

EdPA 5322. School Superintendency. (3 cr; SP–Postbaccalaureate)
Role/responsibility of superintendent in school district. Emphasizes real life experiences, leadership potential as CEO. Purposes, power, politics, practices of position. Interplay of internal school forces, external community forces analyzed in multiple contexts. Manifestations of leadership in public, high-profile appointment.

EdPA 5324. Financial Management for Elementary-Secondary Education. (3 cr)
Provides an overview of state-local school finance systems, budgeting, governmental fund accounting, and interpretation of financial information. For graduate students pursuing licensure as elementary-secondary principals and superintendents.

EdPA 5328. Introduction to Educational Planning. (3 cr)
Principles, tools, comparative practices, and emerging issues in K-12 and higher education settings; decision making models; strategic and project planning; barriers to effectiveness; and change management processes.

EdPA 5332. Leadership Development Seminar. (3 cr)
Assessment and development of skills required of the educator in planning, decision making, and human relations. Introduction to contemporary issues in educational administration.

EdPA 5336. Laboratory in Decision Making. (3 cr)
Contributions of recent research and theory to effective administration. Analysis of administrative behavior in realistic settings; relations of administration to human behavior.

EdPA 5341. The American Middle School. (3 cr)
Focus on the uniqueness of the early adolescent and appropriate learning situations. For educators working with middle-level students.

EdPA 5344. Law and Educational Policy. (3 cr)
Reviews of the legal foundations of educational policy; statutory themes and case law; implications for educational organizations and administrative practice; case studies and emergent issues in recent court rulings.

EdPA 5346. Politics of Education. (3 cr; SP–postbac, M.Ed., or grad student; A-F only)
Political dimensions of policy formulation/implementation in education. Use of power/influence in shaping educational policies and in resolving conflicts over educational issues. Analysis of consequences/cross-impacts.

EdPA 5348. Public School Personnel Programs. (3 cr)
Management concepts, functions, and practices of the personnel subsystem in education; selection, assignment, evaluation, and development of school personnel; collective bargaining and the grievance process.

EdPA 5352. Projective Leadership for Strategic Learning Communities. (3 cr)
Explores many trends and changes facing society, culture, and education from a strategic learning community perspective; helps students "futurize the present."

EdPA 5356. Contemporary Services for Persons With Disabilities. (3 cr)
Policy, research, and current practices related to education, health, and social services that support children, youth, and adults with special needs, and that support their families. Federal, state, local perspectives.

EdPA 5361. Project in Teacher Leadership. (3-6 cr; SP–M.Ed. student in Teacher Leadership Program; S-N only)
Create, implement, evaluate, and present a leadership project designed to initiate positive change in educational environments. Review of related literature, proposal development, project development, implementation and evaluation, critical reflection, sharing learning outcomes.

EdPA 5364. Leadership for School Improvement. (3 cr; SP–M.Ed. student or #; A-F only)
Current research/practice on educational leadership focused on creating school cultures conducive to continuous improvement/change. Strategies for personal/organizational leadership in PK-12 settings.

EdPA 5368. Special Services Policy and Administration. (3 cr)
Legislative, procedural, executive, and judicial actions that affect services, families, and children with special needs at all levels of government: federal, state, and local. For administrators, supervisors, and other professionals responsible for managing general, special, and alternative education programs.

EdPA 5372. Youth in Modern Society. (3 cr)
Youth in advanced societies and as a social entity; functions and roles in industrial society, family, education, politics and government, economy and work, welfare and religion; organizations, social movements, and subcultures; empirical research and cross-cultural perspectives.

EdPA 5374. Leadership for Staff Development. (4 cr; SP–Postbaccalaureate, at least 3 yrs teaching experience)
Designing, implementing, evaluating staff development in PK-12 settings. Research-based standards for effective staff development. Need for embedded time for collaborative learning, evaluating staff/student outcomes.

EdPA 5376. Organizational Approaches to Youth Development. (3 cr)
Defining youth development within framework of formal and informal organizations; organizational systems responsible for youth development in the community; policy issues surrounding these systems.

EdPA 5378. Experiential Learning: Theory and Practice. (3 cr)
Theory/practice of learning by doing. Educator's personal engagement in process. Technical, motivational, and evaluative aspects.

EdPA 5381. The Search for Children and Youth Policy in the U.S. (3 cr)
Review of contemporary policy issues affecting children and youth in the U.S. and South Africa; identify national standards, norms and principles of youth development; conflicting expectations facing policy-makers; and search for the critical content of youth policy.

EdPA 5384. Collaboration in Heterogeneous Classrooms and Schools. (3 cr; A-F only)
Policy, research, practice base for addressing range of student abilities/backgrounds in diverse schools. Collaborative approaches to curricular, instructional, social support.

EdPA 5396. Field Experience in PK-12 Educational Administration. (3 cr [max 6 cr]; SP–#; S-N only)
Field experience or internship arranged for students seeking licensure as PK-12 principal/superintendent. Content/credit depend on licensure requirements specified in individual field experience agreement.

EdPA 5501. Principles and Methods of Evaluation. (3 cr)
Introduction to program evaluation. Planning an evaluation study, collecting and analyzing information, reporting results; evaluation strategies; overview of the field of program evaluation.

EdPA 5521. Cost and Economic Analysis in Educational Evaluation. (3 cr; S-N only)
Use and application of cost-effectiveness, cost-benefit, cost-utility, and cost-feasibility in evaluation of educational problems and programs.

EdPA 5524. Evaluation Colloquium. (1 cr [max 24 cr]; QP–5240 or 5285 or EPsy 5243; SP–5501 or EPsy 5243; S-N only)
Informal seminar of faculty and advanced students interested in the issues and problems of program evaluation.

EdPA 5701. U.S. Higher Education. (3 cr)
U.S. higher/postsecondary education in historical/contemporary perspective. Emphasizes structure, history, and purposes of system as a whole.

EdPA 5704. Student and Faculty Issues in Higher Education. (3 cr; QP–5201)
College student development, curricular/extracurricular activities, faculty work/development, student-faculty interaction.

EdPA 5721. Racial and Ethnic Diversity in Higher Education. (3 cr)
Review of research. Theoretical frameworks, methodological perspectives, and research strategies used to study students, staff, and faculty; historical perspectives.

EdPA 5724. Leadership and Administration of Student Affairs. (3 cr)
Scope, administration, coordination, and evaluation of programs in college and university student affairs.

EdPA 5728. Two-Year Postsecondary Institutions. (3 cr)
Present status, development, functions, organization, curriculum, and trends in postsecondary, but nonbaccalaureate, institutions.

EdPA 5732. The Law and Postsecondary Institutions. (3 cr)
Analysis of court opinions and federal regulations affecting postsecondary educational institutions.

EdPA 8002. Critical Issues in Contemporary Education. (3 cr; SP–Ed.D. or Ph.D. student)
Meanings of difference from sociological, psychological, historical and philosophical perspectives as related to current and emerging critical issues in education. Participants help design, facilitate, and present the course.

EdPA 8011. Doctoral Research Seminar I. (1 cr; SP–EdPA doctoral student; S-N only)
Introduction/planning for individual program development, preliminary examinations, and dissertation prospectus. Modes of inquiry used in current research in education, databases relating to education, recent writings on literature synthesis, key contributions to education literature.

EdPA 8012. Doctoral Research Seminar II. (1 cr; SP–EdPA doctoral student; S-N only)
Introduction to quantitative/qualitative research approaches/methods. Nature of research, role of researcher, philosophical perspectives on research, ethical issues in conducting research.

EdPA 8013. Doctoral Research Seminar III. (1 cr; SP–EdPA doctoral student; S-N only)
Introduction to most important quantitative/qualitative approaches employed in educational policy research.

EdPA 8014. Doctoral Research Seminar IV. (1 cr; SP–EdPA doctoral student; S-N only)
Preparation of thesis prospectus.

EdPA 8087. Seminar: Educational Policy and Administration. (1-3 cr [max 24 cr])

EdPA 8095. Problems: Educational Policy and Administration. (1-3 cr [max 24 cr])

EdPA 8096. Internship: Educational Policy and Administration. (1-9 cr [max 24 cr])

EdPA 8104. General Systems Thinking for the Analysis of Education. (3 cr)
Critical aspects of historical and contemporary systems philosophy, thinking, and analysis. Development of concepts and skills applicable to coping with evolutionary and chaotic environments. Modeling and simulation of learning systems in rapidly changing national and international contexts.

EdPA 8121. Doctoral Seminar: Comparative and International Development Education. (1-6 cr; SP–EdPA Ph.D. candidate; S-N only)
Focuses on needs of students while writing the dissertation; general guidance in how to construct the thesis.

EdPA 8124. Classic Readings in Anthropology and Education. (3 cr; A-F only)
Major contributions to theory or working paradigms.

EdPA 8301. Contexts of Learning. (3 cr)
Study of long-term contextual understanding of education as a social institution. Development of perspective-driven explanation.

EdPA 8302. Educational Policy Perspectives. (3 cr)
Public policy issues in education. Historical, international, political, research perspectives. Current policy strategies for reforming U.S. public schools.

EdPA 8303. Modeling the Learning Organization. (3 cr)
Computer software, perspectives on learning organization used to study global education, human service organizations.

EdPA 8304. Leadership and Ethics. (3 cr)
Review of major leadership theories, their application to problems of practice in educational organizations. Studies of leadership behavior illustrate major emerging issues in educational management.

EdPA 8321. Data Analysis for Educational Management. (3 cr)
Managers of educational organizations are faced with problems that require analysis of a wide range of information. Outlines a frame for data analysis and introduces a set of computer-based tools suited to the practice of educational administration.

EdPA 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

EdPA 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

EdPA 8502. Program Evaluation Theory and Models: Qualitative and Quantitative Alternatives. (3 cr; QP–5240 or 5285 or EPsy 5243; SP–5501 or EPsy 5243)
Concepts, approaches, models, and theoretical frameworks for program evaluation that have developed since the 1960s.

EdPA 8595. Evaluation Problems. (1-6 cr [max 24 cr]; QP–5240 or 5285 or EPsy 5243; SP–[5501 or EPsy 5243], #)
Independent study of an issue in theory or practice of program evaluation.

EdPA 8596. Evaluation Internship. (1-9 cr [max 24 cr]; QP–5240 or 5285 or EPsy 5243; SP–[5501 or EPsy 5243], #)
Hands-on experience in conducting a program evaluation in a real-world setting under supervision of an evaluation professional.

EdPA 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

EdPA 8702. Administration and Leadership in Higher Education. (3 cr; QP–5201, 5250; SP–5001, 5701)
Leadership, governance, and administration in higher education through theoretical perspectives and practical analysis. Planning, change, decision making, organizational culture, budgets, conflict.

EdPA 8703. Public Policy in Higher Education. (3 cr; QP–5201, 5250; SP–5001, 5701; A-F only)
Theories, analytic methods, and critical issues in postsecondary education policy at national/state levels. Equality of educational opportunity, affirmative action, system governance/coordination, research funding, student financial aid, public accountability.

EdPA 8721. Instruction and Learning in Higher Education. (3 cr)
Theory/practice of teaching strategies. Implications of student differences (learning style, ethnicity, gender, age) for teaching. Evaluation and professional development of teaching. Context/nature of faculty work, ethical issues, teaching portfolio development.

EdPA 8724. Strategic Planning in Higher Education. (3 cr; QP–8250 or 8258; SP–5701)
Strategic planning principles, their application to higher education, pitfalls encountered by planners in higher education. Selected tools of strategic planning/management, strategic planning case studies.

EdPA 8728. Economics of Higher Education. (3 cr)
Institutional responses to changing external economic factors; economic effects resulting from higher education's output in teaching, research, and service; research on institutional and governmental policies.

EdPA 8732. Financing Higher Education. (3 cr; SP–5701)
Theories and critical issues in financing postsecondary education. Budgeting, cost-effectiveness, state/federal funding policies, tuition policies, student financial aid, financing educational opportunity.

EdPA 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

EdPA 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Educational Psychology (EPsy)

Department of Educational Psychology

College of Education and Human Development

EPsy 5100. Colloquium Series: Research and Issues in Psychological Foundations of Education. (1 cr [max 3 cr]; SP–Grad student in psychological foundations of education or #; S-N only)
Presentation/critique of faculty/student research.

EPsy 5101. Intelligence and Creativity. (3 cr; A-F only)
Contemporary theories of intelligence and intellectual development and contemporary theories of creativity and their implications for educational practices and psychological research.

EPsy 5112. Knowing, Learning, and Thinking. (4 cr; A-F only)
Principles of human information processing, memory, and thought; mental operations in comprehension and problem solving; developing expertise and automaticity; emphasis on applied settings.

EPsy 5113. Psychology of Instruction and Technology. (3 cr)
Introduction to adult learning and instructional design. Application of core foundational knowledge to development of effective learning environments for adults. Topics include philosophy, learning theories, instructional models, development and experience, individual differences, evaluation, assessment, and technology.

EPsy 5114. Psychology of Student Learning. (3 cr; A-F only)
Principles of educational psychology: how learning occurs, why it fails, and implications for instruction. Topics include models of learning, development, creativity, problem-solving, intelligence, character education, motivation, diversity, special populations.

EPsy 5115. Psychology of Adult Learning and Instruction. (3 cr)
Survey of adult learning/instruction. Emphasizes instructional design, learning theories, experience, individual differences, evaluation, tests/measurement, technology. Implications for curricular/instructional design in higher education, continuing education, professional/business related training.

EPsy 5117. Problem Solving and Decision Making. (3 cr; A-F only)
Strategies, rules, methods, and other cognitive components involved in problem solving and decision making, implications for educational practices, and applied domains.

EPsy 5125. Psychology of Building Character, Values, and Behavior. (3 cr; A-F only)
New approaches to motivation, building prosocial values and behavior; how to alter values and behavior of anti-social individuals; strengths and weaknesses of traditional approaches to character education; instilling prosocial values as a way to alter negative behaviors.

EPsy 5135. Human Relations Workshop. (4 cr; S-N only)
Experiential course addressing issues of prejudice and discrimination in terms of history, power, and social perception. Includes knowledge and skills acquisition in cooperative learning, multicultural education, group dynamics, social influence, effective leadership, judgment and decision-making, prejudice reduction, conflict resolution.

EPsy 5151. Cooperative Learning. (3 cr)
Participants learn how to use cooperative learning in their setting. Topics include theory and research, teacher's role, essential components that make cooperation work, teaching social skills, assessment procedures, and collegial teaching teams.

EPsy 5152. Psychology of Conflict Resolution. (3 cr)
Overview of the field of conflict resolution. Major theories, research, major figures in the field, factors influencing quality of conflict resolution are covered. The nature of conflict, the history of field, and intrapersonal, interpersonal, intergroup conflict, negotiation, mediation are discussed.

EPsy 5154. Organization Development and Change. (3 cr)
Overview of organizational development and change. Normative models of effective organizations, entry and contracting skills, diagnosis procedures and intervention procedures (data feedback, skills training, continuous improvement, mediation).

EPsy 5155. Group Dynamics and Social Influence. (3 cr)
Overview of the field of group dynamics with emphasis on social influence. Major theories, research, and figures in the field are covered. Group goals, communication, leadership, decision making, problem solving, conflicts, power, uniqueness theory, deindividuation, and minority influence will be covered.

EPsy 5156. Social and Personality Influences on Education. (4 cr; A-F only)
Survey of social psychology and personality applied to education. Application of major theories and research to classroom and school practices and educational issues are emphasized. Class sessions include lectures, discussions, simulations, experiential exercises. Intrapersonal, interpersonal, and group dynamics are discussed.

EPsy 5157. Social Psychology of Education. (3 cr; A-F only)
Overview of social psychology and its application to education. Participants study the major theories, research, and major figures in field. Class sessions include lectures, discussions, simulations, role-plays, and experiential exercises.

EPsy 5191. Education of the Gifted and Talented. (3 cr; A-F only)
Theories of giftedness, talent development, instructional strategies, diversity and technological issues, implications for educational practices and psychological inquiry, and international considerations.

EPsy 5200. Special Topics: Psychological Foundations. (1-4 cr [max 30 cr])
Focus on special topics in psychological and methodological concepts relevant to advanced educational theory, research, and practice not covered in other courses.

EPsy 5216. Introduction to Research in Educational Psychology. (3 cr; QP–5260 or other intro statistics course; SP–5261 or other intro statistics course; A-F only)
Introduction to educational research, leading students through the basic steps involved in designing and conducting a research study. Topics include reviewing literature, formulating research problem, using different approaches to gather data, managing and analyzing data, and reporting results.

EPsy 5221. Principles of Educational and Psychological Measurement. (4 cr; QP–5260 or equiv; SP–5261 or equiv)
Concepts, principles, and methods in educational/psychological measurement. Reliability, validity, item analysis, scores, score reports (e.g., grades). Modern measurement theories, including item response theory and generalizability theory. Emphasizes construction, interpretation, use, and evaluation of assessments regarding achievement, aptitude, interests, attitudes, personality, and exceptionality.

EPsy 5231. Introductory Statistics and Measurement in Education. (4 cr)
Students develop an understanding of basic statistics and measurement concepts and tools and apply them to the collection, analysis, and interpretation of data.

EPsy 5243. Principles and Methods of Evaluation. (3 cr)
Introductory course in program evaluation; planning an evaluation study, collecting and analyzing information, reporting results; overview of the field of program evaluation.

EPsy 5246. Evaluation Colloquium: Psychological Foundations. (1 cr [max 8 cr]; QP–5240/EdPA 5285; SP–5243/EdPA 5501; S-N only)
Informal seminar of faculty and advanced students interested in the issues and problems of program evaluation.

EPsy 5261. Introductory Statistical Methods. (3 cr)
Application of statistical concepts/procedures. Graphs, numerical summaries. Normal distribution, correlation/regression analyses, probability, statistical inferences for one or two samples. Hypothesis tests, Chi-square tests. Conceptual understanding/application of statistics.

EPsy 5262. Intermediate Statistical Methods. (3 cr; SP–5261 or equiv)
Application of statistical concepts/procedures. Analysis of variance, covariance, multiple regression. Experimental design: completely randomized, block, split plot/repeated measures.

EPsy 5263. Statistics for Preprofessional Students. (3 cr)
Descriptive statistics for continuous variables, simple regression and correlation, inferences on means, introduction to analysis of variance and multiple regression, contingency tables, and computer analysis techniques.

EPsy 5281. Introduction to Computer Operations and Data Analysis in Education and Related Fields. (3 cr; S-N only)
Introductory computer literacy course to familiarize students with personal computers and computing resources at the University. Applications include electronic communications, spreadsheets, graphical presentation, and data analysis.

EPsy 5300. Special Topics in Educational Psychology. (1-9 cr [max 9 cr])
Current issues in educational psychology or related areas not normally available through regular curriculum offerings.

EPsy 5400. Special Topics in Counseling Psychology. (1-4 cr [max 8 cr])
Theory, research, and practice in counseling and student personnel psychology. Topics vary.

EPsy 5401. Counseling Procedures. (3 cr; QP–Upper div student; SP–Upper div student)
Emphasis on the counseling relationship and principles of interviewing. Case studies, role playing, and demonstration. For individuals whose professional work includes counseling and interviewing.

EPsy 5412. Introduction to Developmental Counseling and Guidance. (3 cr; QP–#; SP–#)
Contemporary models of counselors as advocates for all students. Emphasizes prevention and systems intervention with counselors involved in the developmental guidance curriculum, school change, staff and community collaboration, individual student planning, and learning success with diverse populations.

EPsy 5421. Leadership and Administration of Student Affairs. (3 cr; A-F only)
Theoretical approaches, administrative structure, and evaluation methods used in college/university student affairs.

EPsy 5422. Principles of Group Work: Theory and Procedures. (3 cr; QP–Advanced undergrad or grad student in the helping professions; SP–Advanced undergrad or grad student in the helping professions)
Principles and practices of group work for educators and the helping professions. Discussion of various types of groups (e.g., counseling support, task, psychoeducational). Applications to various settings and populations (e.g., schools and community agencies).

EPsy 5432. Foundations of Individual/Organizational Career Development. (3 cr; A-F only)
Introduction to individual and organizational career development theory and practice. Examines critical issues in work patterns, work values, and workplaces in a changing global society, with implications for career planning, development, and transitions, emphasizing personal and organizational change. For nonmajors: serves students in adult ed, HRD, IR, college student advising, and other related fields.

EPsy 5433. Counseling Women Over the Life Span. (3 cr; QP–Counseling or career development course; SP–Counseling or career development course)
Counseling skills and interventions to facilitate career development of girls and women of different life stages and backgrounds (school girls to older women); developmental issues from a systematic integrative life planning framework; facts, myths, and trends regarding women's changing roles.

EPsy 5434. Counseling Adults in Transition. (3 cr; QP–Advanced undergrad or grad student in the helping professions; SP–Advanced undergrad or grad student in the helping professions)
Psychological, physical, and social dimensions of adult transitions (e.g., family and personal relationships, career). Adult development theories, stress and coping, and helping skills and strategies as they relate to adult transition.

EPsy 5451. The College Student. (3 cr)
The psychology and sociology of college students, including research concerning diversity of populations, vocational development of students, student society, culture, mental health, underachievement, dropouts, values and attitudes, and relevant research methods.

EPsy 5461. Cross-Cultural Counseling. (2 cr; A-F only)
Emphasis on the effect of cross-cultural and cross-national psychological differences in human traits and characteristics. These theoretical differences provide a framework for the development and implementation of effective cross-cultural counseling interventions.

EPsy 5601. Survey of Special Education. (2 cr)
Introduction to programs and services provided to people with disabilities in school and community settings. Emphasis on the needs of families, to the roles and responsibilities of teachers, and to related service providers.

EPsy 5602. Computer Technology in Special Education. (2 cr; A-F only)
Develop skills, understand processes, and identify resources needed to utilize technology to benefit persons with disabilities. Emphasis on learning theory, principles of effective instruction, instructional and assistive technology integration.

EPsy 5603. Childhood Language Development: Classroom Implications. (3 cr)
Recent trends and findings in the study of language acquisition and communication; classroom implications, including education of exceptional children and implications of diversity on instruction.

EPsy 5604. Transition from School to Work and Community Living for Persons With Special Needs. (2 cr)
Design of training programs to promote independent living. Vocational and community adjustment for persons with disabilities and who are at-risk. Curriculum materials, methods, and organizational strategies for adolescents and adults, families, and community service providers.

EPsy 5609. Family-Centered Services. (2 cr; A-F only)
Methods for collaborating with families in the education of children with disabilities. Focus on family-centered approach to design of educational plans and procedures. Specific emphasis on multicultural perspectives of family life and expectations for children.

EPsy 5612. Understanding of Academic Disabilities. (3 cr; A-F only)
Introduction to issues related to the education of students with academic disabilities (learning disabilities, mild mental intellectual disabilities, and emotional/behavioral disabilities) including history, definition, assessment, classification, legislation, and intervention approaches.

EPsy 5613. Foundations of Special Education I. (3 cr; QP–Child development course, 5601 or equiv; SP–Child development course, 5601 or equiv; A-F only)
Emphasis on the organization of educational programs and services for people with disabilities and their families. First course for students seeking to become licensed teachers in special education.

EPsy 5614. Foundations of Special Education II. (3 cr; QP–5601, 5608 or 5609; SP–5613; A-F only)
Emphasis on assessment, planning, and implementing educational programs for people with disabilities. Second course for students seeking to become licensed teachers in special education.

EPsy 5615. Advanced Academic Interventions. (3 cr; QP–5612; SP–5612; A-F only)
Develop knowledge and skills in designing, implementing, and evaluating Individual Educational Plans (IEPs) for students eligible for special education service in learning disabilities, emotional/behavioral disorders, and mild mental intellectual disabilities.

EPsy 5616. Behavior Analysis and Classroom Management. (3 cr)
Introduction to assumptions, principles, and procedures of behavioral approach to analyzing behavior and programs for classroom management. Emphasis on specifying problems, conducting observations, intervening, and evaluating behavioral change.

EPsy 5621. Functional/Basic Academic Interventions in Mental Retardation. (3 cr; QP–5601; SP–5613, 5614; A-F only)
Methods and materials course emphasizing functional approaches to promoting academic learning in students with mild to moderate mental retardation and moderate to severe mental retardation.

EPsy 5622. Programs and Curricula for Learners With Severe Disabilities. (3 cr; QP–5116; SP–5616)
Emphasis on developing programs and curricula for students with moderate, severe, and profound developmental delays, as well as severe multihandicapping conditions. Special consideration given to preparing children and youth for integrated community environments.

EPsy 5624. Biomedical and Physical Aspects of Developmental Disabilities. (2 cr; A-F only)
Anatomy, physiology, and kinesthiology. Central/peripheral nervous system. Prenatal, perinatal, and postnatal development. Physically disabling conditions. Management/education procedures.

EPsy 5625. Education of Infants, Toddlers, and Preschool Children With Disabilities: Introduction. (2 cr; A-F only)
Overview of the issues, problems, and practical applications in designing early intervention services for young children with disabilities and their families.

EPsy 5626. Seminar: Developmental Disabilities and Instructional Management. (3 cr; QP–5116, 5622; SP–5612, 5622)
Data-based strategies for school and nonschool instruction of learners with developmental disabilities including assessment, design, implementation, and evaluation of curriculum and instruction: curriculum content, concept and task analysis, classroom arrangements, natural and instructional cues, corrections, and consequences.

EPsy 5635. Education of Students With Physical and Health Disabilities. (3 cr; QP–5601 or #; SP–5601 or #; A-F only)
Introduction to students with physical and health disabilities and their characteristics; the educational implications of physical disabilities; assessment procedures and appropriate educational interventions for learners with physical and health disabilities.

EPsy 5636. Education of Multihandicapped Learners With Sensory Impairments. (2 cr; QP–#; SP–5613, 5614)
Characteristics of learners with visual and auditory impairments; design of instructional programs to remediate or circumvent disabilities, including use of prosthetic devices; related areas of performance affected by sensory impairments.

EPsy 5641. Foundations of Education for Individuals Who Are Deaf/Hard of Hearing. (3 cr)
Historical and current issues related to education of individuals who are deaf or hard of hearing. Implications of causes of hearing loss, social and cultural relationships, philosophies of education, characteristics and legislative guidelines and their applicability to education of individuals who are deaf or hard of hearing.

EPsy 5642. Early Childhood Intervention for Infants, Toddlers, and Preschoolers Who Are Deaf/Hard of Hearing. (3 cr; SP–Preservice teacher in deaf education licensing program or #)
Early identification/assessment. Family-centered, interdisciplinary servicing. Program development for infants, toddlers, preschoolers who are deaf/hard of hearing. Presentations, discussions, activities.

EPsy 5644. Language Development and Programming for Deaf/Hard of Hearing Children. (3 cr)
Comparative study of the development of functional language in communicatively disabled and nondisabled individuals. Philosophies, programs, and practices focusing on the development of language with deaf and hard of hearing individuals. Models of assessment and instruction for use in educational settings.

EPsy 5646. Reading and Writing Practices With Deaf/Hard of Hearing Children. (3 cr; QP–5643, 5644 or #; SP–5644 or general educ methods in tchg reading and writing skills, or #)
Gain knowledge and skills to assess, plan, and implement instruction for children and youth with hearing loss. Emphasis is placed on research, theoretical, and programmatic issues in developing reading and writing skills, curricular adaptations, and effective instructional approaches.

EPsy 5647. Aural and Speech Programming for Persons Who Are Deaf/Hard of Hearing. (3 cr)
Study of the speech and hearing mechanisms, causes of hearing loss, and rehabilitation. Emphasis on instructional practices, aural rehabilitation in the educational setting, adaptive technology, and adaptations to optimize functional skills with individuals who are deaf or hard of hearing.

EPsy 5648. Communication Systems for Children With Disabilities. (2 cr)
Applied study of assessment, selection, and application of alternative communication strategies for infants, children, and youth with disabilities. Emphasis on children with hearing loss and additional disabilities.

EPsy 5649. Models of Instructional Programming With Deaf and Hard of Hearing Students. (3 cr; QP–5644 or #; SP–[5641, 5644] or #)
Design/development of portfolios for various models of educational service delivery systems for individuals with hearing loss. Emphasizes consultation skills, curriculum management/modifications, material/technology applications, and support service adaptations.

EPsy 5656. Social and Interpersonal Characteristics of Students With Disabilities. (3 cr; A-F only)
Emphasis on children and youth of school age and on the ways in which their emotional, social, and behavioral disorders affect their functioning in school and on ways in which their behaviors disturb others.

EPsy 5657. Interventions for Social and Emotional Disabilities. (3 cr; QP–5116, 5656; SP–5616, 5656; A-F only)
Developing comprehensive behavioral programs for students with social and emotional disabilities. Instructing students with social and emotional disabilities.

EPsy 5671. Literary Braille. (3 cr; A-F only)
Mastery of literary braille code including all contractions and short-form words used in Grade 2 English Braille: American Usage. Use of specialized braille writing equipment including, braille writer, slate and stylus, and computer programs with six-key input.

EPsy 5672. Advanced Braille Codes. (2 cr; QP–5671 or #; SP–5671 or #; A-F only)
Mastery of the Nemeth code for braille mathematics transcription including elementary math computation, algebra, geometry, trigonometry, and symbolic logic notation. Introduction to foreign languages, computer notation, music, and raised line drawing techniques.

EPsy 5673. Reading and Writing for Children With Visual Disabilities. (2 cr; QP–5671, CI 5414 or equiv, or #; SP–5671, CI 5414 or equiv, or #; A-F only)
Principles of preparation, selection, and use of instructional materials and adaptive technology for children with visual disabilities, including use of braille, large print, auditory tapes, and computer files to access and electronically convert information between these different media.

EPsy 5674. Techniques of Orientation, Mobility, and Independence for Students With Visual Disabilities. (3 cr; QP–5673, 5675 or #; SP–5675 or #; A-F only)
Introduction to basic techniques to gain skills in pre-cane techniques, orientation to learning environments, and adaptations for activities of daily living and independence. Introduction to mobility maps, consideration of cane, guide dog, and telescopic aids to mobility.

EPsy 5675. Structure and Function of the Eye: Educational Implications. (3 cr; A-F only)
Anatomy and physiology of the eye and its relation to visual perception. Educational considerations for students with low vision studied in relation to ophthalmological and optometric evaluations and functional vision assessment.

EPsy 5676. Case Management for Children With Visual Disabilities. (3 cr; QP–5671, 5673, 5675; SP–5671, 5673, 5675; A-F only)
Advanced course evaluating and managing cognitive, psychosocial, physical, and academic needs of students. Consideration of parent, teacher, and student in counseling and educational program management.

EPsy 5681. Education of Infants, Toddlers, and Preschool Children With Disabilities: Methods and Materials. (3 cr; QP–5625; SP–5625; A-F only)
Overview of the methods and materials available to maximize the developmental and educational outcomes for young children, birth to age 5, with disabilities and their families in home, community, and school based-settings.

EPsy 5701. Practicum: Field Experience in Special Education. (1-6 cr [max 12 cr]; SP–[[SpEd grad or SpEd licensure program or Foundations of Educ Program], [[[5613 or ¶5613], [5614 or ¶5614]] or equiv]] or #; A-F only)
Observations, supervised support of teaching practice in schools or other agencies serving children with disabilities in integrated programs.

EPsy 5720. Special Topics: Special Education. (1-4 cr [max 12 cr]; SP–#)
Lab and fieldwork approach, often assuming a product orientation, e.g., generation of action plan, creating set of observation field notes, collecting data in some form. Provides opportunities for educational personnel to study specific problems and possibilities related to special education.

EPsy 5740. Special Topics: Interventions and Practices in Educational and Human Service Programs. (1-4 cr [max 8 cr]; QP–#; SP–#)
Concepts, issues, and practices related to the community inclusion of children, youth, and adults with developmental disabilities through weekly seminar and extensive supervised experience working with individuals within the community.

EPsy 5751. Student Teaching: Deaf/Hard of Hearing. (1-6 cr [max 10 cr]; QP–#; SP–#)
Students participate in educational programming for infants, children, and youth who are deaf or hard of hearing, as well as in onsite, directed experiences under the supervision of master teachers of deaf and hard of hearing students.

EPsy 5752. Student Teaching: Learning Disabilities. (1-6 cr [max 10 cr]; QP–#; SP–#; S-N only)
Supervised experience in teaching or related work in schools or other agencies serving children and adolescents with learning disabilities.

EPsy 5753. Student Teaching: Early Childhood Special Education. (1-6 cr [max 8 cr]; QP–#; SP–#; completion of all course requirements for license in ECSE; S-N only)
Supervised experience in teaching or related work in schools, agencies, or home settings with infants, toddlers, and preschoolers with disabilities and their families.

EPsy 5754. Student Teaching: Social and Emotional Disabilities. (1-6 cr [max 8 cr]; QP–Completion of licensure courses for social and emotional disorders; #; SP–Completion of licensure courses for social and emotional disorders; #; A-F only)
Teach students with social and emotional disorders at public schools and other appropriate sites. Attend a weekly seminar on student teaching competencies.

EPsy 5755. Student Teaching: Developmental Disabilities—Secondary. (1-6 cr [max 6 cr]; QP–Completion of all licensure coursework; #; SP–Completion of all licensure coursework; #; A-F only)
Supervised student teaching, or special practicum project, in schools, or other agencies serving individuals at the secondary level who have mild to moderate as well as moderate to severe disabilities.

EPsy 5756. Student Teaching: Developmental Disabilities—Elementary. (1-6 cr [max 6 cr]; QP–Completion of all licensure coursework; #; SP–Completion of all licensure coursework; #; S-N only)
Supervised student teaching, or special practicum project, in schools or other agencies serving children at the elementary level who have mild to moderate as well as moderate to severe disabilities.

EPsy 5757. Student Teaching: Physical and Health Related Disabilities. (1-6 cr [max 8 cr]; QP–#; SP–#; A-F only)
Supervised student teaching and related work (direct instruction and consultation) in schools or other agencies serving children and adolescents who have physical disabilities.

EPsy 5758. Student Teaching: Visual Impairments. (1-6 cr [max 8 cr]; QP–#; SP–#; A-F only)
Supervised student teaching, or special practicum project, in schools or other agencies serving children and adolescents who have visual impairments.

EPsy 5800. Special Topics in School Psychology. (1-9 cr [max 9 cr])
Current issues in school psychology or areas not normally available through regular curriculum offerings.

EPsy 5801. Assessment and Decision Making in School and Community Settings. (3 cr; A-F only)
Introduction to psychological and educational assessment for individuals who work with children, especially those experiencing academic and behavior problems. Study of standardized group and individual tests of intelligence, achievement, socio-emotional functioning, perception, reading, mathematics, adaptive behavior, and language.

EPsy 5849. Observation and Assessment of the Preschool Child. (3 cr)
Introduction to assessment principles and practices, including observational assessment methods, for children (birth to 5). Intended primarily for teachers in training and others interested in basic information regarding assessment and its relationship to intervention services for young children.

EPsy 5851. Collaborative Family-School Relationships. (2-3 cr; QP–Honors senior class or grad student; SP–Honors senior class or grad student)
Theoretical and empirical bases for creating collaborative family-school relationships for students' development and educational success in school. Emphasis on model programs for K-12 and practical strategies for educational personnel to address National Educational goal 8.

EPsy 5852. Prevention and Early Intervention. (3 cr)
Theory/research base for school-based primary/secondary programs to promote academic/social competence of children/youth (birth to grade 12).

EPsy 5871. Interdisciplinary Practice and Interagency Coordination in Education and Human Services. (3 cr)
Principles and procedures of interdisciplinary practice and interagency coordination. Examine the relative strengths of interdisciplinary approaches, develop skills for collaborating with others, and examine different approaches to interagency coordination.

EPsy 5991. Independent Study in Educational Psychology. (1-8 cr [max 20 cr]; QP–#; SP–#; A-F only)
Self-directed study in areas not covered by regular courses. Specific program of study is jointly determined by student and advising faculty member.

EPsy 8111. Seminar: Knowledge and Skill. (3 cr; SP–Learning and cognition courses; A-F only)
Analysis of expertise in human problem solving; representation of knowledge and skill; issues in human and artificial intelligence; semantic memory; processes of acquisition; research in cognitive science useful for educational practice; design of educational environments.

EPsy 8114. Seminar: Cognition and Learning. (3 cr)
Advanced study in critical analysis and application of contemporary psychological theory and research in cognition and learning for education.

EPsy 8115. Psychology of Instruction and Technology. (3 cr)
Seminar including, but not limited to, learning and instructional theories, advanced and emerging technologies, and measurement and evaluation.

EPsy 8131. Development of Moral-Political Judgment. (3 cr; A-F only)
Current research topics in socio-political moral judgment and moral development.

EPsy 8132. Personality Development and Socialization. (3 cr; SP–Personality or child psych course)
Major research and theoretical work. Developmental and educational influences on personality.

EPsy 8216. Seminar: Research Processes in Psychological Foundations of Education. (3 cr; SP–[5216, admitted to doctoral program in psych foundations] or #; A-F only)
Advanced examination of research processes in educational psychology. Invited faculty discuss specific research designs. Students refine/implement research projects and present them in class.

EPsy 8221. Psychological Scaling. (3 cr; SP–5221 or equiv, 8261-8262 or equiv)
Elementary and advanced topics in unidimensional and multidimensional scaling: measurement theory and statistics, rating scales and other category scaling methods, magnitude estimation, paired comparisons, multi-attribute scaling, and multidimensional scaling.

EPsy 8222. Advanced Measurement: Theory and Application. (3 cr; SP–5221 or equiv, 8261-8262 or equiv)
Educational and psychological measurement, their applications, and their interrelationships: classical reliability and validity theory, item response theory, generalizability theory, differential item functioning, matrix sampling, and test equating.

EPsy 8261. Statistical Methods I: Probability and Inference. (3 cr; QP–5260 or equiv; SP–[5261 or equiv], grad student)
Advanced theory, derivations of quantitative statistics. Descriptive statistics, probability, normal distribution. One-/two-sample hypothesis tests, confidence intervals. Chi square tests. One-way analysis of variance, follow up tests.

EPsy 8262. Statistical Methods II: Regression and the General Linear Model. (3 cr; QP–[8260, 8261] or equiv; SP–8261 or equiv)
Analysis of variance designs (two-/three-way), repeated measures, correlation, simple/multiple regression methods, non-parametric procedures, multivariate analyses.

EPsy 8263. Design and Analysis of Experiments. (3 cr; QP–8260, 8261, 8262 or equiv; SP–8261, 8262 or equiv)
Advanced treatment of various experimental designs, including completely randomized factorial, randomized block, hierarchical, repeated measures, and Latin square designs. Major computer packages used for data analyses. Univariate and multivariate approaches to these designs.

EPsy 8264. Advanced Multiple Regression Analysis. (3 cr; QP–8260-8262, regression and ANOVA course, familiarity with a statistical analysis package; SP–8261-8262, regression and ANOVA course, familiarity with a statistical analysis package)
General linear model used as a context for regression. Matrix algebra, multiple regression, path analysis, polynomial regression, standardized regression, stepwise solutions, analysis of variance, weighted least squares, and logistic regression.

EPsy 8265. Factor Analysis. (3 cr; QP–8262, familiarity with a statistical analysis package; SP–8262, familiarity with a statistical analysis package)
Factor analytic techniques and applications. Component, common factor, and image analysis; general discussion of factor extraction. Estimating number of dimensions, rotation, and factor score estimation.

EPsy 8266. Statistical Analysis Using Structural Equation Methods. (3 cr; QP–8263 or 8264; SP–8263 or 8264)
Quantitative techniques using manifest and latent variable approaches for analysis of educational and social science data. Introduction to structural equation modeling approaches to multiple regression, factor analysis, and path modeling. Developing, estimating, and interpreting structural equation models.

EPsy 8281. Advanced Statistical Computing and Data Analysis. (3 cr; QP–5260 or equiv, 5281 or 5262 or equiv; SP–5261 or equiv, 5281 or equiv)
Cross-disciplinary course. Students learn to use SAS statistical package to perform data management, data analysis, and report writing.

EPsy 8290. Special Topics: Seminar in Psychological Foundations. (1-6 cr [max 15 cr]; SP–#)
Students formulate research designs. Learning and cognition, social psychology, measurement, and statistics.

EPsy 8295. Problems: Evaluation. (1-6 cr [max 6 cr]; QP–5240 or EdPA 5285; #; SP–5243 or EdPA 5501; #)
Individually directed study of an issue in the theory or practice of program evaluation.

EPsy 8296. Internship: Evaluation. (1-9 cr [max 9 cr]; QP–5240 or EdPA 5285, #; SP–5243 or EdPA 5501, #)
Hands-on experience in conducting a program evaluation in a real-world setting under supervision of an evaluation professional.

EPsy 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

EPsy 8402. Individual Counseling: Theory and Applications. (3 cr; SP–Grad ed psy major with CSPP subprog or #; A-F only)
Traditional and contemporary theories of counseling and psychotherapy. Applications to various settings and populations.

EPsy 8403. Social/Cultural Contexts: Counseling and Skills. (3 cr; SP–Grad ed psy major with CSPP subprog or #; A-F only)
Broad personal dimensions of race, ethnicity, gender, class, beliefs, disability, age, sexual orientation, and geographic origin. Societal and personal biases and stereotypes; multicultural concepts and culturally appropriate counseling procedures.

EPsy 8404. Group Counseling: Theory, Applications, and Skills. (3 cr; SP–Ed psy M.A. or Ph.D. student with CSPP subprog or #; A-F only)
Theories, research, and procedures of group counseling and of groups such as psychoeducational groups. Applications to various settings and populations. Ethical issues in group work. Practice of group skills and techniques, including group participation and observation.

EPsy 8405. Career Development: Theory, Skills, and Counseling Applications. (3 cr; QP–CSPP; SP–CSPP; A-F only)
Career development theory/practice over life span. Emphasizes career counseling for individuals/organizations, systems approaches to career programs in education/business. Traditional/contemporary theories/practices.

EPsy 8411. Advanced Counseling Research. (4 cr; SP–Ed psy Ph.D. student with CSPP subprog or #; A-F only)
Focus on critically reviewing counseling research, qualitatively and quantitatively integrating research, and designing valid research.

EPsy 8412. Seminar: Advanced Counseling Theory and Ethics. (4 cr; SP–Ed psy Ph.D. student with CSPP subprog or #; A-F only)
Comparative analysis of theoretical models and methods used in contemporary counseling and psychotherapy; ethical standards and models of ethical decision making for professional roles.

EPsy 8413. Personality Assessment of Adolescents and Adults. (3 cr; SP–Grad ed psy major or #; A-F only)
Students develop or increase expertise in psychological assessment of adolescents and adults through assessment interviews, MMPI-2, MMPI-A, DSM4, and integration of this content in written assessment reports.

EPsy 8431. Master's Research Seminar: CSPP. (4 cr; QP–5260 or equiv, 5221 or equiv; SP–5261 or equiv, 5221 or equiv, ed psy M.A. student with CSPP subprog or #; A-F only)
Survey of research methods, data-based decision making, basic research design skills, and research simulation.

EPsy 8435. Integrative Seminar: School Counseling. (3-6 cr [max 6 cr]; SP–CSPP grad student in school counselor licensure prog; not open to M.Ed. students)
Integrates previous work in counseling, career development, consultation, and multicultural issues with school counseling practicum/internship. Semester I: New roles of the counselor and developing and managing guidance program. Semester 2: Ways guidance program addresses developmental and cultural issues.

EPsy 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

EPsy 8452. Psychological Aspects of Counseling Supervision. (3 cr; SP–Ed psy Ph.D. student with CSPP subprog or #)
Theories, review of relevant research, demonstration, and in-class practice of supervision skills.

EPsy 8501. Counseling Pre-Practicum. (3 cr; QP–[CSPP or genetic counseling] grad student; SP–[CSPP or genetic counseling] grad student; A-F only)
Overview of basic helping skills through demonstration, in-class practice.

EPsy 8502. Field Placement in Counseling and Student Personnel Psychology. (2 cr; QP–8501; SP–8501 or #; S-N only)
Students participate under supervision in practitioner activities within a counseling work environment.

EPsy 8503. Counseling Practicum I. (1-4 cr; SP–8502 or #; A-F only)
Beginning-level supervised practice in counseling with individuals and groups; emphasizes systematic evaluation of student's counseling practice through direct observations, video, and audio tapes.

EPsy 8504. Counseling Practicum II. (1-4 cr; SP–8503 or #; A-F only)
Intermediate supervised practice in counseling with individuals and groups; emphasizes ethical issues with systematic evaluation of student's practice through direct observations, video, and audio tapes.

EPsy 8509. Supervision Practicum: CSPP. (2 cr; SP–[Ed psy Ph.D. student with CSPP subprog] or #)
Students involved in counseling supervision of beginning courses.

EPsy 8512. Internship: CSPP. (1-6 cr [max 12 cr]; SP–Ed psy M.A. or Ph.D. student with CSPP subprog; A-F only)
Supervised internship in counseling, counseling psychology, or student personnel psychology at sites approved by CSPP program.

EPsy 8513. University Counseling Practicum I. (4 cr; SP–Ed psy M.A. or Ph.D. student with CSPP subprog or #; S-N only)
Integrates science of counseling psychology with supervised practice in University Counseling and Consulting Services with career, academic, and personal clients.

EPsy 8514. University Counseling Practicum II. (4 cr; QP–8513, #; SP–8513, #; S-N only)
Integrates science of counseling psychology with supervised practice in University Counseling and Consulting Services with career, academic, and personal clients.

EPsy 8521. Practicum in Student Affairs and Student Development. (1-4 cr [max 8 cr]; SP–Ed psy M.A. or Ph.D. student with CSPP subprog or #; A-F only)
Supervised practice in university and college student development offices.

EPsy 8522. Counseling Practicum: Advanced. (3 cr [max 9 cr]; SP–[Grad ed psy major with CSPP subprog] or #)
Advanced skills practicum in counseling, counseling psychology, or student development.

EPsy 8600. Special Topics: Special Education Issues. (1-3 cr [max 9 cr])
Current trends (e.g., schoolwide discipline, models of collaboration, and diversity) investigated by formulating research projects. Students write a media piece describing an issue and its impact on the community.

EPsy 8612. Seminar: Students With Academic Difficulties. (3 cr; A-F only)
Survey, analysis, and application of relevant theories and research related to current issues. Students in course develop skills in scholarly inquiry, writing, and debate.

EPsy 8621. Seminar on Intellectual Impairments. (3 cr; SP–Grad students interested in mental retardation and related intellectual impairments)
Review of research and theories in context of relevant developmental theories; important contributions in primary sources concerning principles of cognition and behavior and applied problems. Procedures for deriving appropriate field applications; generalizing and implementing researchable questions.

EPsy 8651. Seminar on Social and Emotional Disabilities. (3 cr; A-F only)
Review and critical analysis of current trends and future directions of education of students with social and emotional disabilities.

EPsy 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

EPsy 8677. Seminar: Information Acquisition for Persons With Disabilities. (3 cr [max 6 cr]; A-F only)
Research findings from diverse disciplines on impact of hearing and visual disabilities on ability to acquire and/or access information.

EPsy 8694. Research in Special Education. (3 cr)
Design and implementation of research related to the unique developmental characteristics of exceptional learners.

EPsy 8701. Doctoral Core Seminar: Special Education I. (3 cr [max 6 cr]; SP–Ed psy Ph.D. student with spec ed subprog or #; A-F only)
Required for students with a family/life span focus on social development, behavioral interaction, and cultural interactions.

EPsy 8702. Doctoral Core Seminar: Special Education II. (3 cr [max 6 cr]; SP–8701 or #; A-F only)
Required for students focusing on communication/language/academics.

EPsy 8706. Single Case Designs in Intervention Research. (3 cr)
Design and analysis of single-case experiments to examine effects of interventions on individual behavior in school, home, and community.

EPsy 8772. Seminar in Early Intervention. (2 cr)
Explores research from diverse disciplines related to education of infants, toddlers, and preschool children with disabilities and their families. Discusses practical application of this research.

EPsy 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

EPsy 8811. Assessment in School Psychology I: Foundations of Academic Assessment. (3 cr; SP–Grad ed psy major with school psy subprog or #; A-F only)
Theories and models of psychoeducational assessment of children and adolescents within home, school, and community. Conceptual and empirical foundations of eco-behavioral assessment that lead to efficient but comprehensive assessment of children presented from problem-solving perspective.

EPsy 8812. Assessment in School Psychology II: Intellectual and Social-Emotional Domains. (3 cr; SP–Grad ed psy major with school psy subprog or #; A-F only)
Builds on EPsy 8811. Emphasizes gathering data on a child's intellectual and social-emotional functioning and educational progress.

EPsy 8813. Assessment Practicum in School Psychology. (2 cr [max 4 cr]; QP–¶8811 or ¶8812; SP–8821, grad ed psy major with school psy subprog or #, ¶8811 or ¶8812; A-F only)
Students administer, score, and interpret standardized tests of intellectual, adaptive, and social-emotional assessment, and assess educational progress using both formal and informal instructional assessment strategies. All measures complement other facets of assessment presented in 8811 and 8812.

EPsy 8815. Systemic Intervention and Consultation. (3 cr; A-F only)
Principles/models of consultation/interventions for social-emotional problems exhibited by school-aged children. Emphasizes universal intervention, competence enhancement approaches. All interventions presented from a system-level perspective.

EPsy 8816. Individual Intervention and Consultation. (3 cr; A-F only)
In-depth study/analysis of instructional interventions/procedures necessary to work with school personnel in developing schoolwide, classroom, individual instructional interventions. Practice in developing/applying interventions with individual students.

EPsy 8818. Intervention Practicum in School Psychology. (1 cr [max 2 cr]; QP–¶8815 or ¶8816; SP–Grad ed psy major with school psy subprog, ¶8815 or ¶8816; A-F only)
Students design, implement, and evaluate interventions for individuals or groups of children and for system-level concerns under supervision of practicing school psychologists. Students observe school psychologists collaborate with educators and parents in intervention-related activities.

EPsy 8821. Seminar: School Psychology. (2 cr [max 4 cr]; SP–Grad ed psy major with school psy subprog; A-F only)
Introduction to school psychology as a professional field of specialization. Students learn about how school systems work and common roles and functions of school psychologists. Ethical and professional standards and future employment options.

EPsy 8822. Seminar on Research in School Psychology. (1 cr [max 2 cr]; SP–Grad ed psy major with school psy subprog or #; S-N only)
Integrative, developmental series of discussions and activities related to research in school psychology and related disciplines; assists students preparing written research and scholarly works. Students from other programs are welcome.

EPsy 8831. Practicum: School Psychological Services. (1-3 cr [max 6 cr]; SP–Grad ed psy major with school psy subprog)
Field placements in schools. Experiences may include consultation, assessment, direct service to individuals or groups, and report writing. Supervised on-site as well as by University through required participation in seminar.

EPsy 8832. Clinical/Community Practice in School Psychology. (1-3 cr [max 6 cr]; SP–Grad ed psy major with school psy subprog)
Supervised experience in assessment and intervention planning of children referred to psychoeducational settings; training in broad range of approaches to problems of adjustment in school-age children and their families, schools, and community settings.

EPsy 8841. Practicum: Instruction and Supervision in School Psychology. (2 cr [max 4 cr]; SP–Grad ed psy major with school psy subprog or #; A-F only)
Review of best practice literature and strategies for evaluating supervision skills. Students give lectures to and supervise school psychology students in order to learn firsthand the issues related to providing supervision and to understand responsibilities related to academic careers.

EPsy 8842. Internship: School Psychological Services. (1-10 cr [max 10 cr]; SP–Grad ed psy major with school psy subprog, #; S-N only)
Advanced field placement. Full-time supervised experience for one year or part-time for no more than two years.

EPsy 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

EPsy 8905. History and Systems of Psychology: Landmark Issues in Educational Psychology. (3 cr; SP–Ed psy Ph.D. student)
Critical issues in learning and cognition, statistics and measurement, counseling, school psychology, social psychology of education, and special education.

EPsy 8993. Directed Study: Educational Psychology. (1-10 cr [max 20 cr]; SP–#; A-F only)

EPsy 8994. Research Problems: Educational Psychology. (1-6 cr [max 18 cr]; SP–#; A-F only)
Research methodology and techniques; examination of literature; participation in formulating and executing research proposal.

Electrical Engineering (EE)

Department of Electrical and Computer Engineering

Institute of Technology

EE 5141. Integrated Sensors and Transducers. (4 cr; QP–3063, 3111; SP–3161, 3601)
Microelectromechanical systems composed of microsensors, microactuators, and electronics integrated onto common substrate. Design, fabrication, and operation principles. Labs on micromachining, photolithography, etching, thin film deposition, metallization, packaging, and device characterization.

EE 5163. Semiconductor Properties and Devices I. (3 cr; QP–3063, 3111 or #; SP–3161, 3601 or #)
Principles and properties of semiconductor devices. Selected topics in semiconductor materials, statistics, and transport. Aspects of transport in p-n junctions, heterojunctions.

EE 5164. Semiconductor Properties and Devices II. (3 cr; QP–5661 or #; SP–5163 or #)
Principles and properties of semiconductor devices. Charge control in different FETs, transport, modeling. Bipolar transistor models (Ebers-Moll, Gummel-Poon), heterostructure bipolar transistors. Special devices.

EE 5171. Microelectronic Fabrication. (4 cr; QP–IT sr or grad; SP–IT sr or grad)
Fabrication of microelectronic devices; silicon integrated circuits, GaAs devices; lithography, oxidation, diffusion; process integration of various technologies, including CMOS, double poly bipolar, and GaAs MESFET.

EE 5173. Basic Microelectronics Laboratory. (1 cr; QP–5670; SP–5171 or ¶5171)
Students fabricate a polysilicon gate, single-layer metal, NMOS chip, performing 80 percent of processing, including photolithography, diffusion, oxidation, and etching. In-process measurement results are compared with final electrical test results. Simple circuits are used to estimate technology performance.

EE 5231. Linear Systems and Optimal Control. (3 cr; QP–IT grad, Math 5242, Math 5243 or #; SP–IT grad, 3015 or #)
Properties and modeling of linear systems; linear quadratic and linear-quadratic-Gaussian regulators; maximum principle.

EE 5235. Robust Control System Design. (3 cr; QP–IT grad, Math 5243 or ¶Math 5243 or #; SP–IT grad, 3015, 5231 or #)
Development of control system design ideas; frequency response techniques in design of single-input/single-output (and MI/MO) systems. Robust control concepts. CAD tools.

EE 5301. VLSI Design Automation I. (3 cr; QP–3351 or #; SP–2301 or #)
Basic graph/numerical algorithms. Algorithms for logic/high-level synthesis. Simulation algorithms at logic/circuit level. Physical-design algorithms.

EE 5302. VLSI Design Automation II. (3 cr; QP–5874; SP–5301 or #)
Basic algorithms, computational complexity. High-level synthesis. Test generation. Power estimation. Timing optimization. Current topics.

EE 5323. VLSI Design I. (3 cr; QP–[3351, 3062] or #; SP–[2301, 3115] or #)
Combinational static CMOS circuits. Transmission gate networks. Clocking strategies, sequential circuits. CMOS process flows, design rules, structured layout techniques. Dynamic circuits, including Domino CMOS and DCVS. Performance analysis, design optimization, device sizing.

EE 5324. VLSI Design II. (3 cr; QP–5571 or #; SP–5323 or #)
CMOS arithmetic logic units, high-speed carry chains, fast CMOS multipliers. High-speed performance parallel shifters. CMOS memory cells, array structures, read/write circuits. Design for testability, including scan design and built-in self test. VLSI case studies.

EE 5327. VLSI Design Laboratory. (3 cr; QP–[5358, 5572] or #; SP–[4301, [5323 or ¶5323]] or #)
Complete design of an integrated circuit. Designs evaluated by computer simulation.

EE 5329. VLSI Digital Signal Processing Systems. (3 cr; QP–5572 or #; SP–5323 or ¶5323 or #)
Programmable architectures for signal/media processing. Data-flow representation. Architecture transformations. Low-power design. Architectures for two's complement/redundant representation, carry-save, and canonic signed digit. Scheduling/allocation for high-level synthesis.

EE 5333. Analog Integrated Circuit Design. (3 cr; QP–[3062, grad student] or #; SP–[3115, grad student] or #)
Fundamental circuits for analog signal processing. Design issues associated with MOS/BJT devices. Design/testing of circuits. Selected topics (e.g., modeling of basic IC components, design of operational amplifier or comparator or analog sampled-data circuit filter).

EE 5361. Computer Architecture and Machine Organization. (3 cr; QP–3351, 3352; SP–2301, 2361; §CSci 5201)
Introduction to computer architecture. Aspects of computer systems, such as pipelining, memory hierarchy, and input/output systems. Performance metrics. Examination of each component of a complicated computer system.

EE 5371. Computer Systems Performance Measurement and Evaluation. (3 cr; QP–5852 or #; SP–5361 or #)
Tools and techniques for analyzing computer hardware, software, and system performance. Benchmark programs, measurement tools, performance metrics. Deterministic and probabilistic simulation techniques, random number generation and testing. Bottleneck analysis.

EE 5381. Telecommunications Networks. (3 cr; QP–[5203, 5702] or #; SP–[4501, 5531] or #)
Fundamental concepts of modern telecommunications networks, mathematical tools required for their performance analysis. Layered network architecture, point-to-point protocols/links, delay models, multiaccess communication/routing.

EE 5391. Computing With Neural Networks. (3 cr; QP–3021 or Stat 3091 or #; SP–3025 or Stat 3091 or #)
Neural networks as a computational model; connections to AI, statistics and model-based computation; associative memory and matrix computation; Hopfield networks; supervised networks for classification and prediction; unsupervised networks for data reduction; associative recognition and retrieval, optimization, time series prediction and knowledge extraction.

EE 5501. Digital Communication. (3 cr; QP–5203, 3021, sr or grad in IT major or #; SP–4501, 3025, sr or grad in IT major or #)
Theory and techniques of modern digital communications. Communication limits; modulation and detection; data transmission over channels with intersymbol interference; optimal and suboptimal sequence detection; equalization. Error correction coding; trellis-coded modulation; multiple access.

EE 5505. Wireless Communication. (3 cr; QP–5203; SP–4501, [IT grad student or #]; 5501 recommended)
Introduction to wireless communication systems. Propagation modeling, digital communication over fading channels, diversity and spread spectrum techniques, radio mobile cellular systems design, performance evaluation. Current European, North American, and Japanese wireless networks.

EE 5531. Probability and Stochastic Processes. (3 cr; QP–3021, grad in IT major or #; SP–3025, grad in IT major or #)
Probability, random variables and random processes. System response to random inputs. Gaussian, Markov and other processes for modeling and engineering applications. Correlation and spectral analysis. Basic estimation principles. Examples from digital communications and computer networks.

EE 5542. Adaptive Digital Signal Processing. (3 cr; QP–[5511, 5702] or #; SP–[4541, 5531] or #)
Design, application, and implementation of optimum/adaptive discrete-time FIR/IIR filters. Wiener, Kalman, and Least-Squares. Linear prediction. Lattice structure. LMS, RLS, and Levinson-Durbin algorithms. Channel equalization, system identification, biomedical/sensor array processing, spectrum estimation. Noise cancellation applications.

EE 5545. Real-Time Digital Signal Processing Laboratory. (2 cr; QP–3352, 5511, EE sr or grad in IT major or #; SP–4541)
Lab. Real-time computation of digital signal processing (DSP) functions, including filtering, sample-rate change, and differential pulse code modulation; implementation on a current DSP chip. DSP chip architecture, assembly language, arithmetic; real-time processing issues; processor limitations; I/O handling.

EE 5549. Digital Signal Processing Structures for VLSI. (3 cr; QP–5511; SP–4541)
Pipelining; parallel processing; fast convolution; FIR, rank-order, IIR, lattice, adaptive digital filters; scaling and roundoff noise; DCT; Viterbi coders; lossless coders, video compression.

EE 5551. Multiscale and Multirate Signal Processing. (3 cr; QP–5511, 5702, grad in IT major or #; SP–4541, 5531, grad in IT major or #)
Multirate discrete-time systems. Bases, frames; continuous wavelet transform; scaling equations; discrete wavelet transform; applications in signal and image processing.

EE 5581. Information Theory and Coding. (3 cr; QP–5702 or #; SP–5531 or #)
Source and channel models, codes for sources and channels. Entropy, mutual information, capacity, rate-distortion functions. Coding theorems.

EE 5585. Data Compression. (3 cr; QP–IT sr or grad or #; SP–IT sr or grad or #)
Source coding in digital communications and recording; codes for lossless compression; universal lossless codes; lossless image compression; scalar and vector quantizer design; loss source coding theory; differential coding, trellis codes, transform and subband coding; analysis/synthesis schemes.

EE 5601. Introduction to RF/Microwave Engineering. (3 cr; QP–3111, [IT sr or grad in IT major]; SP–4601, [IT sr or grad])
Fundamentals of EM theory and transmission lines concepts. Transmission lines and network analysis. CAD tool. Lumped circuit component designs. Passive circuit components. Connectivity to central communication theme.

EE 5602. RF/Microwave Circuit Design. (3 cr; QP–5604; SP–5601 or equiv)
Transmission lines, network analysis concepts. CAD tools for passive/active designs. Diode based circuit designs (detectors, frequency multipliers, mixers). Transistor based circuit design (amplifiers, oscillators, mixer/doubler).

EE 5611. Plasma-Aided Manufacturing. (4 cr; QP–Grad or upper div IT, ME 3301, ME 3303; SP–Grad or upper div IT , ME 3321, ME 3322 or equiv; §ME 5361)
Manufacturing using plasma processes; plasma properties as a processing medium; plasma spraying, welding and microelectronics processing; process control and system design; industrial speakers; a cross-disciplinary experience between heat transfer design issues and manufacturing technology.

EE 5613. RF/Microwave Circuit Design Laboratory. (2 cr; QP–5604; SP–5601)
Scattering parameters, planar lumped circuits, transmission lines, RF/microwave substrate materials, matching networks/tuning elements, resonators, filters, combiners/dividers, couplers. Integral lab.

EE 5616. Antenna Theory and Design. (3 cr; QP–5604; SP–5601 or concurrent registration in 5601)
Antenna performance parameters, vector potential/radiation integral, wire antenna structures, broadband antenna structures, microstrips/aperture theory, antenna measurements.

EE 5621. Physical Optics. (3 cr; QP–3011 or #; SP–3015 or #)
Physical optics principles, including Fourier analysis of optical systems and images, scalar diffraction theory, interferometry, and coherence theory. Applications discussed include diffractive optical elements, holography, astronomical imaging, optical information processing, and microoptics.

EE 5622. Physical Optics Laboratory. (1 cr; QP–5625; SP–5621 or ¶5621)
Fundamental optical techniques. Diffraction and optical pattern recognition. Spatial and temporal coherence. Interferometry. Speckle. Coherent and incoherent imaging. Coherent image processing. Fiber Optics.

EE 5624. Optical Electronics. (4 cr; QP–3111; SP–3601 or Phys 3002 or #)
Fundamentals of lasers, including propagation of Gaussian beams, optical resonators, and theory of laser oscillation. Polarization optics, electro-optic, acousto-optic modulation, nonlinear optics, and phase conjugation.

EE 5627. Optical Fiber Communication. (3 cr; QP–3011, 3111 or #; SP–3015, 3601 or #)
Components and systems aspects of optical fiber communication. Modes of optical fibers. Signal degradation and dispersion. Optical sources and detectors. Digital and analog transmissions systems. Direct detection and coherent detection. Optical amplifiers. Optical soliton propagation.

EE 5629. Optical System Design. (2 cr; QP–IT sr or grad; SP–IT sr or grad)
Elementary or paraxial optics. Non-paraxial, exact ray tracing. Energy considerations in instrument design. Fourier optics and image quality. Design examples: telescopes, microscopes, diffraction-limited lenses, projectors, and scientific instruments.

EE 5632. Photonic Communication Devices and Systems. (3 cr; QP–5630; SP–5163 or 5624 or equiv or #)
Primary solid-state components using optical communication systems. Semiconductor lasers, detectors, and optical fibers. Basic optoelectronic properties of III-V semiconductors: band structure, optical transitions, heterostructures. LEDs, semiconductor lasers, detectors. Optical network components/systems: fibers, amplifiers, power, system architectures.

EE 5653. Physical Principles of Magnetic Materials. (3 cr; QP–IT grad or #; SP–IT grad or #)
Physics of diamagnetism, paramagnetism, ferromagnetism, antiferromagnetism, ferrimagnetism; ferromagnetic phenomena; static and dynamic theory of micromagnetics, magneto-optics, and magnetization dynamics; magnetic material applications.

EE 5655. Magnetic Recording. (3 cr; QP–IT grad or #; SP–IT grad or #)
Magnetic fundamentals, recording materials, idealized models of magnetic records/reproduction, analytic models of magnetic record heads, sinusoidal magnetic recording, digital magnetic recording, magnetic recording heads/media, digital recording systems.

EE 5657. Physical Principles of Thin Film Technology. (4 cr; QP–IT sr or grad student or #; SP–IT sr or grad student or #)
Physical principles of deposition, characterization, and processing of thin film materials. Materials science, vacuum science, and technology. Physical vapor deposition techniques. Properties of thin films and metallurgical/protective coatings. Modification of surface films. Emerging thin film materials/applications. Lab. Demonstration experiments.

EE 5705. Advanced Electric Drives. (3 cr; QP–5300, 5322 or #; SP–4701)
D-q axis analysis of salient-pole synchronous motor drives; vector-controlled induction motor drives, sensor-less drives, voltage space-vector modulation techniques, current-source inverter drives, reluctance drives; power quality issues. Integrated software lab.

EE 5721. Power Generation Operation and Control. (3 cr; QP–5802 or #; SP–4721)
Engineering aspects of power system operation; economic analysis of generation plants and scheduling to minimize total cost of operation; scheduling of hydro resources and thermal plants with limited fuel supplies; loss analysis and secure operation; state estimation and optimal power flow; power system organizations.

EE 5725. Power Systems Engineering. (3 cr; QP–3010, 5300, 5310 or #; SP–4721)
Reliability analysis of large power generation and transmission systems; writing programs for state-by-state analysis and Monte Carlo analysis; power system protection systems, circuit current calculations, short circuit detection, isolating faulted components; characteristics of protection components.

EE 5741. Advanced Power Electronics. (3 cr; QP–5814 or #; SP–4741)
Physics of solid-state power devices, passive components, magnetic optimization, advanced topologies. Unity power factor correction circuits, EMI issues, snubbers, soft switching in dc/ac converters. Practical considerations. Very low voltage output converters. Integrated computer simulations.

EE 5811. Biomedical Instrumentation. (3 cr; QP–IT sr or life-science sr or grad student; SP–IT sr or life-science sr or grad student)
Biological signal sources. Electrodes, microelectrodes, other transducers. Characteristics of amplifiers. Noise in biological signals. Filtering, recording, display. Protection of patients from electrical hazards. Experiments in neural/muscle stimulation, EKG/EMG recording, neuron simulation, filtering, and low-noise amplifiers.

EE 5821. Biological System Modeling and Analysis. (3 cr; QP–IT sr or life science sr or grad; SP–IT sr or life science sr or grad)
Purpose of biological system modeling; advantages, limitations, special problems. Models of nerve excitation and propagation. Biological control systems; respiratory and cardiovascular systems. Sensory organs and theories of perception. Limbs and locomotion.

EE 5863. Computer Systems Performance Analysis. (2 cr; QP–5852 or #; SP–§5371; 5361 or #)
Basic performance measurement/simulation techniques necessary for experimental computer science/engineering. Hands-on performance evaluation techniques using simulations/measurements of existing systems. Using measured data to compare computer systems or to judge how much a new architectural feature improves systems performance.

EE 5940. Special Topics in Electrical Engineering I. (1-4 cr; QP–#; SP–#)
Special topics in electrical and computer engineering. Topics vary.

EE 5950. Special Topics in Electrical Engineering II. (1-4 cr; QP–#; SP–#)
Special topics in electrical and computer engineering. Topics vary.

EE 5960. Special Topics in Electrical Engineering III. (1-4 cr; QP–#; SP–#)
Special topics in electrical and computer engineering. Topics vary.

EE 8141. Advanced Heterojunction Transistors. (3 cr; QP–5660 or 5661; SP–5664 or #)
Recent developments in device modeling with emphasis on bipolar junction transistors. High-level effects in base and collector regions and their interrelationship.

EE 8161. Properties of Semiconductors I. (3 cr; SP–#)
Modern solid-state theory applied to specific semiconductor materials; influence of band structure and scattering mechanisms upon semiconductor properties; plasma effects in semiconductors; mathematical treatments of generation-recombination kinetics, carrier injection, drift, and diffusion; use of semiconductor properties in devices of current importance.

EE 8162. Properties of Semiconductors II. (3 cr; SP–8161 or #)
Modern solid-state theory applied to specific semiconductor materials; influence of band structure and scattering mechanisms upon semiconductor properties; plasma effects in semiconductors; mathematical treatments of generation-recombination kinetics, carrier injection, drift and diffusion; use of semiconductor properties in devices of current importance.

EE 8163. Quantum Electronics. (3 cr; SP–5632 or #; A-F only)
Quantum theory of light/laser systems. Planck's radiation law, Einstein's coefficients. Quantum mechanics of atom-radiation interaction. Quantized radiation field. Interaction of quantized field with atoms. Generation/amplification of light. Nonlinear optics. Specific laser systems. Semiconductor lasers.

EE 8190. Electronics Seminar. (1 cr [max 3 cr]; SP–#; S-N only)
Current literature, individual assignments.

EE 8210. System Theory Seminar. (1 cr [max 3 cr]; S-N only)
Current literature, individual assignments.

EE 8213. Advanced System Theory. (3 cr; SP–IT grad student, #)
Generalized linear systems; applications, structural properties, computational approaches, classification, functional behavior, and synthesis.

EE 8215. Nonlinear Systems. (3 cr; SP–#)
Current topics in stability analysis of nonlinear systems, design of controllers for nonlinear systems, discrete-time and stochastic nonlinear systems.

EE 8230. Control Theory Seminar. (1 cr [max 3 cr]; S-N only)
Current literature, individual assignments.

EE 8231. Optimization Theory. (3 cr; SP–#)
Introduction to optimization in engineering; approximation theory. Least squares estimation, optimal control theory, and computational approaches.

EE 8235. Advanced Control Topics. (3 cr; SP–#)
Adaptive and learning systems, optimal and robust control and stabilization, and stability of dynamic systems.

EE 8301. Advanced Topics in Design Automation. (3 cr; A-F only)
Advanced topics in state-of-the-art automated design tools used for electronic system design. Topics vary.

EE 8331. CMOS Data Converters: A/D and D/A. (3 cr; QP–5505, 5506; SP–5333; A-F only)
Data converters, low power low voltage analog circuits. Basic background in design of CMOS analog-to-digital and digital-to-analog converters. Special circuit design techniques for low power design. Students design/test several design problems.

EE 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

EE 8337. Analog Circuits for Wire/Wireless Communications. (3 cr; QP–5505, 5506; SP–5333; A-F only)
Basic background, advanced design concepts necessary to design integrated CMOS RF circuits.

Emphasizes CMOS and RF. Where appropriate, mention is made of bipolar circuits and applications to other communications areas.

EE 8360. Computer Systems Seminar. (1 cr [max 3 cr]; S-N only)
Current literature, individual assignments.

EE 8365. Advanced Computer Architecture. (3 cr; QP–5853 or CSci 5201; SP–§CSci 8203, 5361 or CSci 5201 or #)
Instruction set architecture, processor microarchitecture, and memory and I/O systems. Interactions between computer software and hardware; methodologies of computer design.

EE 8367. Parallel Machine Organization. (3 cr; QP–8362 or CSci 8203; SP–§CSci 8205, 8365 or CSci 8203)
Design and implementation of multiprocessor systems. Issues of compiler and system software related to multiprocessor systems.

EE 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

EE 8500. Seminar: Communications. (1 cr [max 3 cr]; S-N only)
Current literature, individual assignments.

EE 8541. Image Processing and Applications. (3 cr; SP–4541, 5581 or #)
Two-dimensional digital filtering and transforms; application to image enhancement, restoration, compression, and segmentation.

EE 8581. Detection and Estimation Theory. (3 cr; QP–5702; SP–5531 or #)
Risk theory approach to detection and estimation, random process representation, signal parameter estimation. Waveform estimation; detection of phase, frequency, and delay in signals. Applications to communications and radar-sonar signal design and processing.

EE 8591. Predictive Learning from Data. (3 cr; SP–IT grad student or #)
Basic elements and application areas of artificial intelligence (AI) related to design and implementation of expert systems (ES). Knowledge representation, reasoning under uncertainty, ES and their environment, planning, natural language processing (NLP), intelligent computer-aided instruction (ICAI), and AI tools (software and hardware).

EE 8610. Seminar: Quantum Electronics. (1 cr [max 3 cr]; S-N only)
Current literature, individual assignments.

EE 8611. Plasma Physics. (3 cr; SP–#)
Plasma theory and charged particle transport phenomena: collision processes, orbit theory, kinetic theory, Boltzmann transport equation, moment (continuity) equations, magnetohydrodynamics, transport properties. Applications of plasma theory to modeling of dc, rf, and microwave discharges.

EE 8660. Seminar: Magnetics. (1 cr [max 3 cr]; S-N only)
Current literature, individual assignments.

EE 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

EE 8725. Advanced Power System Analysis and Economics. (3 cr; QP–5802; SP–4721, IT grad student or #)
Solving sets of equations that involve large sparse matrices. Sparse matrix storage, ordering schemes, application to power flow, short circuit calculation, optimal power flow, and state estimation.

EE 8741. Power Electronics in Power Systems. (3 cr; QP–5814; SP–4741, IT grad student or #)
Impact of power electronics loads on power quality. Passive and active filters. Active input current wave shaping. HVDC transmission. Static VAR control, energy storage systems. Interconnecting photovoltaic and wind generators. Static phase shifters and circuit breakers for flexible AC transmission (FACTS).

EE 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

EE 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

EE 8940. Special Investigations. (1-3 cr; SP–May be repeated for cr; IT grad student or #)
Studies of approved theoretical or experimental topics.

EE 8950. Advanced Topics in Electrical and Computer Engineering. (1-3 cr; SP–Cr ar, may be repeated for cr; #)
Topics vary according to needs and staff availability.

EE 8961. Plan B Project I. (3 cr; SP–Grad EE major; may be taken for Plan B master's degree, may appear on master's program but may not be applied toward minimum cr in major field; no cr toward Ph.D.)
Project topic(s) arranged between student and adviser. Written report(s).

EE 8963. Plan B Project II. (1-2 cr; SP–EE grad student; may be taken for Plan B master's degree, may appear on master's program but may not be applied toward minimum cr in major field, no cr toward Ph.D.)
Project topic(s) arranged between student and adviser. Written report(s).

EE 8970. Graduate Seminar I. (1 cr [max 3 cr]; QP–Grad student or staff; SP–Grad student; S-N only)
Recent developments in electrical engineering, related disciplines.

EE 8980. Graduate Seminar II. (1 cr [max 3 cr]; QP–Grad student or staff; S-N only)
Recent developments in electrical engineering, related disciplines.

English: Creative and Professional Writing (EngW)

Department of English Language and Literature
College of Liberal Arts

EngW 5102. Advanced Fiction Writing. (4 cr [max 8 cr]; SP–Δ)
Advanced workshop for graduate students with considerable experience in writing fiction.

EngW 5103. Advanced Fiction Writing. (4 cr [max 8 cr]; SP–Δ)
Advanced workshop for students with considerable experience in writing fiction.

EngW 5104. Advanced Poetry Writing. (4 cr [max 8 cr]; SP–Δ)
Advanced workshop for graduate students with considerable experience in writing poetry. An opportunity to explore new poetic possibilities and to read widely in contemporary poetry and poetics.

EngW 5105. Advanced Poetry Writing. (4 cr [max 8 cr]; SP–Δ)
Advanced workshop for students with considerable experience in writing poetry. An opportunity to explore new poetic possibilities and to read widely in contemporary poetry and poetics.

EngW 5106. Advanced Literary Nonfiction Writing. (4 cr [max 8 cr]; SP–Δ)
Advanced workshop for graduate students with considerable experience in writing literary nonfiction.

EngW 5107. Advanced Nonfiction Writing. (4 cr [max 16 cr]; SP–Δ)
Advanced workshop for students with considerable experience in writing literary nonfiction.

EngW 5110. Topics in Advanced Fiction Writing. (4 cr [max 16 cr]; SP–Δ)
Special topics in fiction writing. Topics specified in *Class Schedule*.

EngW 5120. Topics in Advanced Poetry. (4 cr [max 16 cr]; SP–Δ)
Special topics in poetry writing. Topics specified in *Class Schedule*.

EngW 5130. Topics in Advanced Creative Writing. (4 cr [max 16 cr]; SP–#)
Workshop. Might include work in more than one genre.

EngW 5201. Journal and Memoir Writing. (3 cr)
Using memory in writing, from brainstorming to drafting to revising, in several genres (poems, traditional memoir essays, fiction). How diverse cultures shape memory differently.

EngW 5202. Journal and Memoir Writing. (3 cr; A-F only)
Using memory in writing, from brainstorming to drafting to revision, in several genres (poems, traditional memoir essays, fiction). How diverse cultures shape memory differently.

EngW 5204. Playwriting. (4 cr [max 8 cr]; SP–Δ)
Advanced workshop. Contact creative writing program for specific description.

EngW 5205. Screenwriting. (4 cr; SP–Δ)
Advanced workshop. Contact creative writing program for specific description.

EngW 5210. Topics in Advanced Literary Nonfiction. (4 cr [max 16 cr]; SP–Δ)
Special topics in essay writing (e.g., arts reviewing, writing about public affairs, writing in personal voice). Topics specified in *Class Schedule*.

EngW 5310. Reading as Writers. (4 cr [max 8 cr]; SP–Grad student, Δ)
Special topics in reading fiction, literary nonfiction, poetry. Topics specified in *Class Schedule*.

EngW 5501. Minnesota Writing Project Selective Institute. (3 cr [max 3 cr]; SP–Competitive selection for 20 educators [K-college])
Emphasizes participants' teaching each other best practices in writing instruction. Participants attend a retreat before beginning.

EngW 5502. Minnesota Writing Project Open Institute. (2 cr; SP–Teacher (K-college), [school district sponsorship or MWP approval])
Summer workshop to refine skills in writing instruction.

EngW 5570. Minnesota Writing Project Directed Studies. (1-3 cr [max 3 cr]; A-F only)
Current theories of writing and writing pedagogy. Topics vary. Workshop.

EngW 5606. Literary Aspects of Journalism. (3 cr; SP–§Jour 5606; A-F only)
Literary aspects of journalism as exemplified in and influenced by works of English/American writers past/present. Lectures, discussions, weekly papers.

EngW 5993. Directed Study in Writing. (1-4 cr [max 18 cr]; SP–#, Δ, ❑)
Projects in writing poetry, fiction, drama, and nonfiction, or study of ways to improve writing.

EngW 8101. Reading Across Genres. (4 cr; SP–Creative writing M.F.A. student, Δ; S-N only)
Contemporary writing in fiction, poetry, and creative nonfiction. Primarily a reading course rather than a writing course.

EngW 8110. Seminar: Writing of Fiction. (4 cr [max 16 cr]; SP–Δ)
Focuses on full-length book, e.g., a novel or short story collection. Assignments in common and individual project.

EngW 8120. Seminar: Writing of Poetry. (4 cr [max 8 cr]; SP–Δ)
Focuses on exploration and practice of various styles. Assignments in common and individual project.

EngW 8130. Seminar: Writing of Literary Nonfiction. (4 cr [max 8 cr]; SP–Δ)
Advanced workshop. Assignments in common and individual projects.

EngW 8140. Fiction: Manuscript Preparation. (4 cr [max 8 cr]; SP–8110, creative writing M.F.A. student, #)
For students working on their creative project.

EngW 8150. Poetry: Manuscript Preparation. (4 cr [max 8 cr]; SP–8120, creative writing M.F.A. student, #)
For students working on their creative project.

EngW 8160. Literary Nonfiction: Manuscript Preparation. (4 cr [max 8 cr]; SP–8130, creative writing M.F.A. student, #)
For students working on their creative project

EngW 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

EngW 8990. MFA Creative Thesis. (2-8 cr [max 48 cr]; QP–8140, 8150, 8160, #; SP–8140, 8150, 8160, creative writing M.F.A. student, #)
For students working on their creative project.

English: Literature (EngL)

Department of English Language and Literature
College of Liberal Arts

EngL 5001. Introduction to Methods in Literary Studies. (3 cr; SP–Grad or #)
Ends/methods of literary research, including professional literary criticism, analytical bibliography, and textual criticism.

EngL 5002. Introduction to Literary and Cultural Theory. (3 cr; SP–Grad or #)
Approaches to practical/theoretical problems of literary history/genre.

EngL 5100. Readings in Special Subjects. (3 cr [max 9 cr]; SP–Grad student or #)
General background preparation for advanced study. Diverse selection of literatures written in English, usually bridging national cultures and time periods. Readings specified in *Class Schedule*.

EngL 5120. Reading in American Literature. (3 cr [max 9 cr]; SP–Grad or #)
General background/preparation for advanced graduate study. Readings cover either a wide historical range (e.g., 19th century), a genre (e.g., the novel), or a major literary movement (e.g., Modernism).

EngL 5130. Readings in American Minority Literature. (3 cr [max 9 cr]; SP–Grad or #)
Contextual readings of 19th-/20th-century American minority writers. Topics specified in *Class Schedule*.

EngL 5140. Post-Colonial Literatures. (3 cr [max 9 cr]; SP–Grad or #)
Selected readings in post-colonial literatures. Topics specified in *Class Schedule*.

EngL 5150. Readings in Criticism and Theory. (3 cr [max 9 cr]; SP–Grad or #)
Major works of classical criticism in the English critical tradition from Renaissance to 1920. Leading theories of criticism from 1920 to present. Theories of fiction, narratology. Feminist criticisms. Marxist criticisms. Psychoanalytic criticisms. Theories of postmodernism.

EngL 5210. Middle English Literature and Culture. (3 cr [max 9 cr]; SP–Grad student or #)
Wide reading in literature of period. Relevant scholarship/criticism. Topics vary. See *Class Schedule*.

EngL 5230. Early Modern Literature and Culture. (3 cr [max 9 cr]; SP–Grad or #)
Topical readings in early modern poetry, prose, fiction, and drama. Attention to relevant scholarship or criticism. Prepares graduate students for work in other courses or seminars.

EngL 5250. 19th-Century Literature and Culture. (3 cr [max 9 cr]; SP–Grad or #)
19th-century British, American, and post-Colonial literatures. Topics may include British Romantic or Victorian literatures, 19th-century American literature, important writers from a particular literary school, a genre (e.g., the novel). Readings.

EngL 5270. 20th-Century Literature and Culture. (3 cr [max 9 cr]; SP–Grad student or #)
20th-century British, Irish, or American literatures, or topics involving literatures of two nations. Focus either on a few important writers from a particular literary school or on a genre (e.g., drama). Topics specified in *Class Schedule*.

EngL 5291. Contemporary Literature and Culture. (3 cr)
Multi-genre reading in contemporary American, British, Anglophone literature. Relevant scholarship/criticism. Topics vary. See *Class Schedule*.

EngL 5330. Topics in Drama. (3 cr [max 9 cr]; SP–Grad student or #)
Wide reading in literature of a given period or subject. Prepares students for work in other courses/seminars. Relevant scholarship/criticism. Topics specified in *Class Schedule*.

EngL 5401. Introduction to Editing. (4 cr)
Editor-writer relationship, manuscript reading, author querying, rewriting, style. Some discussion of copy editing. Students develop editing skills by working on varied writing samples.

EngL 5402. Advanced Editing. (4 cr; SP–5401, #, Δ)
Editing long text. Fiction, children's literature, translations, indexes. Workshop/seminar.

EngL 5581. Folklore I. (3 cr; SP–Grad student or #)
Folklore genres such as proverbs, oral prose narratives (tales/legends), foodways, and games. Manner in which folklore is transmitted/changed. Focus on how folklore functions in literature, the mass media, and everyday life.

EngL 5582. Folklore II. (3 cr; SP–[5581, grad student] or #)
Training in collection of folklore materials.

EngL 5602. Gender and the English Language . (3 cr; SP–Grad student or #)
Introduction to features of English that are gender-marked or gender-biased. Connections between language theory and social structures, including class and ethnicity. Patterns of women's/men's speech in specific social contexts. Gender and writing. Sociolinguistics and sexual orientation.

EngL 5603. Varieties of World English. (3 cr; SP–Grad student or #)
Historical background, psychosocial significance, and linguistic characteristics of diverging varieties of English spoken around world, especially in postcolonial contexts (Caribbean, Africa, Asia). Development of local standards/vernaculars. Sociolinguistic methods of analysis.

EngL 5605. Social Variation in American English. (3 cr; SP–Grad student or #)
Description/analysis of English language variation from sociohistorical perspective in the United States and the Caribbean. Social history of voluntary/enforced migrations leading to development of regional/rural dialects, pidgins, creoles, and urban varieties.

EngL 5611. History of the English Language. (3 cr; SP–Grad student or #)
Development of English language from Old English (mid-5th century) to Middle English (around 1100) to Early Modern English (about 1500).

EngL 5612. Old English I. (3 cr; SP–§3612; grad student or #)
Introduction to the language through A.D. 1150. Anglo-Saxon culture. Selected readings in prose/poetry.

EngL 5613. Old English II. (3 cr; SP–§3613; [[3612 or 5612], grad student] or #)
Critical reading of texts, introduction to versification. Reading of Beowulf.

EngL 5621. Irish Language I. (4 cr; QP–[Grad or undergrad] English major or #; SP–Undergrad English major or Δ)
Grammatical structures of modern Irish dialect of Connemara, Co. Galway. Development of oral/written language skills: vocabulary, manipulation of grammatical structures, speaking, listening, reading, writing. Modern Gaelic culture.

EngL 5622. Irish Language II. (4 cr; SP–5621)
Grammatical structures of modern Irish dialect. Development of oral/written language skills: vocabulary, manipulation of grammatical structures, speaking, listening, reading, writing. Modern Gaelic culture.

EngL 5630. Theories of Writing and Instruction. (3 cr; SP–Grad student or #)
Introduction to major theories that inform teaching of writing in college and upper-level high school curriculums. Topics specified in *Class Schedule*.

EngL 5631. History of Rhetoric and Writing. (3 cr; SP–Grad student or #)
Assumptions of classical/contemporary rhetorical theory, especially as they influence interdisciplinary field of composition studies.

EngL 5632. Electronic Text. (3 cr; SP–§3632; grad student or #)
Status/function of text in electronic networking. Related questions as reframed by electronic text.

EngL 5640. Research Methods in Rhetoric, Composition, and Language. (3 cr; SP–Grad student or #)
Research paradigms, methodologies, and procedures (e.g., ethnographic, case-study, historical, critical, quantitative, text-analytical, survey-based). Emphasizes reading/analyzing existing research studies and preparing original research. Topics specified in *Class Schedule*.

EngL 5650. Topics in Rhetoric, Composition, and Language. (3 cr; SP–Grad student or #)
Topics specified in *Class Schedule*.

EngL 5690. Minnesota Writing Project: Directed Studies. (1-3 cr [max 30 cr])
Workshops. Theories of writing and writing pedagogy. Writing for publication. Research topics in applied literacy.

EngL 5800. Practicum in the Teaching of English. (2 cr [max 9 cr]; SP–Grad student, #; S-N only)
Discussion of and practice in recitation, lecture, small-groups, tutoring, individual conferences, and evaluation of writing/reading. Emphasizes theory informing effective course design/teaching for different disciplinary goals. Topics vary. See *Class Schedule*.

EngL 5992. Directed Readings/Study/Research. (1-15 cr [max 15 cr]; SP–Grad student or [#, Δ, ❑]; A-F only)
Guided individual reading.

EngL 8110. Studies in Medieval Literature and Culture. (3 cr [max 12 cr])
Sample topics: Chaucer; "Piers Plowman"; Middle English literature, 1300-1475; medieval literary theory; literature/class in 14th-century; texts/heresies in late Middle Ages.

EngL 8120. English Early Modern Studies. (3 cr [max 12 cr]; SP–# for grad non-major; A-F only)
British writers and topics from the Reformation to the French Revolution. In the first half of this period (which divides at 1640), a typical topic is Spenser and the epic tradition; in the second half, women historians before Wollstonecraft.

EngL 8150. Shakespeare. (3 cr [max 9 cr]; SP–# for grad non-major)
Perspectives and works vary with offering and instructor's emphases, characteristically on text, performance, interpretation, criticism; feminism; intellectual history. Recent topics: Shakespeare at comedy, "Elegy by W.S." (is it Shakespeare's?), Roman political tragedies. Topics specified in *Class Schedule*.

EngL 8170. 19th-Century British Studies. (3 cr [max 12 cr]; SP–# for grad non-major)
Advanced study in 19th-century British literature and culture. Sample topics: Romantic poetry, Victorian poetry, Englishness in the Victorian novel, Victorian cultural criticism, text and image in 19th-century British culture. Topics specified in *Class Schedule.*

EngL 8180. Twentieth-Century British Studies. (3 cr [max 12 cr]; SP–Grad student or #; A-F only)
Advanced study in 20th-century British literature/culture. Sample topics: modernism, Bloomsbury Group, working-class/immigrant literature. Topics specified in *Class Schedule.*

EngL 8190. 20th-Century Anglophone Literatures and Cultures. (3 cr [max 12 cr]; SP–# for grad non-major)
Topics in Anglophone literatures of Canada, Africa, the Caribbean, India and Pakistan, and the Pacific. Sample topics: Stuart Hall and Black Britain; Salman Rushdie and cosmopolitan literatures; national literatures and partitioned states. Topics specified in *Class Schedule.*

EngL 8200. Seminar in American Literature. (3 cr [max 12 cr]; SP–Course in seminar topic or #)
American literary history. Recent topics: first American novels, film, contemporary short stories and poetry, American Renaissance, Cold War fiction, history of the book. Topics specified in *Class Schedule.*

EngL 8290. Topics, Figures, and Themes in American Literature. (3 cr [max 12 cr]; SP–Course in seminar topic or #)
Recent topics: Dickinson, 19th-century imperialism, Faulkner, San Francisco poets, humor, Chaplin, Hitchcock, and popular culture. Topics specified in *Class Schedule.*

EngL 8300. Seminar in American Minority Literature. (3 cr [max 12 cr]; SP–Course in seminar topic or #)
Recent topics: Harlem Renaissance, ethnic autobiographies, Black Arts movement. Topics specified in *Class Schedule.*

EngL 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

EngL 8400. Advanced Studies in Post-Colonial Literature, Culture, and Theory. (3 cr [max 12 cr]; SP–# for grad non-major)
Sample topics: Marxism and nationalism, modern India, feminism and decolonization, "The Empire Writes Back," and Islam and the West. Topics specified in *Class Schedule.*

EngL 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

EngL 8510. Studies in Criticism and Theory. (3 cr [max 12 cr]; SP–Grad student in English or #)
Developments within critical theory that have affected literary criticism, either by altering conceptions of its object ("literature") or by challenging conceptions of critical practice. Topics specified in *Class Schedule.*

EngL 8520. Advanced Studies in Cultural Theory and Practice. (3 cr [max 12 cr]; SP–# for grad nonmajor)
Contact varies and might focus on a body of theory and use. Sample topics: semiotics applied to perspective paintings, numbers, and money; in-depth analysis of a particular set of cultural practices by applying various theories to them.

EngL 8530. Advanced Studies in Feminist Criticism. (3 cr [max 12 cr]; SP–# for grad nonmajor)
Brief history of feminist criticism and in-depth treatment of contemporary perspectives and issues. Topics specified in *Class Schedule.*

EngL 8600. Seminar in Rhetoric, Composition, and Literacy Studies. (3 cr [max 9 cr]; SP–Grad student)
Students read/conduct research on theories/literature relevant to cross-disciplinary fields committed to writing and to teaching writing.

EngL 8610. Seminar in Language and Discourse Studies. (3 cr [max 12 cr]; SP–#, grad nonmajor)
Current theoretical/methodological issues in discourse analysis. Social/psychological determinants of language choice (class, ethnicity, gender) in various English-speaking societies. Application to case studies, review of scholarship.

EngL 8621. Seminar on Writing for Publication. (3 cr; SP–# for grad nonmajor)
Conference presentations, book reviews, revision of seminar papers for journal publication, and preparation of a scholarly monograph. Style, goals, and politics of journal and university press editors and readers, electronic publication, and other professional concerns.

EngL 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

EngL 8780. Folklore. (3 cr [max 12 cr]; SP–Grad student in English or #)
Folklore methodology. Application to topics such as fieldwork in folklore, horror in oral tradition, writing, and film; liminality/tradition; folklore or literatures; folklore of the uncanny; tradition, alterity, and liminality.

EngL 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

EngL 8910. Studies in Special Subjects. (3 cr [max 12 cr]; SP–# for grad nonmajor)
Sample topics: literature of World War II, writings of the Holocaust, literature of the English Civil War, and advanced seminar in versification.

EngL 8992. Directed Reading in Language, Literature, Culture, Rhetoric, Composition, or Creative Writing. (1-9 cr [max 15 cr]; SP–#, Δ)

English: Writing, Rhetoric, and Language (EngC)

Department of English Language and Literature

College of Liberal Arts

EngC 5051. Graduate Research Writing Practice for Non-native Speakers of English. (3 cr; SP–Grad student)
Graduate-level writing techniques/formats for summaries, critiques, research, and abstracts. Persuasion, documentation, structure, grammar, vocabulary, field-specific requirements. Writing through several drafts, using mentor in specific field of study. Revising/editing to meet graduate standards. Discussions.

EngC 5690. Minnesota Writing Project: Directed Studies. (1-3 cr [max 30 cr])
Workshops in which writing teachers investigate current theories of writing and writing pedagogy, write for publication, and explore research topics in applied literacy.

Entomology (Ent)

Department of Entomology

College of Agricultural, Food, and Environmental Sciences

Ent 5011. Insect Structure and Function. (4 cr; QP–3005 or #; SP–3005 or #; A-F only)
Comparative study of insect structures/functions from evolutionary perspective. Introduction to physiology of digestion, respiration, other organ systems.

Ent 5021. Insect Taxonomy and Phylogeny. (4 cr; QP–Biol 1009 or #; SP–3001 or equiv)
Identification of families of adult insects; evolution and classification of insects; techniques of collecting and curating insects; principles of phylogeny reconstruction.

Ent 5031. Insect Physiology. (2 cr; QP–5010, biochem course or #; SP–5011, biochem course or #; A-F only)
Essential processes of insects. Nerve and muscle mechanisms, energy metabolism, respiration, nutrition and digestion, excretion, regulation and interactions of processes, sensory mechanisms, and behavior. Reproductive behavior, embryology, and postembryonic development of insects.

Ent 5041. Insect Ecology. (3 cr; QP–Biol 5041 or EBB 5122 or #; offered fall 1998 and alt yrs; SP–Biol 5041 or EBB 5122 or #; offered fall 1998 and alt yrs)
Synthetic analysis of the causes of insect diversity and of fluctuations in insect abundance. Focus on abiotic, biotic, and evolutionary mechanisms influencing insect populations and communities.

Ent 5211. Insect Pest Management. (3 cr; QP–3005 or #; SP–3005 or #)
Prevention or suppression of injurious insects by integrating multiple control tactics, e.g., chemical, biological, cultural. Strategies to optimize the dynamic integration of control methodologies in context of their economic, environmental, and social consequences.

Ent 5275. Medical Entomology. (3 cr; QP–3005 or #, offered 1998 and alt yrs; SP–3005 or #; offered 1998 and alt yrs)
Biology of arthropod vectors of human disease. Emphasis on disease transmission and host, vector, and pathogen interactions.

Ent 5311. Sampling Biological Populations. (3 cr; QP–Stat 5021 or equiv; SP–Stat 5021 or equiv)
Sampling plans for study of field/lab populations. Statistical distributions/techniques for detecting/coping with aggregation. Randomization, required sample size, optimal allocation for common probability design. Sequential plans for making decisions.

Ent 5321. Ecology of Agricultural Systems. (3 cr; QP–§Agro 5321; [[3xxx or above] course in [Agro or AnSc or Hort], [3xxx or above] course in [Ent or PlPa or Soil]] or #; SP–§Agro 5321; [[3xxx or above] course in [Agro or AnSc or Hort], [3xxx or above] course in [Ent or PlPa or Soil]] or #; A-F only)
Ecological approach to problems in agricultural systems. Formal methodologies of systems inquiry are developed/applied.

Ent 5341. Biological Control of Insects and Weeds. (3-4 cr; QP–Biol 1009, EEB 3001 grad or #; SP–3001, Biol 1009, EEB 3001 or grad; A-F only)
Biological control of arthropod pests and weeds. Analysis of relevant ecological theory and case studies; biological control agents. Lab includes natural enemy identification, short experiments, and computer exercises.

Ent 5351. Insect Pathology. (2 cr; QP–5030; SP–5011)
Major pathogenic microorganisms that cause diseases in insects. Routes of infection of insects. Lab propagation of disease agents. Factors in application of disease to pest insect control. Safety considerations.

Ent 5361. Aquatic Insects. (4 cr; QP–1005 or #; SP–#; A-F only)
Taxonomy, natural history of aquatic insects including their importance in aquatic ecology, water resource management, recreation, and conservation. Emphasizes family-level identification of immatures/adults. Field trips scheduled to local aquatic habitats. A collection is required.

Ent 5371. Principles of Systematics. (3 cr; QP–#; offered alt yrs; SP–#; offered alt yrs)
Theoretical/practical procedures of biological systematics. Phylogeny reconstruction, including computer assisted analyses, morphological/molecular approaches, species concepts, speciation, comparative methods, classification, historical biogeography, nomenclature. Use/value of museums.

Ent 5381. Lepidopterology. (2-3 cr; QP–Ent course or #, one course each in ecology and genetics recommended; SP–Ent course or #, one course each in ecology and genetics recommended)
Overview of Lepidoptera with emphasis on processes and phenomena such as polymorphism, mimicry, and individual quality that are well demonstrated by this insect order.

Ent 5481. Invertebrate Neurobiology. (2-3 cr; QP–§5480; SP–§NSc 5481)
Fundamental principles/concepts underlying cellular bases of behavior/systems neuroscience. Particular invertebrate preparations.

Ent 5900. Basic Entomology. (1-6 cr; QP–#; SP–#)
For graduate students who need to make up certain deficiencies in their biological science background.

Ent 5910. Special Problems in Entomology. (1-6 cr [max 10 cr]; QP–#; SP–#)
Individual field, lab, or library studies in various aspects of entomology.

Ent 5920. Special Lectures in Entomology. (1-3 cr)
Lectures or labs in special fields of entomological research. Given by visiting scholar or regular staff member.

Ent 8041. Advanced Insect Genetics. (2 cr; SP–Basic genetics course, 5031 or #; offered alt yrs)
Molecular genetic techniques and their applications, emphasizing insect species other than *Drosophila*. Application of genetic techniques to physiological processes.

Ent 8051. Toxicology. (2 cr; SP–[5011, [organic, inorganic] chem courses, biochem course] or #)
Chemistry, mode of action of conventional insecticides. Insect growth regulators, microbial pesticides. Transgenic viruses, genetically modified plants. Offered alternate years.

Ent 8200. Colloquium in Social Insects. (1-3 cr; SP–3020 or 3200)
Current research on bees, wasps, ants, and termites. Student critiques and research reports.

Ent 8210. Colloquium in Insect Evolution. (1-3 cr; QP–5370; SP–5371 or #)
Research issues in systematics and evolution. Comparative biology, biogeography, and molecular evolution. Students may re-enroll as topics alternate. Students critique papers from primary literature.

Ent 8240. Colloquium in Insect Ecology. (1-2 cr; QP–5040; SP–5041 or #)
Advanced topics.

Ent 8300. Graduate Seminar. (1 cr; SP–#)
Oral and written reports on and discussion by students of selected topics from current literature.

Ent 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Ent 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

Ent 8594. Research in Entomology. (1-16 cr [max 36 cr]; S-N only)
Directed research.

Ent 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Ent 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Ent 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Experimental and Clinical Pharmacology (ECP)

College of Pharmacy

ECP 8100. Seminar. (1 cr [max 8 cr]; SP–SACP grad major in ECP track or #)
Selected topics in experimental and clinical pharmacology.

ECP 8200. Research Problems. (1-8 cr [max 16 cr]; SP–Grad SACP major (ECP Track) or #)
Individually designed research experience directed at contemporary problems related to drug use.

ECP 8210. Clinical Therapeutics. (3 cr; SP–SACP grad major in ECP track or #)
Topics in clinical pharmacology that illustrate continuum of pathophysiology of a disease state, its contemporary treatment, problems or controversial issues with treatment approaches, strategies to advance therapy. Lectures, readings.

ECP 8220. Experimental and Clinical Pharmacology. (3 cr; SP–SACP grad major (ECP track) or #)
Theory of advanced methodologies, applications, and evaluation techniques used to determine efficacy/toxicity of new drug therapies. Techniques for collecting/evaluating data.

ECP 8290. Clinical Clerkship. (2 cr; SP–Grad SACP major in ECP track or #)
Supervised study of pharmaceutical services at Fairview-University Medical Center or affiliated institutions.

ECP 8400. Pharmacometrics. (3 cr; SP–SACP grad major in ECP track or #)
Theory/application of contemporary methods for analysis of concentration-time data and exposure-response relationships.

ECP 8410. Population Pharmacokinetic Modeling. (2 cr; A-F only)
Theoretical background for using mixed effects model in population analysis. Building fixed/random effects into a pharmacostatistical model. Project allows students to become familiar with a contemporary population pharmacokinetic analysis program.

ECP 8420. Clinical Trial Simulation. (2 cr; SP–SACP grad major in ECP track or #)
Theory/application of contemporary methods of using simulations to design more efficient/informative clinical trials.

ECP 8900. Advanced Topics in Experimental and Clinical Pharmacology. (1-4 cr [max 8 cr]; SP–SACP grad major in ECP track or #)
Topic varies depending on faculty teaching course.

ECP 8992. Directed Readings in Experimental and Clinical Pharmacology. (1-2 cr [max 4 cr])

ECP 8993. Directed Study in Experimental and Clinical Pharmacology. (1-4 cr [max 4 cr])

Family Education (FE)

Department of Work, Community, and Family Education

College of Education and Human Development

FE 5001. Family Education Perspectives. (3 cr; A-F only)
Origins, evolution, and critique of alternative perspectives on family education. Implications for clients, programs, and educators.

FE 5003. Contemporary Family Education. (3 cr; A-F only)
Transitions in family life examined, with emphasis on preparing educators and educational programs.

FE 5200. Special Topics in Family Education. (1-4 cr [max 20 cr])
Topics either not covered in available courses or not covered in sufficient breadth/depth to meet student needs/interests. Topics vary.

FE 5201. Family and Work Relationships. (3 cr; A-F only)
Examination of the interactions of work and family to prepare professionals for improving work and family relationships.

FE 5202. Sexuality Education. (3 cr; SP–Human sexual behavior course, family ed course; A-F only)
Preparation to develop, deliver, and evaluate sexuality education. Strategies to help children and adults acquire information, form values, develop interpersonal skills, and exercise personal responsibility in the sexual dimensions of individual and family life.

FE 5203. Family Communication Education. (3 cr; A-F only)
Knowledge and skills needed to develop, deliver, and evaluate educational programs about family communications. Examination of family communications principles and issues. Development of appropriate teaching methods and materials.

FE 5301. Program Planning in Family Education. (3 cr; A-F only)
Exploration of curriculum research and theory; examination and critique of alternative perspectives and their concomitant implications for families; development and evaluation of family education curriculum and programs.

FE 5302. Family Education Curriculum in Secondary Schools. (3 cr; A-F only)
Examination, development, and implementation of family and consumer science curriculum in secondary schools. Emphasis on curricular perspectives from social reconstruction and cognitive processes.

FE 5303. Instructional Strategies in Family Education. (3 cr; A-F only)
Theory and research relevant to methods of teaching; development of skill in using methods; emphasis on methods that support families taking technical, communicative, and emancipatory action.

FE 5701. Practice of Parent Education I. (3 cr; A-F only)
Examination of parent education in community settings; consideration of parents as adult learners with diverse backgrounds; development of group facilitation skills; observation and interviewing in community settings; reflection on and critique of the practice of parent education.

FE 5702. Practice of Parent Education II. (3 cr; SP–5701 or Δ; A-F only)
Development of curriculum for parent education; consideration of teaching groups and individuals; consideration of ethics in parent education; evaluation of parent education programs; development of curriculum and teaching portfolio; reflection on and critique of the practice of parent education.

FE 5703. Advanced Practice of Parent Education. (3 cr; SP–5702 or Δ)
Evolving perspectives of parent education. Emphasis on psycho-dynamic, conceptual-change approaches. Reflective and dialogic approaches for working with parents in understanding beliefs and examining their origins and consequences. Examination of issues related to diversity, self-awareness, ethics, and evaluation.

FE 5796. Parent Education Practicum. (1-4 cr [max 4 cr]; QP–5320; SP–5702 or Δ)
Supervised parent education field assignments designed according to licensure requirements and individual student needs, interests, and prior competencies.

FE 5993. Directed Study in Family Education. (1-3 cr [max 9 cr]; SP–Δ; A-F only)
Self-directed study in areas not covered by regular courses. Specific program of study is jointly determined by student and advising faculty member.

FE 5996. Internship in Family Education. (1-6 cr [max 6 cr]; SP–Δ)
Planned work experience focusing on educational competencies in family education settings. Nature and extent of responsibilities are defined by the position student assumes.

FE 8900. Family Education Colloquium. (1-4 cr [max 4 cr]; SP–Δ; S-N only)
In-depth discussion about current issues not covered or covered as thoroughly in available courses. For family education graduate students, faculty, and community professionals.

FE 8994. Directed Research in Family Education. (1-6 cr [max 6 cr]; SP–Family ed student doing Plan B research, Δ; A-F only)

Family Practice and Community Health (FPCH)

Department of Family Practice and Community Health

Medical School

FPCH 5251. Cross-Cultural Medicine and International Health. (2 cr; SP–Family practice residency or #)
Concepts of illness and healing within different cultural contexts; interaction of cultural and biological factors in disease and illness; population-based health, illness, disease.

FPCH 5345. Curriculum Design and Teaching Strategies for Medical Education I. (3 cr; SP–¶5346, #)
Identifying/developing course goals. Developing course, teacher, learner evaluations.

FPCH 5346. Curriculum Design and Teaching Strategies for Medical Education II. (1 cr; SP–¶5345, #)
Lecture, demonstration, small-group discussion, clinical teaching, computer-assisted instruction.

FPCH 5555. Sexual Counseling for Family Physicians. (1-2 cr; SP–Medical school completion)
Assessment of and therapy for sexual dysfunction problems that arise in clinical practice of primary care physicians.

FPCH 5563. Clinical Neuropsychopharmacology. (1 cr; SP–FPCH residency)
Identification, diagnosis, treatment, and follow-up of major psychiatric disorders. Emphasis on neuropsychopharmacological approach, identification of psychoactive drugs, contraindications, side effects, and long-term management of patients.

FPCH 5564. Family Practice Seminar. (1 cr [max 9 cr]; SP–M.D. or D.O. degree)
Knowledge, skills, and attitudes in biomedical and behavioral sciences that form foundation for academic discipline of family medicine; medical decision making, common problems and procedures, family theory and assessment, clinical pharmacy, human sexuality.

FPCH 5570. Practicum in Counseling. (1 cr; SP–Completion of first-yr residency)
Short-term counseling techniques. Lectures, classroom exercises, and actual counseling contact.

FPCH 5582. Practice Management Workshop. (1 cr; SP–Completion of first-yr residency or #)
Practical counsel and information on day-to-day management of medical clinics (including economic and legal aspects, community and hospital relations, and human relations) and types of practice opportunities. Workshop with department faculty and community specialists.

FPCH 5598. Introduction to Physician's Role in Nursing Homes. (1 cr [max 9 cr]; SP–Medical school or dental school or GNP school graduate; S-N only)
Practicum in caring for nursing home residents. Students participate in in-depth, multidisciplinary case discussion of geriatric patients and then attend bedside rounds of residents at two nursing homes in the Twin Cities area.

FPCH 5650. Principles of Geriatrics I. (1 cr [max 5 cr]; SP–Medical School or dental school or GNP School graduate; S-N only)
First in two-course sequence. Survey of major topics in geriatric medicine. Epidemiology, etiology, diagnosis, and treatment of major geriatric syndromes and illnesses.

FPCH 5651. Principles of Geriatrics II. (1 cr [max 5 cr]; SP–Medical school or dental school or GNP school graduate; S-N only)
Second in two-course sequence. Survey of major topics in geriatric medicine. Epidemiology, etiology, diagnosis, and treatment of major geriatric syndromes and illnesses.

FPCH 5653. Future Health Interventions for Older Populations. (2 cr; SP–Health sci grad students or health sci grad degree)
Practitioners and academicians lead discussions about promising new approaches to health care for older adults.

FPCH 5904. Community Health. (1 cr; SP–Second- or third-yr residency status or #)
Tools and techniques for studying contemporary health problems. Strategies to meet community health needs. In-depth look at community health activities in Minnesota.

FPCH 5950. Clinical Issues in Human Sexuality. (2 cr; SP–Enrollment in health sci grad programs in CSPP, Psy, PubH, SW or FSoS or #)
Assessment and treatment techniques pertaining to common sexual problems.

FPCH 5952. Practicum in Sexual Counseling I. (2-4 cr; SP–#)

FPCH 5953. Practicum in Sexual Counseling II. (2-4 cr; SP–#)

FPCH 5955. Directed Study. (1-10 cr; SP–#; qualified students may arrange for work on a tutorial basis.)
Studies on special topics as arranged between student and faculty.

FPCH 5956. Human Sexuality for the Primary Care Physician. (2 cr; SP–College-level human sexuality intro course or #)
Developmental aspects of sexuality throughout the life cycle examined using such theories as psychodynamics and social role theory, with emphasis on significance of psychosocial aspects of sexuality for the primary care physician.

FPCH 5958. Small Group Process. (2 cr; SP–#)
Group dynamics; current schools of group process and therapy. Experiential and cognitive methods.

FPCH 5960. Basic Research Methods in Family Practice. (3 cr; SP–#)

FPCH 5962. Clinical Hypnosis Workshop. (1-2 cr; SP–#)
New applications from the behavioral science area of clinical practice. Lectures, workshops, conferences.

FPCH 5972. Research Methods in Family Medicine I. (2 cr; SP–FPCH grad student or #)
First in a two-course sequence. Research design and methodology, biostatistics, epidemiology, and demography. Steps necessary to formulate a question, determine its significance, develop an appropriate methodology, implement and complete a study, analyze data, and report findings in peer-reviewed literature.

FPCH 5973. Research Methods in Family Medicine II. (2 cr; SP–FPCH grad student or #)
Second in two-course sequence. Research design and methodology, biostatistics, epidemiology, and demography. Steps necessary to formulate a question, determine its significance, develop an appropriate methodology, implement and complete a study, analyze data, and report findings in peer-reviewed literature.

FPCH 8201. Clinical Family Medicine. (12 cr [max 108 cr]; SP–Fam practice resident or #)
Supervised care for patients of all ages on a continuous, primary, preventive, and general diagnostic basis. Diagnosis, methods of treatment, and problem-solving devices for benefit of patient and family, emphasizing health hazard appraisal. New and refined methods of recording, documentation, and retrieval of clinical data.

FPCH 8208. Family Medicine Conferences. (1 cr [max 9 cr]; SP–Fam practice resident or #)
Problem cases from family practice service. Diagnosis, treatment, and consideration of current literature.

FPCH 8210. Family Medicine Grand Rounds. (1 cr [max 9 cr]; SP–Fam practice resident or #)
Monthly conference on medical topics.

FPCH 8212. Clinical Psychiatry Rounds. (1 cr [max 9 cr]; SP–1st-yr fam practice resident or #)
Medical fellows meet with a teaching psychiatrist to review cases, preferably from among patients. Topics of high clinical relevance.

FPCH 8215. Seminar: Psychosomatic Medicine. (1-2 cr; SP–Completion of 1st-yr fam practice residency or #)
Multicausality of disease, including biologic, psychologic, and social factors that may predispose, precipitate, or aggravate disease. Theoretical models of psychosomatic disease; concept of "symptom choice" by patients. Methods of recognition, quantification, and treatment, including pharmacotherapy and psychotherapy.

FPCH 8217. Seminar in Counseling. (1-2 cr; SP–8215 or #)
Skills and strategies for performing short-term supportive counseling in family practice setting. Patient selection. Skills applicable to beginning, middle, and end of counseling. Strategies for working with patients presenting different types of problems seen by the family physician.

FPCH 8242. Economics of Healthcare Delivery Systems. (2 cr; SP–Grad FPCH major or #)
Impact of changing economic systems on medical practice models. Healthcare economics and provider reimbursement. Healthcare finance, accounting, productivity, delivery, and risk.

FPCH 8253. Research Problems. (1-6 cr [max 20 cr]; SP–#)
Students complete research projects under faculty direction.

FPCH 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Family Social Science (FSoS)

Department of Family Social Science

College of Human Ecology

FSoS 5101. Family Systems. (3 cr; QP–Intro course in psych, soc; SP–§3102, grad student)
Family systems and other family theories focusing on the dynamics and processes relevant to family life. Diversity issues related to gender, ethnicity, sexual orientation, and disability. Issues related to divorce, single parenthood, and remarriage are covered. Family strengths and family problems are integrated.

FSoS 5193. Directed Study in Family Social Science. (1-6 cr [max 6 cr]; SP–FSoS or grad student in related field)

FSoS 8001. Conceptual Frameworks in the Family. (3 cr; SP–Family course or #)
Major theoretical models about families, emphasizing sociohistorical context.

FSoS 8013. Qualitative Family Research Methods. (3 cr)
Approaches to qualitative family research evaluation. Phenomenological, feminist, grounded theory, content analytic, ethnomethodological, ethnographic, program evaluation. Theory, research examples, student projects.

FSoS 8014. Quantitative Family Research Methods. (3 cr; SP–8001 or equiv, 2 stat courses or #)
Builds on basic understanding of quantitative research in behavioral sciences by focusing on special issues associated with conducting research on the family as the unit of analysis. Proposal writing and analysis of secondary data.

FSoS 8031. Family of Origin. (3 cr; SP–Preference given to marriage and fam therapy students; S-N only)
In-depth study of each student's family of origin in a group of other students and a clinical faculty therapy supervisor.

FSoS 8032. Theories of Marital and Family Therapy. (3 cr)
General systems theory and cybernetics: influence of, application to family systems, historical roots, and theoretical and clinical models they have influenced. How change processes affect interactional patterns, information processing, family structure, family belief systems, and family life cycle transitions.

FSoS 8033. Clinical Issues in Marriage and Family Therapy. (3 cr; SP–8032 or equiv; A-F only)
Family therapy assessment and treatment approaches to problems such as depression, alcoholism, and sexual abuse, and to challenges of varying family structures, such as single-parent and remarried families.

FSoS 8034. Marriage and Family Therapy Supervision. (3 cr; QP–FSoS 8214 or #; SP–FSoS 8032 or #)
For marriage and family therapists who want to become supervisors, this course is designed to meet didactic and interactional course requirements for the Approved Supervisor designation as stipulated by the American Marriage and Family Therapy Association (AAMFT). Topics included are theories of supervision, structures for supervision, methods of supervision, the evaluation process, and legal/ethical issues. Also covered are the therapist-client-supervisor relationships, potential problems, and contextual issues.

FSoS 8035. Assessment of Couples and Families. (3 cr; SP–8014 or equiv or #; A-F only)
Issues in research and clinical assessment. Assumptions and values underlying assessment approaches. Specific assessment techniques discussed, evaluated, and administered. Ethical, legal, and practical issues.

FSoS 8036. Couple and Family Therapy Research. (3 cr; SP–8013, 8014; A-F only)
Strengths and limitations of current couple and family outcome research; methodological approaches, including qualitative and quantitative.

FSoS 8037. Ethical, Legal, and Professional Issues in Mental Health Practice: Issues with Couples and Families. (2-10 cr [max 10 cr]; SP–[8032, practicum or internship exper] or [grad student in cooperating mental hlth practice prog who has completed 1 course on therapy with children or couples or families, practicum or internship exper] or #; A-F only)
Boundaries and triangles, gender inequities, family law, confidentiality and reporting requirements, dual roles, client diversity, and value clashes.

FSoS 8039. Clinical Interventions for Couples. (3 cr; SP–8032 or equiv or #; A-F only)
Interventions into problems faced by couples at various ages and stages of their relationship. Developing and implementing effective strategies for problem solving, relationship maintenance, and partner growth, including integration of sex therapy into ongoing couple therapy.

FSoS 8043. Family Theory Development: A Systemic Perspective. (3 cr; SP–8001 or equiv or #, FSoS Ph.D. student beyond 1st yr)
Concepts and principles of systems and ecosystems and their applications in family science; emphasizes theoretical integration and development of research models with appropriate methodologies.

FSoS 8047. Integrative Research Seminar. (3 cr; SP–8001 or equiv, 8013 or equiv, 8014 or equiv)
For advanced doctoral students primarily in family social science who are working on independent research projects. Giving and receiving of constructive criticism and support in integrating theories, methods, and applications in order to create a totality that is logically coherent and conceptually and methodologically sound.

FSoS 8101. Family Stress, Coping, and Adaptation. (3 cr; SP–8001 or equiv, research methods course)
Helping families become more resilient to stress by decreasing vulnerability to crises and traumatic stress disorders. Students develop research or intervention proposal on family stress, coping, adaptation, crisis, trauma, or resilience.

FSoS 8102. Seminar in Gender Roles. (3 cr; SP–Two grad family courses or #)
Theory and research on gender roles in families. Gender issues in roles of mothers, fathers, marital partners, and same-sex partners. Issues of race, ethnicity, and social class as they intersect with gender.

FSoS 8103. Family Decision Making. (3 cr; SP–Two grad family courses or #)
Analysis and assessment of methodological and theoretical approaches to studying problem-solving and decision-making processes of individuals and family groups.

FSoS 8104. Family Policy Research. (3 cr; SP–4003 or equiv or #)
Seminar identifies characteristics distinguishing family policy research from other family research; conceptual frameworks, methods, and roles family policy research can play in policy-making and knowledge-building processes.

FSoS 8105. Family Gerontology. (3 cr; SP–4154 or equiv or #)
Integrates gerontology and family studies; new lines of inquiry, qualitative and quantitative, into aging families. Family gerontological research, family relationships, family and long-term care institutions, theoretical frameworks and research methods, and research and interventions.

FSoS 8106. Family Research from Economic Perspectives. (3 cr; SP–8013 or equiv, 8014 or equiv or #)
Seminar integrates conceptual and methodological perspectives of family social science with economic approaches to studying families. Family investments in human and social capital. Diversities in families; interface of public policies and family economic well-being.

FSoS 8107. Family Values Research: Theories and Critical Methods. (3 cr; SP–8013 or equiv, 8014 or equiv or #; WCFE 8920 recommended)
Interdisciplinary seminar on critical modes of inquiry in the family domain that require designing studies using normative theories, examining values as units of observation, and solving practical problems by collaborative strategies designed to encourage change.

FSoS 8150. Topics in Family Social Science. (1-6 cr [max 6 cr]; QP–Graduate student or #; SP–Graduate student or #)
Special seminars on timely topics suited to the needs of students.

FSoS 8193. Directed Study in Family Social Science. (1-6 cr [max 6 cr]; SP–Doctoral student in FSoS or related field)
Directed study.

FSoS 8200. Process Seminar for Family. (1 cr; SP–#; S-N only)
Required of all first-year family social science students (orientation to graduate program); not open to other students.

FSoS 8201. Teaching Family Courses in Higher Education I. (3 cr; SP–12 FSoS grad cr; teaching assistant exper recommended; S-N only)
Students cooperatively plan, administer, and evaluate (with a graduate faculty supervisor) an undergraduate core course. Improvement of teaching and evaluation methods, and conceptualization and presentation of research-based course in family studies.

FSoS 8202. Teaching Family Courses in Higher Education II. (3 cr; SP–8201 or equiv; S-N only)
Under faculty supervision, students teach an undergraduate course in family social science for which they have appropriate academic preparation and professional experience.

FSoS 8275. Clinical Consultation with Couples and Families. (3 cr; SP–#; required for grad FSoS majors in marriage and family therapy prog; S-N only)
Supervised students serve as a consultation group working with community clinicians and their clients, utilizing a one-way window and observation room; opportunities for cotherapy.

FSoS 8295. Family Therapy Practicum. (1-12 cr [max 12 cr]; SP–Marriage and family therapy student; S-N only)
Clinical placement doing marriage and family therapy in a community setting.

FSoS 8296. Family Therapy Internship. (1-21 cr [max 21 cr]; SP–8295, marriage and family therapy student; S-N only)
Full-time clinical placement doing marriage and family therapy in a community setting.

FSoS 8297. Supervision of Supervision. (1-3 cr [max 12 cr]; QP–#; SP–MFT student, #; S-N only)
Hands-on practicum to gain AAMFT-approved supervisor status.

FSoS 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

FSoS 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

FSoS 8550. Advanced Topics in Family Social Science. (1-6 cr [max 6 cr]; SP–FSoS Ph.D. student; A-F only)
Special seminars on topics suited to student needs.

FSoS 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

FSoS 8755. Master's Paper: Plan B Project. (1-6 cr [max 6 cr]; SP–FSoS M.S. student; S-N only)
Graduate faculty work with students on research for Plan B paper.

FSoS 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

FSoS 8794. Directed Research in Family Social Science. (1-6 cr [max 6 cr]; SP–Grad FSoS major)

FSoS 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Finance (Fina)

Department of Finance

Curtis L. Carlson School of Management

Fina 8801. Theory of Capital Markets. (4 cr; QP–Econ 8101; SP–Econ 8101, Econ 8102, business admin Ph.D. student or #)
Expected utility theory, discrete theory, continuous theory, theory of the term structure, measures of risk, portfolio choice, aggregation and separation, linear pricing.

Fina 8811. Corporate Finance. (4 cr; QP–8801; SP–Econ 8103, Econ 8104, business admin Ph.D. student or #)
Theoretical and empirical works in five major areas of corporate finance: capital structure, payout policy, mergers and corporate control, capital acquisition process, and corporate risk management. Theoretical frameworks are used to understand empirical evidence.

Fina 8821. Empirical Methods in Finance. (4 cr; QP–8801, [Stat 5121, Stat 5122] or [Stat 5131, State 5132]; SP–8801, business admin Ph.D. student or #)
Introduction to commonly used econometric methods in the empirical financial markets area. Econometric tests of linear pricing models, tests of market efficiency, event studies.

Fina 8892. Independent Study in Finance. (1-8 cr [max 16 cr]; SP–Business admin Ph.D. student or #)
Problems or developments of special interest to the student.

Fina 8894. Directed Research in Finance. (1-8 cr [max 16 cr]; SP–Business admin Ph.D. student specializing in finance or #)
Individualized directed research on a project of interest to the student, approved and advised by faculty.

Fisheries and Wildlife (FW)

Department of Fisheries and Wildlife

College of Natural Resources

FW 5003. Human Dimensions of Biological Conservation. (3 cr; QP–[Biol 1201 or 1009], Biol 3008; SP–[Biol 1001 or 1009], Biol 3407)
Survey of social, psychological, economic, policy aspects of managing/conserving wildlife, fisheries, and related resources.

FW 5051. Analysis of Populations. (3-4 cr; QP–[[Biol 1009 or 1201], [Stat 3011 or 5021]] or #; SP–[[Biol 1001 or 1009], [FW 4001 or Stat 3011 or 5021]] or #)
Factors involved in regulation, growth, general dynamics of populations. Data needed to describe populations, population growth, population models, regulatory mechanisms.

FW 5411. Aquatic Toxicology. (3 cr; QP–Biol 3008 or EEB 5601; SP–Biol 3407 or EEB 4601)
Pollution assessment approaches, biological effects, fate/flow of contaminants in aquatic systems, major types of pollutants.

FW 5455. Sustainable Aquaculture. (3 cr; QP–[Biol 1106, Chem 1051, Math 1031] or #; SP–Biol 2012, Chem 1021, Math 1031] or #; A-F only)
Role of aquaculture in fisheries management, biodiversity rehabilitation, and food production around the world. Implications for sustainability of human-environment interactions in different societies. Principles of fish husbandry.

FW 5571. Avian Conservation and Management. (3 cr; QP–EEB 5134 or grad or #; SP–EEB 4134 or grad or #)
Current problems in avian conservation/management. Nongame, wetland, game birds.

FW 5601. Fisheries Population Analysis. (3 cr; QP–Biol 3008, Math 1251, [Stat 3012 or 5021]; SP–[4001 or Stat 5021], Biol 3407, [Math 1192 or 1271]; A-F only)
Introduction to theory/methods for estimating vital statistics of fish populations. Using microcomputers/statistical software to describe, analyze, model attributes of fish populations. Case studies from literature of marine/freshwater fisheries management.

FW 5603W. Habitats and Regulation of Wildlife. (3 cr; QP–Biol 3008; SP–Biol 3407; A-F only)
Environmental interactions of wildlife at population/community levels. Environmental threats from human activities. Habitat management practices. Objectives, polices, regulations in population management.

FW 5604W. Fisheries Ecology and Management. (3 cr; QP–EEB 5601; SP–EEB 4601)
Managed species/systems. Applied aquatic/fish ecology related to fisheries. Role of planning in fisheries management. Application of management tools, assessment of their efficacy.

FW 5621. Geographic Information Systems for Fisheries, Wildlife, and Biology Conservation. (3 cr)
Hands-on experience with GIS as tool for understanding, analyzing, managing ecological systems. ARC-INFO; how to apply it to problems in fisheries, wildlife, and biological conservation.

FW 5625. Wildlife Handling and Immobilization for Research and Management. (2 cr; QP–General biology, [grad student or vet med student or FW sr]; SP–General biology, [grad student or vet med student or FW sr], Δ; S-N only)
Practical techniques to maximize human/animal safety and encourage effective operations. Preparation procedures, legal responsibilities, capture drugs/delivery systems, safety measures, ethical issues, basic veterinary procedures for handling wildlife. Field course. Uses live animals.

FW 8200. Seminar. (1-4 cr; S-N only)
Oral and written student reports on selected topics from current literature in fisheries biology and management and wildlife. Lectures by and discussions with faculty and visiting specialists.

FW 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

FW 8394. Research in Fisheries. (1-4 cr)
Directed research.

FW 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

FW 8448. Fishery Science. (3 cr; SP–Grad student [in fisheries or wildlife conserv or conserv biol or ecology] or #; S-N only)
Applying ecological theory to study/manipulation of fish populations. Dynamics of growth, mortality, and yield of fish stocks. Field assessment methodology. Simulation applied to management problems. Web-assisted course. Students produce a publishable (print or electronic) project.

FW 8452. Conservation Biology. (3 cr; A-F only)
Seminar examining population- to system-level biological issues (genetics; demographic processes; community, ecosystem, and landscape scale interaction; restoration ecology; ex situ strategies for restoration and recovery) and societal issues (social, economic, cultural perspectives; sustainable development strategies; roles of institutions; international and U.S. policies).

FW 8459. Stream and River Ecology. (3 cr; QP–Limnology course; SP–Limnology course or #)
Structure/dynamics of running waters from ecosystem perspective. Historical perspective, basic hydrology/fluvial geomorphology, terrestrial-aquatic interactions, detrital dynamics, metabolism, drift, trophic relations, biotic/abiotic interactions, ecosystem experiments and natural alterations, stability/succession, ecosystem dynamics in a watershed.

FW 8461. Advanced Topics in Fish Physiology. (1 cr; QP–Vertebrate physiology course; SP–Vertebrate physiology course or #)
Lectures, discussion, current literature. Complements 5459.

FW 8462. Advanced Topics in Fish Behavior. (1 cr; QP–Behavior course; SP–5459 or behavior course or #)
Current literature. Complements 5459.

FW 8465. Fish Habitats and Restoration. (3 cr; QP–Intro ecology course; SP–Intro ecology course or #)
Mechanisms underlying physiology/behavior that shape fish community structure in specific north temperate habitats. Techniques and planning procedures for restoring lakes/streams.

FW 8494. Research in Wildlife. (1-4 cr; SP–#)
Directed research.

FW 8576. Biology and Management of Large Mammals. (2 cr; QP–Ecology course; SP–[Ecology course, [wildlife, forestry, and ecology grad student]] or #; A-F only)
Ungulates. Ecology, population dynamics, energy, nutrition, predation, disease/parasites, social behavior. Research approaches, management implications/practices. Key information on North American species.

FW 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

FW 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

FW 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Food Science and Nutrition (FScN)

Department of Food Science and Nutrition

College of Agricultural, Food, and Environmental Sciences

FScN 5411. Food Biotechnology. (2 cr; QP–5120; SP–4121)
Genetic tools as applied to food biotechnology. Improvement of microbes used in food production by modern biotechnological approaches. Discuss need for stringent regulation of modern biotechnology as well as ethical and legal issues.

FScN 5421. Introduction to Food Law. (3 cr; QP–1102; SP–1102)
Analysis of the federal legal requirements affecting the production processing, packaging, marketing, and distribution of food and food products using case law studies and regulatory history.

FScN 5431. Physiochemistry of Food. (2 cr; QP–5110; SP–4111)
Surface phenomena, colloidal interactions, liquid dispersions, gels, emulsions and foams, and functionality of food macromolecules in these systems.

FScN 5441. Introduction to New Product Development. (2 cr; QP–5110, 5135; SP–4111, 4331)
Interactive course that introduces students to the principles of new product development, from identification and testing of new product concepts, through prototype testing, to basic process design using examples from industry.

FScN 5451. Structure and Function in Foods: Quantitative Analysis. (2 cr; QP–5312; SP–4312)
Introduction to various procedures for analysis of structure and organization in raw and processed food.

FScN 5461. Food Packaging. (2 cr; QP–1102, 3102, Phys 1042; SP–1102, 3102, Phys 1102 or Phys 1302)
Materials, principles, and procedures of packaging as they apply to food products. Emphasis is on consumer products, but the principles also apply to bulk and institutional foods and ingredients.

FScN 5511. Meat, Poultry, and Seafood Protein Processing. (2 cr; QP–1102, Chem 3305; SP–1102, Chem 2302)
Industrial processing of meat, poultry, and seafood products with emphasis on protein systems: comminuted products, nutraceutical products, thermal processing optimization, pasteurization, least cost analysis, and color stability.

FScN 5531. Grains: Introduction to Cereal Chemistry and Technology. (2 cr; QP–Biol 1009, Chem 1052; SP–Biol 1009, Chem 1022)
Origins, structure, biochemistry, and cellular properties of major cereal grains as they relate to primary processing (milling) and secondary processing (production of cereal products).

FScN 5621W. Nutrition and Metabolism. (4 cr; QP–3612, BioC 3021, Phsl 3051; SP–4612, BioC 3021, Phsl 3051)
Carbohydrate, lipid, and protein metabolism. Uses "systems" or "holistic" approach to emphasize how metabolic pathways interrelate.

FScN 5622. Vitamin and Mineral Biochemistry. (3 cr; QP–3612, BioC 3021, Phsl 3051; SP–4612, BioC 3021, Phsl 3051)
Nutritional, biochemical, and physiological aspects of vitamins/essential minerals in human/experimental-animal models.

FScN 5623. Regulation of Energy Balance. (2 cr; QP–5620; SP–5621 or ¶5621)
Regulation of energy balance in humans, including regulation of food intake and of energy expenditure.

FScN 5631. Dietary Supplements: Regulatory, Scientific, and Cultural Perspectives. (3 cr)
Concepts/principles of dietary supplements-RDA, dose-response, risk assessment. Laws/regulations, their interpretation concerning dietary supplements. Vitamins/minerals. Philosophy/use of botanicals/nutraceuticals in Western medicine in contrast to other cultures. Use of herbal supplements in Western medicine.

FScN 8211. Risk Analysis in Food Science and Nutrition. (2 cr)
Risks and benefits in various areas of the field (e.g., food preservatives and supplements).

FScN 8212. Advances in Nutrition: Nutrition and Exercise Metabolism. (2 cr)
Seminar examines topics related to effects of diet on exercise metabolism.

FScN 8213. Food Lipids: Biological and Toxicological Aspects. (2 cr; QP–5110; SP–1112, 4111)
Lipids, including chemical reactions of nutritional and toxicological significance, lipid stability in foods, antioxidants, health aspects, and lipid oxidation products, including oxysterols, cytobiology, atherogenicity, membrane effects, and biological properties.

FScN 8310. General Seminar. (1 cr [max 2 cr]; SP–#; S-N only)
Presentations by faculty, graduate students, and outside speakers.

FScN 8318. Current Issues in Food Science. (2 cr [max 4 cr]; QP–5110, 5120; SP–4111, 4121, Δ; A-F only)
Current issues, how they impact food industry.

FScN 8320. Advanced Topics in Food Science. (1-3 cr [max 6 cr]; SP–#)
Recent research or special topics.

FScN 8330. Research Topics. (1 cr [max 6 cr]; SP–#)
Seminar in which faculty member or group of faculty/graduate students discuss research progress or review/discuss current research literature.

FScN 8332. Microbial Starter Cultures. (2 cr; QP–5120, BIOC 3021; SP–4121, BioC 3021)
Microbiology, physiology, and genetics of lactic acid bacteria used in food fermentations.

FScN 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

FScN 8334. Reaction Kinetics of Food Deterioration. (2 cr; QP–Chem 5520; SP–Chem 3501)
Basis for use of applied chemical kinetics to deteriorative reactions occurring in processing and storage of foods and drugs. Systems include enzymatic reactions, lipid oxidation, nonenzymatic browning, acid base catalysis, and microbial growth and death. Application of these kinetics to study of accelerated shelf-life testing of foods, drugs, and biologics.

FScN 8335. Carbohydrate Chemistry in Food and Nutrition. (2 cr; QP–5110; SP–4111)
Current methods of carbohydrate and polysaccharide analysis, including structural and chemical characterization methods, polymer reactions, and modifications.

FScN 8336. Lipid Chemistry and Rancidity of Foods. (2 cr; QP–5110; SP–4111)
Chemistry of food lipid oxidation and rancidification, and protective functions of antioxidants.

FScN 8337. Flavor Chemistry. (2 cr; QP–5110; SP–4111)
Chemistry involved in formation, analysis, and release of flavoring materials in foods.

FScN 8391. Independent Study: Food Science. (1-4 cr [max 6 cr]; SP–Δ)
Includes written reports.

FScN 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

FScN 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

FScN 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

FScN 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Forest Resources (FR)

Department of Forest Resources
College of Natural Resources

FR 5104. Forest Ecology. (4 cr; QP–[Biol course, chem course, grad student] or #; SP–§3104; [biol course, chem course, grad student] or #; A-F only)
Form/function of forests as ecological systems. Characteristics/dynamics of species, populations, communities, landscapes, ecosystem processes. Examples apply ecology to forest management. Emphasizes fire ecology. Weekend field trip (required). Weekly recitations.

FR 5142. Tropical Forest Ecology. (3-4 cr; QP–3xxx or above ecology course; SP–3xxx or above ecology course)
Ecological principles related to form, function, development of wet/dry tropical forests at organismal, community, ecosystem scales. Succession, productivity, biodiversity, sustainability, agroforestry, management alternatives. Natural distribution of forest types. Causes, consequences, extent of deforestation.

FR 5146. Dynamics of Global Change. (3-4 cr; QP–3xxx or above ecology course; SP–3xxx or above ecology course)
Implications of global change upon wild/cultivated vegetation, including forests, grasslands, agricultural ecosystems. Responses at ecosystem, community, organismal, physiological scales. Potential climate change. Elevated atmospheric concentrations of carbon dioxide, ozone, other trace gasses. Acid deposition. Other pollutants.

FR 5153. Forest and Wetland Hydrology. (3 cr; QP–5114 or #; SP–Basic hydrology course or #)
Current topics, problems, methods associated with forest/wetland hydrology. Hydrologic role of forest vegetation in snow/rainfall regimes. Analytical methods/models to evaluate effects of vegetation management in uplands/wetlands on amount/timing of water flow.

FR 5161. Forest Biology and Measurements: Field Experience. (2 cr; QP–#; SP–#; A-F only)
Forest plant identification, forest community description/dynamics, mapping forests, tree/stand measurement. Taught at Itasca State Park.

FR 5228. Advanced Topics in Assessment and Modeling of Forests. (3 cr; QP–[5218 or equiv], [NRES 5210 or equiv], [Stat 5021 or equiv]; SP–4218, Math 1272, Stat 5021; A-F only)
Recently developed mathematics, computer science, and statistics methodologies applied to forest resource functioning, management, and use problems.

FR 5251. Role of Renewable Natural Resources in Developing Countries. (1 cr; QP–Sr or grad or #; SP–§3251; sr or grad or #; A-F only)
International perspectives on resource issues. Integration of natural resource, social, economic considerations. Overviews of issues, case studies.

FR 5264. Advanced Forest Management Planning. (2 cr; QP–5270 or #; SP–4471 or #)
Strengths/weaknesses of modeling tools used in forest planning. Emphasizes problem sets and applications, from stand-level management to regional timber supply analyses and landscape-level planning. Review of recent literature. Practical problems with implementation.

FR 5403. Fundamentals of Natural Resource Education. (1-2 cr; SP–Elementary teacher or #)
The forest community, tools used by foresters, forest management practices. Forestry-related indoor/outdoor activities that can be translated for classroom use.

FR 5412. Advanced Remote Sensing. (3 cr; QP–5262 or #; SP–4262)
Biophysical-quantitative remote sensing, its applications to monitoring environmental/natural resources. Experience working with digital remote sensing data, models, image processing.

FR 5700. Colloquium in Natural Resources. (1-3 cr; QP–Varies with topic; SP–Varies with topic)
Colloquium in specialized topics in natural resources.

FR 8101. Research Problems: Forest-Tree Physiology. (1-5 cr)
Independent research under faculty guidance.

FR 8102. Research Problems: Forest-Tree Genetics. (1-5 cr)
Independent research under faculty guidance.

FR 8103. Research Problems: Forest Hydrology. (1-5 cr)
Independent research under faculty guidance.

FR 8104. Research Problems: Forest Ecology. (1-5 cr)
Independent research under faculty guidance.

FR 8105. Research Problems: Silviculture. (1-5 cr)
Independent research under faculty guidance.

FR 8106. Research Problems: Urban Forestry—Biology and Management. (1-5 cr)
Independent research under faculty guidance.

FR 8107. Seminar: Forest Resources. (1 cr)
Assigned topics, problem analyses, and research reports.

FR 8112. Research Problems: Physiological Ecology. (1-5 cr)
Interaction between plants and their environment. Focuses on mechanisms that affect whole plant, community, and ecosystem processes.

FR 8201. Research Problems: Forest Economics. (1-5 cr)
Independent research under faculty guidance.

FR 8202. Research Problems: Forest Biometry and Measurements. (1-5 cr)
Independent research under faculty guidance.

FR 8203. Research Problems: Forest Recreation. (1-5 cr)
Independent research under faculty guidance.

FR 8204. Research Problems: Forest Policy. (1-5 cr)
Independent research under faculty guidance.

FR 8205. Research Problems: Remote Sensing. (1-5 cr)
Independent research under faculty guidance.

FR 8206. Research Problems: Forest Management. (1-5 cr)
Independent research under faculty guidance.

FR 8207. Economic Analysis of Forestry Projects. (2 cr; SP–#; A-F only)
Economics of public/private forestry/watershed management projects. Commercial profitability analysis, cost-benefit analysis, preparing feasibility studies. Case studies developed/presented.

FR 8208. Research Problems: Environmental Learning and Leadership. (1-5 cr; SP–#)
Independent research under faculty guidance.

Forestry (Fors)

Department of Forest Resources
College of Natural Resources

Fors 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Fors 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

Fors 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Fors 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Fors 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

French (Fren)

Department of French and Italian
College of Liberal Arts

Fren 5251. Promenades Poétiques: The Subject in Motion. (3 cr; SP–3111 or above)
The search for the subject in poetry and poetic prose as revealed through the motif of the "promenade" and experimentation with literary forms.

Fren 5261. The Returns of Tragedy. (3 cr; SP–3111 or above)
Tragedy as dramatic form in relation to social order, myth and history, and theatre.

Fren 5271. "To Change or not to Change?": Speculations on (Post) Modern French Texts. (3 cr; SP–3111)
The meaning and purpose of the notion of "change" in French novels. Explore how a multiplicity of causes produces major changes in an individual's personal and public life. The notion of change as it relates to financial and intellectual speculation.

Fren 5301. Critical Issues in French Studies. (3 cr; SP–# for undergrads)
Introduces the methods of interpretation and critical debates that have shaped and continue to define the discipline of French studies. Provides a practical introduction to graduate-level literary research.

Fren 5350. Topics in Literature and Culture. (3 cr [max 12 cr]; SP–3101 or equiv)
Problem, period, author, or topic of interest. See *Class Schedule.*

Fren 5479. Post/Colonial Francophone Literatures. (3 cr; SP–3111 or above)
Francophone literature from North Africa, Africa, and the Caribbean of the colonial and/or post-colonial eras in the light of relevant literary and cultural theories.

Fren 5501. Structure of French: Phonology. (3 cr; SP–§3501; [Ling 3001 or Ling 5001], grad student)
Advanced study of sound system of contemporary French.

Fren 5502. Structure of French: Morphology and Syntax. (3 cr; SP–§3502; 5501 or #)
Linguistic study of contemporary French word forms (inflectional and derivational morphology); introduction to French syntax (linguistic study of grammar) and characteristic syntactic constructions.

Fren 5531. Sociolinguistics of French. (3 cr; SP–§3531; Ling 3001 or 5001, grad)
Explores variation in the use of French associated with factors such as medium (oral/written), style (formal/informal), region, social and economic groups.

Fren 5995. Directed Teaching. (1-6 cr [max 24 cr]; SP–#; S-N only)
Directed teaching.

Fren 8111. Introduction to Old French. (3 cr)
Studies in medieval French: instruction in reading Old French, sources of bibliography, and topics in medieval studies (language and literature). Taught in French.

Fren 8112. Early Medieval French Literature. (3 cr; SP–8111)
Introduction to epic, romance, allegory, and theater in Old French readings (12th-13th centuries). Taught in French.

Fren 8113. Later Medieval French Literature. (3 cr; SP–8111 or #)
Study of a problem presented by texts written in France ca. 1300-1500. Evolution of Middle French language.

Fren 8114. Old Provençal Language and Literature. (3 cr)
Language and literature of Old Occitan (Old Provençal), chiefly troubadours' poems. Some language instruction, reading of poems and other works, and consideration of nature and origins of "courtly love." Knowledge of French, Spanish, or Italian desirable. Taught in English.

Fren 8201. Narrative, History, and Memory. (3 cr)
Significance of the narrative paradigm in literature, history, and cultural memory.

Fren 8202. Staging Modernity: Seminar in Problems of 20th-Century Theatre. (3 cr)
Developments in 20th-century drama and performance in relation to French theatrical tradition, post-1945 avant-garde innovation, and interculturalism in contemporary theater.

Fren 8250. Critical Issues: Poetry. (3 cr [max 12 cr])
Significant critical issues relating to poetic writing of selected authors or periods.

Fren 8260. Critical Issues: Theatre. (3 cr [max 12 cr])
Significant critical issues relating to dramatic writing of selected authors or periods.

Fren 8270. Critical Issues: Prose. (3 cr [max 12 cr])
Significant critical issues relating to prose writing of selected authors or periods.

Fren 8271. The Novel of the Ancien Regime. (3 cr)
Considers major novels of the 17th and 18th centuries in connection with developments in such areas as esthetic theory, intellectual currents, social transformations, and reading practices.

Fren 8290. Critical Issues: Perspectives on an Author. (3 cr [max 12 cr])
In-depth study of major author's writing, critical tradition this writing has occasioned, and theoretical issues upon which this writing may be brought to bear.

Fren 8291. Jean Genet's Writings and French Institutions. (3 cr)
Jean Genet's writings at the crossroads of several disciplines (politics, psychoanalysis, religion, and law). Genet's novels, dramas, and political essays explore the power of institutional settings and strategies imagined by individuals to short-circuit their impact.

Fren 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Fren 8371. The Rule of Reason, The Reign of Madness: Readings in Early Modern France. (3 cr)
Relationship between construction of reason and madness in philosophy, legitimation of political rule, and the institution of literature in early modern France.

Fren 8401. Seminar in Quebecois Literature. (3 cr)
Quebecois writing as a literature of its own, not simply as part of Canadian literature. It is studied in relation to other North American literatures and to Francophone literature produced elsewhere in the world.

Fren 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

Fren 8521. History of the French Language. (3 cr)
History of French from its origins in Latin to the present day. Aspects of diachronic phonology (sound change), morphology, syntax. Taught in French.

Fren 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Fren 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Fren 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Fren 8980. Directed Teaching. (1-5 cr [max 25 cr])

Fren 8992. Directed Readings for Graduate Students. (1-5 cr [max 25 cr]; SP–#)

Fren 8994. Directed Research. (1-5 cr [max 25 cr]; SP–#, may be taken as tutorial with #)

French and Italian (FrIt)

Department of French and Italian
College of Liberal Arts

FrIt 5257. Passionate Beings: Literary and Medical Problematics in Italy and France from 1800 to the Present. (4 cr)
Literary and medical representations of the passions in France and in Italy from 1800 to the present. Texts range from theatrical works to medical treatises on the passions as ways for exploring notions of subjectivity, responsibility, order. Taught in English.

FrIt 5850. Topics in French and Italian Cinema. (3 cr [max 9 cr]; SP–Knowledge of [French or Italian] helpful but not required)
Focuses on a theme, problem, period, filmmaker, or other topic of interest in French or Italian cinema. See *Class Schedule.* Taught in English.

FrIt 5999. Teaching of French and Italian: Theory and Practice. (3 cr)
Theoretical and practical aspects of language learning and teaching applied to French and Italian. Includes history of foreign language teaching in 20th-century United States. Taught in English.

Genetics, Cellular, and Developmental Biology (GCD)

Department of Genetics, Cell Biology, and Developmental Biology

College of Biological Sciences

GCD 5036. Molecular Cell Biology. (3 cr; QP–Biol 5004 or #; SP–Biol 4004 or #; [sr or grad student] recommended)
Modern, integrative approaches combining cell/molecular biology, biochemistry, and genetics to investigate cell organization/function. Membranes, signaling, extracellular matrix, secretion, endocytosis, cytoskeleton, nucleus. Analysis of scientific papers to illustrate new concepts in and experimental approaches to cell organization/function.

GCD 8073. Advanced Human Genetics. (3 cr; QP–8132; SP–8121 or #)
Application of molecular, biochemical, chromosomal, and population genetics to human variation and disease. Abnormal chromosome number and structure; abnormal enzyme, structural protein, receptor and transport; analysis of inheritance patterns; behavioral genetics; genetic basis of common disease. Current research articles in human genetics.

GCD 8121. Advanced Molecular Genetics. (3 cr; QP–Biol 5003, BioC 3021 or 5331; SP–Biol 4003, BioC 3021 or 4331)
Action of gene in molecular, cellular, and organismal development. Mechanisms of information transfer and regulation of these processes in various biological systems; examination of original research.

GCD 8131. Advanced Genetics. (3 cr; QP–3022 or Biol 5003, BioC 3021 or 5331; SP–3022 or Biol 4003, BioC 3021 or 4331 or #)
Literature-based course covering modern genetic analysis, including mutant screens, characterization of multiple alleles, gene mapping and cloning, genome sequencing, intergenic interactions, transposable elements, genetic mosaics, and molecular mechanisms of recombination.

GCD 8136. Techniques of Biological Electron Microscopy. (4 cr; SP–#)
Theory and methodology of transmission and scanning electron microscopy.

GCD 8151. Advanced Cell Biology. (3 cr; QP–5034 or 8132 or BioC 8002, Biol 5004 or #; SP–Biol 4004, GCB 5034 or 8121 or BioC 8002 or #)
Eukaryotic systems with emphasis on structure, function, and chemistry of cell organelles; selected specialized cells. Membranes, secretion, trafficking, cytoskeleton, cell motility, cell cycle, nucleus, and compartmentalization.

GCD 8161. Advanced Developmental Biology. (3 cr; QP–Biol 5004, [Biol 5003 or GCB 8131], GCB 5034 or GCB 8132 or BioC 8002; SP–Biol 4004, [GCB 8131 or Biol 4003], GCB 5034 or 8121 or BioC 8002 or #)
Current concepts of and experimental approaches taken to understand basic mechanisms of development. Model organisms. Embryology, cell fate determination, differentiation, pattern formation, polarity, cell migration, and cell interactions. Analysis of original research articles.

GCD 8171. Literature Analysis. (2 cr; SP–Grad MCDG major; A-F only)
Critical reading and evaluation of current literature. May include evaluation of both excellent and flawed papers. Intensive and in-depth discussions of selected papers in molecular biology, genetics, cell biology, and developmental biology.

GCD 8212. Selected Topics in Cell and Developmental Biology. (3 cr; QP–[8132 or BioC 8002], [GCB 8148 or 8149], [GCB 5024 or 5061]; SP–[8121 or BioC 8002], GCB 8151, [GCB 4161 or 8161 or #])
Reading and discussion of papers from current literature. Topics selected from research areas of cell biology and developmental biology and experimental approaches taken in these fields. Topics vary annually.

GCD 8213. Selected Topics in Molecular Biology. (4 cr; QP–8132 or BioC 8002 or MdBc 8002; SP–§BioC 8213; 8121 or BioC 8002 or #)
Sample topics: DNA replication, recombination and gene conversion, regulation of gene expression in procaryotes, regulation of gene expression in eucaryotes, chromatin structure and transcription, organellar gene expression. Lectures, readings, discussions.

GCD 8900. Seminar. (1 cr [max 4 cr]; SP–Grad MCDG major or #; S-N only)
Current scientific research.

GCD 8910. Journal Club. (1 cr [max 4 cr]; SP–Grad MCDG major or #; S-N only)
Critical evaluation of selected current literature.

GCD 8912. Genetic Counseling in Practice. (4 cr; SP–MCDG M.S. student with genetic counseling specialization or #; A-F only)
Practical genetic counseling, communicating genetics and medical information to the family, helping families with decision making.

GCD 8913. Psychosocial Issues in Genetic Counseling. (3 cr; SP–MCDG M.S. student with genetic counseling specialization or #; A-F only)
Interviewing skills, supportive counseling, and case-study analysis specific to genetic counseling.

GCD 8914. Ethical and Legal Issues in Genetic Counseling. (3 cr; SP–MCDG M.S. student with genetic counseling specialization or #; A-F only)
Professional ethics; ethical and legal concerns with new genetic technologies.

GCD 8920. Special Topics. (1-4 cr [max 8 cr]; SP–Grad MCDG major or #)
Special topics.

GCD 8993. Directed Studies. (1-5 cr [max 15 cr]; SP–#)
Directed studies.

GCD 8994. Research. (1-5 cr [max 20 cr]; SP–#; S-N only)
Independent research determined by student's interests, in consultation with faculty mentor.

Geographic Information Science (GIS)

Department of Geography

College of Liberal Arts

GIS 5571. Introduction to Arc/Info. (3 cr; SP–Geog 5561 or equiv, status in MGIS program, familiarity with computer operating systems or #)
Introductory overview of the Arc/Info system. Topics include data capture, geometric transformations and map projections, topology, editing systems, database management and map production.

GIS 5572. Advanced Arc/Info. (3 cr; SP–5571, Geog 5561 or equiv, status in MGIS program or #)
Advanced course in Arc/Info providing in-depth exploration of the topics emphasized in GIS 5571 as well as advanced topics including dynamic segmentation, address matching, and macro language programming.

GIS 5573. Desktop Mapping. (1.5 cr; SP–Geog 5561 or equiv, Geog 3511 or equiv, status in MGIS program or #)
Introduction to desktop mapping systems such as ArcView, MapInfo and Maptitude. Emphasizes the application of these systems to the display and analysis of geographical data.

GIS 5574. GIS and the Internet. (1.5 cr; SP–Geog 5561 or equiv, status in MGIS program or #)
The role of the Internet in GIS applications. Topics include GIS data sources on the Internet, the role of the Internet in information dissemination, Internet capabilities for interactive mapping and issues surrounding the development of GIS-related Web sites.

GIS 5575. Surveying and the Global Positioning System (GPS). (2 cr; SP–Geog 5561 or equiv, status in MGIS program or #)
Introduction to GPS (Global Positioning System) and other surveying techniques of use to GIS professionals. Topics include geodesy, data adjustment, datums, ellipsoids, coordinate systems, and transformations.

GIS 5576. Raster-Based GIS. (1.5 cr; SP–Geog 5561 or equiv, status in MGIS program or #)
Introduction to raster-based geographic information systems. Focuses on raster data sets and the use of grid-based models. Practical experience is offered using a widely-available raster GIS package.

GIS 5577. Spatial Data Administration. (2 cr; SP–Geog 5561, Geog 5563 or equivs, status in MGIS program, familiarity with computer operating systems or #)
Theory and application for the administration of geographic databases including the topics of quality assurance, development planning and management, maintenance, access and distribution, and documentation.

GIS 5590. Special Topics in GIS. (1-3 cr [max 6 cr]; SP–#)
Special topics in geographic information science (GIS). Topics vary according to student needs, technological developments in field.

GIS 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

GIS 8990. MGIS Capstone Project. (2-6 cr [max 6 cr]; SP–MGIS, #; A-F only)
Project of sufficient scope/complexity to document student's ability to analyze issues and address them. Written summary of work. Done under supervision of faculty member and, where appropriate, workplace supervisor.

Geography (Geog)

Department of Geography

College of Liberal Arts

Geog 5143. Geography of West Africa. (3 cr)
West Africa from Senegal to Cameroon; social geography of resource use, population, settlement, economic development, and international relations.

Geog 5145. Development in Africa. (3 cr; SP–§Afro 5145)
Economic, political, and social development in Africa from independence to the present. Emphasis on reordering colonial landscapes, bases for North-South relations, big power intervention, and participation in the world economy.

Geog 5181. Russia and Environs. (3 cr; SP–§3181)
Physical and human geography of Russia and former Soviet republics. Legacy of central planning on regional economies, city systems and city structure. Economic and cultural links among regions and republics. Conflicts rooted in religion, ethnicity and tradition. Relations with nearby states and regions. Physical environmental problems.

Geog 5211. East Asia. (3 cr; SP–§3211, §EAS 3211)
Open to graduate students in East Asian studies and other disciplines who wish to study the region from a geographical perspective. Research paper. Meets with 3211.

Geog 5215. Geography of China. (3 cr; SP–§3215)
Open to graduate students in East Asian studies and other disciplines who wish to study the region from a geographical perspective. Research paper. Meets with 3215.

Geog 5361. Geography and Real Estate. (4 cr)
Origins and evolution of land ownership in the United States.

Geog 5371W. American Cities I: Population and Housing. (4 cr; SP–§PA 5201)
Emergence of North American cities; residential building cycles, density patterns; metropolitan housing stocks, supply of housing services; population and household types; neighborhood-level patterns of housing use; housing prices; intraurban migration; housing submarkets inside metro areas; emphasis on linking theory, method, case studies.

Geog 5372W. American Cities II: Land Use, Transportation and the Urban Economy. (4 cr; SP–§PA 5202; A-F only)
Urban economy, its locational requirements. Central place theory. Transportation, urban land use: patterns/conflicts. Industrial/commercial land blight. Real estate redevelopment. Historic preservation. Emphasizes links between land use, transportation policy, economic development, local fiscal issues. U.S.-Canadian contrasts.

Geog 5374W. The City in Film. (4 cr; SP–§3374; grad student or #)
Cinematic portrayal of changes in 20th-century cities worldwide. Social/cultural conflict, political/economic processes, changing gender relationships, rural versus urban areas, population/development issues (especially as they affect women/children). Meets concurrently with 3374. Additional weekly meeting discusses films, readings. Project on a topic selected in consultation with instructor.

Geog 5385. Political Economy of Development. (4 cr; SP–Sr or grad or #)
Nature and scope of the modern world system (capitalism) and its impact on regional development processes; roles of the state and international financial institutions.

Geog 5393. The Rural Landscape. (4 cr)
Analysis of the three principal components of the rural landscape (the form of the land surface, the plant life that cloaks it, and the structures that people have placed upon it). Emphasis on structures associated with agriculture including some discussion on mining, forestry, resort areas, and small towns.

Geog 5411W. Geography of Health and Health Care. (3 cr; SP–§3411)
Application of human ecology, spatial analysis, political economy, and other geographical approaches to analyze problems of health and health care. Topics include distribution and diffusion of disease; impact of environmental, demographic, and social change on health; distribution, accessibility, and utilization of health practitioners and facilities.

Geog 5421. Introduction to Atmospheric Science. (3 cr; SP–§Soil 5401; familiarity with fundamentals of physics, calculus, and statistics, including differential and integral calculus and basic differential equations and basic thermodynamics, mechanics, and the electromagnetic spectrum)
Calculus-based introduction to atmospheric dynamics, radiation, thermodynamics, chemical composition, and cloud processes. Applications to climate, meteorology, the hydrologic cycle, air quality, and biogeochemical cycles.

Geog 5423. Climate Models and Modeling. (3 cr; SP–3401 or #)
Survey of development and research with simple and complex (three-dimensional) climate models. Environmental processes and their numerical representation in climate models; evaluation of model sensitivity and accuracy; coupling between atmosphere, biosphere, hydrosphere, and cryosphere; assessment of model predictions for climate change.

Geog 5426. Climatic Variations. (3 cr; SP–1425 or 3401 or #)
Theories of climatic fluctuations and change at decadal to centuries time scales; analysis of temporal and spatial fluctuations especially during the period of instrumental record.

Geog 5441. Quaternary Landscape Evolution. (3 cr; SP–3401 or grad student or #)
Roles of climate change, geomorphic history, vegetation change, and soil development in the evolution of landscape patterns during the Quaternary Period, with emphasis on North America.

Geog 5444. Water Resources, Individuals, and Institutions. (3 cr; SP–§ WRS 5101; 1402 or 3401 or grad or #)
How water resources are controlled by natural system functions, user actions, and the influence of social and political institutions. Explore how these three levels of control vary in space and time, paying particular attention to the complexities of each of these controls and the feedbacks among them.

Geog 5511. Advanced Cartography. (3 cr; SP–3511 or #)
Advanced topics on data sources for mapping; history of thematic cartography (focused on 19th-century European activity); multivariate classification and symbolization; models for cartographic generalization, spatial interpolation, and surface representation; principles of animated and multimedia cartography.

Geog 5512. Cartography: Topics. (3 cr; SP–3511 or 3531 or #)
Selected topics include the system of cartographic communication, map design, map reading, map analysis, history of cartography.

Geog 5530. Cartography Internship. (2-7 cr [max 10 cr]; SP–#; S-N only)
Provides intensive hands-on experience in contemporary map production and design, ranging from GIS applications to digital prepress. Strong computer skills essential.

Geog 5561. Principles of Geographic Information Science. (4 cr; SP–Grad)
Introduction to the study of geographic information systems (GIS) for geography and non-geography students. Topics include GIS application domains, data models and sources, analysis methods and output techniques. Lectures, reading, and hands-on experience with GIS software.

Geog 5562. Geographic Information Science and Analytical Cartography. (3 cr; SP–3561 or 5561 and 3511; or #)
Topics include algorithms and data structures for digital cartographic data, topological relationships, surface modeling and interpolation, map projections and geometric transformations, numerical generalization, and raster and vector processing. Hands-on experience using a variety of software packages.

Geog 5563. Advanced Geographic Information Science. (3 cr; SP–B or better in 3561 or 5561 or #)
Advanced study of geographic information systems (GIS). Topics include spatial data models, topology, data encoding, data quality, database management, spatial analysis tools and visualization techniques. Hands-on experience using an advanced vector GIS package.

Geog 5564. Urban Geographic Information Science and Analysis. (3 cr; SP–3561 or 5561)
Core concepts in urban geographic information science including sources for urban geographical and attribute data (including census data), urban data structures (focusing on the TIGER data structure), urban spatial analyses (including location-allocation models), geodemographic analysis, network analysis, and the display of urban data.

Geog 5565. Geographical Analysis of Environmental Systems and Global Change. (3 cr; SP–3561 or 5561 or FR 4131 or LA 5573 or one intro GIS course or grad or #)
Applications of geographic information systems and other spatial analysis tools to the analysis of environmental systems patterns, dynamics, and interactions. Focus on global to landscape databases developed to analyze atmospheric, hydrospheric, geomorphic, pedologic, biologic, and human land use systems.

Geog 5588. Multimedia Cartography. (3 cr; SP–Minimum of three geog courses, including one cartography course or advanced standing in an allied field such as landscape architecture or #)
Conceptualizing geographic topics in animatable form, selecting appropriate animation metaphors for specific ideas, using standard graphic software to prepare images for computer display and animation.

Geog 5605V. Honors: Geographical Perspectives on Planning. (4 cr; SP–§3605W; honors or grad student)
Role of planning in reshaping 19th-/20th-century cities in Europe, North America, selected Third World countries. History of planning. Societal change, interest groups, power relations in planning process. Citizen participation/practice in planning. Meets with 3605. Includes additional weekly seminar-style meeting, bibliography project on topic selected in consultation with instructor.

Geog 5605W. Geographical Perspectives on Planning. (4 cr; SP–§3605)
Open to graduate students and undergraduates wishing Honors credits. Includes one additional weekly seminar-style meeting and a bibliography project on a topic selected in consultation with the instructor. Meets with 3605.

Geog 5701. Field Research. (3 cr; SP–9 cr in geog, #)
Field investigation in physical, cultural, and economic geography; techniques of analysis and presentation; reconstruction of environments.

Geog 5724. Meanings of Place. (3 cr; SP–Jr or sr or grad, §Arch 5724; A-F only)
Analysis of the messages and meanings of our natural and built surroundings. Considers place-based responses to urban and rural settings based on aesthetic, historic, social, personal, and design perspectives. Uses extensive project and field work components and involves significant writing.

Geog 5775. Geographic Education. (3 cr; SP–Three courses in geography or history or social sciences or education or #)
Teaching geography from middle school up; pedagogical use of geographical themes; methods for effective teaching of multiple cognitive domains—facts, theories, analytical skills, and evaluations; designing audio-visual aids, independent projects, simulations, etc. to meet National Standards in geography.

Geog 5900. Topics in Geography. (3 cr [max 9 cr]; SP–Sr or grad, #)
Special topics and regions. Course offered by visiting professors in their research fields.

Geog 8001. Proseminar: Nature and Society. (3 cr; SP–#)
Interconnectedness of environment and people, nature and society. Conceptual literature and empirical studies in human/cultural/political ecology.

Geog 8002. Proseminar: The State, the Economy, and Spatial Development. (3 cr; SP–#)
Introduction to research in economic, political, and urban geography: conceptual research addressing interrelationship between political and economic processes and spatial dynamics of urban and regional development; empirical research documenting nature and extent of this interrelationship at different spatial scales.

Geog 8003. Proseminar: Historical Geography. (3 cr; SP–#)
Introduction to conceptual research and empirical studies.

Geog 8004. Proseminar: Physical Geography. (3 cr; SP–#)
Historical development of research in physical geography, current research trends, and transfer of current research to undergraduate education.

Geog 8005. Proseminar: Population Geography. (3 cr; SP–#)
Conceptual literature and empirical studies on fertility, mortality, and migrations in different parts of the world.

Geog 8006. Proseminar: Research Methods in Geography. (3 cr; SP–#)
Introduction to research design, strategies, methods of data collection, analysis, interpretation, and representation in contemporary geographic research.

Geog 8007. Proseminar: Theories of Development and Change. (3 cr; SP–#)
Recent research themes and questions in geography and related social sciences on Third World development; development theories, conceptually grounded case studies, and grassroots-based research.

Geog 8010. Research Seminar: Theoretical Geography. (3 cr; SP–#)
Advanced topics, which vary with interests of faculty offering course; contemporary theoretical and philosophical themes transcending subdisciplines of human and physical geography.

Geog 8020. Research Seminar: Economic Geography. (3 cr; SP–#)
Contemporary research. Advanced topics, which vary with interests of faculty offering course.

Geog 8120. Seminar: Historical Geography. (3 cr; SP–#)
Contemporary research. Advanced topics, which vary with interests of faculty offering course.

Geog 8140. Seminar: Africa. (3 cr; SP–#)
Advanced topics, which vary with interests of faculty offering course.

Geog 8200. Seminar: East Asia/China. (3 cr; SP–#)
Contemporary research. Advanced topics, which vary with interests of faculty offering course.

Geog 8210. Seminar: South Asia. (3 cr)
Advanced topics, which vary with interests of faculty offering course.

Geog 8300. Geographic Writing. (3 cr; SP–#; S-N only)
Analysis of organization and presentation of geographic research. Critiques of selected examples of geographic writing.

Geog 8302. Research Development. (3 cr; SP–#; S-N only)
Students in geography and related social sciences are guided in key steps to effective research proposal writing.

Geog 8310. Seminar: Social and Cultural Geography. (3 cr; SP–#)
Role of space and place in constitution of social and cultural life, social relations, and social identities; class, space, and place; geography of race and racism; environmental racism; geography of gender and sexuality; nationalism, national identity, and territory.

Geog 8320. Seminar: Considering Space and Place. (3 cr; SP–#)
Aspects of place analysis/place description from variety of analytical and perceptual perspectives.

Geog 8330. Seminar: Rural Geography. (3 cr; SP–#; S-N only)
Sources of data and other information necessary for an understanding of rural areas in the United States.

Geog 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Geog 8335. Agrarian Change and Rural Development. (3 cr; A-F only)
Contours of agricultural and rural development in the Third World; theories of agrarian transformation and rural development; role of agriculture in economic development; peasant economy; the nature and role of state intervention in rural sector.

Geog 8340. Seminar: Land Use Planning. (3 cr; SP–#)
Topics of contemporary research, which vary with interests of faculty offering course.

Geog 8344. Environmental Policy. (3 cr; SP–#)
U.S. environmental policies at the federal and state level; policy formulation, implementation, and evaluation.

Geog 8350. Seminar: World Population. (3 cr; SP–#)
Contemporary research in world population development and problems. Topics vary with interests of faculty offering course.

Geog 8380. Seminar: Medical Geography. (3 cr; QP–5411; SP–5411 or #)
Geographic inquiry concerning selected problems of health and healthcare.

Geog 8400. Seminar: Physical Geography. (3 cr; SP–#)
Topics of contemporary research, which vary with interests of faculty offering course.

Geog 8420. Seminar: Climatology. (3 cr; SP–#; A-F only)
Sample topics: climate modeling, climatic variability, climate change and predictability, severe local storms, drought, energy balance, urban climate, statistical climatology.

Geog 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

Geog 8510. Seminar: Geographic Information Systems (GIS) and Cartography. (3 cr; SP–#)
Selected concepts and methods. Topics, which vary yearly, include spatial analysis methods in GIS; advanced visualization methods; data quality and error propagation in GIS; generalization methods in GIS and cartography; role of time in GIS; interactive and animated cartography; incorporation of uncertainty.

Geog 8520. Seminar: Geographic Information Science, Technology, and Society. (3 cr; SP–#)
Relationships between practice of GIS and political, economic, legal, institutional structures of society. Effects of GIS on society. Nontraditional spaces in GIS. GIS and local decision making. Privacy issues.

Geog 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Geog 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Geog 8800. Seminar: Development of Geographic Thought. (3 cr; SP–#)
Topics vary with interests of faculty offering course.

Geog 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Geog 8970. Directed Readings. (1-5 cr)

Geog 8980. Topics in Geography. (1-3 cr [max 15 cr]; SP–#)
Seminar offered by visiting or regular faculty. Topics vary with interests of faculty.

Geog 8990. Research Problems in Geography. (1-5 cr)
Individual research projects.

Geological Engineering (GeoE)

Department of Civil Engineering

Institute of Technology

GeoE 5311. Experimental Geomechanics. (3 cr; QP–IT upper div or grad student, 5603; SP–IT upper division or grad student; 4301, CE 4301, or #; A-F only)
Machine stiffness; closed-loop testing. Small-strain theory. Measurement of deformation; strain gages, LVDTs, accelerometers, and associated circuits. Direct and indirect testing. Material behavior: experiments on anisotropic, damaged, and fluid-filled solids.

GeoE 5321. Geomechanics. (3 cr; QP–CE 3300, 5301; SP–IT upper division or grad student; 4301, CE 4301 or #; A-F only)
Review of elasticity theory and solution of some elastic boundary value problems relevant to geomechanics. Wave propagation in unbounded elastic media. Elements of fracture mechanics and applications. Elements of poroelasticity and applications.

GeoE 5331. Geomechanics Modeling. (3 cr; QP–CE 5301; SP–IT upper division or grad student, 4301 or CE 4301; A-F only)
Soil and rock response in triaxial testing; drained and undrained behavior; elastic and plastic properties. Modeling stresses, strains, and failure in geomechanics problems.

GeoE 5431. Wave Methods for Nondestructive Testing. (4 cr; QP–[AEM 3016, AEM 3036] or #; SP–§CE 5431; [AEM 2021, AEM 3031] or #; A-F only)
Introduction to contemporary methods for nondestructive characterization of objects of civil infrastructure (e.g., highways, bridges, geotechnical sites). Imaging technologies based on propagation of elastic waves: ultrasonic and resonant frequency methods, seismic surveys, acoustic emission monitoring. Lecture, lab.

GeoE 8300. Seminar: Geomechanics. (1 cr [max 4 cr]; SP–#)
Presentations on various topics.

GeoE 8301. Fracture of Geomaterials. (3 cr; QP–CE 5300; SP–5331, CE 5331 or #, IT grad student; A-F only)
Crack tip stress and displacement fields; stress intensity factors. Energy principles of fracture; compliance method. Process zone models. J integral. Mixed-mode fracture. Behavior of cracked solids. Numerical and experimental approaches.

GeoE 8302. Soil/Rock Plasticity and Limit Analysis. (4 cr; QP–CE 3300; SP–[IT grad student, CE 4300] or #; A-F only)
Plasticity of soils and rocks. Yield conditions, flow rules. Theorems of limit analysis. Static solutions, method of characteristics. Kinematic solutions, hodograph. Energy balance. Applications to soil/rock engineering problems.

GeoE 8311. Advanced Rock Mechanics. (3 cr; QP–5302; SP–5331, CE 5331 or #, IT grad student; A-F only)
Stress transformations; principal stresses and directions. Friction and behavior of rock joints; stability of frictional sliding. Elastic waves; acoustic emission and seismic measurements. Fragmentation and rock breakage.

GeoE 8321. Thermoporoelasticity. (4 cr; QP–AEM 5580; SP–5321, CE 5321 or #, IT grad student; A-F only)
Micro-mechanical description of porous media. Thermodynamics foundations. Linear theory of thermoporoelasticity: constitutive, transport, and balance laws; field equations. Determination of material constants. Singular solutions. Methods of solution: integral transform, method of singularities, finite and boundary element method.

GeoE 8322. Storage and Flow of Granular Materials. (3 cr; QP–CE 5301 or 5302; SP–CE 4301 or #, IT grad student; A-F only)
Plasticity of soils and rocks. Yield conditions, flow rules. Theorems of limit analysis. Static solutions, method of characteristics. Kinematic solutions, hodograph. Energy balance. Applications to soil/rock engineering problems.

GeoE 8331. Modeling Geomechanical Processes. (3 cr; SP–5321 or CE 5321 or #, IT grad student; A-F only)
Data-limited nature of problems in geomechanics. Dimensional analysis. Regimes of solution. Similarity solutions. Elements of fracture mechanics, elastoplasticity, poroelasticity. Geomechanical applications to stability of underground excavations, fluid flow in fracture, tool-rock interaction, hydraulic fracturing.

GeoE 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

GeoE 8336. Boundary Element Methods I. (3 cr; QP–AEM 3016; SP–IT grad student or #; A-F only)
Introduction to boundary element methods for elastostatics; stress discontinuity method; displacement discontinuity method; direct boundary integral method. Derivation of basic mathematical solutions from the theory of elasticity. Applications of boundary element methods in geomechanics.

GeoE 8337. Boundary Element Methods II. (3 cr; QP–8336 or CE 8336; SP–8336, CE 8336 or #; A-F only)
Transient and nonlinear problems.

GeoE 8351. Advanced Groundwater Mechanics I. (3 cr; QP–CE 5425; SP–CE 4351, IT grad student or #; A-F only)
Solute transport; shallow flow in leaky aquifers; complex variable methods in groundwater flow; analytic element method: potentials for line sinks, line doublet, line dipoles, area sinks, and special analytic elements; singular Cauchy integrals; analytic elements in domains with closed boundaries.

GeoE 8352. Advanced Groundwater Mechanics II. (3 cr; QP–CE 5425; SP–4351 or CE 4351, IT grad student or #; A-F only)
Applying complex methods, including conformal mapping, in groundwater mechanics; solving problems with free boundaries using the hodograph method; drains in aquifers with free boundaries; superposition of solutions with drains; singular Cauchy integrals; boundary elements.

GeoE 8361. Engineering Model Fitting. (3 cr; SP–IT grad student or #; A-F only)
Parameter estimation and inverse modeling for civil and geological engineering. Formulating engineering model fitting problems; comparing and selecting various fit criteria; implementing numerical algorithms; analyzing and interpreting results using both statistical and qualitative tools; designing future measurement plans.

GeoE 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

GeoE 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

GeoE 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

GeoE 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Geology and Geophysics (Geo)

Department of Geology and Geophysics
Institute of Technology

Geo 5001. Earth Systems Science for Teachers. (3 cr; QP–§1001; [one qtr chem or physics], ed degree; SP–§1001; ed degree)
Solid Earth, hydrosphere, atmosphere, biosphere, their interconnections in natural cycles of material/energy. Consequences of natural cycles for land-water-atmosphere-life environments/Earth's habitability. Human impact on natural cycles. Evidence for global environmental changes. Required project.

Geo 5002. Earth History for Teachers. (4 cr; QP–§1002, ed degree; SP–§1002, ed degree)
Evolution of life on Earth. Interrelationships of plate tectonism, climate change, and organic evolution leading to present ecosystem. Impact of hominid evolution on Earth systems and geological processes on human society. Required project designed to enhance ability to teach Earth history to K-12 students.

Geo 5003. Dinosaur Evolution for Teachers. (3 cr; QP–§1003, ed degree; SP–§1003, ed degree)
Dinosaurs and Mesozoic Earth used to introduce evolution, plate tectonics, climate change, and Earth systems. History of theories about dinosaurs illustrates principles and social aspects of scientific investigation. Required project designed to enhance ability to teach dinosaur evolution to K-12 students.

Geo 5006. Oceanography for Teachers. (3 cr; QP–§1601, ed degree; SP–§1006, ed degree)
How various processes in the ocean interact. Marine biology, waves, tides, chemical oceanography, marine geology, and human interaction with the sea. Labs include study of live marine invertebrates, manipulation of oceanographic data, and discussion using videos showing unique aspects of ocean research. Required design of modules for presenting course material to elementary or secondary school students.

Geo 5108. Principles of Environmental Geology. (3 cr; QP–Geo core courses through 5201 or equiv or #; SP–Geology majors: core curriculum through 4501 or #; nonmajors: 1001 or #)
Human impact on geological environment and effect of geology/geologic processes on human life from an ecosystems and biogeochemical cycles perspective. Geologic limits to resources and carrying capacity of Earth. Land use planning, environmental impact assessment, ecogeologic world models. Field project and trip.

Geo 5201. Time-Series Analysis of Geological Phenomena. (3 cr; QP–Math 3221 or #; SP–Math 2263 or #; A-F only)
Time-series analysis of linear and nonlinear geological and geophysical phenomena. Examples drawn from ice age cycles, earthquakes, climatic fluctuations, volcanic eruptions, atmospheric phenomena, thermal convection and other time-dependent natural phenomena. Modern concepts of nonlinear dynamics and complexity theory applied to geological phenomena.

Geo 5202. Geological Thermomechanical Modeling. (3 cr; QP–Math 3261 or #; SP–Math 2263 or #; A-F only)
Concept of heat and mass transfer processes in Earth's crust and mantle. Quantitative study of thermomechanical phenomena. Emphasis on analytical and modern numerical techniques.

Geo 5203. Mineral and Rock Physics. (3 cr; QP–3201, Phys 1253; SP–2201, Phys 1302)
Physical properties of minerals and rocks as related to the composition and dynamics of the Earth's crust, mantle, and core.

Geo 5301. Aqueous Environmental Geochemistry. (3 cr; QP–Chem 5501 or #; SP–Chem 3501 or #)
General principles of solution chemistry applied to geology. Solution-mineral equilibria. Redox processes in natural waters. Geochemistry of hydrothermal fluids. Environmental geochemistry.

Geo 5302. Isotope Geology. (3 cr; QP–3301 or #; SP–2303 or #; A-F only)
Theory and uses of radioactive, radiogenic, and stable isotopes in geology. Radioactive dating, geothermometry, and tracer techniques in geologic processes.

Geo 5353. Electron Microprobe Theory and Practice. (2-3 cr; QP–3401, one yr chem and physics or #; SP–2301, one yr chem and physics or #)
Theory and practice of characterizing solid materials with electron beam instrumentation, including the reduction of X-ray data to chemical compositions.

Geo 5502. Advanced Structural Geology. (3 cr; QP–5201 or #; SP–4501 or #)
Analysis of structures and fabric of deformed rocks. Determination of states of stress and strain in rocks and of evolution of these with time. Deformation mechanisms. Extensive reading in journal literature. Field trips.

Geo 5601. Advanced Sedimentology. (4 cr; QP–5653 or #; SP–4602 or #)
Modern techniques of sedimentary basin analysis focusing on interactions among the lithosphere, atmosphere, and hydrosphere. Sedimentary facies of modern and ancient systems, petrology of clastic and carbonate deposits, tectonic and paleoclimatic interpretations, paleocurrent analysis, diagenetic effects on subsurface fluid flow, and volcanic sedimentation.

Geo 5602. Depositional Mechanics. (3 cr; QP–5651, Math 3261 or #; SP–4602, Math 2243 or #)
Elementary mechanics of sediment transport applied to quantitative interpretation of sedimentary rocks.

Geo 5701. General Hydrogeology. (4 cr; QP–1001, Chem 1052, Math 1252, Phys 1105, Geo majors-core curriculum through 3402 or #; SP–Chem 1022, Math 1271, Phys 1201, Geo majors-core curriculum through 2402 or #)
Theory of groundwater geology, hydrologic cycle, watershed hydrology, Darcy's law, governing equations of groundwater motion, flow net analysis, analog models, and groundwater resource evaluation and development. Applied analysis of steady and transient equations of groundwater motion and chemical transport. Chemistry of natural waters.

Geo 5702. Regional Aquifer Systems of North America. (3 cr; QP–5643 or #; SP–5701 or #)
Geologic controls on flow patterns within aquifer systems. Case histories and specific examples from glaciated terrains and Paleozoic basins in Minnesota. Analysis of basin-scale regional aquifer systems of North America. Survey of famous aquifer systems of the world.

Geo 5703. Regional Geomorphology. (2 cr [max 6 cr]; QP–5201 or #; SP–4501 or #)
Geology of a particular region of the country, emphasizing its geomorphology. One-week field trip to the area is taken during spring break. May be taken for credit more than once if regions are different.

Geo 5704. Glaciology. (3-4 cr; QP–Math 3261 or #; SP–Math 2263 or #)
Theories of glacier flow. Internal structures and heat flow in glaciers and ice sheets. Geomorphic features produced by glaciers. Reading assignments and problems.

Geo 5705. Limnogeology and Paleoclimate. (3-4 cr; QP–5601 or EEB 5601; SP–1001, 4601 or #)
Systems study of modern and ancient lakes of the world as archives of environmental history, as natural resources, as biogeochemical and physical process models, and as basins in geologic history. Includes many case studies and examines aquatic signatures for interpreting paleoclimate.

Geo 5713. Tracers and Karst Hydrogeology. (3 cr; QP–5641, #; SP–5701, #)
Karst hydrogeology and application of tracers to determine source, age, and mixing parameters of water in various natural reservoirs. Physical and chemical principles and processes operating in karst hydrogeology; use of natural and synthetic chemical and isotopic labels or tracers to follow movement and mixing of water through hydrologic cycle.

Geo 5802. Scientific Visualization. (3 cr; QP–CSci 3101 or 3102 or 3113 or #; SP–CSci 1107 or 1113 or #)
Visualization hardware and software, three-dimensional graphics, representation of scientific data, modeling, user interface techniques, output, commonly used algorithms, animation, case studies and examples.

Geo 8243. Principles of Rock Magnetism. (1-3 cr; QP–5541; SP–4204 or #)
Remanent magnetizations, their classification and origins. Fundamentals of fine particle magnetism; magnetic minerals; separation of multicomponent magnetizations; effects of chemical change on magnetization; magnetic proxies of climatic and environmental change; biomagnetism.

Geo 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Geo 8351. Geochemical Modeling of Aqueous Systems. (3 cr; QP–5313; SP–5301 or #)
Using mass transfer reaction path models to assess chemical evolution of natural fluids, hydrothermal alteration processes, and formation of hydrothermal ore deposits.

Geo 8353. Phase Equilibrium in Mineral Systems. (3 cr; QP–5452, Chem 5520, Math 3261; SP–4301, Chem 3501, Math 2243)
Principles of homogeneous and heterogeneous equilibria and their application to problems in petrology. Emphasis on derivations from first principles and formulation of algebraic and graphical methods essential to multicomponent systems.

Geo 8354. Igneous Petrology. (3 cr; QP–5452; SP–4301 or #)
Igneous rocks and processes, emphasizing geochemistry of melts and minerals. Content varies with instructor and student interest.

Geo 8355. Metamorphic Petrology. (3 cr; QP–8453; SP–8353)
Metamorphic processes; relation of theory and observation to current problems. Relation of fundamental concepts and techniques to progressive development of mineral assemblages. Term paper required.

Geo 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

Geo 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Geo 8712. Transport Phenomena and Analytical Geohydrology. (3-4 cr; QP–Math 3261, CE 3400 or Chem 5520 or equiv; SP–5701 or CE 3502 or #)
Microscopic flow parameters, momentum, mass and energy transport through porous media. Geologic factors in aquifer performance, equations for groundwater flow, and analysis of pump tests.

Geo 8718. Numerical Methods in Hydrogeology. (4 cr; SP–5701, CSci 1107 or #; A-F only)
Introduction to finite difference and finite element methods in hydrogeology. Students develop one- and two-dimensional models of diffusion and advection-dispersion equations.

Geo 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Geo 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Geo 8970. Seminar: Current Topics in Geology and Geophysics. (1-4 cr [max 30 cr]; SP–#; A-F only)

Geo 8980. Seminar: Current Topics in Geology and Geophysics. (1-4 cr [max 30 cr]; SP–#; S-N only)

Geo 8994. Research in Geology and Geophysics. (1-4 cr [max 30 cr]; SP–#)
Independent research under faculty supervision.

German (Ger)

Department of German, Scandinavian, and Dutch
College of Liberal Arts

Ger 5011. Advanced Conversation and Composition. (3 cr; SP–3012)
Helps graduate and advanced undergraduate students achieve high proficiency in writing and speaking professional and academic German.

Ger 5016. Advanced Translation: Theory and Practice. (3 cr; SP–3016 or #)
Translation theory, related issues in stylistics, philosophy of language; sample translations; student production of translations with methodological commentary.

Ger 5101. Analysis of German. (3 cr; SP–1004, Ling 3001 or 5001 or #)
Phonology, morphology, and syntax of standard German.

Ger 5410. Topics in German Literature. (3 cr [max 9 cr]; SP–3104 or equiv)
Topic may focus on a specific author, group of authors, genre, period, or subject matter. Topics specified in *Class Schedule.*

Ger 5510. Topics in Contemporary German Culture. (3 cr [max 9 cr]; SP–3104 or equiv)
A single topic of contemporary German culture explored in depth.

Ger 5610. German Literature in Translation. (3 cr [max 9 cr]; SP–No knowledge of German required; cr toward major or minor requires reading in German)
Study in depth of authors or topics from various periods in German literature. Requires no knowledge of German.

Ger 5630. Topics in German Cinema. (3 cr [max 9 cr]; SP–3xxx film course or #)
Topics chosen may focus on specific directors, genres, film production or reception, and/or other formal, theoretical, historical, or political issues.

Ger 5711. History of the German Language I. (3 cr; SP–¶3012)
Historical development of German from the beginnings to 1450.

Ger 5712. History of the German Language II. (3 cr; SP–5711)
Historical development of German from 1450 to 2000.

Ger 5721. Introduction to Middle High German. (3 cr)
Introduction to Middle High German language and literature. Study of grammar through formal description of Middle High German phonology, morphology, and syntax. Normalized MHG texts read.

Ger 5722. Middle High German: Advanced Readings. (3 cr; SP–5721)
Acquisition of fluency in reading Middle High German normalized as well as non-normalized texts, both poetry and prose.

Ger 5731. Old High German I. (3 cr)
Study of the monuments of Old High German. Detailed investigation of Old High German in comparison with the other Germanic languages.

Ger 5732. Old High German II. (3 cr; SP–5731)
Study of the monuments of Old High German. Detailed investigation of Old High German in comparison with the other Germanic languages.

Ger 5734. Old Saxon. (3 cr)
Study of the poetry of Old Saxon. Detailed investigation of Old Saxon in comparison with the other Old Germanic languages.

Ger 5740. Readings in Philology. (3 cr [max 9 cr])
Philological analysis of a chosen text in any medieval Germanic language.

Ger 5771. Early New High German. (3 cr)
Reading and analysis of Early New High German texts. Formal description of Early New High German phonology, morphology, syntax.

Ger 5781. Varieties of Modern German. (3 cr; SP–5101)
Lexical, syntactic, and phonological variations examined using contemporary methods of dialectology and sociolinguistics.

Ger 5801. German Script Since 1500: Readings. (3 cr)
Handwriting and printed book scripts will be read, 1500-2000.

Ger 5993. Directed Studies. (1-4 cr [max 12 cr]; SP–#, Δ, ❑)
Guided individual reading or study.

Ger 8002. Basic Seminar in German Studies. (3 cr)
Theory and methods applicable in study of German literature and culture; introduction to bibliography and research skills; guided research projects.

Ger 8200. Seminar in Medieval German Literature and Culture. (3 cr [max 9 cr]; SP–5721)
Topics on specific author, group of authors, genre, or subject matter in German literature, ca. 800-1450.

Ger 8210. Seminar in Early Modern German Literature and Culture. (3 cr [max 9 cr])
Topics on specific author, group of authors, genre, or subject matter in German literature, 1450-1750.

Ger 8220. Seminar in 18th-Century German Literature and Culture. (3 cr [max 9 cr])
Literary, philosophical, and aesthetic texts emerging from major 18th-century literary trends, 1720-1810. Cultural and historical contexts of Enlightenment and Weimar Classicism.

Ger 8230. Seminar in 19th-Century German Literature and Culture. (3 cr [max 9 cr])
Examination of an author, issue, or movement, using a variety of critical approaches.

Ger 8240. Seminar in 20th-Century German Literature and Culture. (3 cr [max 9 cr]; A-F only)
Topics on literature, film, or other forms of "high" and popular culture.

Ger 8300. Topics in Literature and Cultural Theory. (3 cr [max 9 cr])
Authors, themes, movements, and social issues from 1700 to present. Focus varies each semester.

Ger 8700. Philological Seminar. (3 cr [max 9 cr])
Sample topics: history of Germanic tribes, history of scholarship in Germanic philology, Germanic dialects.

Ger 8701. Philological Proseminar I: Bibliography. (3 cr; A-F only)
Introduction to bibliography emphasizing Germanic medieval languages and literatures and medieval Latin. See Scan 8702.

Ger 8741. Gothic and Methods of Comparative Reconstruction I. (3 cr)
The oldest extant Germanic language and the prehistory of Germanic group of languages.

Ger 8742. Gothic and Methods of Comparative Reconstruction II. (3 cr; SP–8741)
Continuation of study of the oldest extant Germanic language and the prehistory of Germanic group of languages.

Ger 8751. Paleography: Medieval Manuscript Readings. (3 cr; A-F only)
Introduction to techniques of reading and transcribing medieval German and Latin manuscripts.

Ger 8752. Medieval Text Editing. (3 cr)
Introduction to techniques of historical text-critical editing of medieval Germanic and Latin manuscripts.

Ger 8793. Germanic Philology Directed Study. (1-3 cr [max 12 cr]; SP–#, Δ)

Ger 8810. Feminist Literary Theory and History. (3 cr [max 9 cr])
Cultural, historical, and literary examination of writings of German women, 18th-20th centuries, and feminist theoretical tools used to analyze their work.

Ger 8820. Seminar: Advanced Theory. (3 cr [max 9 cr])
Topic in critical thought, e.g., the Frankfurt School, hermeneutics, reception theory.

Ger 8994. Directed Research. (1-3 cr [max 12 cr]; SP–#, Δ; may be taken as tutorial with #)

German, Scandinavian, and Dutch (GSD)

Department of German, Scandinavian, and Dutch
College of Liberal Arts

GSD 5103. Teaching of Germanic Languages. (4 cr)
Second language acquisition theory, methods, testing, and technology applicable to teaching of modern Germanic languages.

GSD 8333. FTE: Master's. (1 cr; SP–Master's student, adviser approval, Δ)

GSD 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser approval, Δ)

GSD 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Doctoral student who has not passed prelim oral)

GSD 8801. Dissertation Seminar. (3 cr)
For doctoral students in German and Scandinavian studies who are beginning to establish topics and do research for their dissertations. Discussion of a variety of topics related to this process as well as presentation of some written work.

GSD 8802. Dissertation Writing Seminar. (3 cr; SP–8801, completion of doctoral prelim exams; S-N only)
Critical, supportive forum for discussion of problems/issues related to dissertation research/writing. Shaping/controlling one's topic. Developing chapter outlines. Questions of audience. Careful uses of language. Turning a dissertation into a book.

GSD 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr])

Gerontology (Gero)

Graduate School

Gero 5105. Multidisciplinary Perspectives on Aging. (3 cr)
Sociological, psychological aspects of aging; theories of aging; death and bereavement; issues and problems of older adults in America; human services and their delivery systems (health, nutrition, long-term care, education); public policy and legislation; environment and housing; retirement.

Gero 5110. Biology of Aging. (3 cr; A-F only)
Biological changes that occur with aging. Methods for studying aging, descriptions of population aging, theories on how/why we age. Process of aging in each body system, variation between individuals/populations. Clinical implications of biological changes with age. Guest lecturers from different disciplines.

Gero 8020. Seminar in Gerontology. (2 cr; SP–#)
Meets weekly. Students present and discuss new or completed research projects on aging; conduct formal reviews using NIH formats; critique published papers using formal review criteria employed by gerontologic journals; become familiar with large database in aging and describe how that database has been used in research for secondary analyses.

Global Studies (GloS)

Institute of International Studies
College of Liberal Arts

GloS 5103. Colonialism and Modernity. (3 cr; SP–[3101, Area 3144] or #; A-F only)
How modern world has been constituted by colonial encounter. Role of colonialism in construction of the west. Images of non-western societies. Modernity in colonial/postcolonial societies. Problems/potential of universal categories such as democracy, gender, history, human rights. globalization at the margins.

GloS 5114. International Perspectives—U.S.-Mexico Border Cultures. (3 cr; SP–Grad student)
The relations of Mexico and the United States from an international perspective with a central focus on the cultural interchange in the border lands between the two countries. Uses both literary and historical materials.

GloS 5301. Environment and Empire. (3 cr; SP–[3101, Area 3144] or #; A-F only)
Key issues in environmental history. Emphasizes global/colonial processes that have made modern environment. Global spread of diseases, modern remaking of world's flora/fauna, idea of nature. New technologies and the environment. Conservationist ideology.

GloS 5602. Other Worlds: Globality and Culture. (3 cr; SP–[3101, Area 3144, grad student] or #; A-F only)
Interconnectedness of world. Considering not one world, but many. Colonialism, consumption, diasporic conditions, global media, nationalism, supra-national governance. How globality is experienced/contested locally/specifically.

GloS 5603. Socialist/Post-socialist Transformations. (3 cr; A-F only)
Transformations underway in post-socialist societies of Eastern Europe, former Soviet Union. Ramifications of abandonment of state socialism, introduction of market relations. Effect of former system, new market system on cultural institutions/identities.

GloS 5900. Topics in Global Studies. (1-3 cr)
Proseminar. Selected issues in global studies. Topics specified in *Class Schedule.*

GloS 5910. Topics in East Asian Studies. (1-3 cr)
Description varies with topic title.

GloS 5920. Topics in European Studies. (3 cr)
Description varies with topic title.

GloS 5930. Topics in Latin American Studies. (3 cr)
Description varies with topic title.

GloS 5940. Topics in Middle Eastern Studies. (3 cr)
Description varies with topic title.

GloS 5950. Topics in Russian Area Studies. (3 cr)
Description varies with topic title.

GloS 5960. Topics in South Asian Studies. (3 cr)
Description varies with topic title.

GloS 5993. Directed Studies. (1-4 cr [max 12 cr]; QP–#, Δ, ❑; SP–#, Δ, ❑)
Guided individual reading or study. Open to qualified students for one or more semesters.

GloS 5994. Directed Research. (1-4 cr [max 12 cr]; QP–#, Δ, ❑; SP–#, Δ, ❑)
Qualified students work on a tutorial basis.

GloS 8061. Scope and Methods of Area Studies. (3 cr; A-F only)
Introduction to subfields, problems, and methodologies. Scholarly norms and ethics of cross-cultural academic research.

Graduate School (Grad)

Graduate School

Grad 8101. Teaching in Higher Education. (3 cr; SP–#)
Teaching methods/techniques. Focus on active learning, critical thinking,practice teaching, and preparation of a portfolio to document and reflectupon teaching. Readings, discussion, peer teaching, e-mail dialog, reflective writing, co-facilitation of course.

Grad 8102. Practicum for Future Faculty. (3 cr; QP–8100 or equiv; SP–[8101 or equiv], #; S-N only)
Collegial support for teaching, faculty mentorship at regional college or university, investigation of faculty role at variety of institutions, classroom observation/feedback, preparation for academic job search. Non-native English speakers must pass University requirements for international teaching assistants.

Greek (Grk)

Department of Classical and Near Eastern Studies
College of Liberal Arts

Grk 5012. Prose Composition. (3 cr)
Moving step by step through Ancient Greek grammar, starting with simple sentences and progressing to complex ones. Course ends with students translating short passages of modern English prose into Greek.

Grk 5013. Advanced Composition. (3 cr; SP–5012 or #)
Detailed study of English-to-Greek verse composition and/or the writing styles of individual Greek authors.

Grk 5032. Text Criticism. (3 cr; SP–Greek 3114)
Theory and practice. Elements of paleography and manuscript study. Basic tools for analyzing a textual apparatus with some independence; constructing a critical edition of a literary text.

Grk 5121. Biblical and Patristic Greek. (3 cr; SP–3114 or 3120)
Septuagint, Philo, Josephus, New Testament, Apostolic Fathers, and other patristic literature to 5th century C.E. Reading and discussion of selected texts in the major genres.

Grk 5310. Greek Literature: Oratory. (3 cr [max 9 cr])
One or more appropriate authors studied in a given course.

Grk 5320. Greek Literature: Tragedy. (3 cr [max 9 cr])
Reading of Greek tragedy on advanced level.

Grk 5330. Greek Literature: Comedy. (3 cr [max 9 cr])
Advanced readings in Greek comedy.

Grk 5340. Greek Literature: History. (3 cr [max 9 cr])
Advanced readings from the Greek historians; traditions of Greek historiography.

Grk 5350. Greek Literature: Philosophy. (3 cr)
Read one or more works of Plato or Aristotle in the original Greek and find out what they really mean. Selections vary with each offering.

Grk 5360. Literature: Religious Texts. (3 cr [max 9 cr])
Reading and discussion of religious texts from Greek antiquity, such as the Homeric Hymns, cultic verse, aretalogy, sacred tales, oracle texts.

Grk 5370. Greek Literature: Epic. (3 cr [max 9 cr])
Reading of classical Greek epic on an advanced level.

Grk 5380. Greek Literature: Lyric. (3 cr [max 9 cr])
Selections from the Greek lyric poets.

Grk 5390. Greek Literature: Romance. (3 cr [max 9 cr])
Selections from the Hellenistic Romances of, e.g., Chariton, Longus.

Grk 5440. Greek Literature: Later Authors. (3 cr [max 9 cr])
Selected topics in later Greek literature, especially Byzantine prose.

Grk 5450. Greek Literature: Classical Authors. (3 cr [max 9 cr])
Selected topics in classical Greek literature; topics specified in *Class Schedule.*

Grk 5621. Greek Paleography. (3 cr)
Analysis of various hands used in Greek manuscripts with attention to date and provenance; history of the transmission of Greek literature.

Grk 5715. Introduction to the Historical-Comparative Grammar of Greek and Latin. (3 cr; SP–# or 2 yrs college Latin)
Historical and comparative grammar of Greek and Latin from their Proto-Indo-European origins to the classical norms.

Grk 5716. History of Greek. (3 cr; SP–Grk/Lat 5715 or equiv, 2 yrs Greek)
Reading and formal analysis of documents illustrating the evolution of the Greek language from Mycenaean to modern times.

Grk 5993. Directed Studies. (1-4 cr [max 18 cr]; SP–#, Δ, ❑)
Guided individual reading or study.

Grk 5994. Directed Research. (1-12 cr [max 18 cr]; SP–#, Δ, ❑)
Supervised original research on topic chosen by student.

Grk 5996. Directed Instruction. (1-12 cr [max 20 cr]; SP–#, Δ, ❑)
Supervised teaching internship.

Grk 8120. Greek Text Course. (3 cr [max 15 cr]; SP–3111 or Δ; not for students in dept of Classical and Nr East Sts)
Students attend 3xxx Greek courses. Supplementary work at discretion of instructor.

Grk 8262. Survey of Greek Literature I. (3 cr)
Extensive selections from all genres of Greek literature of archaic and early classical periods.

Grk 8263. Survey of Greek Literature II. (3 cr)
Extensive selections from Greek authors of the classical and Hellenistic eras.

Grk 8910. Seminar. (3 cr [max 30 cr])
Various topics in Greek literature examined in depth with emphasis on current scholarship and original student research.

Health Informatics (HInf)

Department of Laboratory Medicine and Pathology

Medical School

HInf 5430. Health Informatics I. (3 cr; A-F only)
History/challenges of health informatics. Structure of healthcare delivery system. Computerized patient records. Clinical information systems. Basics of information, computation, communication. Data management in health settings. Clinical information exchange. Managing information technology as strategic resources for healthcare organizations.

HInf 5431. Health Informatics II. (3 cr)
Clinical decision analysis, support systems. Clinical monitoring. Signal processing. Image analysis. modeling/simulation. Databases supporting clinical/research efforts. Informatics support for basic research. Evaluation methodologies. Computational biology.

HInf 5436. Seminar. (1 cr; S-N only)
Presentation and discussion of research problems, current literature and topics of interest in Health Informatics.

HInf 5494. Topics in Health Informatics. (1-6 cr)
Individual or group studies in health informatics.

HInf 5496. Internship in Health Informatics. (1 cr [max 3 cr]; SP–5430, 5431, #; S-N only)
Practical industrial experience not directly related to student's normal academic experience.

HInf 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

HInf 8405. Advanced Topics in Health Computer Sciences I. (3 cr; SP–#)
Computer systems design for health sciences, small computer concepts/use, computers for clinical services, computer-aided medical decision making, biomedical image processing, pattern recognition. All topics use techniques, and examples or case studies, from health sciences.

HInf 8406. Advanced Topics in Health Computer Sciences II. (3 cr; SP–#)
Computer systems design for health sciences, small computer concepts/use, computers for clinical services, computer-aided medical decision making, biomedical image processing, pattern recognition. All topics use techniques, and examples or case studies, from health sciences.

HInf 8434. Medical Decision Support Techniques. (3 cr; SP–5432 or #; A-F only)
Examines systems based on statistical and logical approaches to decision making that include statistical prediction, rule-based systems, case-based reasoning, quantitative reasoning, and neural networks, and issues related to their use.

HInf 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

HInf 8446. Professional Studies in Health Informatics. (1-2 cr; SP–5431, PubH 5452 or #, grad hlth inf major; A-F only)
Health informatics as a profession, including discipline, responsibilities, resources, and job opportunities. Directed experiences in consulting, teaching, writing, conducting research, and managing facilities.

HInf 8492. Advanced Readings in Health Informatics. (1-6 cr; SP–#; A-F only)
Directed readings in topics of current or theoretical interest in medical informatics.

HInf 8494. Research in Health Informatics. (1-6 cr; SP–#; A-F only)
Directed research under faculty guidance.

HInf 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

HInf 8770. Plan B Project. (4 cr; SP–Plan B M.S. student, #; no cr toward Ph.D.; A-F only)
Research project. Topic arranged between student and instructor. Written report required.

HInf 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

HInf 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Hebrew (Hebr)

Department of Classical and Near Eastern Studies

College of Liberal Arts

Hebr 5992. Directed Readings. (1-4 cr [max 12 cr]; SP–3012 or #)
Guided individual reading or study.

Hindi (Hndi)

Department of Asian Languages and Literatures

College of Liberal Arts

Hndi 5710. Topics in Hindi Language, Literature, and Culture. (4-5 cr)
Topics in Hindi literature or the linguistic structure of Hindi.

Hndi 5990. Directed Research. (3-5 cr; SP–#, Δ, ❑)

Hndi 5993. Directed Readings. (3-5 cr; SP–#, Δ, ❑)
Guided individual reading or study of modern Hindi texts.

Hndi 8790. Research. (1-5 cr; SP–#)

History (Hist)

Department of History

College of Liberal Arts

Hist 5011. Quantitative Methods for Historical Research. (4 cr; SP–#)
Basics of quantitative historical data collection, measurement, and analysis.

Hist 5035. The Germ Theory and Modern Medicine. (3 cr; SP–History of medicine or of science course recommended for undergrads)
A study of the development of the modern germ theory of disease and of its applications in medicine and public health. Emphasis will be placed on developments between 1860 and 1950

Hist 5045. The Modern Medical Profession. (3 cr; SP–History of medicine or of science course recommended for undergrads)
A comparative history of the medical professions in the United States and in select northern European nations. Analyze the process of professionalization and the role the profession has played in western industrial societies since 1800.

Hist 5111. Proseminar in the History of Medieval Europe. (3 cr; SP–Advanced undergrads of exceptional ability or grads, #; A-F only)
Examination of basic scholarly bibliography for medieval Western European history. Aim is to help students to prepare for M.A. and Ph.D. examinations.

Hist 5115. Medieval Latin Historians. (3 cr; SP–Reading knowledge of Latin)
Writing of history in Western Europe during the Middle Ages. Focus on idea of history, philosophy of various historians, techniques of research by medieval historians and chroniclers, history as literature, and value of medieval histories to modern research scholars. Latin texts only.

Hist 5251. Socialist/Post-socialist Transformations. (3 cr; A-F only)
Transformations underway in post-socialist societies of Eastern Europe, former Soviet Union. Ramifications of abandonment of state socialism, introduction of market relations. Effect of former system, new market system on cultural institutions/identities.

Hist 5264. Imperial Russia: Formation and Expansion of the Russian Empire in the 18th and 19th Centuries. (3-4 cr)
Interaction with Europe and Asia; attempts at modernization and reform; emancipation of the serfs and rise of revolutionary movements.

Hist 5265. 20th-Century Russia: The Collapse of Imperial Russia, the Revolutions, and the Soviet Regime. (3 cr)
Analysis of the factors that led to the collapse of the tsarist regime; discussion of the 1917 revolution, the evolution of the Soviet regime and the collapse of Soviet communism. Emphasis on the role of nationalities and the rise of the Commonwealth of independent states.

Hist 5274. Southeastern Europe: Ottoman Empire and Successor States. (3 cr [max 3 cr])
The legacy of empires; 18th-century background; rise of Balkan nationalism; the Eastern Questions in the 18th and 19th centuries; the Balkans in the 20th century; population movements or exchanges; ethnic conflict in the Communist and Post-Communist periods.

Hist 5276. Intellectual and Cultural History of Modern Greece. (3 cr)
Literary and cultural contributions of modern Greece. The modern Greek experience seen through Greek historical and cultural monuments. An attempt at self-definition.

Hist 5294. Social History of Russia and Eastern Europe Through the 19th Century. (3 cr)
Lives of peasants and workers, nobles and merchants. Topics include family, marriage, sexuality; culture and tradition; transformation from an agricultural to a modern society.

Hist 5295. Social History of Russia and Eastern Europe From the Late 19th Century to the Present. (3 cr)
Social movements (revolutionary, nationalist, women's); communist and post-communist societies.

Hist 5301. U.S. Women's Legal History. (3 cr)
Women's legal status in U.S. history, 1648 to present. Changes in women's legal status in marriage, divorce, and child custody; reproductive/sexual autonomy; and economic/educational equality. Differences among women based on race, class, and ethnicity.

Hist 5379. Problems in Early American History. (3 cr)
Intensive consideration of topics in early American history. Topics may include readings in race, class, and gender; comparative colonialism; slavery; demography; economic history; religion; and regions in the colonial world.

Hist 5381. Minnesota History Workshop. (3-4 cr [max 4 cr]; SP–1301, 1302)
A case study and seminar approach to historical research and interpretation. It offers teachers and other scholars a chance to survey a particular topic in Minnesota history and to write their own historical narrative based on primary source research.

Hist 5421. Gender in Latin American History. (3 cr)
Women's history/masculinity. Gender/colonialism, marriage, sexuality, nationalism, labor, political movements, feminism.

Hist 5436. Social History of African Women: 1850 to the Present. (3 cr; SP–# for undergrads)
Explore the historical forces which have shaped African women's everyday lives and the ways in which these women have been active agents in the making of their own histories.

Hist 5438. Seminar: The African American Experience in South Africa. (3 cr; SP–§Afro 5191)
Ideological, political, religious, and cultural ties that have informed African American and black South African relations from late 18th century to present.

Hist 5446. Problems in West African History. (3 cr; SP–# for undergrads)
This problem-centered course explores several of the major historiographical, methodological, and theoretical debates in West African history. Core topics include state formation, trade, slavery, Islam, gender, and colonialism.

Hist 5464. China in the Song, Yuan, and Ming Dynasties. (3 cr; SP–§3464, §EAS 3464)
China during the Song (976-1279), Yuan (1279-1368) and Ming (1368-1644) dynasties, political institutions, and social structures. Attention to primary sources and how historians ask and answer questions about the past.

Hist 5465. China in the Ming and Qing Dynasties. (3 cr; SP–§3465, §EAS 3465; #)
Political/social history of China from 1600 until end of Qing dynasty in 1911. Ethnicity, daily life, legal structures, city life, peasantry.

Hist 5467. State and Revolution in Modern China. (3 cr; SP–§3467, §EAS 3467)
Modern China's political evolution including the Taiping Rebellion, Republican Revolution, rise of Nationalist and Communist parties, Maoist era; reform under Deng Xiaoping, and the emergence of democracy in Taiwan.

Hist 5468. Social Change in Modern China. (3 cr; SP–§3468)
Opium War and opening of Treaty Ports in 19th century; missionary activity and cultural influence; changes in education system; women's movement; early industrialization; socialism and collectivization after 1949; industrialization of Taiwan; PRC's entry into the world trading system.

Hist 5472. Early Modern Japan. (3 cr)
Tradition/change in society/culture under Tokugawa shoguns (1600-1867). Growth of cities. Decline of samurai class. Response to Western intrusion.

Hist 5473. Family, School, and Work in Modern Japanese History. (3 cr; SP–§3473)
Impact of economic, social, and cultural change on males and females in the family, the educational system, the employment system from the 17th century through the 20th centuries.

Hist 5479. Wall and Market: History of Chinese Cities. (3 cr; SP–§Hist 3479; A-F only)
Introduction to traditional Chinese cities and their modern transformation. Ideal city plan in Confucian classics compared with physical layout of some major cities. Models about Chinese cities, influence of the models on our understanding of Chinese history/society.

Hist 5501. Medieval Europe and the World. (3 cr; A-F only)
An examination of the place of medieval Europe in the world. The relations of Europe with Asia, Africa, and the Americas. European knowledge of the world's other great cultures. European travelers and explorers. Assessment of other cultures' knowledge of Europe in the period.

Hist 5505. Survey of the Middle East. (3 cr; SP–Grad or #)
Peoples, lands, cultures of the Middle East, from earliest civilizations to present.

Hist 5520. Topics in Chinese History. (3 cr)

Hist 5541. Islam in the Catholic Age. (3 cr; SP–Grad or #)
Rise of Islam in its Arabian setting. Roles of prophet, orthodox/Umayyad caliphs. Development of Islamic state/empire, organizations, institutions, status of Muslims/non-Muslims.

Hist 5547. The Ottoman Empire. (3 cr; SP–Grad or #)
Funding of Ottoman society, state to empire, 1300 to end of empire in 1920. Lands, institutions, peoples, legacy, impact on Europe.

Hist 5611. Proseminar in Medieval History. (3 cr; QP–Grad student or #; SP–Grad student or #; A-F only)
Examines basic scholarly bibliography for medieval Western Europe history during Middle Ages. Foundation for students to teach courses in medieval history, prepare for general doctoral exam.

Hist 5612. Proseminar in Medieval History. (3 cr; QP–[5611, grad student] or #; SP–[5611, grad student] or #; A-F only)
Examines basic scholarly bibliography for medieval Western Europe History during Middle Ages. Foundation for students to teach courses in medieval history, prepare for general doctoral exam.

Hist 5616. Proseminar in Medieval Spain. (3 cr; SP–#; A-F only)
Graduate research on the development of the medieval kingdoms of Spain from Roman times to ca. 1500. Emphasis on major social, economic, and cultural developments. Christian, Jewish, and Muslim interaction. Spain and the beginnings of European expansion.

Hist 5617. Spain in the Early Modern Period: 1492-1814. (4 cr)
Historiography, documents, and archives of early modern Spain analyzed. Includes reading in modern English and Spanish and practical experience with Spanish manuscript documents from the period.

Hist 5621. Proseminar: The French Revolution. (3 cr; SP–Grad student or [advanced undergrad, #]; A-F only)
Historical literature about French Revolution of 1789. Old Regime political culture, Enlightenment, origins of the revolution, revolutionary transformations in society, politics/culture both in France and abroad, the Terror, Napoleon, revolutionary legacy.

Hist 5631. Proseminar: Comparative Early Modern History. (3 cr; SP–Hist grad or #; A-F only)
Critical reading of historical literature dealing with integration of the globe during the early modern period, ca. 1350-1750; book reports, class discussion.

Hist 5634. Proseminar in Medieval and Early Modern European Russia. (3 cr; SP–Some coursework in history of medieval and early modern European Russia or #; A-F only)
Selected readings covering the major studies, key primary sources, and basic interpretations of the peoples of medieval and early modern European Russia as well as an analysis of the new approaches and interpretations in the field.

Hist 5649. Ideas in Context: Making Early Modern Knowledge, 1500-1800. (3 cr; SP–Grad student or #; A-F only)
Role of institutions/locale in development of early-modern European thought/culture. University, academy, learned society, princely court, museum, printing house, workshop, trading company, armies/navies, state bureaucracies, salons, other independent associations of nascent civil society.

Hist 5650. Proseminar: Early Modern Europe. (3 cr; SP–Hist grad or #; A-F only)
Critical reading of historical literature for early modern Europe, ca. 1450-1700., dealing with France, Germany, Italy, the Low Countries, and Spain. Each student chooses a country to focus on; book reports, class discussion.

Hist 5651. Proseminar in Tudor England: 1485-1603. (3 cr; SP–#; A-F only)
A critical study of principal writings about English history during the Tudor and Stuart periods.

Hist 5652. Proseminar in Stuart England: 1603-1689. (3 cr; SP–#; A-F only)
Critical study of principal writings about English history.

Hist 5671. Proseminar: Modern Britain. (3 cr; SP–#; A-F only)
Critical study of major writings in British history, 1760-1945, and preparation for research in field.

Hist 5715. Readings in European Women's History: 1450-1750. (3 cr; A-F only)
Introduction to current historical research on European women's history, 1450-1750. Topics include gender roles and form of family structure, women's participation in religious movements, legal status of women.

Hist 5720. Society and Politics in Modern Europe. (3 cr [max 6 cr]; SP–Grad or #; A-F only)
Introduction to literature in English on problems of modern European social, cultural, political history. Thematic/geographic focus varies year to year. Topics include historical approaches to class/gender relations, state formation as social/political process, family history, evolution of public life, popular culture.

Hist 5721. Contemporary Europe From the Late 19th Century to the Beginning of the Cold War: 1890-1950. (3 cr; SP–§3721; previous coursework in 19th- and/or 20th-century Europe, #)
The historical literature and debates surrounding major issues in the social, political, cultural, and economic development of Europe from the turn of the century through the impact of WWII. Topics include the development of imperialism, national rivalries, social and political conflict, the rise of fascism and communism, and the origins of war.

Hist 5735. European Women's History; 1750 to the Present. (3-4 cr; SP–#)
Selected themes in modern European women's history. Forms of patriarchy. Women in the Enlightenment. Women and revolution. Gender, class, and family life. Women in the labor force. Sexuality and reproduction. Female education. Women's political movements. Women and imperialism. Gender and fascism.

Hist 5740. Topics in Modern German History. (3-4 cr [max 12 cr]; SP–#; A-F only)
Readings and discussions on some central questions concerning the history of Germany during the modern period with a particular emphasis on the relationship between social change and political development. Offerings vary in thematic and chronological focus.

Hist 5756. Modern Greece; Mid-18th Century to Present: Greek Nationalism and Establishment of the Greek State. (3 cr)
Evolution of modern Greece from mid-18th century to the present. Political, cultural, and socioeconomic factors that contributed to Greek nationalism. Establishment of independent Greece and its role in the European community of nations.

Hist 5761. Proseminar—Imperial Russia.. (3 cr; SP–Knowledge of Russian or German or French)
Western and Russian historiography on crucial issues of imperial Russia. Political institutions; culture and society; modernization and reforms; new interpretations.

Hist 5762. Proseminar in 20th Century Russia. (3 cr; SP–5761, knowledge of Russian or German or French)
Western and Russian historiography on crucial issues of 20th-century Russia. The nature of revolutions, debate over the evolution of the Soviet regime, the collapse of empires, new interpretations.

Hist 5777. Proseminar in Habsburg Central Europe. (3 cr; SP–#)
Central Europe under Habsburg rule from the reforms of Maria Theresa to imperial collapse. Continuity and change in society; economic and political modernization; the rise of national consciousness and anti-Semitism; politics and culture in the Fin de Siecle; the Empire and World War I.

Hist 5794. Proseminar in European Economic History. (3 cr; SP–#)
Europe's rise in the world economy; England's industrial revolution and uneven development in Europe; imperialism and World War I; the Great Depression; the post-1945 economic miracle; continuity and change in Eastern Europe.

Hist 5797. Methods of Population History. (3 cr)
Standard methods of population analysis with a special focus on methods widely used for historical population research.

Hist 5801. Seminar in Early American History. (3 cr; A-F only)
Introduction to the literature of early American history. Readings selected from some of the best scholarship in the field, the questions that now hold the attention of colonial historians, and the theories, methods, and sources they use in pursuit of those questions.

Hist 5821. American History in the Twentieth Century. (4 cr; SP–Grad student; A-F only)
Intensive readings seminar.

Hist 5841. Proseminar in American Economic History. (3 cr; SP–#; A-F only)
Historical literature on American economic and business history from American Revolution to the modern economy.

Hist 5844. U.S. Labor History. (3 cr)
Readings in classic and recent approaches to the history of the working class in the United States. Central topics include slavery and free labor, women's paid and unpaid labor, management strategy, labor protest, and trade union organization.

Hist 5857. Proseminar: Readings in the History of American Women. (3 cr; SP–#)
An intensive graduate-level readings course. Survey selected significant topics in historical literature, conceptual frameworks, and methodological problems in the history of American women from 1600 to the present.

Hist 5861. History of American Immigration. (3 cr; SP–#; A-F only)
Readings in historical literature on immigration to the United States. Emphasis on recent works distinguished by new research methodologies and interpretations.

Hist 5862. History of American Immigration. (3 cr; SP–#; A-F only)
Readings in historical literature on immigration to the United States. Emphasis on recent works distinguished by new research methodologies and interpretations. Each student undertakes an independent reading and/or research project.

Hist 5864. Proseminar: African-American History. (3 cr; QP–#; SP–#)
Readings in African-American history designed for both incoming and advanced graduate students. Structured around various themes and issues including slavery, Reconstruction, the Great Depression, and the civil rights movement.

Hist 5865. Proseminar: African-American History. (3 cr; SP–#)
The second half of the graduate sequence in African-American history is oriented primarily toward thinking about and performing independent research.

Hist 5871. Readings in U.S. Intellectual History: 19th-20th Centuries. (3 cr; SP–#)
Definitions of American national identity from 1789 to the present as expressed in politics, religion, literature, painting, music, architecture, and history.

Hist 5881. American Foreign Relations to 1895. (3 cr; SP–#)
Intensive readings in the historiography of American foreign relations with emphasis on American imperialism, domestic courses of foreign policy, and international political, economic, and cultural relations.

Hist 5882. American Foreign Relations Since 1895. (4 cr; SP–#)
Intensive readings in the historiography of American foreign relations with emphasis on American imperialism, domestic courses of foreign policy, and international political, economic, and cultural relations.

Hist 5890. Problems in American Indian History. (3 cr; SP–#)
Intensive consideration of topics in American Indian history. Topics may include social history, history of particular regions, political systems, education, and American Indian policy.

Hist 5900. Topics in European/Medieval History. (1-4 cr [max 16 cr]; SP–Grad or [advanced undergrad student with #])
Selected topics in European or medieval history not covered in regular courses; taught as staffing permits.

Hist 5901. Latin America Proseminar: Colonial. (3 cr; SP–#)
Introduces beginning graduate and advanced undergraduate students to major historical writings on various Latin American themes.

Hist 5902. Latin America Proseminar: Modern. (3 cr; SP–#)
Introduces beginning graduate and advanced undergraduate students to major historical writings on various Latin American themes.

Hist 5910. Topics in U.S. History. (1-4 cr [max 16 cr]; SP–Grad or advanced undergrad student with #)
Selected topics in U.S. history not covered in regular courses. Taught as staffing permits.

Hist 5920. Topics in African Social History. (3 cr [max 16 cr]; SP–Grad or #)
Focuses on the experiences of Africans in their workplaces, households and communities. Detailed treatment of selected historical themes. Topics vary by semester.

Hist 5930. Topics in Ancient History. (1-4 cr [max 16 cr]; SP–Grad or #; A-F only)
Selected topics in ancient history not covered in regular courses. To be taught as staffing permits and as enrollment warrants.

Hist 5931. Topics in Comparative Third World History. (3 cr [max 16 cr]; SP–Grad student or #; A-F only)
Topics specified in *Class Schedule*.

Hist 5932. African Historiography and Methodology. (3 cr; A-F only)
Recent analysis of several major themes in the historiography of pre-colonial and colonial Africa and the methods used by African historians to reconstruct the African past.

Hist 5933. Seminar in Ancient History. (3 cr; SP–Previous coursework in Greek or Roman history, #; A-F only)
Seminar on a selected topic in ancient history.

Hist 5934. Comparative History and Social Theory. (4 cr; A-F only)
Focuses on works of history/sociology that are broadly comparative/theoretical and speak to issues of state formation, social movements, social structure, and economic development.

Hist 5940. Topics in Modern Chinese History. (1-4 cr [max 16 cr]; SP–#; A-F only)
Possible topics include cultural, economic, intellectual, political, and social history.

Hist 5941. Readings in Chinese Documents. (3 cr; SP–Reading knowledge of Chinese)
Readings in Chinese on a topic to be selected by the instructor. Depending on the topic and the time period, readings may involve a mixture of modern and classical Chinese or may be entirely in modern Chinese. Consult instructor for more information.

Hist 5942. Topics in the History of Medicine. (3 cr; SP–Prior history of medicine or history of science course recommended for undergrads)
An exploration of topics central to the history of medicine. Emphasis on mid-18th century to the present. Topics vary yearly.

Hist 5950. Topics in Latin American History. (1-4 cr [max 16 cr]; SP–Grad or advanced undergrad with #; A-F only)
Selected topics in Latin American history not covered in regular courses. Taught as staffing permits.

Hist 5960. Topics in History. (1-4 cr [max 16 cr]; SP–Grad or [advanced undergrad with #])
Selected topics in history not covered in regular courses. Taught as staffing permits.

Hist 5962. Expansion of Europe. (3 cr; A-F only)
A research proseminar on the actions of Europeans in the wider world from 1350 to 1790. Based on documents in the James Ford Bell Library.

Hist 5964. Comparative Economic History. (3 cr; SP–#)
Theoretical approaches guide cross-cultural examinations of major issues in the economic history of East Asia, Europe, and the New World. Agrarian structures in economic development, markets, the state and economic development, and the industrial revolution.

Hist 5970. Advanced Research in Quantitative History. (4 cr [max 16 cr])
Students will carry out publishable-quality research on a quantitative historical topic.

Hist 5971. Proseminar: Editing and Publishing. (3 cr; A-F only)
Evolution of modern scholarly publication as system of knowledge. Survey of history of printing/manufacture of books. Recent changes in information technology. Contemporary academic publishing. Basics of editing/editorial policy. Journals/presses.

Hist 5980. Topics in Comparative Women's History. (3 cr)
Cross-cultural/thematic explorations in history of women. Topics vary. May include gender and colonialism; women and class formation; women and religion; sexuality; medical construction of gender; women's narratives as historical sources; gender and politics.

Hist 5993. Directed Study. (1-16 cr [max 16 cr]; SP–#, Δ, ❑; A-F only)
Qualified senior and graduate students may register for work on tutorial basis. Guided individual reading or study.

Hist 5994. Directed Research. (1-16 cr [max 16 cr]; SP–#, Δ, ❑; A-F only)
Qualified senior and graduate students may register for work on a tutorial basis.

Hist 8015. Scope and Methods of Historical Studies. (3 cr; SP–#; A-F only)
Development of historical studies over time (especially in 19th and 20th centuries). Methodologies currently shaping historical research. Theoretical developments within the discipline during 19th and 20th centuries.

Hist 8110. Medieval History: Research Seminar. (3 cr; SP–#, good reading knowledge of Latin, French, one other European language; A-F only)
Research in medieval European history, using primary source material.

Hist 8239. Readings in Gender, Race, Class, and/or Ethnicity in the United States. (3 cr; SP–#; A-F only)
Dynamics of gender, racial, class, and ethnic relations in U.S. history; intersections of these forces.

Hist 8240. Research in Gender, Race, Class and/or Ethnicity in the United States. (3 cr [max 6 cr]; SP–#; A-F only)
Dynamics of gender, racial, class, and ethnic relations in U.S. history; intersections of these forces.

Hist 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Hist 8390. Research in American Indian History. (3 cr; SP–5890 or AmIn 5890 or #; A-F only)
Research and writing skills in American Indian history. With instructor and other participants, students identify their research questions, locate sources with which to answer these questions, conduct original research, and produce a substantial research paper.

Hist 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

Hist 8464. Research in Yuan, Ming, and Qing History. (3 cr; SP–Good working knowledge of classical Chinese, background in history of late imperial China; A-F only)
Basic skills and resources for doing research in history of late imperial China. Bibliographic exercises; reading and translating primary documents.

Hist 8465. Research in Yuan, Ming, and Qing History. (3 cr; SP–Good working knowledge of classical Chinese, background in history of late imperial China)
Basic skills and resources for doing research in history of late imperial China. Students select, translate, and annotate texts appropriate to their research interests and write a research paper centering on these texts.

Hist 8630. Seminar in World History. (3 cr; SP–#; A-F only)
Critical examination of historical literature dealing with theoretical approaches to world history and teaching of world history.

Hist 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Hist 8715. Research on European Women's History, 1450-1750. (3 cr; SP–5715)
Research techniques for completing a major research paper based on primary sources.

Hist 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Hist 8857. Seminar: Research in the History of American Women. (3 cr; SP–5857, #; A-F only)
Students define a historical problem or area of research on a topic in American women's history they would like to pursue in depth, identify appropriate sources and accomplish research in primary and secondary sources, write a 25 to 35-page scholarly article, and read and comment upon each other's drafts.

Hist 8858. Research in Early American History. (3 cr; SP–5801 or #; A-F only)
Research and writing skills. With instructor and other participants, students identify their research questions, locate the sources with which to answer these questions, conduct original research, and produce a substantial research paper.

Hist 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Hist 8900. Topics in European/Medieval History. (1-4 cr [max 16 cr]; SP–Offered as staffing permits; A-F only)
Topics not covered in regular courses.

Hist 8910. Topics in U.S. History. (1-4 cr [max 16 cr]; SP–Offered as staffing permits; A-F only)
Topics not covered in regular courses.

Hist 8920. Topics in African History. (1-4 cr [max 16 cr]; SP–Offered as staffing permits; A-F only)
Topics not covered in regular courses.

Hist 8930. Topics in Ancient History. (1-4 cr [max 16 cr]; SP–Offered as staffing permits; A-F only)
Topics not covered in regular courses.

Hist 8940. Topics in Asian History. (1-4 cr [max 16 cr]; SP–Offered as staffing permits; A-F only)
Topics not covered in regular courses.

Hist 8944. Research Seminar: New Directions in African Social History. (3 cr; SP–#; A-F only)
First semester explains radical transformation in field of African social history during past two decades. Students select major research topic and begin preliminary investigation.

Hist 8945. Research Seminar: New Directions in African Social History. (3 cr; SP–8944, #; A-F only)
Second semester: students conceptualize and write major research paper.

Hist 8950. Topics in Latin American History. (1-4 cr [max 16 cr]; SP–Offered as staffing permits; A-F only)
Topics not covered in regular courses.

Hist 8960. Topics in History. (1-4 cr [max 16 cr]; SP–Offered as staffing permits; A-F only)
Topics not covered in regular courses.

Hist 8993. Directed Study. (1-16 cr; SP–#; A-F only)

Hist 8994. Directed Research. (1-16 cr; SP–#; A-F only)

History of Medicine (HMed)

Medical School

HMed 5002. Public Health Issues in Historical Perspective. (3 cr)
Introduction to the evolution of major recurring problems and issues in public health including environment and health, food customs and nutrition, control of alcohol and drugs, venereal diseases and public policy, human resources regulation, and relationship of science to promotion of health.

HMed 5035. The Germ Theory and Modern Medicine. (3 cr)
Analysis of the formulation of the germ theory of disease and of its consequences for medical procedures (therapeutics, surgery, management of hospitals), public health programs, and the structure and prestige of the medical profession.

HMed 5045. Modern Medical Profession. (3 cr)
Historical analysis of American medical profession in 19th/20th centuries. Role of institutions, influence of social/moral values. Consequences of specialization, scientific innovation.

HMed 5055. Women, Health, and History. (3 cr; SP–Grad student or [jr or sr] with prev coursework in hist or #)
Women's historical roles as healers, patients, research subjects, health activists. Biological determinism, reproduction, mental health, nursing, women physicians, public health reformers, alternative practitioners. Gender disparities in diagnosis, treatment, research, careers. Assignments allow students to explore individual interests.

HMed 5200. Early History of Medicine to 1700. (3 cr; A-F only)
An introductory survey of the history of medicine in Europe and America.

HMed 5201. History of Medicine from 1700 to 1900. (3 cr; SP–HMed 5200)
An introductory survey of the history of medicine in Europe and America.

HMed 5210. Seminar: Theories and Methods in Medical History. (3 cr; A-F only)
Historiography of the history of medicine.

HMed 5211. Seminar: Theories and Methods in Medical History. (3 cr; SP–5210; A-F only)
Use of archives, primary sources. Supervised research project.

HMed 5940. Topics in the History of Medicine. (3 cr)
Seminar on the historical relations between medicine and the State from the 18th to 20th centuries.

HMed 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

HMed 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

HMed 8631. Directed Study. (3-6 cr; A-F only)

HMed 8632. Directed Study. (3-6 cr; A-F only)

HMed 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

HMed 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

HMed 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

History of Science and Technology (HSci)

Department of History of Science and Technology

Institute of Technology

HSci 5211. Biology and Culture in the 19th and 20th Centuries. (3 cr; SP–§3211)
Changing conceptions of life and aims and methods of biology; changing relationships between biology and the physical and social sciences; broader intellectual and cultural dimensions of developments in biology.

HSci 5242. The Darwinian Revolution. (3 cr; SP–§3242)
Development of evolutionary thought in 19th/20th centuries. Emphasizes Darwin's theory of evolution by natural selection. Scientific, economic, political, religious, philosophical dimensions of Darwinism. Comparative reception of Darwinism in different countries/cultures.

HSci 5244. History of Ecology and Environmentalism. (3 cr; SP–§3244)
Development of ecological thought from 18th century natural theology to contemporary ecology and conservation biology; changing views of "balance" and the "economy" of nature; conceptual and methodological developments in ecosystems ecology; connections between ecology and conservation, population and environmental politics.

HSci 5331. Technology and American Culture. (3 cr; QP–§3331; SP–§3331)
Development of American technology in its cultural and intellectual context from 1790 to present. Technology of Native Americans; transfer of technology to America; establishment of an infrastructure promoting economic growth; and social response to technological developments.

HSci 5332. Science and American Culture. (3 cr; QP–§3332; SP–§3332)
Development of American science, including transfer of science to America; development of indigenous traditions for pursuit of science; establishment of infrastructure for education and research; response of public to scientific development.

HSci 5401. Ethics in Science and Technology. (3 cr; SP–§3401)
Historical issues involving research ethics (e.g., human experiments and environmental, nuclear, and safety issues).

HSci 5993. Directed Studies. (1-15 cr [max 15 cr]; QP–#; SP–#)
Guided individual reading or study.

HSci 5994. Directed Research. (1-15 cr [max 15 cr]; QP–#; SP–#)

HSci 8111. Historiography of Science and Technology. (3 cr; SP–Grad HSci major or #; S-N only)
Review of methods and historiography. Tools needed to perform creative work in the field. Models of historical practice, different schools of history, work of representative historians of science and technology.

HSci 8124. Foundations for Research in Ancient Science. (3 cr; SP–Grad HSci major or minor or #; A-F only)
Development of natural/mathematical science in ancient Near East and Classical Greece.

HSci 8125. Foundations for Research in Scientific Revolution. (3 cr; SP–Grad HSci major or minor or #; A-F only)
Development of sciences/natural philosophy, 1500-1725.

HSci 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

HSci 8421. Social and Cultural Studies of Science. (3 cr)
Review of recent work; theoretical and methodological differences among practitioners; selected responses from historians and philosophers of science.

HSci 8441. Women in Science: Historical Perspectives. (3 cr; SP–#)
Key literature dealing with patterns of participation in science and medicine since the 18th century. The ways in which modern science is perceived to be gendered, particularly in its practice and in ways that seem to influence theory and applications.

HSci 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

HSci 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

HSci 8777. Thesis Credits: Master1s. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

HSci 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

HSci 8900. Seminar: History of Early Physical Science. (3 cr; SP–#)
For advanced graduate students; topics in development of natural and mathematical science before 1800.

HSci 8910. Seminar: History of Modern Physical Sciences. (3 cr; SP–#)
For advanced graduate students; topics in development of physical sciences since 1800.

HSci 8920. Seminar: History of Biological Sciences. (3 cr; SP–#)
For advanced graduate students; topics in development of natural, biological, and medical sciences from Aristotle to the present.

HSci 8930. Seminar: History of Technology. (3 cr; SP–#)
For advanced graduate students; topics in development of technology from ancient times to the present.

HSci 8940. Seminar: History of Science and Technology in the Americas. (3 cr; SP–#)
For advanced graduate students; topics in development of science and technology, emphasizing the United States and Canada.

HSci 8950. Seminar: Science and Technology in Cultural Settings. (3 cr; SP–#)
For advanced graduate students; topics in development of science and technology in or across specific geographic regions or particular cultures.

HSci 8993. Directed Studies. (1-5 cr [max 15 cr]; SP–#)

HSci 8994. Directed Research. (1-5 cr [max 15 cr]; SP–#)

Horticultural Science (Hort)

Department of Horticultural Science

College of Agricultural, Food, and Environmental Sciences

Hort 5007. Advanced Plant Propagation. (3 cr; QP–3001; SP–3005)
Control of growth and development in sexual and asexual reproduction of plants including effects of environment, plant growth substances and protocols on dormancy, origin and development of adventitious structures, and success with specialized propagation techniques. Lecture/lab.

Hort 5018. Landscape Operations. (3 cr; QP–1036 or #; SP–1001 or #)
Demonstration/hands-on experiences with landscape operations. Planting, mulching, staking, pruning, fertilizing, large tree care, seeding, sodding, aerifying, calibrating, irrigating, surveying. Written report on special project or experiment. Discussion/laboratory. Team taught by faculty, staff, and industry professionals.

Hort 5021. Landscape Design, Implementation, and Management II. (3 cr; QP–5041 or #; SP–4021)
Residential, commercial, and recreational sites. Architectural/graphic techniques, plan drawings, sections elevations, perspectives, working drawings. Grading and site manipulation, including surveying, irrigation, and drainage. Development of business/grounds management plans. Landscape estimating/bidding.

Hort 5022. Topics in Plant Science for Teachers. (1-4 cr; QP–Biol 1103 or equiv or ed course; no cr for Hort major or grad student; SP–Biol 2012 or equiv or ed course; no cr for Hort major or grad student)

Hort 5023. Public Garden Management. (2 cr; SP–#)
Areas of operations (e.g., planning; educational programming; plant conservation/curation; public relations; garden, personnel, and business management). Overview of knowledge/skills necessary for public garden management.

Hort 5024. Landscape Development. (1 cr; SP–5021 or #; A-F only)
Hands-on experience in landscape development. Plan takeoffs, site evaluation/preparation, planting, installation/construction, equipment operation, hard-good/plant handling.

Hort 5031. Sustainable Fruit Production Systems. (2 cr; QP–1036 or #; SP–1001, 3005; A-F only)
Principles of fruit production. Emphasizes temperature fruit crops. Integrated management of fruit cropping systems, including site selection, cultural management practices, taxonomic classification, physiological/environmental control of plant development. Integration of writing into understanding various fruit cropping systems.

Hort 5032. Sustainable Commercial Vegetable Production Systems. (3 cr; SP–[3005, Ent 3001, PlPa2001, Soil 2125] or #; A-F only)
Principles of commercial vegetable production. Integrated management of vegetable cropping systems: site selection/environment, seed/stand establishment, cultural management practices, commodity use, handling from harvest to market. Perspectives on types of vegetable cultivars. Origin, historical significance/improvement through breeding, nutrition/medicinal aspects, physiological/environmental control of development.

Hort 5041. Nursery Production and Management II. (3 cr; QP–5046 or #; SP–4041; A-F only)
In-depth look at nursery practices, including innovative production systems. Specific crop schedules, using technical and economic data for production. Pest management and regulations for the nursery industry.

Hort 5042. Nursery Operations. (1 cr; QP–[5046, 5047] or #; SP–5041 or #)
Hands-on experience in nursery production. Propagating, growing, and harvesting plants. Operating the equipment commonly used in nurseries.

Hort 5051. Bedding Plant and Specialty Annual/Perennial Crop Production. (4 cr; QP–1022, 1036, 3002; SP–1001, 1011, 3002; A-F only)
Propagation, production, and use of floral crops. Emphasizes bedding plants, perennials, and cut flowers. Growing, marketing, and using herbaceous plants. Cultural practices. Manipulation of environment for growth/quality. Lab, field trips.

Hort 5052. Cut Flower Production. (3 cr; QP–1036, 1022, 3002; SP–1001, 1011, 3002; A-F only)
Media management, insect/disease control, management of annual versus perennial plant production systems. Soil modification, seed germination, transplanting, scheduling, weed control, fertilization/irrigation. Environment management, hydroponic solution management, pest management in closed environment. Post-harvest management/care, drying/dying procedures. Consumer surveys at Minneapolis and St. Paul farmers' markets.

Hort 5061. Turfgrass Science. (3 cr; QP–3072; SP–4061)
For advanced students in turf with career objectives in professional turf management. Emphasis on ecology, physiology, and theory of turf population dynamics and specialized management situations such as golf course, commercial sod production, and fine turf athletic settings.

Hort 5071. Restoration and Reclamation Ecology. (3 cr; QP–Biol 1103 or 3012; Biol 1201, 5041, Ecol 3001 or equiv or #; SP–Biol 2022 or 3002, Biol 1001 or 3407 or equiv or #)
Ecological and physiological concepts as a basis for revegetation of grasslands, wetlands, forests, and other landscapes. Plant selection, stand establishment, evaluating revegetation success. State and federal programs that administer restoration and reclamation programs. Field trips within Minnesota.

Hort 5090. Directed Studies. (1-6 cr [max 18 cr]; QP–8 cr upper div Hort courses, #; SP–8 cr upper div Hort courses, #)
In-depth exploration of concepts, technology, aterials, or programs in specific area to expand professional competency and self-confidence. Planning, organizing, implementing, and evaluating knowledge obtained from formal education and from experience.

Hort 5183. Water, Minerals, and Translocation. (3 cr; QP–Soil 3125 or equiv, PlPh 1xxx or #; SP–Soil 2125 or equiv, PlPh 1xxx or #)
Transport processes in plants including water and nutrient absorption and distribution, effects of and adaptations to water and nutrient stress, functions of mineral nutrients, and translocation of photosynthates.

Hort 5990. Special Workshop in Horticulture. (1-4 cr [max 12 cr]; QP–#; SP–#)
Workshops on a variety of topics in horticulture offered in locations other than the Twin Cities campus. See *Class Schedule* or department for current offerings.

Hort 8005. Supervised Classroom or Extension Teaching Experience in Horticulture. (2 cr; SP–#)
Classroom or extension teaching experience in one of the following departments: Agronomy and Plant Genetics; Biosystems and Agricultural Engineering; Horticultural Science; Plant Pathology; or Soil, Water, and Climate. Participation in discussions about effective teaching to strengthen skills and develop personal teaching philosophy.

Hort 8007. Extension Horticulture Practicum. (1-5 cr; QP–12 grad cr in [ag or bio] science; SP–9 grad cr in [ag or bio] science, #)
Selected activities that may include development of an extension fact sheet, assistance in Dial-U Clinic, or preparation of a workshop or short course.

Hort 8023. Evolution of Crop Plants. (2 cr; QP–13 grad cr in ag or bio sciences; SP–9 grad cr in ag or bio sciences; S-N only)
Origin, distribution, and evolution of cultivated plants; implication of the effects of evolutionary processes on crop breeding for needs of people today.

Hort 8040. Horticultural Seminar. (1 cr [max 3 cr]; SP–Grad major in agro or applied plnt sciences or hort or plnt brdg or plnt path or soil or #)
Reports and discussions of problems and investigational work.

Hort 8044. Manipulation of Plant Growth and Reproduction. (2 cr; QP–PBio 3131 or 5131; SP–PBio 5412)
Impact of environmental and genetic factors on crop growth, development, and reproduction. Emphasis on whole plant physiology and plant response to the environment as determined by genotype and its manipulation for the purpose of producing a crop. Lectures, discussion of current literature, and projects.

Hort 8045. Plant Responses to Environmental Stresses. (3 cr; QP–BioC 3021 or 5331, [PBio 3131 or 5131]; SP–BioC 3021 or 4331, PBio 5412)
Examined from molecular to organismal levels.

Hort 8090. Graduate Horticultural Research. (1-12 cr [max 18 cr]; SP–#)
Conduct literature, lab, and/or field research with horticultural plants and cropping systems.

Hort 8201. Plant Breeding Principles I. (3 cr; QP–Stat 5301 or equiv; SP–Stat 5301 or equiv; A-F only)
Principles and current methods involved in breeding agronomic and horticultural crops. Use of genotype/environment data to increase genetic gain, population improvement, parent building, alternative selection strategies, breeding for special traits, and new approaches. Part of a two-semester sequence including Agro 8202.

Hort 8270. Graduate Seminar. (1 cr; SP–Grad major in [hort or applied plant sciences or ent or agro or plnt brdg or plnt path or soil] or #; S-N only)
Reports/discussions on problems, investigation work.

Hort 8280. Current Topics in Applied Plant Sciences. (1 cr; SP–Grad major in [hort or applied plnt sciences or ent or agro or plnt brdg or plnt path or soil] or #; S-N only)
Topics presented by faculty or visiting scientists.

Hort 8305. Physiological Ecology of Plants in Natural and Managed Ecosystems. (4 cr; SP–Biol 1009, 1201/1202, BioC 3000; A-F only)
Introduction to plants and their reactions and responses in managed and natural ecosystems, including carbon and nitrogen allocation, root biology, microbial interaction, secondary metabolism, and plant response to biotic and abiotic stress.

Hort 8900. Advanced Discussions. (1-3 cr; SP–#)
Special workshops or courses in applied plant sciences.

Human Factors (HumF)

Graduate School

HumF 5001. Foundations of Human Factors/Ergonomics. (3 cr; SP–Enrollment in good standing, grad HumF minor; A-F only)
Variability in human performance as influenced by interaction with designs of machines and tools, computers and software, complex technological systems, jobs and working conditions, organizations, and sociotechnical institutions. Conceptual, empirical, practical aspects of human factors/ergonomics.

HumF 8001. Special Topics: Human Factors/Ergonomics. (2-3 cr; SP–Enrollment in good standing, grad HumF minor)
Survey course in human factors/ergonomics, an interdisciplinary science concerned with interaction of performance and behavior with design factors in performance environment. Concepts, methods, empirical findings, different systems applications, and current research. Topics vary.

HumF 8002. Proseminar in Human Factors/Ergonomics. (1 cr [max 2 cr]; SP–Enrollment in good standing, grad HumF minor; A-F only)
Issues and concerns tailored to interests of faculty and students regarding human factors/ergonomics, an interdisciplinary science concerned with interaction of performance and behavior with design factors in performance environment.

Human Resource Development (HRD)

Department of Work, Community, and Family Education

College of Education and Human Development

HRD 5001W. Survey: Human Resource Development and Adult Education. (3 cr)
Overview of fields of human resource development and adult education. Includes societal context, theories, processes, definitions, philosophies, goals, sponsoring agencies, professional roles, participants, and resources. Focus on the unique characteristics and ways the fields overlap and enhance one another.

HRD 5101. Foundations of Human Resource Development. (1 cr)
Introduction to human resource development as a field of study and practice.

HRD 5102. Economic Foundation of Human Resource Development. (1 cr; SP–5101)
Introduction to economics as a core discipline supporting the theory and practice of human resource development.

HRD 5103. Psychological Foundation of Human Resource Development. (1 cr; SP–5101)
Introduction to psychology as a core discipline supporting the theory and practice of human resource development.

HRD 5104. Systems Foundation of Human Resource Development. (1 cr; SP–5101)
Introduction to system theory as a core discipline supporting the theory and practice of human resource development.

HRD 5105. Strategic Planning through Human Resources. (3 cr; SP–5001 or 5101, 5102, 5103, 5104; A-F only)
The theory and practice of strategically developing, utilizing, and aligning human resources as a major contributor to organizational and quality improvement success.

HRD 5106. Evaluation in Human Resource Development. (3 cr; A-F only)
Evaluation of human resource development efforts from the perspective of impact on organizations, work processes, and individuals, plus follow-up decisions.

HRD 5111. Facilitation and Meeting Skills. (1 cr)
Introduction to the disciplines of planning and running effective meetings. Tools and methods for meeting management and evaluation are presented within the context of organization development.

HRD 5196. Internship: Human Resource Development. (1-10 cr [max 10 cr]; SP–5001, 5201 or 5301; S-N only)
Students apply and contract for human resource development positions. Contracts describe specific HRD responsibilities to be fulfilled during internship and theory-to-practice learning outcomes.

HRD 5201. Personnel Training and Development. (3 cr; A-F only)
Introduction to the personnel training and development process in organizations and the advancement of expertise in the areas of analysis, design, development, implementation, and evaluation.

HRD 5202. Training on the Internet. (3 cr)
Major concepts, skills, and techniques for giving and receiving training on the Internet.

HRD 5301. Organization Development. (3 cr; A-F only)
Introduction to major concepts, skills, and techniques for organization development and change.

HRD 5302. Managing Work Teams in Business and Industry. (3 cr; SP–2 core courses in HRD; A-F only)
Frameworks and strategies for developing effective work teams. Skill development in facilitating resolution of conflicts in organizations. Provides foundational information as well as practical applications for participants (upper-level and graduate students) to become small team leaders.

HRD 5408. International Human Resource Development. (3 cr)
Problems, practices, programs, theories, and methodologies in human resource development as practiced internationally.

HRD 5409. Planning and Decision-Making Skills. (1 cr)
Introduction to the disciplines of planning and decision making typically used in process improvement interventions. Tools and methods for facilitating group decisions and problem solving.

HRD 5496. International Field Study in Human Resource Development. (3 cr; SP–5001)
Field study of the organization development, personnel training and development, career development, and quality improvement theories and practices in a selected nation.

HRD 5601. Student and Trainee Assessment. (2 cr; A-F only)
Development of tests of knowledge, effect, and processes for programs focused on instruction of skills associated with business and industry; development of learning progress reporting systems; evaluation of instructional effectiveness.

HRD 5611. Futurism in Human Resource Development and Adult Education. (3 cr)
Exploration of the implications of future developments in several arenas on theory and practice in human resource development and adult education.

HRD 5612. Managing and Consulting in Human Resource Development and Adult Education. (3 cr; SP–5001)
The theory of managing and consulting in human resource development and adult education. Includes a personal assessment of role requirements and experimentation with management and consultation processes and techniques.

HRD 5624. Sales Training. (3 cr; A-F only)
Strategies and techniques for developing effective sales people.

HRD 5625. Technical Skills Training. (3 cr)
Analyzing technical skills training practices in business and industry. Systems and process analysis and trouble-shooting of work behavior; design methods and developing training materials.

HRD 5626. Customer Service Training. (3 cr; A-F only)
Overview of customer service strategies used by successful organizations and training practices used to develop customer-oriented personnel.

HRD 5627. Management and Supervisory Training and Development. (3 cr)
Problems, practices, programs, and methodologies relating to the training and development of managers and supervisors, including needed competencies, needs assessment, delivery modes, and evaluation.

HRD 5628. Multimedia Presentations in Business. (3 cr; SP–BIE 5011 or equiv)
Designing, creating, and presenting information using multimedia resources in business settings.

HRD 5629. Course Development in Business and Industry. (2 cr; A-F only)
Identifying content, stating objectives, sequencing, planning lessons, and selecting methods and media for instruction and evaluation and feedback.

HRD 5661. Instructional Methods in Business and Industry Education. (2 cr)
Exploration of basic strategies and techniques used by instructors in settings ranging from schools and colleges to business and industry.

HRD 5662. Computer Training in School and Industry Settings. (2 cr; SP–BIE 5011 or equiv)
Alternative practices for teaching business applications software use—such as word processors, spreadsheets, graphics software, desktop publishing software, databases, and communications software—in both public school and industry settings.

HRD 5770. Special Topics in Human Resource Development. (1-4 cr [max 12 cr])
Explanation of issues, methods, and knowledge in HRD areas. Topics vary.

HRD 5821. Diversity Issues and Practices in Work, Community, and Family Settings. (3 cr)
Nature of diverse populations and their unique learning and training needs, exemplary programs, and collaborative efforts among persons representing work, community, and family settings.

HRD 5822. Diversity and Organizational Transformation in Education, Work, and Community. (2 cr)
Develop models for understanding the impact of diversity on individual, organizational, and community outcomes. Discuss organizational change in relation to diversity.

HRD 8001. Advanced Theory in Human Resource Development and Adult Education. (3 cr; SP–5001 or AdEd 5001; A-F only)
Theoretical understanding of individuals and organizations as adaptive entities; roles of human resource development and adult education in mediating complex demands.

Human Resources and Industrial Relations (HRIR)

Industrial Relations Center

Curtis L. Carlson School of Management

HRIR 5000. Topics in Human Resources and Industrial Relations. (1-8 cr)
Selected topics of current relevance to human resource management and industrial relations.

HRIR 5021. Systems of Conflict and Dispute Resolution. (4 cr)
Introduction to theoretical and practical treatment of conflict settlement in interpersonal, work-related, community, business, and international settings. Lectures, discussions, observations of actual dispute resolution sessions, and lab exercises with students participating in dispute resolution simulations applied to real world conflicts.

HRIR 5022. Managing Diversity. (2 cr; SP–[[At least 50 sem cr or 75 qtr cr], 2.00 GPA] or grad student or Δ)
Ways to effectively manage increasingly diverse workforce. Human resource practices examined with respect to diversity. How to incorporate diversity into decision making to enhance organizational performance.

HRIR 5023. Personnel and Industrial Relations Law. (2 cr; SP–[[At least 50 sem cr or 75 qtr cr], 2.00 GPA] or grad student or Δ)
Growing body of laws and their application to workplace: human rights, equal employment, compensation/benefit, employee protection, labor relations. Special issues (e.g., wrongful discharge, sexual harassment, defamation) discussed in context of statute, case law, and their application to work setting.

HRIR 5024. Employee Performance: Appraisal and Management. (2 cr; SP–[[At least 50 sem cr or 75 qtr cr], 2.00 GPA] or grad student or Δ)
How employee performance is organized, appraised, and managed to achieve organizational/individual performance goals. Job design standards, employee appraisal systems, worker satisfaction.

HRIR 5025. Comparative and International Human Resources and Industrial Relations. (2 cr; SP–Grad majors must register A-F)
Emergence, evolution, structures, functions, current challenges of labor movements in industrialized societies. Critical differences in key human resource management practices. Industrial relations systems, collective bargaining in comparative perspective. International Labor Organization.

HRIR 5054. Public Policy and Employee Benefits. (2 cr; QP–8005; SP–Undergrad micro economics; HRIR grad majors must register A-F)
Survey of federally/state-mandated employee benefits: worker compensation, unemployment insurance, temporary disability insurance, social security. Effects of providing benefits on workers' incentives in regard to performance, acquisition, and maintenance of human capital, mobility, and risk sharing.

HRIR 5061. Public Policies on Work and Pay. (3 cr)
Analysis of public policies regarding employment, unions, and labor markets. Public programs affecting wages, unemployment, training, worker mobility, security, and quality of work life. Policy implications of the changing nature of work.

HRIR 5991. Independent Study in Human Resources and Industrial Relations. (1-8 cr [max 8 cr]; QP–Δ or #; SP–Δ or #)
Individual readings or research topics.

HRIR 8000. Graduate Topics in Human Resources and Industrial Relations. (1-8 cr [max 8 cr]; QP–8002; SP–HRIR M.A. student or Sch Mgmt approval; grad majors must register A-F)

HRIR 8011. Quantitative Methods in Human Resources and Industrial Relations. (4 cr; SP–Grad HRIR major or Δ; grad majors must register A-F)
Applications of descriptive and inferential statistics, including probability, hypothesis testing, confidence intervals, analysis of variance, and regression. Computers used in class and homework exercises.

HRIR 8012. Applied Quantitative Methods in Human Resources and Industrial Relations. (2 cr; QP–8001; SP–[8011, grad HRIR major] or Δ; grad majors must register A-F)
Evaluation of applied statistical research in human resources and industrial relations. Appropriate statistical inferences/applications. Sampling issues, multiple regression, advanced topics.

HRIR 8013. Research Methods in Social and Labor Policy. (3 cr; QP–8001; SP–8011, grad HRIR major or Δ; grad majors must register A-F)
Application of social science research methods to public policy issues.

HRIR 8014. Human Resource Information Systems. (2 cr; QP–IR core; SP–Grad HRIR major or Δ; grad majors must register A-F)
Hardware and database fundamentals, software applications, security issues, vendor evaluation, system and software development and design issues, and strategies for gaining user acceptance.

HRIR 8019. Advanced Quantitative Methods in Human Resources and Industrial Relations (Transition). (4 cr; QP–HRIR 8001)
Sampling and experimental design, factor analysis, and multiple regression using instrumental variables. Computers used for data analysis, including a course paper employing quantitative tools. Semester transition course for 1999-2000 for those who completed HRIR 8001 under quarters but did not complete HRIR 8011 under quarters.

HRIR 8021. Introduction to Human Resources and Industrial Relations. (3 cr; QP–Econ 1101, 1102, Psy 1001; SP–§3021, Econ 1101, 1102, Psy 1001, Δ; grad HRIR majors must register A-F)
Human resource management in contexts of labor markets and organizations. Valuing, employing, developing, motivating, and maintaining human resources in an industrial society. Staffing, training, and development; organizational behavior and theory; compensation and benefits; labor market analysis; and labor relations and collective bargaining.

HRIR 8022. Field Project. (4 cr; QP–IR core; SP–[8011, 8031, 8041, 8051, 8061, 8071, grad HRIR major] or Δ; grad majors must register A-F, must have instructors consent to drop course)
Teams formulate and execute study of actual business problem faced by business, non-profit, or governmental organization, generally in Twin Cities.

HRIR 8023. International Human Resource Management. (2 cr; QP–8002 or MBA 8015; SP–MBA 6215 or grad HRIR major or Δ; grad majors must register A-F)
Growing U.S. interdependence with rest of the world and its implications for human resource management policies and practices at home and abroad.

HRIR 8031. Staffing, Training, and Development. (4 cr; QP–8002; SP–Psy 1001, grad HRIR major or Δ; grad majors must register A-F)
Introduction to staffing processes (recruitment, selection, promotion, demotion, transfer, dismissal, layoff, retirement); training development theory and techniques as mechanisms for influencing individual and organizational outcomes, such as performance, satisfaction, and climate.

HRIR 8032. Staffing and Selection: Strategic and Operational Concerns. (2 cr; QP–8003; SP–[8031, HRIR grad student] or Δ; HRIR grad students must register A-F)
Theory/practice related to staffing decisions (recruitment, selection, promotion, transfer, dismissal, layoff, retirement) in organizations. Legal environment in which staffing decisions are made. Staffing from strategic/organizational perspectives.

HRIR 8033. Employee Training: Creating a Learning Organization. (2 cr; QP–8003; SP–[8031, HRIR grad student] or Δ; HRIR grad students must register A-F)
Theory, research, practice related to design/implement employee training programs. Instructional design, training techniques, transfer of training, program evaluation/costing. Role of employees, firm policies/practices in training.

HRIR 8034. Employee Development: Creating a Competitive Advantage. (2 cr; QP–8003; SP–8031 or #, grad HRIR major or Δ; grad majors must register A-F)
Career development and planning, employee and management development techniques, and organizational and employee concerns related to mobility, job stress, balancing work and family, obsolescence and plateauing, and cross-cultural assignments.

HRIR 8041. Design and Management of Organizations. (4 cr; QP–8002; SP–Econ 1101, Econ 1102, Psy 1001 or #, grad HRIR major or Δ; grad majors must register A-F)
Introduction to micro through macro organizational issues at individual, dyadic, group, organizational, and environmental levels; their implications for organizational design, control, coordination, and development.

HRIR 8042. Organizational Structure and Performance. (2 cr; QP–8004; SP–[8041 or #], [grad HRIR major or Δ]; grad majors must register A-F)
How different organizational practices (e.g., employee empowerment, job enrichment, profit sharing, employee stock ownership, individual incentives, information sharing, integration mechanisms) affect organizations in their competitiveness, profitability, workplace safety, employment stability, and wages. Coherence of system of organizational practices.

HRIR 8043. Comparative Organizations and HRM Systems. (2 cr; QP–8004; SP–[8041 or #], [grad HRIR major or Δ]; grad majors must register A-F)
Variations in organizational practices related to variations in ownership (profit, nonprofit, government, cooperatives), economic systems, culture, technology, market structure, etc. Organizational practices: employee empowerment, job enrichment, profit sharing, employee stock ownership, individual incentives, information sharing, integration mechanisms, and international comparisons.

HRIR 8044. Motivation and Work Behavior in Contemporary Organizations. (2 cr; QP–8004; SP–8041 or #, grad HRIR major or Δ; grad majors must register A-F)
In-depth study of major topics in microlevel organizational behavior. Accountability, organization citizenship behaviors, forms of organizational attachment, motivation, and issues of equity and justice.

HRIR 8051. Compensation and Benefits. (4 cr; QP–8002; SP–Econ 1101, 1102, Psy 1001 or #, grad HRIR major or Δ; grad majors must register A-F)
Economic and behavioral theory and research on pay program applications. Effect of laws and regulations on pay. Work design, job analysis, and job evaluation. Performance measurement and evaluation. Incentive programs. Managerial and executive compensation. Comparative perspectives. Costing and forecasting.

HRIR 8052. Compensation Theory and Applications. (2 cr; QP–8005; SP–8051 or #, grad HRIR major or Δ; grad majors must register A-F)
Relationship between economic and psychological theories and the design and operation of compensation programs. Demographic influences on compensation program outcomes. Statistical analysis applied to pay program design and administration. Global pay variations. Current pay issues and controversies.

HRIR 8053. Employer-Sponsored Employee Benefit Programs. (2 cr; QP–8005; SP–8011, 8051 or #, grad HRIR major or Δ; grad majors must register A-F)
Design and administration of nonmandatory compensation benefit programs: medical expense insurance, pensions, profit sharing plans, disability, and other employee benefits. Effects of providing benefits on workers' incentives with regard to performance, acquisition and maintenance of human capital, mobility, and risk sharing.

HRIR 8061. Introduction to Labor Market Analysis. (4 cr; QP–8002; SP–Econ 1101, Econ 1102 or #, grad HRIR major or Δ; grad majors must register A-F)
Labor supply and demand analysis, its international dimensions; determination of wages, employment and unemployment; accumulation of human capital and investment in education and training; government regulation in areas of discrimination and workplace safety; role of unions in wage determination.

HRIR 8062. Human Resource Strategy and Planning. (2 cr; QP–8006; SP–8061 or #, grad HRIR major or Δ; grad majors must register A-F)
Case studies used to diagnose strategy.

HRIR 8063. Human Resources and Organizational Performance. (2 cr; QP–8006; SP–8061 or #, grad HRIR major or Δ; grad majors must register A-F)
Impact of human resource policies and practices on organizational productivity and effectiveness. Role of government, unions, and private sector institutions on organizational effectiveness.

HRIR 8064. Topics in Micro Labor Market Analysis. (2-4 cr; QP–8006; SP–8061 or #, HRIR Ph.D. student or Δ; grad majors must register A-F)
May include micro aspects of unemployment, implicit contracts and efficiency wages, investment in human capital, occupational choice, job search, job matching and turnover, migration, labor force participation, and government program evaluation.

HRIR 8065. Topics in Macro Labor Market Analysis. (2-4 cr; QP–8006; SP–8061 or #, HRIR Ph.D. student or Δ; grad majors must register A-F)
May include theories of unemployment based on sectoral shocks, theories of wage rigidity, efficiency wage theories, interindustry wage structure, role of labor market in resource allocation, and effects of government intervention in labor market.

HRIR 8071. Labor Relations and Collective Bargaining. (4 cr; QP–8002; SP–Econ 1101, Econ 1102 or #, grad HRIR major or Δ; grad majors must register A-F)
Evolution of U.S. labor unions and public policy, bargaining environment and structure, goals and negotiations, contract administration and results. International comparisons, labor-management cooperation, and newly emerging issues.

HRIR 8072. Labor Movements in a Changing World. (2 cr; QP–8007; SP–8071 or #, grad HRIR major or Δ; grad majors must register A-F)
Labor movement philosophies. Critical evaluation of labor movement growth and adjustment to environmental change. Domestic and international perspectives of labor movement innovations.

HRIR 8073. Dispute Resolution: Labor Arbitration. (2 cr; QP–8007; SP–8071 or #, grad HRIR major or Δ; grad majors must register A-F)
Arbitration to resolve grievances and impasses arising out of the collective bargaining agreement's administration and negotiation. Arbitration law and legal issues, procedures and practices, case presentation, management rights, discipline and discharge, evidence, contract language interpretation, and remedies. Newly emerging approaches.

HRIR 8074. Labor-Management Negotiations. (2 cr; QP–8007; SP–8071 or #, grad HRIR major or Δ; grad majors must register A-F)
Analysis of the nature of negotiations with applications to private and public sector collective bargaining. Nature of conflict and dilemma between competition and cooperation. Determinants of bargaining strategies, tactics, outcomes, and impasses. Newly emerging issues.

HRIR 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

HRIR 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

HRIR 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

HRIR 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

HRIR 8811. Advanced Quantitative Research Methods in Human Resources and Industrial Relations. (2-4 cr; QP–IR core; SP–HRIR core or #, HRIR Ph.D. student or Δ; grad majors must register A-F)
General linear model and its assumptions and violations; simultaneous equations; pooling cross-section and time series; limited qualitative dependent variable models; sample selection models; hazard models. Emphasizes application to human resources and industrial relations.

HRIR 8812. Seminar: Human Resources and Industrial Relations Research Methodology. (2-4 cr [max 8 cr]; SP–HRIR Ph.D. student or Δ; grad majors must register A-F)
Application in research projects.

HRIR 8821. Seminar: Human Resources and Industrial Relations Systems. (1-4 cr; QP–IR core; SP–HRIR core or #, HRIR Ph.D. student or Δ; grad majors must register A-F)
Thought and research in the field. Investigating, integrating, and synthesizing more traditional related disciplines, theories, and research into interdisciplinary body of knowledge concerned with human resource and industrial relations problems and employment relationships.

HRIR 8830. Seminar: Staffing, Training, and Development. (1-4 cr [max 8 cr]; QP–8003; SP–8031 or #, HRIR Ph.D. student or Δ; grad majors must register A-F)
Concepts, problems, and research.

HRIR 8840. Seminar: Organization Theory and Behavior. (1-4 cr [max 8 cr]; QP–8004; SP–8041 or #, HRIR Ph.D. student or Δ; grad majors must register A-F)
Application in human resources and industrial relations research/practice.

HRIR 8850. Seminar: Compensation and Reward. (1-4 cr [max 8 cr]; QP–8005; SP–8051 or #, HRIR Ph.D. student or Δ; grad majors must register A-F)
Relevant theoretical models; formulation of research into compensation and reward issues.

HRIR 8860. Seminar: Analysis of Current Labor Market Theory and Empirical Research. (1-4 cr [max 8 cr]; QP–8006; SP–8061 or #, HRIR Ph.D. student or Δ; grad majors must register A-F)
Functions and operations of labor markets, theory, and research.

HRIR 8870. Seminar: Labor Relations and Collective Bargaining. (1-4 cr [max 8 cr]; QP–8007; SP–8071 or #, HRIR Ph.D. student or Δ; grad majors must register A-F)
Analysis of contemporary theoretical and empirical research.

HRIR 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

HRIR 8991. Independent Study in Human Resources and Industrial Relations. (1-8 cr [max 8 cr]; SP–#; A-F only)
Individual readings and/or research projects.

Industrial Engineering (IE)

Department of Mechanical Engineering
Institute of Technology

IE 5080. Topics in Industrial Engineering. (4 cr; QP–Upper div or grad student; SP–Upper div or grad student)
Topics vary each semester.

IE 5441. Engineering Cost Accounting, Analysis, and Control. (4 cr; QP–IT upper div or grad student; A-F only)
Financial accounting, managerial accounting, engineering economics. Preparing financial statements, handling accounts payable and receivable, inventories, depreciation. Financing sources, capital cost and structure. Concepts of time value of money and risk used in managerial decision making. Design of cost accounting system and activity-based accounting.

IE 5511. Human Factors and Work Analysis. (4 cr; QP–Upper div IT or grad student or public health major; SP–Upper div IT or grad student; A-F only)
Human factors engineering (ergonomics), methods engineering, and work measurement. Human-machine interface: displays, controls, instrument layout, and supervisory control. Anthropometry, work physiology and biomechanics. Work environmental factors: noise, illumination, toxicology. Methods engineering, including operations analysis, motion study, and time standards.

IE 5512. Applied Ergonomics. (4 cr; QP–IEOR 5010 or 5070; SP–Upper div IT or grad student, 5511; A-F only)
Small groups of students work on practical ergonomic problems in local industrial firms. Projects cover a variety of ergonomic issues: workstation design, equipment and tool design, back injuries and material handling, cumulative trauma disorders, illumination and noise, and safety.

IE 5513. Engineering Safety. (4 cr; QP–IT or grad student; SP–Upper div IT or grad student; A-F only)
Occupational, health, and product safety. Standards, laws, and regulations. Hazards and their engineering control, including general principles, tools and machines, mechanics and structures, electrical safety, materials handling, fire safety, and chemicals. Human behavior and safety, procedures and training, warnings and instructions.

IE 5522. Quality Engineering and Reliability. (4 cr; QP–IT or grad student; SP–[4521 or equiv], [upper div or grad student or CNR])
Quality engineering/management, economics of quality, statistical process control design of experiments, reliability, maintainability, availability.

IE 5531. Engineering Optimization I. (4 cr; QP–Math 1261, [IT or grad student]; SP–Upper div or grad student or CNR)
Linear programming, simplex method, duality theory, sensitivity analysis, interior point methods, integer programming, branch/bound/dynamic programming. Emphasizes applications in production/logistics, including resource allocation, transportation, facility location, networks/flows, scheduling, production planning.

IE 5541. Project Management. (4 cr; QP–IT sr or grad student; SP–Upper div or grad student)
Project screening/selection, multiple-criteria methods for project evaluation, project structuring/work breakdown, project teams, project scheduling, resource management, life-cycle costing, project control, project termination, research/development projects, computer support for project management.

IE 5551. Production Planning and Control. (4 cr; QP–[IT or grad student], IEOR 5040, ME 3900; SP–Upper div or grad student or CNR)
Inventory control, supply chain management, demand forecasting, aggregate planning, capacity planning, material requirement planning, just-in-time manufacturing, cellular manufacturing, production scheduling, line balancing, shop floor control.

IE 5552. Design and Analysis of Manufacturing Systems. (4 cr; QP–IT or grad student, IEOR 5010, 5020, 5030, 5040; SP–Upper div or grad student)
Flow lines, assembly systems, cellular manufacturing systems, and flexible manufacturing systems. Emphasis is on methodologies for modeling, analysis and optimization. Lead time analysis, capacity and workload allocation, scheduling and shop floor control, work-in-process management, facilities planning and layout, and information management.

IE 5553. Simulation of Manufacturing Systems. (4 cr; QP–IT upper div or grad student; SP–Upper div or grad student or CNR)
Discrete event simulation. Using integrated simulation/animation environment to create, analyze, and evaluate realistic models for various manufacturing, assembly, and material handling systems. Experimental design for simulation. Random number generation, selecting input distributions, evaluating simulation output.

IE 5554. Facility Planning. (4 cr; QP–IT or grad student; SP–Upper div or grad student or CNR)
Design/planning of manufacturing/service facilities. Warehousing/storage, facility layout/location, material handling, material transportation distribution.

IE 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

IE 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

IE 8531. Engineering Optimization II. (4 cr; QP–5040)
Non-linear/global optimization, computational tools/algorithms for solving constrained/unconstrained optimization problems, necessary/sufficient conditions of optimality. Jacobian/Lagrangian methods. Kuhn-Tucker condition. Direct search, gradient methods. Separable, quadratic, geometric, stochastic programming. Emerging search techniques/heuristics.

IE 8532. Stochastic Processes and Queuing Systems. (4 cr; QP–5441; SP–4521 or equiv)
Introduction to stochastic modeling and processes. Random variables, discrete and continuous Markov chains, renewal processes, queuing systems, Brownian motion, and elements of reliability and stochastic simulation. Applications to design, planning, and control of manufacturing and production systems.

IE 8533. Advanced Stochastic Processes and Queuing Systems. (4 cr; SP–8532 or #)
Renewal/generative processes, Markov/semi-Markov processes, martingales, queuing theory, queuing networks, computational methods, fluid models, Brownian motion.

IE 8534. Advanced Optimization. (4 cr; SP–5531)
Combinatorial optimization, search techniques/algorithms, complexity theory, heuristics. Emerging heuristic methods such as tabu search, genetic algorithms, simulated annealing, neural networks. Applications to product/process optimization.

IE 8541. Decision Support Systems. (4 cr; SP–#)
Introduction to theory of decision analysis, including value analysis, utility theory, multi-objective decision making, analytical hierarchy process, behavioral decision making, cognitive engineering, knowledge systems, and learning systems. Development of tools for decision support systems and computer-assisted decision making.

IE 8551. Computer Integrated Manufacturing. (4 cr; SP–#)
Introduction to communication networks and databases, computer-aided process planning, computer-aided manufacturing, real time shop floor control, automated material handling and robotics, and computer-aided quality and inspection.

IE 8552. Advanced Production Systems. (4 cr; QP–5361; SP–5551, 5552)
Design, analysis, control of production/logistic systems. Inventory theory, multi-echelon inventory systems, production-inventory systems, supply chain management, demand forecasting, operations scheduling.

IE 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

IE 8773. Graduate Seminar. (1 cr; S-N only)
Recent developments.

IE 8774. Graduate Seminar. (1 cr; QP–8773; SP–8773; S-N only)
Recent developments.

IE 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

IE 8794. Industrial Engineering Research. (1-6 cr [max 10 cr]; SP–#)
Directed research.

IE 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

IE 8990. Topics in Industrial Engineering. (3 cr)
Key issues in computer integration, such as communication networks and databases, computer-aided process planning, computer-aided manufacturing, and real time shop floor control.

Information and Decision Sciences (IDSc)

Department of Information and Decision Sciences
Curtis L. Carlson School of Management

IDSc 8511. Conceptual Topics and Research Methods in Information and Decision Sciences. (4 cr; SP–Business admin Ph.D. student or #)
Relationships to underlying disciplines; major research streams; seminal articles, survey literature, and major researchers. Provides framework for organizing knowledge about information and decision sciences.

IDSc 8521. System Development. (2 cr; SP–Business admin Ph.D. student or #; offered alt yrs)
Why it is hard to develop efficient/effective information systems, what can be done to improve situation. Defining efficiency/effectiveness in development process and in systems. Producing/evaluating artifacts (constructs, models, methods, tools) that enable more efficient/effective information systems to be developed.

IDSc 8711. Cognitive Science. (4 cr; SP–Business admin Ph.D. student or #; offered alt yrs)
Empirically based concepts of knowledge and reason, mental representation and conceptual systems that guide problem solving and decision making. Computational metaphor of mind drawn from psychology, computer science, linguistics, anthropology, and philosophy. Implications for understanding of knowledge work.

IDSc 8721. Behavioral Decision Theory. (2 cr; SP–Business admin Ph.D. student or #; offered alt yrs)
Traditional/current research. Major models/methodologies. Issues of preference, judgment, and choice under conditions of certainty/uncertainty. Seminar format.

IDSc 8722. Heuristic Decision Making. (2 cr; SP–Business admin Ph.D. student or #; offered alt yrs)
How decisions are made, how knowledge is stored/used, how knowledge of variability/feedback influence decisions. Decisions at strategic, operational, individual level. Exceptional performance, pathologies of decision making. Basis for "best practice." How knowledge is managed in decisions, decision failure. Folly, normal accidents, decision problems in which individuals manipulate information to influence/deceive others.

IDSc 8800. Research Seminar in Information and Decision Sciences. (4 cr [max 20 cr]; SP–Business admin Ph.D. student or #)
Topics, which vary by semester, are selected from new areas of research, research methods, and significant issues.

IDSc 8801. Research Seminar in Information and Decision Sciences. (2-3 cr [max 20 cr])
New areas of research, research methods, issues.

IDSc 8802. Research Seminar in IDSc. (3 cr [max 15 cr]; SP–Ph.D. student or #; A-F only)
Topics selected from new areas of research, research methods and significant issues in information and decision sciences.

IDSc 8892. Readings in Information and Decision Sciences. (1-8 cr [max 16 cr]; SP–Business admin Ph.D. student or #)
Readings useful to a student's individual program and objectives that are not available through regular courses.

IDSc 8894. Graduate Research in Information and Decision Sciences. (1-8 cr [max 16 cr]; SP–Business admin Ph.D. student or #)
Individual research on an approved topic appropriate to student's program and objectives.

Infrastructure Systems Engineering (ISE)

Center for Development of Technological Leadership

Institute of Technology

ISE 5104. Construction Estimating. (1 cr; SP–ISE grad student; A-F only)
Methods for quantity take-offs. Identification of resources for price/availability information.

ISE 5105. Computer Applications II. (1 cr; SP–ISE grad student; A-F only)
Application features in Excel, Visual Basic, and Web Authoring. Data reduction, data presentation, interactive Web calculations. Student projects.

ISE 5112. Infrastructure Systems Engineering Management. (2 cr; SP–ISE grad student; A-F only)
Managing a public works infrastructure. Case studies of decision making in an environment of conflicting interests.

ISE 5113. Computer Applications in Infrastructure Systems Engineering. (2 cr; SP–ISE grad student; A-F only)
Advanced application of computer tools/methods in infrastructure engineering problems. Spreadsheet Visual Basic programming, HTML, JAVA script.

ISE 5114. Pavement Management, Maintenance, and Rehabilitation. (3 cr; SP–ISE grad student; A-F only)
Concepts in network/project level pavement management for flexible/rigid pavements. Pavement distress identification/quantification. Functional/structural evaluation. Identification of appropriate maintenance activities. Selection/design of rehabilitation alternatives.

ISE 5201. Pavement Management Maintenance and Rehabilitation. (3 cr; SP–ISE grad student; A-F only)
Concepts in network/project-level pavement management for flexible/rigid pavements. Pavement distress identification/quantification. Functional/structural evaluation. Identification of appropriate preventative/reactive maintenance activities. Selection/design of rehabilitation alternatives.

ISE 5202. Traffic Engineering Management. (2 cr; SP–ISE student; A-F only)
Identification and effective use of traffic control devices. Automated method of characterizing/assessing traffic flow. Evaluation/improvement of geometric features.

ISE 5301. Bridge Management Maintenance and Rehabilitation. (2 cr; SP–ISE grad student; A-F only)
Structural/functional evaluation of steel, concrete, and timber bridges. Distress identification. Modes of failure, including fatigue, corrosion, and foundation erosion (scour). Preventative/reactive maintenance techniques. Rehabilitation design/construction.

ISE 5401. Water Distribution Systems. (1 cr; SP–ISE grad student; A-F only)
Components/design of water distribution systems. Methods of evaluation/management. Maintenance/rehabilitation techniques.

ISE 5402. Sewage Collection Systems. (1 cr; SP–ISE grad student; A-F only)
Components/design of storm/waste water sewer systems. Methods of evaluation/management. Maintenance/rehabilitation techniques.

ISE 5403. Water Treatment Systems. (2 cr; SP–ISE student; A-F only)
Components/design of water treatment systems. Evaluation/management methods. Maintenance/rehabilitation techniques.

ISE 5500. Public Interactions. (1 cr [max 3 cr]; A-F only)
Techniques for effective public communication. How to run a public hearing. Resources for publishing public notices. Sequence course, in three parts.

ISE 5501. Geographic Information Systems. (1 cr; SP–ISE student; A-F only)
Introduction to geographic Information Systems (GIS) for infrastructure. GIS application domains, data models/sources, analysis methods, and output techniques. Lectures, readings, hands-on experience with GIS software.

ISE 5503. Financial Management in Public Organizations. (2 cr; SP–ISE student; A-F only)
Design, installation, and use of accounting/control systems in public organizations. Public accounting standards/practices, financial administration, financial reporting, debt management, budgeting, and contract/procurement management systems. Lecture, discussion, case analysis.

ISE 8105. Capstone Project. (3 cr; SP–ISE student; A-F only)
Integrates knowledge from courses in Master's program with job experience. Students prepare proposal, conduct project, and report results in written and oral form. Project involves aspect of design, management, or operation of some feature of infrastructure.

ISE 8333. FTE: Master's. (1 cr; SP–Master's student, adviser approval, DGS approval)

Insurance (Ins)

Department of Industrial Relations Center

Curtis L. Carlson School of Management

Ins 5100. Corporate Risk Management. (2 cr)
Theory applied to corporate risk management and insurance practices. Identification, measurement, and treatment of an organization's financial risks integrated with its property, liability, workers compensation, and human resource risks. Selection and application of risk control and risk financing tools: risk retention, reduction and transfer, including insurance.

Ins 5101. Employee Benefits. (2 cr; SP–5100 or HRIR 3021 or #)
Design/administration of employee benefit plans and pension programs: health insurance, disability plans, salary reduction/deferred compensation programs—from social insurance to executive benefits. Multiple employer trusts. Alternative funding methods, including self-insurance. Ethical issues, legal liability, compliance with regulations.

Ins 5200. Insurance Theory and Practice. (2 cr)
Risk theory is applied to practices in health, liability, life, property, and workers compensation insurance. Insurance marketing, pricing, underwriting, and claims administration, with adverse selection and moral hazard effects. Policy issues of tort versus no-fault compensation systems. Self-insurance and integrated risk financing methods.

Ins 5201. Personal Financial Management. (2 cr; SP–5200)
Personal financial planning. Financial statements, cash flow/debt analysis, time value of money. Management of liability, disability, life, medical, and property risks. Investments, portfolio management. Tax reduction, employee benefits, retirement/estate planning. Ethical issues, regulation of financial planners.

Interdisciplinary Archeological Studies (InAr)

College of Liberal Arts

InAr 5100. Topics in Interdisciplinary Archaeological Studies. (3 cr; SP–InAr grad major or #; A-F only)
Topics specified in the *Class Schedule*.

InAr 8004. Method and Theory in Archaeology. (3 cr; SP–Grad InAr major or #; A-F only)
Survey and evaluation of archaeological approaches to non-literary, material evidence for past human activities and societies.

InAr 8100. Interdisciplinary Seminar. (3 cr; SP–Grad InAr major or #; A-F only)
Review and evaluation of approaches to interdisciplinary research; themes vary. Leadership and research shared by staff, visitors, and students.

InAr 8200. Directed Readings. (1-7 cr; SP–Grad InAr major or #)

InAr 8300. Directed Research. (1-7 cr; SP–Grad InAr major or #)

InAr 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

InAr 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

InAr 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

InAr 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

InAr 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Interpersonal Relationships Research (IRel)

Graduate School

IRel 8001. Proseminar in Interpersonal Relationships Research. (1 cr [max 2 cr]; SP–Grad IRel minor; S-N only)
Survey of major topics, including theoretical assumptions, methods, and samples of current research.

IRel 8021. Seminar: Statistical and Methodological Issues in Research on Dyadic Relationships. (2 cr; SP–Grad IRel minor, #; S-N only)
Survey of topics in design and analysis of research on behavior in two-person interactions.

IRel 8360. Seminar: Topics in Interpersonal Relationships Research. (2 cr [max 6 cr]; SP–Grad IRel minor or #)
Intensive study of topics.

Italian (Ital)

Department of French and Italian

College of Liberal Arts

Ital 5209. Trecento Literature: Ruling the Canon. (4 cr; SP–3015, 3201 or #)
Works of Boccaccio and Petrarch and their role in establishing the canon of Italian vernacular literature. Taught in English also as MeSt 5610.

Ital 5289. The Narrow Door: Women Writers and Feminist Practices in Italian Literature and Culture. (4 cr; SP–3015)
Focuses on issues of gender, sexual difference, equality, and emancipation raised by Italian women writers and thinkers from the 19th century to the present.

Ital 5321. Italian Renaissance Epic. (4 cr; SP–3015, 3201 or #)
Study of the narrative poems of Boiardo, Ariosto, and Tasso in the context of the fashioning of early modern Europe.

Ital 5337. Nation and Narration: Writings in the 19th Century. (4 cr; SP–3015)
Introduces the construction of modern Italian national identity by examining the role that literature plays in this process. Works by Manzoni, Foscolo, Leopardi, Gioia, Verga, Serao, and Deledda studied in the context of a range of sociopolitical and cultural issues.

Ital 5401. Mondo di Dante. (4 cr; SP–3015, 3201 or #)
Intensive reading of Dante's Inferno, Purgatorio, and Vita Nuova with emphasis on Dante's linguistic and cultural contributions.

Ital 5609. World of Dante. (4 cr [max 8 cr])
Taught in English. Intensive reading of Dante's Inferno, Purgatorio, and Vita Nuova with emphasis on the personal, poetic, and political stakes of the journey of Dante's pilgrim through hell to the earthly paradise.

Ital 5970. Directed Readings. (1-4 cr; SP–#)
Meets unique requirements decided on by faculty member and student. Individual contracts list contact hours, number of credits, written and other work required.

Ital 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Ital 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Ital 8992. Directed Readings. (1-4 cr; SP–#)

Japanese (Jpn)

Department of Asian Languages and Literatures

College of Liberal Arts

Jpn 5071. Communicative Competence for Japan-Oriented Careers. (4 cr; SP–4041 or 4042 or #)
Effective communication using spoken and written Japanese in contexts likely to be encountered by a career-oriented professional in Japan.

Jpn 5072. Communicative Competence for Japan-Oriented Careers. (4 cr; SP–5071 or #)
Effective communication using spoken and written Japanese in contexts likely to be encountered by a career-oriented professional in Japan.

Jpn 5160. Topics in Japanese Literature. (4 cr [max 8 cr])
Literary, historical, or cultural study of selected Japanese literature.

Jpn 5161. Women's Writing in Premodern Japan. (4 cr; SP–3162, 4061 or # when readings are in Japanese; 3162 or # when in translation; A-F only)
Works by women in premodern Japan including Genji monogatari, a lengthy narrative, Makura no soshi, a collection of vignettes, and poetry. Concerns include gendered writing system/authorship, narrative techniques, sexuality and the figure of the author, and strategies of fictionality.

Jpn 5162. Tale Literature in Premodern Japan. (4 cr; SP–3162, course from classical Japanese language sequence or #; A-F only)
Tale literature, both Buddhist and secular, presents the world of the middle- to lower-class people. Rhetoric and religion, fiction and history, gender and sexuality, the role of the supernatural/fantastic, and re-tellings of earlier texts.

Jpn 5163. Premodern Historical Narratives. (4 cr; SP–3162, course from classical Japanese language sequence or #; A-F only)
Narratives rooted in history. Issues include the problematization of reality, the formation of national identity, the idea of divine Imperial power, oral storytelling and its relationship to written texts, and the popularization of historical writings.

Jpn 5164. Readings in Early Modern Japanese Literature. (4 cr; QP–Third-yr Japanese or #; SP–3032 when readings are in Japanese or #; A-F only)
An examination of the stylistic and ideological aspects of the prose fiction, poetry, and non-fiction of the period 1863 to 1945. Offered in a rotating format alternating between readings in the original language and readings in English translation.

Jpn 5165. Readings in Postwar and Contemporary Japanese Literature. (4 cr; QP–Third-year Japanese or #; SP–3032 when offered in Japanese or #; A-F only)
Literary and historical exploration of selected works published between 1945 and the present. Focus may be on a writer, a period, or a theme. Offered in a rotating format alternating between readings in the original language and readings in English translation.

Jpn 5166. Literature by 20th-Century Japanese Women. (4 cr; SP–3032 or #)
Literary and historical exploration of selected works by Japanese women writers in a variety of genres. All literary texts read in Japanese; critical readings may be in English.

Jpn 5171. Women's Writing in Premodern Japan in Translation. (4 cr; SP–3162 or #; A-F only)
Genji monogatari, a lengthy narrative, Makura no soshi, a collection of vignettes, and poetry. Gendered writing system/authorship, narrative techniques, sexuality and the figure of the author, and strategies of fictionality.

Jpn 5176. Literature by 20th-Century Japanese Women in Translation. (4 cr)
Literary and historical exploration of selected works by Japanese women writers in a variety of genres. All literary texts read in English.

Jpn 5251. History of the Japanese Language. (4 cr; SP–3032, 5451 or #)
Development of Japanese grammar from classical to the modern language.

Jpn 5451. Structure of Japanese: Syntax/Semantics. (4 cr; SP–3032, Ling 3001 or #)
Analysis of structure and meaning of Japanese sentence patterns.

Jpn 5452. Structure of Japanese: Phonology/Morphology. (4 cr; SP–3032, Ling 3001 or #)
Generative and nongenerative approaches to Japanese sound and word structure.

Jpn 5453. Structure of Japanese: Discourse/Conversation Analysis. (4 cr; SP–3032, Ling 3001 or #)
Analysis of Japanese written texts and conversations. Emergence of grammar in discourse, discourse/conversational structural units, patterns genre, strategies, style, and sociolinguistics variables.

Jpn 5650. Proseminar: Japanese Linguistics. (4 cr [max 12 cr]; SP–5451 or 5452 or 5453 or #)
Selected topics in Japanese linguistics and/or contrastive analysis of Japanese and English with attention to contributions from Eastern and Western linguistic traditions.

Jpn 5993. Directed Studies in Japanese. (1-15 cr [max 15 cr]; SP–#, Δ, ❑)
Individual study with guidance of a faculty member.

Jpn 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Jpn 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

Jpn 8630. Seminar in Premodern Japanese Literature. (4 cr [max 12 cr]; SP–#; A-F only)
Selected topic in Japanese literature from 8th century to 1860s; theoretical tools used to analyze modern Japanese literature.

Jpn 8631. Premodern Poetry. (4 cr; SP–3162, course from classical Japanese language sequence or #; A-F only)
Presentation of poetry in four genres: imperial anthologies, narratives centered around poetry, personal collections, and noh plays. Implications of anthologizing/collecting, relationships between prose and poetry, and construction of an authorial figure.

Jpn 8632. Marginalized Literatures of Premodern Japan. (4 cr; SP–3162, course from classical Japanese language sequence [preferably both courses] or #; A-F only)
Texts located at fringes of premodern Japanese literary canon. Ranges from collection of songs sung by women entertainers/prostitutes to texts from Ryukyu islands. Power, canon, and center/margin relationship.

Jpn 8633. Premodern Urban Literature. (4 cr; SP–course from classical Japanese language sequence [preferably both courses] or #; A-F only)
Literature and dramatic scripts between 1600-1868 about urban space and society in regions of Kyoto/Osaka and Edo (Tokyo). Notion of popular culture, relationship between textual production and consumption, and discourses of the urban.

Jpn 8640. Seminar in Modern Japanese Literature. (4 cr [max 12 cr]; SP–#)
Selected topic in Japanese literature from 1860s to the present, including analytical styles and strategies used in Japanese literary criticism.

Jpn 8650. Seminar: Japanese Linguistics. (4 cr [max 12 cr]; SP–5451, 5452, 5453 or #)
Research on selected topic in Japanese linguistics; emphasizes collecting and analyzing primary data.

Jpn 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Jpn 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Jpn 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Jewish Studies (JwSt)

Department of Classical and Near Eastern Studies

College of Liberal Arts

JwSt 5013. Biblical Law and Jewish Ethics. (3 cr; SP–§3013, §RelA 3013, §RelA 5013)
Significance of religious law in Judaism. Babylonian background of biblical law. Biblical creation of the person as a legal category. Rabbinic transformations of biblical norms. Covenant in Christianity/Islam. Contemporary Jewish literature/philosophy.

JwSt 5111. Problems in Historiography and Representation of the Holocaust. (3 cr; QP–RelS 3541; SP–JwSt 3521 or RelS 3521 or #)
Focuses on issues connected with the Holocaust. Inclusiveness of other groups, Holocaust vs. "Shoah," historiographical conflicts about perpetrators, an examination of the problems of representation in literature and art, problems of narrative theology after Auschwitz.

JwSt 5900. Topics in Jewish Studies. (1-3 cr [max 6 cr]; A-F only)
Topics specified in *Class Schedule*.

JwSt 5992. Directed Readings. (1-12 cr [max 12 cr]; SP–#)
Guided individual reading or study.

Journalism and Mass Communications (Jour)

School of Journalism and Mass Communication
College of Liberal Arts

Jour 5251. Psychology of Advertising. (3 cr; SP–[3004 or ¶3004], [jour major or jour minor or design comm premajor or design comm major or graphic design premajor or graphic design major or IDIM major or ICP major or BIS major]; Psy 1001 recommended; A-F only)
Psychological principles, research techniques, and applications in advertising/selling. Consumer attitudes/behavior. Psychological mechanisms upon which effectiveness of advertisements/commercials depends.

Jour 5316. Theories of Visual Communication. (3 cr; SP–[[3004 or ¶3004], 3006, [jour major or jour minor or IDIM major or ICP major or BIS major]] or #; A-F only)
Perspectives on study/analysis of visual communication. Message structure, systems of production, use of visual media. Contributions from sociology, anthropology, psychology, and history.

Jour 5501. Communication and Public Opinion. (3 cr; SP–Open to non-jour majors; jour major must have course appr on prog plan; pre-jour major should not enroll; A-F only)
Theories of communication, persuasion, attitude change. Functions of interpersonal/mediated communication in diffusion of information and in opinion formation.

Jour 5531. Communication and Public Opinion II. (3 cr; QP–3004, [5501 or Soc 5355], [jour major or jour minor], Δ; SP–[3004 or ¶3004], [5501 or Soc 5355], [jour major or jour minor or IDIM major or ICP major or BIS major]; A-F only)
Advanced study of theories/research on opinion formation, persuasion, and diffusion of information. Social science contributions to studies of process/effects of mass communication.

Jour 5541. Mass Communication and Public Health. (2 cr; SP–Jour major or jour minor or grad major or IDIM major or ICP major or BIS major; A-F only)
Role, function, effect of mass media on public health. Planned/unplanned effects. Review/analysis of literature on how theories, models, assumptions of mass communication research relate to public health.

Jour 5601W. History of Journalism. (3 cr; SP–[3004 or ¶3004], [jour major or jour minor or IDIM major or ICP major or BIS major]; A-F only)
Development of American newspapers/periodicals from beginnings in Europe to present day. Rise of radio/television. Relation of communications development to political, economic, social trends.

Jour 5606W. Literary Aspects of Journalism. (3 cr; SP–Jour major or jour minor or IDIM major or ICP major or BIS major; A-F only)
Literary aspects of journalism as exemplified in, and influenced by, works of English/American writers past/present. Lectures, discussions, weekly papers.

Jour 5725. Management of Media Organizations. (3 cr; SP–Jour major or jour minor or IDIM major or ICP major or BIS major; A-F only)
Introduction to concepts/principles of media management. Strategic planning, leadership, organizational strategies, ethical/legal issues. Working in teams. Understanding a balance sheet and income statement. Motivating/promoting people.

Jour 5726. Case Studies in Modern Media Management. (3 cr; SP–[Jour or IDIM or ICP or BIS] major or jour minor; [4725 or 5725] recommended; A-F only)
Key issues confronting media organizations. Integrating journalism, business, and entertainment. Corporate citizenship, public relations. Deciding what organization does. Business/market definition, performance measurement, management of creative process. Investment, new business, media boundaries, technology.

Jour 5741. Minorities and Mass Media. (3 cr; QP–[Jour major or jour minor], 3004, Δ; SP–[3004 or ¶3004], [jour major or jour minor or IDIM major or ICP major or BIS major]; A-F only)
Relationships between mass media and communities of color in the United States. Focuses on issues of content/control.

Jour 5771. Media Ethics: Principles and Practice. (3 cr; SP–Open to non-jour majors; jour major must have course appr on prog plan; A-F only)
What it means to act "ethically." Tools to identify/analyze ethical issues. Ethical norms of print/broadcast journalism, photojournalism, public relations, and advertising.

Jour 5777. Contemporary Problems in Freedom of Speech and Press. (3 cr; SP–[3004 or ¶3004], [jour major or jour minor or IDIM major or ICP major or BIS major]; A-F only)
Legal/constitutional derivation of freedom of speech/press. Emphasizes case law, judicial theories, doctrines, tests, and values. Symbolic, commercial, compelled speech, speech plus, petition/assembly, leading press cases, legal research techniques.

Jour 5825. World Communication Systems. (3 cr; SP–Open to non-jour majors; jour major must have course appr on prog plan; pre-jour major should not enroll; A-F only)
Mass media systems of world, described/analyzed regionally/nationally. Historical roots. Social, economic, cultural context. Contemporary conditions/prospects. Relevance of journalism/mass communication to international affairs.

Jour 5990. Special Topics in Mass Communication. (1-4 cr; SP–Jour major or jour minor or IDIM major or ICP major or BIS major or #; A-F only)
Topics specified in *Class Schedule*.

Jour 5993. Directed Study. (1-3 cr; SP–3004, [jour major or jour minor or IDIM major or ICP major or BIS major], GPA of at least 3.00, ❑, #; A-F only)
Directed study/projects.

Jour 8001. Studies in Mass Communication I. (3 cr; A-F only)
Historical development of mass communication studies in social sciences, humanities, and legal areas; survey of research literature utilizing individualistic and structural approaches to mass communication.

Jour 8002. Studies in Mass Communication II. (3 cr; QP–8010; SP–8001; A-F only)
Literature on history of the field, cultural and humanistic approaches to its study, and legal and ethical issues.

Jour 8317. Seminar: Visual Communication Research. (3 cr; QP–5316, 8010, 8020, Δ; SP–4316, [[8001, 8002] or #]; A-F only)
Theoretical approaches, analysis of research methods, development of research designs/projects.

Jour 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Jour 8442. Seminar: Broadcast News. (3 cr; QP–5442; SP–4442 or #; A-F only)
Major issues. Confrontations between federal government and network news departments. Historical studies.

Jour 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

Jour 8501. Seminar: The Process of Quantitative Mass Communication Research. (3 cr; QP–12 cr soc sci, stat course; SP–9 cr soc sci, EPsy 5260 or equiv or ¶EPsy 5260; A-F only)
Logic of social sciences research. Relationship between theory and research, concept explication, measurement, instrumentation, and design issues.

Jour 8502. Seminar: Mass Communication Research Design. (3 cr; QP–8501, stat course; SP–8501, EPsy 5260 or equiv or ¶EPsy 5260; A-F only)
Principles and application of techniques of psychosocial research with reference to mass communication questions. Reliability, generalizability, and validity in their classic and contemporary senses. Survey instruments, methods, and designs.

Jour 8513. Seminar: Ethnographic Methods in Mass Communication Research. (3 cr; QP–8010, 8020, Δ; SP–[8001, 8002] or #; A-F only)
Theoretical foundations in anthropology/sociology. Field projects.

Jour 8514. Seminar: Mass Communication Theory. (3 cr; QP–8010, 8020, #, Δ; SP–8001, 8002; A-F only)
Research paradigms, concepts, and findings for developing a general theory of mass communication.

Jour 8601. Seminar: Methods in Mass Communication History Research. (3 cr; QP–5601, #, Δ; SP–5601, #; A-F only)
Critical analysis of research in journalism/communication history. Research designs/methods. Development of a research project.

Jour 8602. Seminar: History of Mass Communication. (3 cr; QP–5601, #, Δ; SP–5601; A-F only)
Research in history/development of U.S. mass media.

Jour 8603. Seminar: Theories and Models in Mass Communication History Research. (3 cr; QP–5601, #, Δ; SP–5601, #; A-F only)
Literature on theory in historical research. Uses of theoretical models in historical explanations. Role of theory in historical research, debate about uses. Specific works in journalism/communication history in context of theoretical models. Development of major paper examining models/theories relevant to student's project.

Jour 8620. Seminar: Advertising Research. (3 cr; QP–5251, Δ; SP–5251 or #; A-F only)
Advertising as persuasive communication. Current research/theory related to advertising decision-making process. Measurement issues in advertising and in market research.

Jour 8651. Seminar: Mass Media and Social Change. (3 cr; QP–Stat course, #; SP–8001 or 8002 or equiv; A-F only)
Interplay between major social theories (pragmatism, structural-functionalism, Marxism, postmodernism) and communication studies that seek to explain social change.

Jour 8662. Seminar: Literary Aspects of Journalism. (3 cr; QP–5606, #, Δ; SP–5606; A-F only)
Research in literary aspects of journalism exemplified in careers/works of American/British writers.

Jour 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Jour 8671. Seminar: Communication Ethics—Public/Civic Journalism. (3 cr; A-F only)
Historical underpinnings, philosophical debate, theoretical dynamics, legal concerns, ethical implications.

Jour 8673. Seminar: Media Management. (3 cr; QP–[5725 or 5726] recommended; SP–[4725 or 4726] recommended; A-F only)
Management issues in media organizations. Relation to dynamics of organization structure, employees, markets, economics/finances.

Jour 8675. Seminar: Issues in Information Access and Communication. (3 cr; QP–[5731 or equiv], Δ; A-F only)
Societal, industry, technological, and policy aspects/developments that affect information access, particularly through mass media.

Jour 8678. Seminar: Constitutional Law—Theories of Freedom of Expression. (3 cr; QP–5777, Δ; SP–5777 or #; A-F only)
Problems of constitutional/tort law affecting the press. Underlying theories.

Jour 8679. Seminar: Research Methods in Media Ethics and Law. (3 cr; A-F only)
Research at intersection of first amendment and media ethics.

Jour 8681. Seminar: International Mass Communication. (3 cr; QP–[5801 or 5825], Δ; SP–4801 or 5825 or #; A-F only)
Main problems/currents. Concepts, research, policy relevant to global development. Issues of freedom/constraint, media technology, role of journalism in world affairs.

Jour 8721. Seminar: Communication Agencies as Social Institutions. (3 cr [max 3 cr]; QP–[5721 or equiv], Δ; SP–4721 or equiv or #; A-F only)
Influence/effects of mass communication, internal dynamics of media organizations, criticism/modes of reform. Theoretical frameworks for analysis.

Jour 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Jour 8801. Seminar: Comparative Research in Mass Communication, a Cross-National Approach. (3 cr; QP–[5801 or 5825], Δ; SP–4801 or 5825; A-F only)
Comparative research designs/strategies. Analysis of production, presentation, transmission, and consumption of mass media products/services (particularly news, entertainment, and information) across national borders. Theoretical concerns, empirical problems, policy. Ethical issues involving research on form/content of mass communication within/between countries.

Jour 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Jour 8990. Special Problems in Mass Communication. (3-4 cr [max 12 cr]; A-F only)
Topics specified in *Class Schedule*.

Jour 8993. Directed Study. (1-6 cr; SP–Grad mass comm major or minor, #, Δ; A-F only)

Kinesiology (Kin)

School of Kinesiology and Leisure Studies
College of Education and Human Development

Kin 5001. Foundations of Human Factors/Ergonomics. (3 cr; A-F only)
Variability in human performance as influenced by interaction with designs of machines and tools, computers and software, complex technological systems, jobs and working conditions, organizations, and sociotechnical institutions. Emphasizes conceptual, empirical, practical aspects of human factors/ergonomic science.

Kin 5103. Developmental/Adapted Physical Education. (3 cr; A-F only)
Introduction to physical education for students with disabilities, emphasizing conceptual, organizational, and administrative issues. Topics include historical and legal foundations, service components, individualized education plans, professional roles, and assessment of movement skills.

Kin 5104. Physical Activities for Persons with Disabilities. (3 cr; A-F only)
Different approaches to providing physical education service and related movement interventions for persons with disabilities. Topics: movement behavior foundations, movement skill progressions, unique considerations for specific impairments, and sport for persons with disabilities

Kin 5106. Adapted Aquatics. (2 cr; QP–If certification as Adapted Aquatic Instructor desired, then current American Red Cross Water Safety Instructor or equivalent YMCA certification is required; SP–If certification as Adapted Aquatic Instructor desired, then current American Red Cross Water Safety Instructor or equivalent YMCA certification is required)
Introduction to adapted aquatics for students in kinesiology and leisure studies, physical therapy, and those interested in working with people with disabilities. Topics: teaching approaches, programming, accommodations/adaptations, assessments, individualized plans. Activities: pool sessions with/without clients, groups, site observations.

Kin 5111. Sports Facilities. (3 cr; QP–Kin or Rec grad student or M.Ed. student; SP–§Rec 5111; Kin or Rec grad student or M.Ed. student; A-F only)
Steps in planning/building facilities for athletics, physical education, and sport for college, professional, and public use.

Kin 5121. Application of Basic Sciences to Kinesiology. (3 cr; A-F only)
Examination of how knowledge from the basics of science can lead to differing perspectives from which to approach questions directed to kinesiological inquiry.

Kin 5122. Applied Exercise Physiology. (3 cr; QP–4385 or equiv or #; SP–4385 or equiv or #; A-F only)
Mechanisms of cardiorespiratory and muscular responses to exercise; application of exercise physiology to assessment of work capacity, athletic conditioning, and requirements of human powered vehicles; low to moderate exercise as an intervention in lowering risk for common health problems.

Kin 5124. Human Factors Physiology. (3 cr; QP–#; SP–#; A-F only)
In-depth view of the concepts, problems, and issues associated with ergonomic applications to improving the design and operation of human work spaces.

Kin 5126. Sport Psychology. (3 cr; SP–3126 or equiv or #)
Theory and research in sport psychology. Focus on the psychological study of human behavior in sport and physical activity settings.

Kin 5132. Motor Development. (3 cr; QP–[3132 or #], phys ed lic; SP–3133 or #; A-F only)
Developmental aspects of human movement behavior/learning. Life span change of motor skills.

Kin 5135. Motor Control and Learning. (3 cr; QP–3135 or #; SP–3133 or #)
Main theoretical ideas/research that have advanced motor control/learning over last three decades.

Kin 5136. Psychology of Coaching. (3 cr)
Psychological dimensions of coaching across age levels, including coaching philosophy, leadership, communication skills, motivation, and mental skills training for performance enhancement.

Kin 5141. Nutrition for Health and Physical Performance. (3 cr; QP–FScN 1612 or equiv; SP–FSci 1121 or equiv; A-F only)
Requirements and physiologic roles of nutrients and physical activity in promotion of health and performance; assessment of energy requirements. RDAs, food composition and safety, weight management, and prevention of chronic diseases with emphasis on coronary heart disease.

Kin 5152. Curriculum Development in Physical Education. (2 cr; QP–Init lic/M.Ed. phys ed student or #; SP–Init lic/M.Ed. phys ed student; A-F only)
Trends, issues, and challenges in early childhood/K-12 physical education. Potential effect on curriculum.

Kin 5171. Foundations of Kinesiology. (3 cr; SP–Kin major or #; A-F only)
Introduction to the emerging field of kinesiology, broadly conceived as the study of human movement. Development and emergence of the term kinesiology and the scholarly, political, and educational ramifications of its development.

Kin 5196. Practicum: Developmental/Adapted Physical Education. (1-4 cr [max 4 cr]; QP–5100 or equiv or #; SP–5103 or equiv or #; S-N only)
Observation of, participation in physical education instruction for students with disabilities. Current issues in developmental/adapted physical education. Exchange of ideas/problems.

Kin 5235. Advanced Biomechanics II: Kinetics. (3 cr; SP–[3112 or equiv], PMed 5135, undergrad college physics, intro calculus,; A-F only)
Kinetic aspects of human movement (single/multi-joint torques, simple inverted pendulum models, mass-spring systems). Analysis of experimental data and of computer simulations. Lectures, seminars, lab.

Kin 5328. International and Comparative Sport and Physical Education: The Olympic Games. (3 cr; QP–Grad or #; SP–Grad or #; A-F only)
Explores the role the Olympic Games has played and continues to play in the global village. Advanced insight into the substance, nature, and significance of sport to nation building and the international and comparative sociocultural process.

Kin 5365. Health Promotion Program Design and Implementation. (3 cr; QP–3001; SP–3001; A-F only)
Study of behavioral change methodology and theory related to nutrition, weight control, exercise, stress management, healthy lifestyles, and lifetime health. Application of these concepts in health promotion settings including work sites, managed care organizations, clinics, fitness centers, and educational institutes.

Kin 5371. Sociology of Sport. (3 cr; QP–5126, grad or #; SP–3126, grad or #; A-F only)
A study of sport, sporting processes, social influences, systems, and structures that have effected and exist within, and among societies, nations, and cultures. Exploration of contemporary issues concerning social differentiation and social concerns such as violence and honesty.

Kin 5375. Competitive Sport for Children and Youth. (3 cr)
Cognitive, behavioral, and biological factors having important implications for competitive sport participants from early childhood through high school age. Emphasis on translating sport science research into practical implications for youth sport coaches, teachers, and administrators.

Kin 5385. Exercise for Special Populations. (2 cr; QP–Undergrad physiology or biology; SP–Undergrad physiology or biology; A-F only)
Exercise testing and prescription with modifications required because of special considerations associated with aging, gender differences, environmental conditions, and the presence of medical conditions.

Kin 5461. Foundations of Sport Management. (3 cr; QP–Kin or rec major; grad, M.Ed.; SP–Kin or rec major; grad, MEd: §5460, §Rec 5460; A-F only)
Principles of sport management including theories and techniques in administration and management of sport enterprises. Organizational theory and policy with practical examples of sport management skills and strategies.

Kin 5505. Human-Centered Design: Principles and Applications. (3 cr; SP–§3505)
Application of design to meet human needs. Design of fabricated products, tools/machines, software/hardware interfaces, art/culture, living environments, and complex sociotechnical systems.

Kin 5511. Women in Sport and Leisure. (3 cr; SP–§Rec 5511; A-F only)
Critically examines women's involvement in/contributions to sport, physical activity, and leisure.

Kin 5621. Advanced Athletic Training: Evaluation of Athletic Injury. (3 cr; QP–3114, CBN 1027; SP–3114, [3027 or CBN 1027]; A-F only)
Theory, principles, techniques to recognize/evaluate athletic injury to all major body parts.

Kin 5622. Therapeutic Modalities in Athletic Training. (3 cr; QP–3114; SP–3114; A-F only)
Theoretically based guide for the use of therapeutic modalities for the management of athletic injuries in a practical setting.

Kin 5696. Practicum in Kinesiology. (1-6 cr [max 6 cr]; SP–Grad student in Kin, #; S-N only)
Practical experience in kinesiology under supervision of a University adviser and an agency supervisor.

Kin 5697. Student Teaching: Coaching. (1-10 cr [max 10 cr]; QP–#; SP–Admission to coaching program, #; S-N only)
Student coaching experience under supervision of a mentor coach.

Kin 5720. Special Topics in Kinesiology. (1-8 cr [max 9 cr]; SP–Upper div undergrad or grad student in kin or #)
Current issues in the broad field and subfields in kinesiology, or related coursework in areas not normally available through regular offerings.

Kin 5722. Human Factors Psychology. (3 cr; SP–Grad student or #; A-F only)
Psychological principles that underlie human interactions with technological systems. Techniques/methodologies to assess faulty/incorrect system design. Emphasizes human-centered approaches. Rigorous evaluation of human-machine interaction.

Kin 5723. Psychology of Sport Injury. (3 cr; QP–Intro psych course; SP–Intro psych course)
Psychosocial bases of risk factors preceding sport injury, responses to the occurrence of sport injury, and the rehabilitation process. Lecture, discussion, guest lecture, interviews, and presentation experience.

Kin 5725. Organization and Management of Physical Education and Sport. (3 cr; QP–Grad/init lic or #; SP–Grad/init lic or #; A-F only)
Comprehensive analysis of organization and management of physical education and sport in educational settings. Focus on management and planning processes, management skills, functions, roles, decision making, leadership, shared systems, and organizational motivation. For physical education teachers, coaches, community sport administrators.

Kin 5726. Physical Education—Teaming and Trekking. (2 cr; QP–Kin major, M.Ed. student, or #; SP–Kin major, M.Ed. student, or #; A-F only)
Development of cooperative and team-building activities, group planning, and leadership skills in preparation for a two-day trip in a state park using practiced outdoor skills of camping, canoeing, and backpacking. Must be comfortable in water.

Kin 5727. Physical Education—An Adventure Experience. (1 cr; QP–Kin major, M.Ed. student, or #; SP–Kin major, M.Ed. student, or #; A-F only)
Group and individual initiatives in an experientially based program emphasizing participation in leadership, group cooperation, problem solving, low ropes, climbing walls, sensible risk taking, and trust-oriented activities.

Kin 5740. Topics: Coaching of Individual, Dual, or Team Sports. (1-9 cr [max 9 cr]; QP–PEL; SP–PEL; A-F only)
Instruction at the advanced level, including analyses of skills, game strategies, specific techniques of coaching, and methods of training and conditioning.

Kin 5801. Legal Aspects of Sport and Recreation. (4 cr; QP–Kin or rec major; SP–§Rec 5801; kin or rec major; A-F only)
Legal issues related to recreation, park, and sport programs/facilities in public/private sectors.

Kin 5941. Neural Basis of Movement. (3 cr; SP–[[3111, CBN 1027] or equiv], [Phsl 3051 or equiv]; A-F only)
Overview of various neural subsystems involved in controlling human/primate sensorimotor behavior. Effects of brain lesions on overt behavior, possibilities for rehabilitation. Systems theory approach. Lectures, seminars, class presentations.

Kin 5981. Research Methodology in Kinesiology and Leisure Studies. (3 cr; QP–3150 or equiv; SP–§Rec 5981; 3151 or equiv; A-F only)
Defines/reviews various types of research in exercise/sport science, physical education, and recreation studies. Qualitative research, field studies, and methods of introspection as alternative research strategies to traditional scientific paradigm.

Kin 5992. Readings in Kinesiology. (1-9 cr [max 9 cr]; QP–CEHD student, grad, #; SP–CEHD student, grad, #; A-F only)
Independent study under tutorial guidance.

Kin 5995. Research Problems in Kinesiology or Physical Education. (1-6 cr [max 6 cr]; QP–Grad student or [M.Ed. student in kin, Phys Ed Lic] or #; SP–Grad student or M.Ed. student in kin or #; A-F only)
Focus on selected topics in physical activity/human performance.

Kin 8122. Seminar: Exercise Physiology. (2-6 cr [max 6 cr]; QP–5122 or equiv; SP–5122 or equiv or #; A-F only)
Classic and contemporary literature in exercise physiology and allied disciplines, emphasizing contributions of major leaders in the field and opportunities for interdisciplinary research.

Kin 8126. Seminar: Sport Psychology. (3 cr; QP–5126 or equiv; SP–5126 or #; A-F only)
Literature, theoretical constructs, research methodology, design. Focuses on student-selected topics/problems.

Kin 8132. Seminar: Motor Development. (3 cr; QP–5132 or equiv; SP–5132 or equiv or #; A-F only)
Contemporary research literature focusing on motor skill development from before birth to senescence; emphasizes interaction between physical, environmental, and performer constraints, and coordination and control of movement.

Kin 8135. Seminar: Motor Control and Learning. (3 cr [max 6 cr]; QP–5135 or equiv; SP–5135 or equiv or #; A-F only)
Advanced reading and discussion of research on motor control, motor learning, and human performance.

Kin 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Kin 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

Kin 8607. Seminar: International and Comparative Physical Education and Sport. (3 cr; SP–#; A-F only)
Comparative analysis of selected physical education and sport delivery systems, structures, sport policies, and management of practices and systems of selected countries. Sociocultural impact and issues concerning conduct of sport.

Kin 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Kin 8696. Internship: Applied Sport Psychology. (3-6 cr [max 6 cr]; QP–5126, 8126, #; SP–5126, 8126, kin Ph.D. student, #; S-N only)
Supervised internship; emphasis on educational sport psychology approaches to athletic performance enhancement and psychological adjustment to sport injury.

Kin 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Kin 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Kin 8980. Graduate Research Seminar in Kinesiology. (1-9 cr [max 9 cr]; SP–Grad kin major, #; S-N only)
Reporting and discussion of student and faculty research activity.

Kin 8995. Research Problems in Kinesiology. (1-9 cr [max 9 cr]; SP–Kin Ph.D. student or #; S-N only)

Laboratory Medicine and Pathology (LaMP)

Department of Laboratory Medicine and Pathology

Medical School

LaMP 5125. Chronobiology. (2-6 cr; A-F only)
How to interpret biologic time series and how to use them in practice as well as in designing chronobiology experiments. Chronobiologic procedures of data collection and analysis, interpretation of the output in clinical practice.

Landscape Architecture (LA)

Department of Landscape Architecture

College of Architecture and Landscape Architecture

LA 5201. Making Landscape Spaces and Types. (6 cr; SP–B.E.D. accelerated status or LA grad or #; A-F only)
Design exploration using 3-D models and historical precedent studies to create outdoor spaces for human habitation and use. Application of the basic landscape palette of landform, plants, and structures to give physical, emotional, cognitive, and social definition to created places.

LA 5202. Landscape Analysis Workshop. (1 cr; S-N only)
Introduction to field techniques for site analysis, including vegetation, soil, and landform description. One-week session, before fall term, at lake Itasca Forestry and Biological Station.

LA 5203. Ecological Dimensions of Space Making. (6 cr; SP–LA major or #; recommended for both B.E.D. and grad students; A-F only)
Design studio experience drawing on ecological, cultural, aesthetic influences to explore development of design ideas responsive to ecological issues and human experience.

LA 5301. Introduction to Drawing in Architecture and Landscape Architecture. (3 cr; SP–§1301; LA grad student, accelerated B.E.D. student; A-F only)
Perceiving/representing material environment. Sketching/drawing conventions, visual phenomena/forms.

LA 5351. AutoCAD I. (3 cr; SP–B.E.D. major or LA grad or #; may not be taken for graduate credit; A-F only)
Basic concepts, tools, and techniques of computer-aided drawing. Introduction to current AutoCAD Release software. Strategies and techniques for producing dimensioned and annotated drawings. Introduction to 3-D drawing capabilities. Use of dimension variables, attributes, blocks, symbols, and creation of customized menus.

LA 5352. AutoCAD II. (3 cr; SP–Arch 5351 or LA 5351, B.E.D. major or LA grad or #; may not be taken for graduate credit; A-F only)
Intermediate concepts, tools, and techniques of computer-aided drawing with current AutoCAD Release software. Strategies and techniques for producing dimensioned and annotated drawing. Use of dimension variables, attributes, blocks, symbols, and creation of customized menus.

LA 5371. Computer Methods I. (1 cr; SP–B.E.D. accelerated status or LA grad or #)
Introduction to current techniques, programs, and new editions of computer programs, and their application to landscape architecture computing.

LA 5372. Computer Methods II. (1 cr; SP–Arch/LA 5371, LA grad or #)
Current techniques and computer programs, and their application to landscape architecture computing.

LA 5373. Computer Methods III. (1 cr; SP–Arch/LA 5372, LA grad or #)
Advanced techniques and computer programs, and their application to landscape architecture computing in design, theory, and technology.

LA 5400. Topics in Landscape Architecture. (1-3 cr [max 12 cr]; SP–B.E.D. accelerated status or LA grad or #; A-F only)
Current topics in landscape architecture. Taught by regular or visiting faculty in their areas of specialization.

LA 5401. Directed Studies in Emerging Areas of Landscape Architecture. (1-6 cr [max 12 cr]; QP–Sr B.E.D. major or LA grad or #; SP–B.E.D. accelerated status or LA grad or #)
Independent studies under the direction of landscape architecture faculty.

LA 5402. Directed Studies in Landscape Architecture History and Theory. (1-6 cr [max 12 cr]; QP–Sr B.E.D. major or LA grad or #; SP–B.E.D. accelerated status or LA grad or #; A-F only)
Independent studies under the direction of landscape architecture faculty.

LA 5403. Directed Studies in Landscape Architecture Technology. (1-6 cr [max 12 cr]; QP–Sr B.E.D. major or LA grad or #; SP–B.E.D. accelerated status or LA grad or #; A-F only)
Independent studies under the direction of landscape architecture faculty.

LA 5404. Directed Studies in Landscape Architecture Design. (1-6 cr [max 12 cr]; QP–Sr B.E.D. major or LA grad or #; SP–B.E.D. accelerated status or LA grad or #; A-F only)
Independent studies under the direction of landscape architecture faculty.

LA 5405. Interdisciplinary Studies in Landscape Architecture. (1-6 cr [max 12 cr]; QP–Sr B.E.D. major or LA grad or #; SP–B.E.D. accelerated status or LA grad or #; A-F only)
Research, planning, and/or design projects. Topics vary.

LA 5413. Introduction to Landscape Architectural History. (3 cr [max 3 cr]; SP–One course in history at 1xxx or higher; A-F only)
Introductory course examines the multiple roots of landscape architecture by examining the making of types of landscapes over time. Emphasis on ecological and environmental issues, and issues related to political, economic, and social contexts of landscape architectural works.

LA 5431. History of Landscape Architecture: Individual Influences. (3 cr; A-F only)
Assessment of influences of individuals on formation of the profession of landscape architecture from 1800 to present. Lectures, presentations, field trips, readings, papers, projects.

LA 5571. Landscape Construction: Landform Systems and Spatial Performance. (3 cr; SP–B.E.D. major or LA grad or #)
Theory and professional applications of landform systems for design. Topics include landform typology, representation methods, manipulation techniques, use of land survey data, earthwork construction issues, and spatial accommodation of vehicles in landscape architecture, including road design.

LA 5572. Plants in Design. (3 cr; QP–[5211, 5212, plant identification course] or #; SP–[5201, 5203, plant identification course] or #; A-F only)
Design principles for using plants in landscape. Cultural/ecological principles in design projects of various scales. Lectures, presentations, field trips, readings, projects.

LA 5573. Landscape Technology: Introduction to Geographic Information Systems. (3 cr; QP–Jr or sr B.E.D. major or LA grad or #; SP–Jr or sr B.E.D. major or LA grad or #; A-F only)
GIS as an analytical tool to solve geographical problems of regional landscape design and resource management. Topics include application techniques, analytical procedures, data characteristics, data sources, input/output methods, and implementation.

LA 8201. Designing Landscapes for Dwelling and Settlement. (6 cr; QP–5212, 5571, ¶8202; SP–5203, 5571, grad land arch major, ¶8202 or #; A-F only)
Professional design studio. Hypothetical projects include development of schematic master plans for site layout, grading, and planting. Design for residential, commercial, and civic uses with attention to zoning and other controls, environmental quality, human behavior, markets, project finance, and technics. Requires concurrent registration in LA 8202.

LA 8202. Design of Planned Developments. (2-3 cr; SP–Grad land arch major or #)
Issues related to planned community developments: historical precedents; design for residential, commercial, and civic uses; role of zoning and other controls; deed restrictions; preparation of design brief; environmental quality; human behavior; market; project finance; and techniques of site development.

LA 8203. Making Regional Landscape Space. (6 cr; QP–8221, ¶8204; SP–8202, grad land arch major, ¶8204 or #; A-F only)
Design exploration of landscape ecology, landscape perception, regional economics, and public policy as informants of design decision-making in regional landscapes at or exceeding township level. Geographic information systems as design tools.

LA 8204. Regional Landscape Space. (3 cr; SP–Grad land arch major or #; A-F only)
Theoretical investigations and current advances in use of landscape ecology, landscape perception, regional economics, and public policy as informants of design decision-making in regional landscapes at or exceeding township level. Geographic information systems as design tools.

LA 8205. Urban Form Options: Landscape Architecture Studio. (6-8 cr; SP–2 yrs of studio, grad land arch major or #)
Urban landscape design issues, theories, and problems explored via formal/spatial inquiry in studio, reading, and the exposition of ideas in paired seminar. Urban systems, gathering spaces, ecology, infrastructure, recreation, and public space.

LA 8301. Landscape Architecture: Research Issues and Methods. (3 cr; QP–8221, grad land arch major or #; SP–8201 or ¶8201, grad land arch major or #; A-F only)
Alternative methodological approaches to landscape architectural research and consideration of their appropriateness for contemporary research topics.

LA 8302. Professional Practice. (3 cr; QP–8231; SP–8205, grad land arch major or #; A-F only)
Office and project management case studies. Organizational behavior, marketing, sales, strategic planning, financial and cost accounting, insurance, legal issues and contracts.

LA 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

LA 8400. Topics in Landscape Architecture. (1-3 cr [max 12 cr]; SP–Grad land arch major or #)
Seminar offered by regular or visiting faculty in their area of specialization. Content varies with interest of instructor.

LA 8401. Directed Studies in Emerging Areas of Landscape Architecture. (1-6 cr [max 12 cr]; SP–Grad land arch major or #; A-F only)

LA 8402. Directed Studies in Landscape Architecture History and Theory. (1-6 cr [max 12 cr]; SP–Grad land arch major or #; A-F only)

LA 8403. Directed Studies in Landscape Architecture Technology. (1-6 cr [max 12 cr]; SP–Grad land arch major or #; A-F only)

LA 8404. Directed Studies in Landscape Architecture Design. (1-6 cr; SP–Grad land arch major or #; A-F only)

LA 8405. Interdisciplinary Studies in Landscape Architecture. (1-6 cr [max 12 cr]; SP–Grad land arch major or #; A-F only)
Research, planning, and/or design project. Sample topics: energy efficient design, historic preservation, urban revitalization, agricultural land use, computerized land-use planning, housing.

LA 8406. Concepts of Landscape Evaluation. (3 cr; SP–Grad land arch major or #; A-F only)
Philosophical basis for wide-ranging approaches to evaluating qualitative aspects of landscape. Aesthetic factors and integration of landscape evaluation into regional design decision-making.

LA 8407. Perception Manipulation in Design of Exterior Space. (3 cr; SP–Grad land arch major or #)
Historic and modern design devices that alter one's sense of spatial control and arrangement to create illusionary situations in exterior environment. Organized to inform and test principles of perception distortion in exterior space.

LA 8408. 18th-Century Landscape Theory: Nature and the Sublime, the Beautiful, and the Picturesque. (3 cr; SP–Grad land arch or arch major or #; A-F only)
Eighteenth-century landscape architectural theory underpinned most modern western traditions in landscape architecture. These theoretical positions framed the nature of Nature in the context of human experience through treatises and works of landscape architecture.

LA 8409. Fitting Buildings to the Land. (3 cr; SP–Land arch or arch grad student with 1 yr grad design or #; A-F only)
Exercises and projects in site manipulation to adjust structures and attendant uses and circulation to specific land parcels.

LA 8554. Project Programming. (1 cr; QP–8223; SP–8203, grad land arch major or #; A-F only)
Individual research in preparation for final studio.

LA 8555. Advanced Landscape Planning and Design. (6 cr; QP–8231; SP–8205, grad land arch major or #; A-F only)
Advanced studies in area of student's choice.

LA 8574. Landscape Storm Water Management. (3 cr; QP–8221; SP–8201, grad land arch major or #)
Theory and applications of hydrology and storm water management techniques. Applied hydrology, catchment delineation, storm water runoff models, and storm water management techniques (detention ponds, swales, channels, culverts, small storm sewer systems, run-off systems, sedimentation, and erosion control systems).

LA 8575. Art of Landscape Detail. (3 cr; SP–Grad LA major or #)
Design of pavements, enclosures, decks, lighting, electrical, and irrigation systems for landscape architecture. Theory/principles of design of light structures, properties/use of materials, construction communication. Landscape integrity and economic viability as performance issues.

LA 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Language, Teaching, and Technology (LgTT)

Institute of Linguistics, ESL, and Slavic Languages and Literatures

College of Liberal Arts

LgTT 5101. Applications of Technology in Language Teaching. (3 cr)
Explore uses of technology in language teaching; theoretical background, demonstrations, and applications.

LgTT 5110. Technology in the Second Language Classroom. (2 cr; SP–§5611)
Examine, evaluate, and use technology in language teaching. Theoretical background, demonstration, hands-on exploration.

LgTT 5611. Technology in Second Language Instruction. (3 cr; SP–SLC post bac or #)
Using audio, video, and computer technology in second language teaching/learning in classroom, independent study, and distance education environments.

LgTT 5710. Special Topics in Language Teaching and Technology. (1-3 cr [max 12 cr])
Examine, evaluate, apply specific area of technology to K-higher education, second/foreign language teaching/learning in classroom, independent study, distance education environments.

Latin (Lat)

Department of Classical and Near Eastern Studies

College of Liberal Arts

Lat 5012. Latin Prose Composition. (3 cr; SP–3114 or Δ)
Advanced understanding of Latin grammar, syntax, diction, and prose style through graduated exercises in prose composition.

Lat 5032. Text Criticism. (3 cr; SP–3114)
Theory and practice. Elements of paleography and manuscript study. Basic tools for analyzing a textual apparatus with some independence; constructing a critical edition of a literary text.

Lat 5310. Latin Literature: History. (3 cr [max 12 cr])
One or more appropriate authors studied each semester.

Lat 5320. Latin Literature: Epistles and Essays. (3 cr [max 12 cr])
One or more appropriate authors studied each semester.

Lat 5330. Latin Literature: Oratory. (3 cr [max 12 cr])
One or more appropriate authors studied each semester.

Lat 5340. Latin Literature: Epic and Pastoral. (3 cr [max 12 cr])
One or more appropriate authors studied each semester.

Lat 5350. Latin Literature: Lyric and Elegiac Poetry. (3 cr [max 12 cr])
One or more appropriate authors studied each semester.

Lat 5360. Latin Literature: Latin Dramatists. (3 cr [max 12 cr])
One or more appropriate authors studied each semester. Authors vary.

Lat 5370. Latin Literature: Satire. (3 cr [max 12 cr]; SP–Grad student or #)
One or more authors.

Lat 5380. Latin Literature: Legal Texts. (3 cr [max 12 cr])
One or more appropriate authors studied each semester.

Lat 5390. Literature: Religious Texts. (3 cr [max 12 cr]; SP–3114)
Reading and discussion of religious texts from Latin antiquity, such as Varro's *Antiquitates Divinae*, Cicero's *De natura deorum*, Apuleius's *Metamorphoses*, or Christian writers (Tertullian, Cyprian, Lactantius, Jerome, Augustine).

Lat 5410. Latin of Late Antiquity. (3 cr [max 12 cr]; SP–34xx or equiv or #)
Pagan and Christian Latin literature selected from authors of the 3rd to 6th centuries A.D. Topics specified in *Class Schedule*.

Lat 5420. Medieval Latin. (3 cr [max 12 cr]; SP–34xx or equivalent or #)
Literature from 6th to 15th centuries. Authors and genres vary; topics specified in *Class Schedule*.

Lat 5621. Latin Paleography. (3 cr; SP–Three 3xxx-5xxx Latin cr or #)
Analysis of various hands used in manuscripts of Latin authors with attention to date and provenance; transmission of ancient Latin literature.

Lat 5715. Introduction to the Historical-Comparative Grammar of Greek and Latin. (3 cr; SP–# or 2 yrs college Greek)
Historical and comparative grammar of Greek and Latin from their Proto-Indo-European origins to the classical norms.

Lat 5717. History of Latin. (3 cr)
Reading and analysis of documents illustrating the stylistic registers and evolution of the Latin language from its earliest attestations through the Middle Ages.

Lat 5993. Directed Studies. (1-4 cr [max 18 cr]; SP–#, Δ)
Guided individual reading or study.

Lat 5994. Directed Research. (1-12 cr [max 20 cr]; SP–#, Δ)
Guided research on original topic chosen by student.

Lat 5996. Directed Instruction. (1-12 cr [max 20 cr]; SP–#, Δ)
Supervised teaching internship.

Lat 8120. Latin Text Course. (3 cr [max 15 cr]; SP–3111 or Δ; not for students in dept of Classical and Nr East Studies)
Students attend 3xxx Latin courses. Supplementary work at discretion of instructor.

Lat 8262. Survey of Latin Literature I. (3 cr)
Extensive readings in variety of works from republican and early Augustan period.

Lat 8263. Survey of Latin Literature II. (3 cr)
Variety of works from Augustan and imperial periods.

Lat 8267. Graduate Survey of Latin Literature of Late Antiquity. (3 cr; SP–#, Δ)
Latin literature of 3rd to 6th centuries A.D., including Ammianus and Augustine.

Lat 8910. Seminar. (3 cr [max 30 cr])
Various topics in Latin literature examined in depth with emphasis on current scholarship and original student research.

Learning and Academic Skills (LASk)

Department of Educational Psychology

College of Education and Human Development

LASk 5201. Effective Job Search and Interview Skills for Non-Native Speakers. (1 cr; SP–§3201; S-N only)
Practical assistance for career search process; immediate/long-term career objectives. Develop effective job search strategies; refine written, verbal, behavioral communication job seeking skills; deal with diversity issues. Video-tape mock interviews.

LASk 5301. Career Development and Job-Seeking Skills for Students with Disabilities. (2 cr; SP–§3301)
Adapt career planning, job-seeking process to specialized educational, vocational, personal, and social needs of students with disabilities. Assess skills, interests, values, personality, goals as related to career decisions. Practical assistance occupational choices, resumes, interviewing, evaluating job offers. Legal rights, discrimination, disclosure issues.

LASk 5960. Topics in Graduate Studies. (1 cr; S-N only)
Special classes or seminars on topics related to successful learning and academic performance in graduate school. Topics listed in Learning and Academic Skills Center Office (104 Eddy Hall).

Liberal Studies (LS)

College of Continuing Education

LS 5100. Liberal Studies Seminar. (1-4 cr [max 24 cr]; A-F only)
Interdisciplinary topics.

LS 5993. Directed Studies. (1-4 cr [max 15 cr]; SP–Grad student, Δ)
Guided individual reading or study.

LS 5994. Directed Research. (1-4 cr [max 15 cr]; SP–#)
Tutorial for qualified graduate students.

LS 8001. Introduction to Interdisciplinary Inquiry. (3 cr; SP–M.L.S. student; A-F only)
Required course. Emphasizes what students need to know or be able to do to successfully complete their individually crafted program, including critical thinking, clear writing, and interdisciplinary research.

LS 8002. Final Project for Graduate Liberal Studies. (3 cr; SP–M.L.S.; all M.L.S. coursework must be completed by end of sem; A-F only)
Students synthesize/complete final project.

LS 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Linguistics (Ling)

Institute of Linguistics, ESL, and Slavic Languages and Literatures

College of Liberal Arts

Ling 5001. Introduction to Linguistics. (4 cr; QP–§3001, §3001H; grad or #; SP–§3001, §3011; grad or #)
Phonetics, phonology, morphology, syntax, semantics, and historical-comparative linguistics; language learning andpsychology of language; linguistic universals; language in society.

Ling 5005. Introduction to Applied Linguistics. (3 cr; QP–3001 or 3001H or 5001 or #; SP–3001 or 3011 or 5001 or #)
Relationships between linguistics and neighboring disciplines; applications to practical fields such as lexicography, orthography, translation and interpreting, language planning, reading, language teaching, bilingual education, education of the deaf and correction of language disorders; computer applications; forensic applications. Topics may vary with each offering.

Ling 5101. Language Types and Linguistic Universals. (3 cr; QP–3001 or 3001H or 5001 or #; SP–3001 or 3011 or 5001 or #)
Comparison of languages and language types; cross-linguistic similarities and universals of language, and their explanation.

Ling 5105. Field Methods in Linguistics I. (4 cr; QP–5201, 5302 or #; SP–5201, 5302 or #)
Techniques for obtaining and analyzing linguistic data from unfamiliar languages through direct interaction with a native speaker.

Ling 5106. Field Methods in Linguistics II. (4 cr; SP–5105)
Techniques for obtaining and analyzing linguistic data from unfamiliar languages through direct interaction with a native speaker.

Ling 5201. Introduction to Syntax. (3 cr; QP–3001 or 3001H or 5001 or #; SP–3001 or 3011 or 5001 or #)
Examination of syntactic phenomena and constructions in a variety of languages; principles of grammar construction and evaluation; syntactic theories as instruments of grammatical analysis.

Ling 5202. Syntactic Theory. (3 cr; QP–5201; SP–5201)
A thorough foundation in modern syntactic theory through the investigation of a number of syntactic phenomena in various languages. Emphasizes syntactic argumentation and the development of constraints on grammar formalisms.

Ling 5205. Semantics. (3 cr; SP–5202 or #)
Analysis of sentence meaning with attention to semantic properties and relations such as analyticity, entailment, quantification, and genericity. Philosophical background; formal techniques of semantic analysis; how sentence meaning depends on word meaning, syntax, and context. The role of semantics in grammatical theory.

Ling 5206. Linguistic Pragmatics. (3 cr; SP–5201, 5205 or #)
The analysis of linguistic phenomena in relation to beliefs and intentions of language users; speech act theory, conversational implicature, presupposition, information structure, relevance theory, discourse coherence.

Ling 5301. Introduction to Phonetics. (4 cr; QP–§3301; 3001 or 3001H or 5001 or #; SP–§3301; 3001 or 3011 or 5001 or ¶5001 or #)
Phonetic analysis and transcription of speech. Exploration of articulatory and acoustic correlates of speech sounds. Extensive practice transcribing. Emphasis on narrow transcription of human speech. One section focuses on universal phonetics, another provides emphasis on English.

Ling 5302. Introduction to Phonology. (3 cr; QP–5301; SP–5301)
Concepts and types of information needed for describing patterns in the sounds of words, for all speakers of all human languages, including current theoretical frameworks. Extensive practice identifying and analyzing phonological patterns in the words of a language.

Ling 5303. Phonological Theory. (3 cr; QP–5302 or #; SP–5302 or #)
Further exploration of the phonology of human languages. The course will prepare students to read papers in the literature and to do informed research in phonology.

Ling 5461. Conversation Analysis. (3 cr; QP–3001 or 3001H or 5001 or #; SP–§Spch 5461; 3001 or 3011 or 5001 or #)
Discourse processes. Application of concepts through conversation analysis.

Ling 5462. Field Research in Spoken Language. (3 cr; QP–5461 or Spch 5461 or #; SP–§Spch 5462; 5461 or Spch 5461 or #)
Transcribing and analyzing talk and movement related to talk. Applying concepts to recorded conversations.

Ling 5501. Introduction to Language Acquisition. (3 cr; QP–3001 or 3001H or 5001 or #; SP–3001 or 3011 or 5001 or #)
Overview of first and second language acquisition. Does not fulfill degree requirements for majors in linguistics or the MA in ESL.

Ling 5505. Introduction to Second Language Acquisition. (3 cr; QP–3001 or 3001H or 5001, a course on phonological and grammatical structure of a language; SP–3001 or 3011 or 5001, a course on phonological and grammatical structure of a language)
Introduction to research on the language and learning processes of second-language learners: the linguistic structure of their interlanguage, the cognitive and social factors which influence their acquisition of a new language.

Ling 5601. Introduction to Historical Linguistics. (3 cr; QP–§3601; 3001 or 3001H or 5001; SP–§3601; 3001 or 3011 or 5001)
Historical change in phonology, syntax, semantics and the lexicon; linguistic reconstruction; genetic relationship among languages.

Ling 5701. Sociolinguistics. (3 cr; QP–3001 or 3001H or 5001 or #; SP–3001 or 3011 or 5001 or #)
Social determinants of linguistic diversity, variation, and change. Topics may include social and regional dialects, language style and register, style-shifting and code-switching, the quantitative study of speech, linguistic and social inequality.

Ling 5721. Bilingualism. (3 cr; QP–3001 or 3001H or 5001 or #; SP–3001 or 3011 or 5001 or #)
Sociolinguistic theory and methods in the study of bilingualism; language ecology in multilingual societies; language and language behavior in the bilingual individual; language in ethnic conflict; implications for public policy and planning.

Ling 5801. Introduction to Computational Linguistics. (3 cr; QP–3001 or 3001H or 5001 or #; programming experience helpful; SP–3001 or 3011 or 5001 or #; programming experience helpful)
Methods and issues in computer understanding of natural language. Programming languages and their linguistic applications. Lab projects.

Ling 5802. Computational Linguistics. (3 cr; QP–5401 or #; SP–5801 or #)
Computer processing of natural language. Applications to such areas as speech recognition and information retrieval.

Ling 5900. Topics in Linguistics. (1-4 cr; SP–#)
Topics vary. See *Class Schedule.*

Ling 5931. Fundamentals of Contemporary English. (3 cr; QP–3001 or 3001H or 5001 or #; SP–3001 or 3011 or 5001 or #)
Word and sentence structure of contemporary English.

Ling 5932. Descriptive Studies of Modern English. (3 cr; QP–3001 or 3001H or 5001 or #; SP–3001 or 3011 or 5001, 5201 or 5931 or #)
Studies of selected aspects of the morphology, syntax, and/or semantics/pragmatics of modern English with emphasis on analysis of written or recorded texts.

Ling 5993. Directed Study. (1-3 cr; SP–#, Δ, ❑)
Directed study for Linguistics.

Ling 8005. Research Paper Workshop. (3 cr; SP–[5105, 5202, 5205, 5302] or [#, grad ling major]; S-N only)
Workshop on research methodology/writing in Linguistics.

Ling 8200. Topics in Syntax and Semantics. (3 cr [max 9 cr]; SP–5202, 5205 or #)
Syntax and semantics of natural language, with particular emphasis on the interface between the two.

Ling 8210. Seminar in Syntax. (3 cr; SP–5202, 5205 or #)
Current issues in syntactic theory. Topics vary.

Ling 8220. Seminar in Semantics. (3 cr [max 9 cr]; SP–5202, 5205, 5206 or #)
Current issues in semantics. Topics vary.

Ling 8221. Formal Semantics of Natural Language. (3 cr; QP–Phil 5201; SP–§Phil 8221; Phil 5201 or #; A-F only)
Truth-conditional model-theoretic semantics applied to treatment of opacity, intensionality, quantification, and related phenomena in natural language.

Ling 8300. Topics in Phonetics and Phonology. (3 cr [max 9 cr]; SP–5303 or #)

Ling 8320. Seminar in Phonology. (3 cr [max 9 cr]; SP–5303 or #)
Current issues in phonological theory. Topics vary.

Ling 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Ling 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

Ling 8500. Topics in Second Language Acquisition. (3 cr [max 9 cr]; SP–5001, 5505)

Ling 8531. Research Methods in Language Acquisition. (3 cr; SP–5001, 5505, 5506 or #)
Based on review of published research, students design and carry out their own studies, writing and presenting research reports at the end of the term. Focus on first or second language acquisition, or both, depending on instructor.

Ling 8666. Doctoral Pre-thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Ling 8777. Thesis Credits: Masters. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Ling 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Ling 8900. Seminar: Topics in Linguistics. (3 cr [max 9 cr]; SP–#)

Ling 8920. Topics in Language and Cognition. (3 cr [max 6 cr]; SP–5001 or #)
Language-related issues in cognitive science from a linguistic perspective. Serves as elective for cognitive science minor, but only for linguistics nonmajors.

Ling 8991. Independent Study. (1-4 cr [max 15 cr]; SP–#)

Logistics Management (LM)

Department of Marketing and Logistics Management

Curtis L. Carlson School of Management

LM 8892. Readings in Logistics Management. (1-8 cr [max 16 cr]; SP–Adviser consent or #)
Readings useful to student's individual program or objectives that are not available in regular courses.

LM 8894. Graduate Research in Logistics Management. (1-8 cr [max 16 cr]; SP–Adviser consent or #)
Individual research on an approved topic appropriate to student's program and objectives.

Management (Mgmt)

Department of Strategic Management and Organization

Curtis L. Carlson School of Management

Mgmt 5004. Negotiations. (2 cr; A-F only)
Art and science of securing agreements between two or more parties who are interdependent and who are seeking to maximize their own outcomes; understanding individual, group, and organizational behavior in the context of these competitive situations; theory and process of negotiation applied to broad spectrum of problems faced by managers and professionals.

Mgmt 5019. Business, Natural Environment, and Global Economy. (2 cr; SP–M.B.A. student; A-F only)
Resource deployment policies that affect the natural environment. Sustainability. Local/global environmental threats, how government policies address these issues. Business strategies/practices that produce "win-win" outcomes.

Mgmt 5050. Management of Innovation and Change. (2 cr; SP–3001, CSOM upper div; A-F only)
Applying theories/research on how new organizational programs, products, and technologies are developed/implemented. Diagnostic skills. How innovation unfolds.

Mgmt 5101. Advanced Topics. (4 cr; A-F only)
Specialized topics in management that vary and may include downsizing, ethics, trust, risk, alliances, organizational identity, organizational change, industry definition, team performance, organizational renewal, competitive advantage, hypercompetition, managing the knowledge worker, competence acquisition and preservation, and negotiation.

Mgmt 5175. Managing in Newly Emerging Global Markets. (2 cr)
Understanding the institutional and cultural environments in major new emerging markets. Focus is on two or three countries from emerging markets (such as China, India, Eastern Europe, Mexico, Brazil and others), the problems and opportunities provided by these environments, and how to do business in these countries.

Mgmt 5177. The Business Plan. (2 cr; SP–[4008, Acct 5160] or #; A-F only)
Understanding the structure of business plans. Critically analyzing business plans. Formulating an original business plan.

Mgmt 8101. Theory Building and Research Design. (4 cr; SP–Business admin Ph.D. student or #)
Problem formulation, conceptual modeling, theory building, and research design in the social and behavioral sciences.

Mgmt 8201. Foundations of Business, Government, and Society. (4 cr; SP–Business admin Ph.D. student or #; offered alt yrs)
Considers works in political and legal philosophy, ethics, and economics.

Mgmt 8202. Seminar in International Management. (4 cr; SP–Business admin Ph.D. student or #; offered alt yrs)
Overview of the field of international management research.

Mgmt 8203. International Management/Business, Government, and Society Seminar. (4 cr; SP–Business admin Ph.D. student or #)
Topics vary.

Mgmt 8301. Seminar in Organizational Behavior. (4 cr; SP–Business admin Ph.D. student or #; offered alt yrs)
Major theories and current research on individual behavior and group processes in organizations from a micro perspective.

Mgmt 8302. Seminar in Organizations Theory. (4 cr; SP–Business admin Ph.D. student or #; offered alt yrs)
Major theories and current research on organizational and interorganizational topics from a macro perspective.

Mgmt 8303. Organizations Seminar. (4 cr; SP–Business admin Ph.D. student or #)
Topics vary.

Mgmt 8401. Seminar in Strategy Content. (4 cr; SP–Business admin Ph.D. student or #; offered alt yrs)
Review of research in strategy formulation.

Mgmt 8402. Seminar in Strategy Process. (4 cr; SP–Business admin Ph.D. student or #; offered alt yrs)
Examines research on process by which strategy is formulated and implemented in firms.

Mgmt 8403. Strategy Seminar. (4 cr; SP–Business admin Ph.D. student or #)
Strategic management. Topics vary.

Mgmt 8892. Readings in Management Theory and Administration. (1-8 cr [max 16 cr]; SP–Business admin Ph.D. student or #, adviser consent)
Intensive research on a management topic; major term paper.

Mgmt 8894. Graduate Research in Management Theory and Administration. (1-8 cr [max 16 cr]; SP–Business admin Ph.D. student or #, adviser consent)
Research project on a management problem of interest to student; may be completed in cooperation with a business firm.

Management of Technology (MOT)

Institute of Technology

MOT 8111. Marketing Management in Technology-Based Organizations. (2 cr; QP–§MBA 8045; SP–Grad MOT major; A-F only)
Emphasizes marketing industrial products. Overall consideration of marketing strategy. Product strategy, including pricing, promotion, product mix, and sales and distribution decisions.

MOT 8112. Management Accounting. (2 cr; QP–§MBA 8035; SP–Grad MOT major; A-F only)
Introduction to methods for estimating and analyzing product costs and for using cost information to make product mix and pricing decisions. Cases from manufacturing firms illustrate principles of activity-based costing. Uses of cost data in managerial decision making, budgeting and control, and financial statement analysis.

MOT 8113. Operations Management for Competitive Advantage. (2.5 cr; QP–§MBA 8050, §OMS 5100; SP–Grad MOT major; A-F only)
Strategic framework to describe key relationships between operations and other business functions to achieve optimized operational decisions. Product-process design, production-inventory control. Quality improvement, quality-in-the-product development process. Just-in-time production, work force issues, role of technology.

MOT 8114. Strategic Technology Analysis. (1 cr; SP–Grad MOT major)
Technology, technology-related management procedures, general business disciplines, management functions. Developing a macro-mindset that is comprehensive, future-focused, global, and change-oriented.

MOT 8121. Managing in a Technological Environment. (2 cr; SP–Grad MOT major; A-F only)
General management principles with applications to management of professional, technical, and research and development personnel. Discussions, readings, cases, and projects.

MOT 8122. Financial Management for Technology-Based Organizations. (2 cr; QP–§MBA 8040; SP–Grad MOT major; A-F only)
Creating value within the organization. Financial methods important to managers of technology-based organizations, including budgeting capital, projecting financial needs, and managing working capital.

MOT 8133. Communications in a Technical Environment. (2 cr; SP–Grad MOT major; A-F only)
Oral and written communication. Introductory and specialized workshops on topics such as presentation skills, memo and report writing, listening skills, and visual aid design and integration.

MOT 8212. Managing Internal and External Interfaces in New Product Development. (2 cr; SP–Grad MOT major; A-F only)
Need for and problems of organizational integration in development of product policy. Execution of development process for the new product. Necessary organizational interactions among marketing, research and development, and operations in design and delivery of products.

MOT 8213. Business, Government, and Macroeconomics. (2 cr; QP–§MBA 8055; SP–Grad MOT major; A-F only)
Business-government relations, especially as they affect scientific and technical issues; global competitiveness; macro-economic policies influencing corporations' domestic and international strategies and operations. Effects of legal and economic forces on management and technical strategies of corporations.

MOT 8214. Technology Foresight and Forecasting. (2 cr; SP–Grad MOT major; A-F only)
Introduction to methods of technology assessment/forecasting. Application to study of the history of technology/industry. Technological developments and their economic, social, and industrial impacts.

MOT 8221. Project Management and Leadership. (2 cr; QP–§OMS 8041; SP–Grad MOT major; A-F only)
Principles and methods for planning and controlling a project, including development of a project plan, resource planning and scheduling (PERT/CPM), project monitoring, and termination. Leadership for effective teamwork. Skills to effectively manage interdisciplinary project teams.

MOT 8224. Pivotal Technologies. (2 cr; SP–MOT grad major; A-F only)
Technologies expected to play pivotal roles in industrial development. State-of-the-art technology, principal barriers to its commercialization. Student groups develop/present concepts for applying technology to industry. Lectures by guest experts, international field experience.

MOT 8231. Managing Information Resources in a Technology-Based Organization. (1.5 cr; QP–§IDSc 8101; SP–Grad MOT major; A-F only)
Information technologies such as database management systems and telecommunications. Managerial issues such as power/politics of information systems, role of information technology infrastructures, information systems as competitive weapons.

MOT 8232. Managing Innovation in a Technological Environment. (2 cr; A-F only)
Reviews managing innovation based on scientific studies. Inputs, processes, outputs of innovation ventures from concept through implementation. Focuses on developing a "road map" to guide an innovation manager. Conditions that facilitate/inhibit innovation. Typical patterns of innovation development. Adopting innovations developed elsewhere.

MOT 8233. Strategic Management of Technology. (2 cr; SP–Grad MOT major; A-F only)
Technology from perspective of a general manager as a key strategic resource for building competitive advantage of an organization. Important links between technology and strategic planning. Technology and global competition; creating, acquiring, and leveraging technology competence.

MOT 8234. Capstone Project. (1-2 cr [max 3 cr]; SP–Completion of two semesters, grad MOT major; A-F only)
Practicum carried out in cooperation with home organization of each participant. Full development, analysis, and proposed resolution of a significant issue. Students expected to perform adequate research in problem areas as well as apply concepts and methods learned in the MOT program working with a faculty adviser and a current organization mentor.

MOT 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

MOT 8900. Conflict Management. (0.5 cr; SP–Grad MOT major)
Theory and methods for applying conflict management techniques in organizations. Cooperative and competitive models of conflict, basics of bargaining, conflict strategies, communication styles, listening skills, dispute resolution, third-party mediation, and use of computers for conflict mediation.

MOT 8910. Corporate Responsibility. (1 cr; SP–Grad MOT major; A-F only)
Principles of stakeholder management. Ethical framework for responsible management of investors, employees, suppliers, customers, and external community. Moral leadership, trust in organizations, and quality control. New metaphors and techniques for managing the socially responsible organization.

MOT 8920. Science and Technology Policy. (1.5 cr; SP–MOT grad student; A-F only)
Contribution of science/technology to economic growth/development. Why characteristics of technology R&D necessitate government intervention. Role of government in science/technology R&D and policy. How Congress operates in science/technology areas. How to participate in workings of Congress.

MOT 8930. Topics in Emerging Technologies. (0.5 cr; SP–MOT grad student; S-N only)
Invited speakers give half- or full-day seminars on special topics in emerging technologies (e.g., energy systems, tissue engineering, thermal spray coating technology).

MOT 8940. Managing Intellectual Property. (0.5 cr; SP–MOT grad student; S-N only)
Characteristics of Intellectual Property (IP). Patents, trademarks, copyrights, know-how. Legal protection of IP. Effect of IPR acquisition, its asset valuation on company market valuation. IP as bargaining chip.

MOT 8950. International Residency. (1.5 cr; SP–MOT grad student; A-F only)
Twelve-day visit to educational/manufacturing organizations in Asia Pacific Region. Lectures by local university faculty on economic/managerial practices. Visits to plants, both domestically owned and joint ventures with U.S. companies. First-hand cultural/business experience. Written assignment required.

Manufacturing Systems (MS)

Institute of Technology

MS 5101. Manufacturing Strategy and Operations Management. (3 cr; SP–Grad MS major; A-F only)
Strategic roles of manufacturing, process technology, operations management, and market strategies; their impact on manufacturing. Overview of operations functions such as demand forecasting, capacity planning, inventory planning, inventory control, materials management, Kanban & JIT, facility selection, strategic alliances, and outsourcing.

MS 5102. Manufacturing Processes. (3 cr; SP–Grad MS major; A-F only)
Descriptions/models of commonly used manufacturing processes. Process descriptions, capabilities/performance, models relating process parameters to part/process characteristics, control. Different kinds of manufacturing processes. Lab.

MS 5103. Quality Engineering. (3 cr; SP–Grad MS major; A-F only)
Overview of statistical, engineering, and management approaches to quality improvement. Economics of quality. Quality improvement teams/organization. Information systems. Problem-solving. QFD. Reliability engineering. Design of experiments. Statistical process control. Process validation. Capabilities studies. Quality standards, audits, and certification. TQM.

MS 5104. Design of Manufacturing Systems. (3 cr; SP–Grad MS major; A-F only)
Design/analysis of flow lines, assembly systems, cellular manufacturing, flexible manufacturing, and automated systems. Control issues in facility layout, scheduling, batch sizing, group technology, and bottleneck management. Modeling/analysis of tools. Computer simulation/operations research).

MS 5105. Financial Decision Making in Manufacturing. (2 cr; SP–Grad MS major; A-F only)
Fundamental topics in engineering economics, such as risk and uncertainty, equity and debt, accounting, cost accounting, time value of money, investments, and capital. Skills developed in budget management, capital cost justification, cost estimation, value engineering, equipment depreciation and replacement, and creating business plans.

MS 5106. Intelligent Decision Support Systems in Engineering. (3 cr; SP–Grad MS major; A-F only)
Methods for identifying where to apply DSSs, technologies for building them, strategies for evaluating their effectiveness. Examples from many engineering areas.

MS 5107. Simulation of Manufacturing Systems. (1 cr; SP–MS grad student, #; A-F only)
Using integrated simulation/animation environment to create, analyze, andevaluate realistic models for various manufacturing, assembly, and material handling systems. Experimental design for simulation. Random number generation, selecting input distributions, evaluating simulation output.

MS 5199. Topics in Manufacturing Systems. (1 cr [max 3 cr]; SP–MS grad student; A-F only)
See *Class Schedule*.

MS 5201. Project Management. (1 cr; SP–Grad MS major; A-F only)
Practical understanding of project management. Project planning; scheduling; budgeting; staffing; task and cost control; and communicating with, motivating, and managing team members.

MS 5202. Technology Forecasting. (1 cr; SP–Grad MS major; A-F only)
Introduction to methods of technology assessment/forecasting. Applications to history of technology/industry. Technological developments and their economic, social, and industrial impacts.

MS 5203. Minimizing Environmental Impacts in Manufacturing. (2 cr; SP–Grad MS major; A-F only)
Process engineering approach to waste management and pollution control in the manufacturing industry. Regulatory framework. Waste minimization. Resource recovery. Chemical, physical, and biological treatment processes. Disposal practices. Case studies in treatment/disposal. Site visits.

MS 5204. Automated Machining Processes. (1 cr; SP–Grad MS major; A-F only)
Description and demonstration of automated machine tools and machining cells. Machining center configuration and operation, machine tool controller, machining code generation, in-process sensing and control, cell controllers, and system simulation.

MS 5205. Issues in Quality. (1 cr; SP–Grad MS major; A-F only)
Design/implementation of quality systems. Specifying the condition, process, and context for implementations. Technology in the service of quality. Applying technology to achieve customer interaction. International quality. The transplanted executive.

MS 5206. Industrial Safety. (1 cr; SP–Grad MS major; A-F only)
Occupational safety and health/product safety for engineers. Fundamental safety concepts, engineering intervention principles. Standards, laws, and regulations governing safety of work places/products. Hazards and their engineering control, the human element, management of safety/health.

MS 5207. Design for Manufacturability. (1 cr; SP–Grad MS major; A-F only)
Machine design practice plans for assembly of components into systems. Basic design principles.

MS 5208. Plasma Processing. (1 cr; SP–Grad MS major; A-F only)
Plasma coating processes, manufacturing issues. Details of technologies such as plasma spraying and diamond deposition. Lab demonstrations.

MS 5209. Micro Electrical Mechanical Systems. (1 cr; SP–Grad MS major; A-F only)
Introduces MEMS by presenting various microfabrication techniques such as integrated circuit microfabrication processes, bulk micromachining, bonding, and high-spectration processes. MEMS design processes. MEMS applications. Future of MEMS.

MS 5210. Robotics. (1 cr; SP–Grad MS major; A-F only)

MS 5211. Fabrication of Plastics and Composite Materials. (1 cr; SP–Grad MS major; A-F only)
Standard methods of making polymer and polymer composite parts. Standard test methods, both destructive and nondestructive. Students make polymer parts and test them. Lab.

MS 5502. ISE: Public Interactions. (1 cr [max 4 cr]; SP–ISE grad student; A-F only)
Techniques for effective public communication. How to run a successful public hearing. Resources for publishing public notices.

MS 5900. Directed Study. (1-3 cr; A-F only)
Directed study/research in manufacturing systems. Topics chosen in collaboration with instructor.

MS 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

MS 8760. Computer-assisted Product Realization: Capstone Project. (4 cr; SP–Grad manufacturing systems major; A-F only)
Students experience the complete part design to production process. Manufacturing process design and commercial software packages for use, in part, in process design.

Marathi (Mar)

Department of Asian Languages and Literatures

College of Liberal Arts

Mar 5992. Directed Readings. (3-5 cr [max 12 cr]; SP–#, Δ, ❑)
Individualized guided reading or study of modern Marathi texts.

Mar 5994. Directed Research. (3-5 cr [max 12 cr]; SP–#, Δ, ❑)
Directed research on a subject agreed upon by student and instructor.

Marketing (Mktg)

Department of Marketing and Logistics Management

Curtis L. Carlson School of Management

Mktg 8811. Seminar: Consumer Behavior. (4 cr; QP–MBA 8045 or 8210 or equiv; SP–MBA 6210 or equiv, business admin Ph.D. student or #; offered alt yrs)
Theories and research in consumer behavior and related disciplines of social and cognitive psychology. Perspective primarily from information processing or social cognition. Consumer categorization, memory, beliefs, attitudes, and attitude change.

Mktg 8831. Seminar: Inter-Organizational Relations. (4 cr; QP–MBA 8045 or 8210 or equiv; SP–MBA 6210 or equiv, business admin Ph.D. student or #; offered alt yrs)
From an efficiency perspective, inter-organizational networks involved in task of moving goods and services from point of production to point of consumption. Literature covering the functional, institutional, analytical, and methodological traditions, as well as the behavioral school of thought and transaction cost and relational contracting.

Mktg 8841. Seminar: Theory and Methods of Measurement. (4 cr; QP–MBA 8045 or 8210 or equiv; SP–MBA 6210 or equiv, business admin Ph.D. student or #; offered alt yrs)
Issues surrounding validity and reliability of measures developed as key indicators of constructs in a behavioral context. Various methods of measurement such as indicators of reliability, Multi-Trait Multi-Method, exploratory factor analysis, and confirmatory factor analysis using Lisrel.

Mktg 8851. Seminar: Marketing Management and Strategy. (4 cr; QP–MBA 8045 or 8210 or equiv; SP–MBA 6210 or equiv, business admin Ph.D. student or #; offered alt yrs)
Topics in marketing management and formulation and implementation of marketing strategies. Exposes students to diversity of thought, within marketing and the strategic management literature.

Mktg 8890. Seminar: Marketing Topics. (4 cr [max 8 cr]; QP–MBA 8045 or 8210 or equiv; SP–MBA 6210 or equiv, business admin Ph.D. student or #; offered alt yrs)
Current topics and problems of interest considered in depth. Topics vary with each offering.

Mktg 8892. Readings in Marketing. (1-8 cr [max 16 cr]; QP–MBA 8045 or 8210 or equiv; SP–MBA 6210 or equiv, business admin Ph.D. student or #)
Readings useful to student's individual program and objectives that are not available in regular courses.

Mktg 8894. Graduate Research in Marketing. (1-8 cr [max 16 cr]; QP–MBA 8045 or 8210 or equiv; SP–MBA 6210 or equiv, business admin Ph.D. student or #)
Individual research on an approved topic appropriate to student's program and objectives.

Master of Business Taxation (MBT)

Department of Strategic Management and Organization

Curtis L. Carlson School of Management

MBT 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Master of Healthcare Administration (MHA)

Curtis L. Carlson School of Management

MHA 8750. Seminar: Alternative Patterns of Healthcare. (2 cr; A-F only)
Social and psychological components of health and medical care. Organization and delivery of healthcare services, their problems and perspectives; focus on the patient, provider of care, and environment in which healthcare services are dispensed.

MHA 8762. Contemporary Problems in Healthcare. (2 cr; SP–Ph.D. student; A-F only)
Current concepts, problems, principles, and future developments of health and healthcare selected by students; developing models, based on current literature and research; verbal and written presentations from policy and issue perspectives.

MHA 8763. External Forces Affecting Health Services Delivery. (2 cr; SP–Ph.D. student; A-F only)
Guidance in development of concepts, models, and principles of financing, social policy making, and organizing and human resource development for health services delivery. Written paper and teaching presentation required.

MHA 8764. Research Applications to Health Services Delivery. (2 cr; SP–Ph.D. student; A-F only)
Tutorial guidance and supervised course development covering research design, application, analysis, and presentation in health services delivery.

MHA 8780. Non-Parametric Statistical Methods in Healthcare Research. (2 cr; QP–Theoretical stat course, parametric stat course; SP–Theoretical stat course, parametric stat course; A-F only)
Development of student-selected, non-parametric statistics and its application to health-care delivery and research.

MHA 8782. Research Practicum. (2 cr; SP–Ph.D. student; A-F only)
Field experience in healthcare research. Supervised independent and team research on selected topics and problems.

MHA 8790. Seminar: Political Aspects of Healthcare. (2 cr; SP–HSRP&A grad major or #; A-F only)
Interrelationships between government, politics, and healthcare; political and social basis of health legislation and community decision making in provision and modification of health services.

Materials Science (MatS)

Department of Chemical Engineering and Materials Science

Institute of Technology

MatS 5221. Introduction to Polymer Chemistry. (4 cr; QP–Chem 3302, 5502; SP–[Chem 2302, 3502] or #; A-F only)
Condensation, radical, ionic, emulsion, ring-opening, metal-catalyzed polymerizations. Chain conformation, solution thermodynamics, molecular weight characterization, physical properties.

MatS 5223W. Polymer Laboratory. (2 cr; QP–5610 or Chem 5610 or #; SP–5221 or Chem 5221 or 8221 or #; A-F only)
Synthesis, characterization, and physical properties of polymers. Free radical, condensation, emulsion, anionic polymerization. Infrared spectroscopy/gel permeation chromatography. Viscoelasticity, rubber elasticity, crystallization.

MatS 5517. Electron Microscopy. (3 cr; A-F only)
Transmission electron microscope, scattering and diffraction, electron sources, lenses, apertures and resolution, specimen preparation, diffraction patterns, kikuchi diffraction, planar defects, strain fields, high resolution imaging, X-ray spectrometry.

MatS 5521. Thin Films and Interfaces. (3 cr; QP–MatS 5013, upper div IT or grad.; SP–IT upper div or grad student, MatS 4013 or #)
Fundamentals of vacuum science; vapor pressures and thin film deposition processes (physical and chemical vapor deposition, sputtering, laser ablation); thermodynamics and kinetics of thin film growth; epitaxy; film stability and reactions; structure-property relationship; multilayers and diffusion barriers; characterization techniques to include photon, electron, and ion spectroscopies. Computer-based homework problems.

MatS 5531. Electrochemical Engineering. (3 cr; QP–MatS 5011, upper div IT or grad.; SP–MatS 3011 or #, upper div IT or grad)
Fundamentals of electrochemical engineering. Topics include electrochemical mass transfer electrokinetics, thermodynamics of cells, modern sensors, formation of thin films and microstructured materials. Computer-based problems will be assigned.

MatS 8001. Structure and Symmetry of Materials. (3 cr; A-F only)
Comprehensive description of structure of materials, including metals, semiconductors, organic crystals, polymers, and liquid crystals. Atomic and molecular ordering, influence of intermolecular forces on symmetry and structure. Principles of scattering and use of X-ray, neutron, and electron diffraction.

MatS 8002. Thermodynamics and Kinetics. (3 cr; A-F only)
First three laws of thermodynamics, free energy, equilibrium constants, fugacity and activity relationships, solution models, order-disorder transitions, phase transitions. Elementary statistical mechanics. Applications to materials systems, including surface energies, multicomponent equilibria, reaction kinetics, mass transport, diffusion.

MatS 8003. Electronic Properties. (3 cr; SP–#; A-F only)
Basic physical theory of bonding in metals, alloys, and semiconductors. Review of modern physics, statistical physics, and solid state physics. Structure of matter emphasizing electronic processes. Techniques for predicting and understanding electronic structure of solids. Transport theory, elementary theory of magnetism, and superconductivity.

MatS 8004. Mechanical Properties. (3 cr; A-F only)
Defects in crystalline materials, including point defects, dislocations, and grain boundaries. Structure and movement of defects related to mechanical behavior of materials. Tools used to understand crystals and crystallography.

MatS 8005. Dislocations and Interfaces. (3 cr; A-F only)
Structure and properties at an advanced level. Influence of bonding and crystallography on structures of dislocations cores. CSL and DSCL theory of grain boundaries and of structures of phase boundaries in heterojunctions including thin film epilayers. Effect of defects on electrical, optical, magnetic, and superconducting behavior of materials.

MatS 8211. Physical Chemistry of Polymers. (3 cr; QP–Undergrad physical chem; SP–Undergrad physical chem or #; A-F only)
Introduction to polymer physical chemistry. Chain conformations; thermodynamics of polymer solutions, blends, and copolymers; light, neutron, and X-ray scattering; dynamics in dilute solutions and polymer characterization; dynamics of melts and viscoelasticity; rubber elasticity, networks, and gels; glass transitions; crystallization.

MatS 8212. Solid State Reaction Kinetics. (3 cr; QP–8112; SP–8002)
Reactions between ceramic solids in terms of transport mechanisms. Thermodynamics of point defects in binary and ternary ionic solids, diffusion in the bulk and along line and surface defects, chemical and electrochemical potential gradients, reactions at interfaces, practical examples drawn from oxidation and solid/solid reactions of ceramics.

MatS 8213. Electronic Properties of Materials. (3 cr; SP–#; A-F only)
Band theory studied by tight binding, pseudopotential, K.P. and KKR techniques. Optical and transport properties. Experimental techniques for characterizing electronic properties, including photoemission, Auger spectroscopy, and optical spectroscopy. Microelectronic materials, metal-semiconductor, and other interface phenomena.

MatS 8214. Electronic Properties and Applications of Organic Materials. (3 cr; SP–#; A-F only)
Introduction to current and prospective applications of organic materials in electronic, electroluminescent, and photoconductive devices. Bonding, electronic structure, charge carriers, transport mechanisms, luminescence, and photoconductivity in molecular crystals and conducting polymers.

MatS 8215. Electronic Ceramics. (3 cr; SP–#; A-F only)
Electronic properties of ceramics; electronic and ionic conduction; dielectric behavior; ferroelectric, piezoelectric, pyroelectric, and electroptic properties. Relationships between structure (crystal structure, microstructure) and properties. Introduction to applications (e.g., capacitors, sensors, actuators.

MatS 8216. Contact and Fracture Mechanics. (3 cr; A-F only)
Theories of indentation contact and fracture resistance emphasizing structure/property relationships. Surfaces, thin film interfaces, coatings, and bulk behavior. Theoretical basis and experimental techniques for measuring mechanical behavior at the nano-scale. Lab exercises.

MatS 8218. Thin Film Growth and Epitaxy. (3 cr; A-F only)
Principles of epitaxial growth. Growth models, thermodynamics, kinetics, homoepitaxial growth, continuum models of homoepitaxial growth, models of heteroepitaxial growth, surfaces, interfaces, defects, coincident lattices, experimental methods of growth, characterization.

MatS 8219. Science of Porous Media. (3 cr; SP–§ChEn 5103, §ChEn 8103; A-F only)
Geometry and topology of porous materials. Fundamentals of flow, transports, and deformation in them. One- and two-phase Darcy flows, convective dispersion in microporous materials. Relations of macroscopic properties and behavior to microscopic structures and mechanisms. Nanoporous materials. Examples from nature and technology.

MatS 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

MatS 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

MatS 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

MatS 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

MatS 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

MatS 8993. Directed Study. (1-12 cr)

MatS 8994. Directed Research. (1-12 cr)

MatS 8995. Special Topics. (1-4 cr)
New or experimental courses offered by department or visiting faculty.

Mathematics (Math)

School of Mathematics
Institute of Technology

Math 5067. Actuarial Mathematics I. (4 cr; QP–5056, [one qtr [4xxx or 5xxx] [probability or statistics] course]; SP–4065, [one sem [4xxx or 5xxx] [probability or statistics] course])
Future lifetime random variable, survival function. Insurance, life annuity, future loss random variables. Net single premium, actuarial present value, net premium, net reserves.

Math 5068. Actuarial Mathematics II. (4 cr; QP–#; SP–5067)
Multiple decrement insurance, pension valuation. Expense analysis, gross premium, reserves. Problem of withdrawals. Regulatory reserving systems. Minimum cash values. Additional topics at instructor's discretion.

Math 5075. Mathematics of Options, Futures, and Derivative Securities I. (4 cr; QP–Two yrs calculus, basic computer skills; SP–Two yrs calculus, basic computer skills; A-F only)
Mathematical background (e.g., partial differential equations, Fourier series, computational methods, Black-Scholes theory, numerical methods—including Monte Carlo simulation). Interest-rate derivative securities, exotic options, risk theory. First course of two-course sequence.

Math 5076. Mathematics of Options, Futures, and Derivative Securities II. (4 cr; QP–#; SP–5075; A-F only)
Mathematical background such as partial differential equations, Fourier series, computational methods, Black-Scholes theory, numerical methods (including Monte Carlo simulation), interest-rate derivative securities, exotic options, risk theory.

Math 5165. Mathematical Logic I. (4 cr; QP–3262 or Phil 5201 or CSci course in theory of algorithms or #; SP–2283 or 3283 or Phil 5201 or CSci course in theory of algorithms or #)
Theory of computability: notion of algorithm, Turing machines, primitive recursive functions, recursive functions, Kleene normal form, recursion theorem. Propositional logic.

Math 5166. Mathematical Logic II. (4 cr; QP–#; SP–5165)
First-order logic: provability/truth in formal systems, models of axiom systems, Godel's completeness theorem. Godel's incompleteness theorem: decidable theories, representability of recursive functions in formal theories, undecidable theories, models of arithmetic.

Math 5248. Cryptology and Number Theory. (4 cr; QP–Soph math course; SP–Soph math course)
Classical cryptosystems. One-time pads, perfect secrecy. Public key ciphers: RSA, discrete log. Euclidean algorithm, finite fields, quadratic reciprocity. Message digest, hash functions. Protocols: key exchange, secret sharing, zero-knowledge proofs. Probablistic algorithms: pseudoprimes, prime factorization. Pseudo-random numbers. Elliptic curves.

Math 5251. Error-Correcting Codes, Finite Fields, Algebraic Curves. (4 cr; QP–Soph math course; SP–Soph math course)
Information theory: channel models, transmission errors. Hamming weight and distance. Linear codes and fields, check bits. Error processing: linear codes, Hamming codes, binary Golay codes. Euclidean algorithm. Finite fields, Bose-Chaudhuri-Hocquenghem codes, polynomial codes, Goppa codes, codes from algebraic curves.

Math 5285H. Honors: Fundamental Structures of Algebra I. (4 cr; QP–#; SP–[2243 or 2373 or 2573], [2283 or 2574 or 3283])
Review of matrix theory, linear algebra. Vector spaces, linear transformations over abstract fields. Group theory, including normal subgroups, quotient groups, homomorphisms, class equation, Sylow's theorems. Specific examples: permutation groups, symmetry groups of geometric figures, matrix groups.

Math 5286H. Honors: Fundamental Structures of Algebra II. (4 cr; QP–#; SP–5285)
Ring/module theory, including ideals, quotients, homomorphisms, domains (unique factorization, euclidean, principal ideal), fundamental theorem for finitely generated modules over euclidean domains, Jordan canonical form. Introduction to field theory, including finite fields, algebraic/transcendental extensions, Galois theory.

Math 5335. Geometry I. (4 cr; QP–[3251 or 3354 or 3551], [3261 or 3355 or 3552]; SP–[2243 or 2373 or 2573], [¶2263 or ¶2374 or ¶2574])
Advanced two-dimensional Euclidean geometry from a vector viewpoint. Theorems/problems about triangles/circles, isometries, connections with Euclid's axioms. Hyperbolic geometry, how it compares with Euclidean geometry.

Math 5336. Geometry II. (4 cr; QP–#; SP–5335)
Projective geometry, including: relation to Euclidean geometry, finite geometries, fundamental theorem of projective geometry. N-dimensional Euclidean geometry from a vector viewpoint. Emphasizes N=3, including: polyhedra, spheres, isometries.

Math 5345. Introduction to Topology. (4 cr; QP–[3252 or 3355], 3262]; SP–[2263 or 2374 or 2573], [¶2283 or ¶2574 or ¶3283])
Set theory. Euclidean/metric spaces. Basics of general topology, including compactness/connectedness.

Math 5378. Differential Geometry. (4 cr; QP–[3252 or 3355], 3262]; SP–[2263 or 2374 or 2573], [2283 or 2574 or 3283 or 5345])
Basic geometry of curves in plane and in space, including Frenet formula, theory of surfaces, differential forms, Riemannian geometry.

Math 5385. Introduction to Computational Algebraic Geometry. (4 cr; QP–3251 or 3354 or 3551; SP–2263 or 2374 or 2573)
Geometry of curves/surfaces defined by polynomial equations. Emphasizes concrete computations with polynomials using computer packages, interplay between algebra and geometry. Abstract algebra presented as needed.

Math 5467. Introduction to the Mathematics of Wavelets. (3 cr; QP–#; SP–[2243 or 2373 or 2573], [2283 or 2574 or 3283 or #]; [[2263 or 2374], 4567] recommended)
Background theory/experience in wavelets. Inner product spaces, operator theory, Fourier transforms applied to Gabor transforms, multi-scale analysis, discrete wavelets, self-similarity. Computing techniques.

Math 5481. Mathematics of Industrial Problems I. (4 cr; QP–Two yrs calc, familiarity with some programming language; SP–[2243 or 2373 or 2573], [2263 or 2374 or 2574], familiarity with some programming language)
Topics in industrial math, including crystal precipitation, air quality modeling, electron beam lithography. Problems treated both theoretically and numerically.

Math 5482. Mathematics of Industrial Problems II. (4 cr; QP–Two yrs calc, familiarity with some programming language; SP–[2243 or 2373 or 2573], [2263 or 2374 or 2574], familiarity with some programming language)
Topics in industrial math, including color photography, catalytic converters, photocopying.

Math 5485. Introduction to Numerical Methods I. (4 cr; QP–3261 or 3355 or 3551; some computer skills recommended; SP–2243 or 2373 or 2573; some computer skills recommended)
Solution of nonlinear equations in one variable. Interpolation, polynomial approximation, numerical integration/differentiation, numerical solution of initial-value problems.

Math 5486. Introduction To Numerical Methods II. (4 cr; QP–#; SP–5485)
Direct/iterative methods for solving linear systems, approximation theory, methods for eigenvalue problems, methods for systems of nonlinear equations, numerical solution of boundary value problems for ordinary differential equations.

Math 5487. Computational Methods for Differential and Integral Equations in Engineering and Science I. (4 cr; QP–5242; SP–4242)
Numerical methods for elliptic partial differential equations, integral equations of engineering and science. Methods include finite element, finite difference, spectral, boundary integral.

Math 5488. Computational Methods for Differential and Integral Equations in Engineering and Science II. (4 cr; QP–#; SP–5487)
Numerical methods for time-dependent partial differential equations of engineering/science. Methods include finite element, finite difference, spectral, boundary integral. Applications to fluid flow, elasticity, electromagnetism.

Math 5525. Introduction to Ordinary Differential Equations. (4 cr; QP–[3252 or 3355], 3262; SP–[2243 or 2373 or 2573], [2283 or 2574 or 3283])
Ordinary differential equations, solution of linear systems, qualitative/numerical methods for nonlinear systems. Linear algebra background, fundamental matrix solutions, variation of parameters, existence/uniqueness theorems, phase space. Rest points, their stability. Periodic orbits, Poincare-Bendixson theory, strange attractors.

Math 5535. Dynamical Systems and Chaos. (4 cr; QP–[3252 or 3355], [3261 or 3356]; SP–[2243 or 2373 or 2573], [2263 or 2374 or 2574])
Dynamical systems theory. Emphasizes iteration of one-dimensional mappings. Fixed points, periodic points, stability, bifurcations, symbolic dynamics, chaos, fractals, Julia/Mandelbrot sets.

Math 5583. Complex Analysis. (4 cr; QP–§5553; 3252 or 3355 or 3552; SP–2263 or 2374 or 2573)
Algebra, geometry of complex numbers. Linear fractional transformations. Conformal mappings. Holomorphic functions. Theorems of Abel/Cauchy, power series. Schwarz' lemma. Complex exponential, trig functions. Entire functions, theorems of Liouville/Morera. Reflection principle. Singularities, Laurent series. Residues.

Math 5587. Elementary Partial Differential Equations I. (4 cr; QP–1 yr soph calculus; SP–[2243 or 2373 or 2573], [2263 or 2374 or 2574])
Emphasizes partial differential equations w/physical applications, including heat, wave, Laplace's equations. Interpretations of boundary conditions. Characteristics, Fourier series, transforms, Green's functions, images, computational methods. Applications include wave propagation, diffusions, electrostatics, shocks.

Math 5588. Elementary Partial Differential Equations II. (4 cr; QP–1 yr soph calculus, #; SP–[2243 or 2373 or 2573], [2263 or 2374 or 2574]; 5587 not a prereq but see instructor; A-F only)
Heat, wave, Laplace's equations in higher dimensions. Green's functions, Fourier series, transforms. Asymptotic methods, boundary layer theory, bifurcation theory for linear/nonlinear PDEs. Variational methods. Free boundary problems. Additional topics as time permits.

Math 5615H. Honors: Introduction to Analysis I. (4 cr; QP–3262, 1 yr soph calculus; SP–[[2243 or 2373], [2263 or 2374], [2283 or 3283]] or 2574)
Axiomatic treatment of real/complex number systems. Introduction to metric spaces: convergence, connectedness, compactness. Convergence of sequences/series of real/complex numbers, Cauchy criterion, root/ratio tests. Continuity in metric spaces. Rigorous treatment of differentiation of single-variable functions, Taylor's Theorem.

Math 5616H. Honors: Introduction to Analysis II. (4 cr; QP–#; SP–5615)
Rigorous treatment of Riemann-Stieltjes integration. Sequences/series of functions, uniform convergence, equicontinuous families, Stone-Weierstrass Theorem, power series. Rigorous treatment of differentiation/integration of multivariable functions, Implicit Function Theorem, Stokes' Theorem. Additional topics as time permits.

Math 5651. Basic Theory of Probability and Statistics. (4 cr; QP–3262, 1 yr soph calculus; SP–§Stat 5101; [2263 or 2374 or 2573]; [[2243 or 2373], [2283 or 2574 or 3283]] recommended)
Logical development of probability, basic issues in statistics. Probability spaces, random variables, their distributions/expected values. Law of large numbers, central limit theorem, generating functions, sampling, sufficiency, estimation.

Math 5652. Introduction to Stochastic Processes. (4 cr; QP–#; SP–[2243 or 2373 or 2573], [5651 or Stat 5101])
Random walks, Markov chains, branching processes, martingales, queuing theory, Brownian motion.

Math 5654. Prediction and Filtering. (4 cr; QP–#; SP–[2243 or 2373 or 2573], [5651 or Stat 5101])
Markov chains, Wiener process, stationary sequences, Ornstein-Uhlenbeck process. Partially observable Markov processes (hidden Markov models), stationary processes. Equations for general filters, Kalman filter. Prediction of future values of partially observable processes.

Math 5705. Enumerative Combinatorics. (4 cr; QP–1 yr soph math; soph linear algebra recommended; SP–[2243 or 2373 or 2573], [2263 or 2283 or 2374 or 2574 or 3283])
Basic enumeration, bijections, inclusion-exclusion, recurrence relations, ordinary/exponential generating functions, partitions, Polya theory. Optional topics include trees, asymptotics, listing algorithms, rook theory, involutions, tableaux, permutation statistics.

Math 5707. Graph Theory and Non-enumerative Combinatorics. (4 cr; QP–One year of soph mathematics; [3262 or experience in writing proofs] highly recommended; SP–[2243 or 2373 or 2573], [2263 or 2374 or 2574]; [2283 or 3283 or experience in writing proofs] highly recommended)
Basic topics in graph theory: connectedness, Eulerian/Hamiltonian properties, trees, colorings, planar graphs, matchings, flows in networks. Optional topics include graph algorithms, Latin squares, block designs, Ramsey theory.

Math 5711. Linear Programming and Combinatorial Optimization. (4 cr; QP–Soph linear algebra; SP–2243 or 2373 or 2573)
Simplex method, connections to geometry, duality theory, sensitivity analysis. Applications to cutting stock, allocation of resources, scheduling problems. Flows, matching/transportation problems, spanning trees, distance in graphs, integer programs, branch/bound, cutting planes, heuristics. Applications to traveling salesman, knapsack problems.

Math 5900. Tutorial in Advanced Mathematics. (1-6 cr [max 120 cr]; A-F only)
Individually directed study.

Math 8001. Preparation for College Teaching. (1 cr; SP–!; math grad student in good standing or #; S-N only)
New approaches to teaching/learning, issues in mathematics education, components/expectations of a college mathematics professor.

Math 8141. Applied Logic. (3 cr; SP–#; A-F only)
Applying techniques of mathematical logic to other areas of mathematics and computer science. Sample topics: complexity of computation, computable analysis, unsolvability of diophantine problems, program verification, database theory. Course is generally self-contained.

Math 8142. Applied Logic. (3 cr [max 3 cr]; QP–8140; SP–#; A-F only)
Applying techniques of mathematical logic to other areas of mathematics, computer science. Complexity of computation, computable analysis, unsolvability of diophantine problems, program verification, database theory.

Math 8151. Axiomatic Set Theory. (3 cr; QP–5162-5163-5164; SP–5166 or #; A-F only)
Axiomatic development of basic properties of ordinal/cardinal numbers, infinitary combinatorics, well founded sets, consistency of axiom of foundation, constructible sets, consistency of axiom of choice and of generalized continuum hypothesis.

Math 8152. Axiomatic Set Theory. (3 cr; QP–8150; SP–8151 or #; A-F only)
Notion of forcing, generic extensions, forcing with finite partial functions, independence of continuum hypothesis, forcing with partial functions of infinite cardinalities, relationship between partial orderings and Boolean algebras, Boolean-valued models, independence of axiom of choice.

Math 8166. Recursion Theory. (3 cr; SP–Math grad student or #; A-F only)
Analysis of concept of computability, including various equivalent definitions. Primitive recursive, recursive, partial recursive functions. Oracle Turing machines. Kleene Normal Form Theorem. Recursive, recursively enumerable sets. Degrees of unsolvability. Arithmetic hierarchy.

Math 8167. Recursion Theory. (3 cr; QP–8166; SP–8166, #; A-F only)
Sample topics: complexity theory, recursive analysis, generalized recursion theory, analytical hierarchy, constructive ordinals.

Math 8172. Model Theory. (3 cr; SP–Math grad student or #; A-F only)
Interplay of formal theories, their models. Elementary equivalence, elementary extensions, partial isomorphisms. Lowenheim-Skolem theorems, compactness theorems, preservation theorems. Ultraproducts.

Math 8173. Model Theory. (3 cr; QP–8172, #; SP–8172 or #; A-F only)
Types of elements. Prime models, homogeneity, saturation, categoricity in power. Forking.

Math 8190. Topics in Logic. (1-3 cr [max 12 cr]; SP–#; offered for one year or one semester as circumstances warrant; A-F only)

Math 8201. General Algebra. (3 cr; QP–5xxx algebra or equiv; SP–4xxx algebra or equiv or #; A-F only)
Groups through Sylow, Jordan-Hölder theorems, structure of finitely generated Abelian groups. Rings and algebras, including Gauss theory of factorization. Modules, including projective and injective modules, chain conditions, Hilbert basis theorem, and structure of modules over principal ideal domains.

Math 8202. General Algebra. (3 cr; QP–8200; SP–8201 or #; A-F only)
Classical field theory through Galois theory, including solvable equations. Symmetric, Hermitian, orthogonal, and unitary form. Tensor and exterior algebras. Basic Wedderburn theory of rings; basic representation theory of groups.

Math 8207. Theory of Modular Forms and L-Functions. (3 cr; QP–8202; SP–8202 or #; A-F only)
Zeta and L-functions, prime number theorem, Dirichlet's theorem on primes in arithmetic progressions, class number formulas; Riemann hypothesis; modular forms and associated L-function; Eisenstein series; Hecke operators, Poincaré series, Euler products; Ramanujan conjectures; Theta series and quadratic forms; waveforms and L-functions.

Math 8208. Theory of Modular Forms and L-Functions. (3 cr; SP–8207 or #; A-F only)
Applications of Eisenstein series: special values and analytic continuation and functional equations of L-functions. Trace formulas. Applications of representation theory. Computations.

Math 8211. Commutative and Homological Algebra. (3 cr; QP–8202; SP–8202 or #; A-F only)
Selected topics.

Math 8212. Commutative and Homological Algebra. (3 cr; SP–8211 or #; A-F only)
Selected topics.

Math 8245. Group Theory. (3 cr; QP–8202; SP–8202 or #; A-F only)
Permutations, Sylow's theorems, representations of groups on groups, semi-direct products, solvable and nilpotent groups, generalized Fitting subgroups, p-groups, co-prime action on p-groups.

Math 8246. Group Theory. (3 cr; QP–8245; SP–8245 or #; A-F only)
Representation and character theory, simple groups, free groups and products, presentations, extensions, Schur multipliers.

Math 8251. Algebraic Number Theory. (3 cr; QP–8202; SP–8202 or #; A-F only)
Algebraic number fields and algebraic curves. Basic commutative algebra. Completions: p-adic fields, formal power series, Puiseux series. Ramification, discriminant, different. Finiteness of class number and units theorem.

Math 8252. Algebraic Number Theory. (3 cr; QP–8206; SP–8251 or #; A-F only)
Zeta and L-functions of global fields. Artin L-functions. Hasse-Weil L-functions. Tchebotarev density. Local and global class field theory. Reciprocity laws. Finer theory of cyclotomic fields.

Math 8253. Algebraic Geometry. (3 cr; QP–8202; SP–8202 or #; A-F only)
Curves, surfaces, projective space, affine and projective varieties. Rational maps. Blowing-up points. Zariski topology. Irreducible varieties, divisors.

Math 8254. Algebraic Geometry. (3 cr; QP–8203; SP–8253 or #; A-F only)
Sheaves, ringed spaces, and schemes. Morphisms. Derived functors and cohomology, Serre duality. Riemann-Roch theorem for curves, Hurwitz's theorem. Surfaces: monoidal transformations, birational transformations.

Math 8270. Topics in Algebraic Geometry. (1-3 cr [max 12 cr]; SP–Math 8201, Math 8202; offered for one year or one semester as circumstances warrant; A-F only)

Math 8271. Lie Groups and Lie Algebras. (3 cr; QP–8302; SP–8302 or #; A-F only)
Definitions and basic properties of Lie groups and Lie algebras; classical matrix Lie groups; Lie subgroups and their corresponding Lie subalgebras; covering groups; Maurer-Cartan forms; exponential map; correspondence between Lie algebras and simply connected Lie groups; Baker-Campbell-Hausdorff formula; homogeneous spaces.

Math 8272. Lie Groups and Lie Algebras. (3 cr; QP–8270; SP–8271 or #; A-F only)
Solvable and nilpotent Lie algebras and Lie groups; Lie's and Engels's theorems; semisimple Lie algebras; cohomology of Lie algebras; Whitehead's lemmas and Levi's theorem; classification of complex semisimple Lie algebras and compact Lie groups; representation theory.

Math 8280. Topics in Number Theory. (1-3 cr [max 12 cr]; SP–#; offered for one yr or one semester as circumstances warrant; A-F only)

Math 8300. Topics in Algebra. (1-3 cr [max 12 cr]; SP–Grad math major or #; offered as one yr or one sem crse as circumstances warrant; A-F only)
Selected topics.

Math 8301. Manifolds and Topology. (3 cr; QP–Some point-set topology, algebra; SP–[Some point-set topology, algebra] or #; A-F only)
Classification of compact surfaces, fundamental group/covering spaces. Homology group, basic cohomology. Application to degree of a map, invariance of domain/dimension.

Math 8302. Manifolds and Topology. (3 cr; QP–8300, #; SP–8301 or #; A-F only)
Smooth manifolds, tangent spaces, embedding/immersion, Sard's theorem, Frobenius theorem. Differential forms, integration. Curvature, Gauss-Bonnet theorem. Time permitting: de Rham, duality in manifolds.

Math 8306. Algebraic Topology. (3 cr; QP–8300, #; SP–8301 or #; A-F only)
Singular homology, cohomology theory with coefficients. Eilenberg-Stenrod axioms, Mayer-Vietoris theorem.

Math 8307. Algebraic Topology. (3 cr; QP–8306, #; SP–8306 or #; A-F only)
Basic homotopy theory, cohomology rings with applications. Time permitting: fibre spaces, cohomology operations, extra-ordinary cohomology theories.

Math 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Math 8360. Topics in Topology. (1-3 cr [max 12 cr]; SP–8301 or #; offered as one yr or one sem crse as circumstances warrant; A-F only)
Selected topics.

Math 8365. Riemannian Geometry. (3 cr; QP–8300 or basic point-set topology; SP–8301 or basic point-set topology or #; A-F only)
Riemannian metrics, curvature. Bianchi identities, Gauss-Bonnet theorem, Meyers's theorem, Cartan-Hadamard theorem.

Math 8366. Riemannian Geometry. (3 cr; QP–8365, #; SP–8365 or #; A-F only)
Gauss, Codazzi equations. Tensor calculus, Hodge theory, spinors, global differential geometry, applications.

Math 8370. Topics in Differential Geometry. (1-3 cr [max 12 cr]; QP–8300 or 8365; SP–8301 or 8365; offered for one yr or one sem as circumstances warrant; A-F only)
Current research in differential geometry.

Math 8380. Topics in Advanced Geometry. (1-3 cr [max 12 cr]; SP–8301, 8365, #; offered for one year or one semester as circumstances warrant; A-F only)

Math 8385. Calculus of Variations and Minimal Surfaces. (3 cr; QP–5xxx partial differential equations; SP–4xxx partial differential equations or #; A-F only)
Comprehensive exposition of calculus of variations and its applications. Theory for one-dimensional problems. Survey of typical problems. Necessary conditions. Sufficient conditions. Second variation, accessory eigenvalue problem. Variational problems with subsidiary conditions. Direct methods.

Math 8386. Calculus of Variations and Minimal Surfaces. (3 cr; QP–8560; SP–8595 or #; A-F only)
Theory of multiple integrals. Geometrical differential equations, i.e., theory of minimal surfaces and related structures (surfaces of constant or prescribed mean curvature, solutions to variational integrals involving surface curvatures), all extremals for variational problems of current interest as models for interfaces in real materials.

Math 8387. Mathematical Modeling of Industrial Problems. (3 cr; QP–[5xxx numerical analysis, some computer experience], #; SP–[5xxx numerical analysis, some computer experience] or #; A-F only)
Mathematical models from physical, biological, social systems. Emphasizes industrial applications. Modeling of deterministic/probabilistic, discrete/continuous processes; methods for analysis/computation.

Math 8388. Mathematical Modeling of Industrial Problems. (3 cr; QP–8580; SP–8597 or #; A-F only)
Techniques for analysis of mathematical models. Asymptotic methods; design of simulation and visualization techniques. Specific computation for models arising in industrial problems.

Math 8390. Topics in Mathematical Physics. (1-3 cr [max 12 cr]; QP–8600; SP–8601; offered for one yr or one sem as circumstances warrant; A-F only)
Current research.

Math 8401. Mathematical Modeling and Methods of Applied Mathematics. (3 cr; QP–5xxx numerical analysis and applied linear algebra; SP–4xxx numerical analysis and applied linear algebra or #; A-F only)
Dimension analysis, similarity solutions, linearization, stability theory, well-posedness, and characterization of type. Fourier series and integrals, wavelets, Green's functions, weak solutions and distributions.

Math 8402. Mathematical Modeling and Methods of Applied Mathematics. (3 cr; QP–8401, #; SP–8401 or #; A-F only)
Calculus of variations, integral equations, eigenvalue problems, spectral theory. Perturbation, asymptotic methods. Artificial boundary conditions, conformal mapping, coordinate transformations. Applications to specific modeling problems.

Math 8431. Mathematical Fluid Mechanics. (3 cr; QP–5xxx numerical analysis of partial differential equations; SP–5xxx numerical analysis of partial differential equations or #; A-F only)
Equations of continuity/motion. Kinematics. Bernoulli's theorem, stream function, velocity potential. Applications of conformal mapping.

Math 8432. Mathematical Fluid Mechanics. (3 cr; QP–8430, #; SP–8431 or #)
Plane flow of gas, characteristic method, hodograph method. Singular surfaces, shock waves, shock layers. Viscous flow, Navier-Stokes equations, exact solutions. Uniqueness, stability, existence theorems.

Math 8441. Numerical Analysis and Scientific Computing. (3 cr; QP–5xxx analysis, 5xxx applied linear algebra, #; SP–[4xxx analysis, 4xxx applied linear algebra] or #)
Approximation of functions, numerical integration. Numerical methods for elliptic partial differential equations, including finite element methods, finite difference methods, and spectral methods. Grid generation.

Math 8442. Numerical Analysis and Scientific Computing. (3 cr; QP–8441; SP–8441 or #; 5477-5478 recommended for engineering and science grad students)
Numerical methods for integral equations, parabolic partial differential equations, hyperbolic partial differential equations. Monte Carlo methods.

Math 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

Math 8445. Numerical Analysis of Differential Equations. (3 cr; QP–5xxx numerical analysis, 5xxx partial differential equations; SP–4xxx numerical analysis, 4xxx partial differential equations or #; A-F only)
Finite element and finite difference methods for elliptic boundary value problems (e.g., Laplace's equation) and solution of resulting linear systems by direct and iterative methods.

Math 8446. Numerical Analysis of Differential Equations. (3 cr; QP–8445, #; SP–8445 or #; A-F only)
Numerical methods for parabolic equations (e.g., heat equations). Methods for elasticity, fluid mechanics, electromagnetics. Applications to specific computations.

Math 8450. Topics in Numerical Analysis. (1-3 cr [max 12 cr]; SP–Grad math major or #; offered as one yr or one sem crse as circumstances warrant; A-F only)
Selected topics.

Math 8470. Topics in Mathematical Theory of Continuum Mechanics. (1-3 cr [max 12 cr]; SP–#; offered for one year or one semester as circumstances warrant; A-F only)

Math 8501. Theory of Ordinary Differential Equations. (3 cr; QP–5xxx ODE; SP–4xxx ODE or #; A-F only)
Existence, uniqueness, continuity, and differentiability of solutions. Linear theory and hyperbolicity. Basics of dynamical systems. Local behavior near a fixed point, a periodic orbit, and a homoclinic or heteroclinic orbit. Perturbation theory.

Math 8502. Dynamical Systems and Differential Equations. (3 cr; QP–8500; SP–8501 or #; A-F only)
Selected topics: stable, unstable, and center manifolds. Normal hyperbolicity. Nonautonomous dynamics and skew product flows. Invariant manifolds and quasiperiodicity. Transversality and Melnikov method. Approximation dynamics. Morse-Smale systems. Coupled oscillators and network dynamics.

Math 8503. Bifurcation Theory in Ordinary Differential Equations. (3 cr; QP–8500; SP–8501 or #; A-F only)
Basic bifurcation theory, Hopf bifurcation, and method averaging. Silnikov bifurcations. Singular perturbations. Higher order bifurcations. Applications.

Math 8505. Applied Dynamical Systems and Bifurcation Theory I. (3 cr; QP–5522 or 5533; SP–5525 or 8502 or #; A-F only)
Static/Hopf bifurcations, invariant manifold theory, normal forms, averaging, Hopf bifurcation in maps, forced oscillations, coupled oscillators, chaotic dynamics, co-dimension 2 bifurcations. Emphasizes computational aspects/applications from biology, chemistry, engineering, physics.

Math 8506. Applied Dynamical Systems and Bifurcation Theory II. (3 cr; QP–5522, 5573; SP–5587 or #; A-F only)
Background on analysis in Banach spaces, linear operator theory. Lyapunov-Schmidt reduction, static bifurcation, stability at a simple eigenvalue, Hopf bifurcation in infinite dimensions invariant manifold theory. Applications to hydrodynamic stability problems, reaction-diffusion equations, pattern formation, and elasticity.

Math 8520. Topics in Dynamical Systems. (1-3 cr [max 12 cr]; QP–8502; SP–8502, #; offered for one yr or one sem as circumstances warrant; A-F only)
Current research.

Math 8530. Topics in Ordinary Differential Equations. (1-3 cr; QP–8502, #; SP–8502, #; offered for one year or one semester as circumstances warrant; A-F only)

Math 8540. Topics in Mathematical Biology. (1-3 cr [max 12 cr]; SP–#; A-F only)
Offered for one year or one semester as circumstances warrant.

Math 8571. Theory of Evolutionary Equations. (3 cr; QP–8502; SP–8502 or #; A-F only)
Infinite dimensional dynamical systems, global attractors, existence and robustness. Linear semigroups, analytic semigroups. Linear and nonlinear reaction diffusion equations, strong and weak solutions, well-posedness of solutions.

Math 8572. Theory of Evolutionary Equations. (3 cr; QP–8570, #; SP–8571 or #; A-F only)
Dynamics of Navier-Stokes equations, strong/weak solutions, global attractors. Chemically reacting fluid flows. Dynamics in infinite dimensions, unstable manifolds, center manifolds perturbation theory. Inertial manifolds, finite dimensional structures. Dynamical theories of turbulence.

Math 8580. Topics in Evolutionary Equations. (1-3 cr [max 12 cr]; SP–8572 or #; offered for one yr or one semester as circumstances warrant; A-F only)

Math 8581. Applications of Linear Operator Theory. (3 cr; QP–5xxx applied mathematics, #; SP–4xxx applied mathematics or #; A-F only)
Metric spaces, continuity, completeness, contraction mappings, compactness. Normed linear spaces, continuous linear transformations. Hilbert spaces, orthogonality, projections.

Math 8582. Applications of Linear Operator Theory. (3 cr; QP–8406, #; SP–8581 or #; A-F only)
Fourier theory. Self-adjoint, compact, unbounded linear operators. Spectral analysis, eigenvalue-eigenvector problem, spectral theorem, operational calculus.

Math 8583. Theory of Partial Differential Equations. (3 cr; QP–Some 5xxx PDE, 8601; SP–[Some 5xxx PDE, 8601] or #; A-F only)
Classification of partial differential equations/characteristics. Laplace, wave, heat equations. Some mixed problems.

Math 8584. Theory of Partial Differential Equations. (3 cr; QP–8550; SP–8583 or #; A-F only)
Fundamental solutions/distributions, Sobolev spaces, regularity. Advanced elliptic theory (Schauder estimates, Garding's inequality). Hyperbolic systems.

Math 8590. Topics in Partial Differential Equations. (1-3 cr; QP–8602; SP–8602; offered for one yr or one sem as circumstances warrant; A-F only)
Research topics.

Math 8600. Topics in Advanced Applied Mathematics. (1-3 cr [max 12 cr]; SP–#; offered for one yr or one semester as circumstances warrant; S-N only)

Math 8601. Real Analysis. (3 cr; QP–5613 or equiv; SP–5616 or #; A-F only)
Set theory/fundamentals. Axiom of choice, measures, measure spaces, Borel/Lebesgue measure, integration, fundamental convergence theorems, Riesz representation.

Math 8602. Real Analysis. (3 cr; QP–8600, #; SP–8601 or #; A-F only)
Radon-Nikodym, Fubini theorems. C(X). Lp spaces (introduction to metric, Banach, Hilbert spaces). Stone-Weierstrass theorem. Basic Fourier analysis. Theory of differentiation.

Math 8640. Topics in Real Analysis. (3 cr [max 12 cr]; QP–8602; SP–8602 or #; offered for one yr or one sem as circumstances warrant; A-F only)
Current research.

Math 8641. Spatial Ecology. (3 cr; QP–Three qtrs calculus, theoretical population ecology or six qtrs more robust calculus, course in statistics or probability; SP–Two semesters calculus, theoretical population ecology or four semesters more robust calculus, course in statistics or probability or #; S-N only)
Introduction: role of space in population dynamics and interspecific interaction; includes single species and multispecies models, deterministic and stochastic theory, different modeling approaches, effects of implicit/explicit space on competition, pattern formation, stability diversity and invasion. Recent literature. Computer lab.

Math 8651. Theory of Probability Including Measure Theory. (3 cr; QP–5613; SP–5616 or #)
Probability spaces. Distributions/expectations of random variables. Basic theorems of Lebesque theory. Stochastic independence, sums of independent random variables, random walks, filtrations. Probability, moment generating functions, characteristic functions. Laws of large numbers.

Math 8652. Theory of Probability Including Measure Theory. (3 cr; QP–8656; SP–8651 or #)
Conditional distributions and expectations, convergence of sequences of distributions on real line and on Polish spaces, central limit theorem and related limit theorems, Brownian motion, martingales and introduction to other stochastic sequences.

Math 8654. Fundamentals of Probability Theory and Stochastic Processes. (3 cr; QP–8656 or 8602; SP–8651 or 8602 or #)
Review of basic theorems of probability for independent random variables; introductions to Brownian motion process, Poisson process, conditioning, Markov processes, stationary processes, martingales, super- and sub-martingales, Doob-Meyer decomposition.

Math 8655. Stochastic Calculus with Applications. (3 cr; QP–8654 or 8692; SP–8654 or 8659 or #)
Stochastic integration with respect to martingales, Ito's formula, applications to business models, filtering, and stochastic control theory.

Math 8659. Stochastic Processes. (3 cr; SP–8652 or #)
In-depth coverage of various stochastic processes and related concepts, such as Markov sequences and processes, renewal sequences, exchangeable sequences, stationary sequences, Poisson point processes, Levy processes, interacting particle systems, diffusions, and stochastic integrals.

Math 8660. Topics in Probability. (1-3 cr [max 12 cr]; SP–#; offered for one yr or one semester as circumstances warrant)

Math 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Math 8668. Combinatorial Theory. (3 cr; A-F only)
Basic enumeration, including sets and multisets, permutation statistics, inclusion-exclusion, integer/set partitions, involutions and Polya theory. Partially ordered sets, including lattices, incidence algebras, and Mobius inversion. Generating functions.

Math 8669. Combinatorial Theory. (3 cr; QP–8668; SP–8668 or #; A-F only)
Further topics in enumeration, including symmetric functions, Schensted correspondence, and standard tableaux; non-enumerative combinatorics, including graph theory and coloring, matching theory, connectivity, flows in networks, codes, and extremal set theory.

Math 8680. Topics in Combinatorics. (1-3 cr [max 12 cr]; SP–Grad math major or #; offered as one yr or one sem crse as circumstances warrant; A-F only)
Selected topics.

Math 8701. Complex Analysis. (3 cr; QP–5613; SP–5616 or #; A-F only)
Foundations of holomorphic functions of one variable; relation to potential theory, complex manifolds, algebraic geometry, number theory. Cauchy's theorems, Poisson integral. Singularities, series, product representations. Hyperbolic geometry, isometries. Covering surfaces, Riemann-Hurwitz formula. Schwarz-Christoffel polygonal functions. Residues.

Math 8702. Complex Analysis. (3 cr; QP–8700, #; SP–8701 or #; A-F only)
Riemann mapping, uniformization, Dirichlet problem. Dirichlet principle, Green's functions, harmonic measures. Approximation theory. Complex analysis on tori (elliptic functions, modular functions, conformal moduli). Complex dynamical systems (Julia sets, Mandelbrot set).

Math 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Math 8790. Topics in Complex Analysis. (1-3 cr [max 12 cr]; QP–8702; SP–8702 or #; offered for one yr or one sem as circumstances warrant; A-F only)
Current research.

Math 8801. Functional Analysis. (3 cr; QP–8602; SP–8602 or #; A-F only)
Motivation in terms of specific problems (e.g., Fourier series, eigenfunctions). Theory of compact operators. Basic theory of Banach spaces (Hahn-Banach, open mapping, closed graph theorems). Frechet spaces.

Math 8802. Functional Analysis. (3 cr; QP–8800; SP–8801 or #; A-F only)
Spectral theory of operators, theory of distributions (generalized functions), Fourier transformations and applications. Sobolev spaces and pseudo-differential operators. C-star algebras (Gelfand-Naimark theory) and introduction to von Neumann algebras.

Math 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Math 8990. Topics in Mathematics. (1-6 cr [max 24 cr]; SP–#; S-N only)
Readings, research.

Math 8991. Independent Study. (1-6 cr [max 24 cr]; SP–#; S-N only)
Individually directed study.

Math 8992. Directed Reading. (1-6 cr [max 24 cr]; SP–#; S-N only)
Individually directed reading.

Math 8993. Directed Study. (1-6 cr [max 24 cr]; SP–#; S-N only)
Individually directed study.

Mathematics Education (MthE)

Department of Curriculum and Instruction
College of Education and Human Development

MthE 5011. Arithmetic Structures in School Mathematics. (3 cr; SP–Enrollment in math init lic program or tchg exper)
Pedagogy, content, and instructional strategies for teaching arithmetic. Content and issues relevant to the K-8 mathematics curriculum. Instructional materials and technology appropriate for elementary or middle school arithmetic. Credit hours and targeted level vary with particular classes.

MthE 5021. Algebraic Structures in School Mathematics. (3 cr; SP–Tchg exper or #)
Pedagogy, content, and instructional strategies for teaching arithmetic. Content and issues relevant to the algebra curriculum. Instructional materials and technology appropriate for arithmetic. Each offering of the course will focus on either elementary/middle or middle/secondary grade levels.

MthE 5031. Geometric Structures in School Mathematics. (3 cr; SP–Enrollment in math init lic program)
Pedagogy, content, and instructional strategies for teaching school geometry. Content and issues relevant to the geometry curriculum. Instructional materials and technology appropriate for geometry. Each offering will focus on either elementary/middle or middle/secondary grade levels.

MthE 5100. Topics in Mathematics Education. (1-6 cr [max 9 cr]; SP–Ed or grad student)
Issues, materials, and instructional techniques focusing on a single current topic of particular relevance to secondary school and college mathematics teachers.

MthE 5101. Teaching Elementary School Mathematics. (3 cr; SP–Tchg license or student elem ed M.Ed. or special ed or #)
Modern trends, methods, and materials used to convey mathematical ideas.

MthE 5155. Rational Number Concepts and Proportionality. (3 cr; QP–Educ student or #; SP–Educ student or #)
The relationship between the development of rational number concepts and proportional reasoning skills. Examination of how newer school curricula treat these concepts. Application of materials in the classroom and analysis of results. Reading and responding to current research.

MthE 5161. Developing Leadership in School Mathematics. (3 cr; QP–Tchg exper or #; SP–Tchg exper or #)
Current developments in the psychology and pedagogy of mathematics education as related to the evolving nature of mathematics education objectives. Emerging use of technology in the mathematics classroom. Techniques for the development of supervisory abilities. Characteristics of effective staff development.

MthE 5170. Historical Topics in the Mathematics Classroom. (1-3 cr)
Historical underpinnings of school mathematics content and methodology. Cross-cultural contributions in the development of mathematical ideas. Development of lessons, activities, and materials for school use.

MthE 5171. Teaching Problem Solving. (3 cr)
Investigation of fundamental concepts and principles of problem solving, reasoning, and proof. Emphasis on activities and applications appropriate for junior and senior high classes. Pedagogical experiences to prepare teachers to teach problem solving, reasoning, and proof in classrooms.

MthE 5172. Teaching Probability and Statistics. (3 cr)
Investigation of fundamental concepts and principles of probability and statistics. Emphasis on activities and applications appropriate for junior and senior high school classes. Pedagogical experiences to prepare teachers to integrate quantitative literacy accurately and effectively in classrooms.

MthE 5174. Ethics, Psychophysical Human Development, and the Internet. (1 cr)
Investigation of concepts and themes common to ethics, mathematics, physical science, human development, and the Internet. Emphasis on developing understanding of fundamental concepts and principles, on problem solving in a distributed intelligence environment (WWW) and on activities appropriate for K-12 classes.

MthE 5313. Teaching and Learning Mathematics in the Middle School. (3 cr; SP–Tchg exper or #)
Mathematics learning, instruction methods, mathematical topics, and assessment procedures appropriate for the middle grades. Examination of newer curricular materials. Illustration of successful instructional techniques. Discussion of the relationship between the nature of the learner and effective instruction.

MthE 5314. Teaching and Learning Mathematics. (3 cr; SP–Math ed M.Ed. or grad student or #)
Methods, materials, and curriculum development; principles of learning; review of research; preparation and evaluation of tests, units, and materials of instruction; recent developments in mathematics curriculum and instructional alternatives; issues in teaching and learning; program planning and evaluation.

MthE 5355. Mathematics for Diverse Learners. (3 cr; SP–Teaching license or student in elem ed or special ed or #)
Mathematical concepts and methods for exceptional students, both low achieving and gifted. Experimental materials and methods designed for underachieving students.

MthE 5366. Technology-Assisted Mathematics Instruction. (3 cr)
Technology—including computers, programmable and graphing calculators, and video—as instructional tools in mathematics; design and evaluation of technology-based mathematics lessons; the effect of technology on the mathematics curriculum; managing the technology-enriched classroom.

MthE 5696. Student Teaching in Mathematics. (1-8 cr [max 8 cr]; SP–M.Ed./init lic student or #; S-N only)
Student teaching in secondary school mathematics classes.

MthE 5993. Directed Studies in Mathematics Education. (2 cr; SP–Math ed M.Ed. student, #; S-N only)
Secondary school classroom teaching project to improve specific teaching skills, planned by student, approved/directed by student's adviser.

MthE 8501. Theory and Classical Research in Mathematics Education. (3 cr; SP–Grad math educ major)
Critical review of research and relevant theoretical formulations; criteria for appraising research methods; educational implications.

MthE 8571. Research in Mathematics Education. (3 cr; SP–5313, 8501)
Designed for advanced graduate students in mathematics education. Presentation and discussion of Ph.D. thesis proposals and other contemporary research.

MthE 8591. Seminar: Mathematics Education. (1-3 cr; SP–Math educ Ph.D. student)
Problems of mathematics instruction from kindergarten through junior college; opportunity to develop proposals and design models for empirical research.

MthE 8995. Problems: Mathematics Education. (1-3 cr [max 12 cr]; SP–Ph.D. educ major with math educ concentration)
Students survey most recent literature and design and prepare research reports on special topics.

Mechanical Engineering (ME)

Department of Mechanical Engineering

Institute of Technology

ME 5080. Topics in Mechanical Engineering. (4 cr; QP–IT upper div or grad student; SP–Upper div IT or grad student, submission of permission form, #)
Topics vary each semester.

ME 5090. Advanced Engineering Problems. (1-4 cr; QP–Subject to approval of department form; SP–ME upper div, #)
Special investigations in various fields of mechanical engineering and related areas including an independent study project.

ME 5101. Vapor Cycle Systems. (4 cr; QP–IT or grad student, ME 3303; SP–IT upper div or grad student; A-F only)
Vapor compression and absorption refrigeration systems; heat pumps; vapor power cycle analysis, regeneration, reheat, compound cycle modifications, combines gas turbine—vapor cycle systems.

ME 5103. Thermal Environmental Engineering. (4 cr; QP–IT or grad student, 3303, 5342; SP–IT upper div or grad, 3322 or 3323; A-F only)
Thermodynamic properties of moist air; psychrometric charts; HVAC systems; solar energy; human thermal comfort; indoor air quality; heating and cooling loads in buildings.

ME 5105. HVAC System Design. (4 cr; QP–IT upper div or grad student, ME 3303, ME 5342; SP–IT upper div or grad student, 3322 or 3323; A-F only)
Design procedures used for heat exchangers, cooling towers, hydronic systems, and air handling systems. HVAC system design for a commercial building.

ME 5113. Aerosol/Particle Engineering. (4 cr; QP–IT upper div or grad student, 3303; SP–IT upper div or grad student; A-F only)
Kinetic theory, definition, theory and measurement of particle properties, elementary particle mechanics, particle statistics; Brownian motion and diffusion, coagulation, evaporation and condensation, sampling and transport.

ME 5115. Air Quality and Air Pollution Control. (4 cr; QP–IT upper div or grad student; SP–IT upper div or grad student; A-F only)
Air pollution sources, atmospheric transport, transformations, fate, and emissions control. Air pollution meteorology, dispersion, chemistry of secondary pollutant formation, standards and regulation. Control devices and techniques for gaseous and particulate emissions. Cyclones, electrostatic precipitators, wet and dry scrubbers, combustion modification.

ME 5116. Cleanroom Technology and Particle Monitoring. (4 cr; QP–IT upper div or grad student, 3303 or #; SP–IT upper div or grad student; A-F only)
Fundamentals of clean room technology for microelectronics manufacturing; airborne and liquid-borne particulate contaminants; particle monitors: optical and condensation particle counters, wafer surface scanner, microscopy; filter performance and testing; clean room design and operation; high purity systems; particle detection in processing equipment.

ME 5133. Aerosol Measurement Laboratory. (4 cr; QP–IT upper div or graduate student, #; SP–IT upper div or graduate student; A-F only)
Principles of aerosol measurement. Single particle analysis by optical and electron microscopy. Aerosol samplers and inertial collectors. Integral mass concentration and number concentration detectors. Size distribution by laser particle counter and differential mobility particle sizer. Aerosol generation and instrument calibration.

ME 5221. Computer-Assisted Product Realization. (4 cr; QP–IT or grad student, 5260 or equiv; SP–3221, AEM 3031, CSci 1113, MatS 2001; A-F only)
Injection molding with emphasis on design of manufacturing processes. Tooling design and specification of processing conditions using computer-based tools; process simulation software and computer-controlled machine tools. Simultaneous process and part design. Production of tooling and parts. Part evaluation.

ME 5223. Materials in Design. (4 cr; QP–IT upper div or grad student, 5260 or equiv; SP–3221)
Fundamental properties of engineering materials. Fabrication, treatment. Physical and corrosive properties. Failure mechanism, cost and value analysis as related to material selection and specification.

ME 5228. Introduction to Finite Element Modeling, Analysis, and Design. (4 cr; QP–IT upper div or grad student, 3020, AEM 3016, Math 3261, FORTRAN; SP–IT upper div or grad, 3221, AEM 3031, CSci 1113, MatS 2001; A-F only)
Finite elements as principal analysis tool in computer-aided design (CAD); theoretical issues and implementation aspects for modeling and analyzing engineering problems encompassing stress analysis, heat transfer, and flow problems for linear situations. One-, two-, and three-dimensional practical engineering applications.

ME 5231. Digital and Analog Control Laboratory. (4 cr; QP–IT or grad student; SP–ME or AEM upper div or grad student, 5281 or equiv; A-F only)
Lab experiments illustrate and apply control theory to mechanical engineering systems. Emphasis on real-life control design and implementation, including dynamic modeling, controller design, analysis and simulation, hardware implementation, measurement techniques, sensor calibration, data acquisition, and processing.

ME 5241. Computer-Aided Engineering. (4 cr; QP–IT or grad student, 3020, 3203, 3205; SP–IT upper div or grad, 3222, CSci 1113 or equiv; A-F only)
Apply computer-aided engineering to mechanical design. Engineering design projects and case studies using computer-aided design and finite element analysis software; design optimization and computer graphical presentation of results.

ME 5243. Advanced Mechanism Design. (4 cr; QP–IT or grad student, 3203 or equiv; SP–Upper div IT or grad, 3222 or equiv, basic kinematics and dynamics of machines; knowledge of CAD packages such as Pro-E helpful; A-F only)
Analytical methods of kinematic, dynamic, and kinetoelastodynamic analysis and synthesis of mechanisms. Computerized design for function, path, and motion generation based on Burmeister theory.

ME 5247. Stress Analysis, Sensing, and Transducers. (4 cr; QP–IT upper div or grad student, AEM 3016; SP–AEM 3031, MatS 2001; A-F only)
Electrical resistance strain gage theory and technology. Gage characteristics, selection, and use. Bridge circuits and temperature and stray strain compensation. Signal conditioning. Data analysis. Photoelasticity techniques. Interpretation of fringe patterns. Sensor principles and performance. Transducer design and characterization.

ME 5248. Vibration Engineering. (4 cr; QP–IT or grad student, ME 3201 or equivalent; SP–Upper div IT or grad, 3281)
Apply vibration theory to design; optimize isolators, detuning mechanisms, viscoelastic suspensions and structures. Use modal analysis methods to describe free vibration of complex systems, relating to both theoretical and test procedures.

ME 5281. Analog and Digital Control. (4 cr; QP–IT or grad student, ME 5283; SP–3281)
Continuous and discrete time feedback control systems. Frequency response, stability, poles and zeros; transient responses; Nyquist and Bode diagrams; root locus; lead-lag and PID compensators, Nicols-Ziegler design method. Digital implementation aliasing; computer-aided design and analysis of control system.

ME 5286. Robotics. (4 cr; QP–IT or grad student, ME 5283; SP–Upper div ME or AEM or CSci or grad student, 5281 or equiv; A-F only)
Manipulator forward and inverse kinematics, homogeneous transformations and coordinate frames, the Jacobian and velocity control, task primitives and programming, computational issues; determining path trajectories; reaction forces; manipulator dynamics and control; vehicle kinematics, dynamics and guidance. Lab project demonstrates concepts.

ME 5288. Modeling and Simulation of Dynamic Systems. (4 cr; QP–IT or grad student, 5283 or equiv; SP–IT upper div or grad, 5281; A-F only)
Bond graphs as structured methodology for developing unified models of mechanical, electrical, magnetic, fluid, thermal, and hybrid systems. Causality and formulation of state-space equations. Analytical and numerical solution of equations of motion. Multiport fields, rigid body dynamics, and distributed parameter systems.

ME 5341. Case Studies in Thermal Engineering and Design. (4 cr; QP–IT or grad student, 5342; SP–IT upper div or grad student, 3321, 3322; A-F only)
Characteristics of applied heat transfer problems: nature of problem specification, incompleteness of needed knowledge base, accuracy issues. Categories of applied heat transfer problems (e.g., materials processing, turbomachinery, cooling of electronic equipment, biomedical thermal therapeutic devices, heat exchangers, HVAC systems).

ME 5344. Thermodynamics of Fluid Flow with Applications. (4 cr; SP–3321, 3322, [IT upper div or grad student]; A-F only)
Conservation of mass, momentum, and energy for compressible gas flows. Relevant thermodynamic properties. Nozzles, diffusers, thrust producers, shocks. Fluid-wall frictional interactions. Wall heat transfer, internal heat release. Temperature recovery. Mass addition. Chemical thermodynamics/ applications.

ME 5348. Heat Transfer in Electronic Equipment. (4 cr; QP–IT or grad student, 5342; SP–Upper div IT or grad student, 3322 or 3324)
Technology trends and packaging needs of microelectronic components; thermal characteristics, heat transfer mechanisms, and thermal failure modes of modern electronic and microelectronic equipment; reliability prediction techniques; thermal stress and strain in layered structures and solder joints.

ME 5351. Computational Heat Transfer. (4 cr; QP–IT or grad student, 5342; SP–IT upper div or grad student, 3322; A-F only)
Numerical solution of heat conduction and analogous physical processes. Develop and use a computer program to solve complex problems involving steady and unsteady heat conduction, flow and heat transfer in ducts, flow in porous media, and other special applications.

ME 5361. Plasma-Aided Manufacturing. (4 cr; QP–IT upper div or grad student, 3301, 5342 or equiv; SP–§EE 5611, upper div IT or grad student, 3321, 3322 or equiv; A-F only)
Properties of plasmas as a processing medium, process control and system design considerations using specific examples of plasma spray coating, welding, and microelectronics processing.

ME 5381. Biological Transport Processes. (4 cr; QP–IT upper div or grad student, CE 3400 or equiv; SP–§ChEn 5753, §BMEn 5310, upper div IT or grad student, transport class [3322 or ChEn 5103] or #; A-F only)
Fluid, mass, and heat transport in biological systems. Mass transfer across membranes, fluid flow in capillaries, interstitium, veins and arteries. Biotransport issues in single cells and tissues, artificial organs, membrane oxygenators, and drug delivery applications.

ME 5446. Introduction to Combustion. (4 cr; QP–IT or grad student, 5342 or equiv; SP–Upper div IT or grad student, 3321, 3322; A-F only)
Thermodynamics, kinetics, energy and mass transport, and pollutants in reacting systems. Reactors, laminar and turbulent flames. Ignition, quenching, and flame stability. Diffusion flames. Combustion in reciprocating engines, furnaces, and turbines, with emphasis on internal combustion engine performance and emissions.

ME 5461. Internal Combustion Engines. (4 cr; QP–IT or grad student, 3301 or equiv; SP–IT upper div or grad student, C or better in 3322 or 3324; A-F only)
Basic spark ignition and diesel engine principles, air, fuel-air and actual engine cycles, cycle modeling, combustion and emissions, knock phenomena, air flow and volumetric efficiency, mixture requirements, ignition requirements and performance. Lectures and complementary labs.

ME 5462. Gas Turbines. (4 cr; QP–IT or grad student, 3301 or equiv; SP–Upper div IT or grad student, 3321, ¶3322; A-F only)
Gas turbine cycles, regeneration, recuperation, reheat, intercooling, combined cycle plants, and thermochemical regeneration. Axial and radial flow compressors and turbines; combustor designs, energy analysis, emissions, and noise. Turbojet, fanjet, turboprop engine performance. Stationary power plants, vehicular propulsion, hybrid vehicles.

ME 8113. Advanced Aerosol/Particle Engineering. (4 cr; QP–5613, 5614; SP–IT grad student or #; A-F only)
Introduction to kinetic theory, definition, theory, and measurement of particle properties; elementary particle mechanics, particle statistics; Brownian motion and diffusion, coagulation, evaporation and condensation, sampling, and transport.

ME 8221. New Product Design and Business Development I. (4 cr; SP–§Entr 6087, IT grad student, some design experience; A-F only)
Students and faculty work with company representatives to develop a product concept, a working physical prototype, and an extensive business plan. Concept design, detail design, manufacturing, marketing, introduction strategy, and profit forecasting. Sponsoring company intends to bring product to market. ME 8222 must be taken in sequence the same year.

ME 8222. New Product Design and Business Development II. (4 cr; QP–8250; SP–§Entr 6087, 8221; A-F only)
Students and faculty work with company representatives to develop a product concept, a working physical prototype, and an extensive business plan. Concept design, detail design, manufacturing, marketing, introduction strategy, and profit forecasting. Sponsoring company intends to bring product to market. Must be taken in sequence with 8221 the same year.

ME 8228. Finite Elements in Multidisciplinary Flow/ Thermal/Stress and Manufacturing Applications. (4 cr; QP–5227, AEM 8516, AEM 8522, programming; SP–3222, 5341, AEM 3031, CSci 1113; A-F only)
Multidisciplinary and coupled effects involving flow/ heat transfer/stress. In-depth understanding of modeling and analysis in each discipline. Coupling multi-disciplines for engineering problems. Applications to manufacturing and process modeling of, e.g., metals, alloys, polymers.

ME 8229. Finite Element Methods for Computational Mechanics: Transient/Dynamic Problems. (4 cr; QP–5227, programming; SP–5228 or equiv, 5341, AEM 3031, CSci 1113; A-F only)
Computational mechanics involving transient or dynamic situations; development and analysis of computational algorithms. Stability and accuracy of algorithms, convergence issues; linear/nonlinear situations. Implicit, explicit, mixed, and variable time discretization approaches; modal-based methods for engineering problems.

ME 8243. Advanced Kinematics and Mechanism Dynamics. (4 cr; QP–5203; SP–5241, 5243, CSci 1113, IT grad student; A-F only)
Advanced Burmester theory; dimensional synthesis of complex linkages; solution rectification; 3-D synthesis and analysis; application of graph theory to mechanism synthesis; optimization as linkage synthesis technique; application of dynamics to selected mechanism problems; mechanism balancing.

ME 8262. Analysis and Modeling of Manufacturing Processes. (4 cr; QP–5260; SP–3221, 5229, AEM 3031, CSci 1113, MatS 3011; A-F only)
Finite element simulations of selected manufacturing processes; machining, forming, molding. Models of stress fields, temperature, and fluid flow. Comparison of predicted and measured process and part characteristics: forces, temperature, part shape.

ME 8268. Properties and Fabrication of Plastics and Composites. (4 cr; SP–3221, AEM 3031, MatS 2001; A-F only)
Materials, equipment, and processes. Principles of product and tool design. Hydraulic and temperature circuit control for equipment.

ME 8281. Multivariable Control Systems. (4 cr; QP–5283, 8280; SP–IT grad student; A-F only)
State space description of dynamical systems. Solutions via transition matrices. Lyapunov stability. Eigenstructures, similarity transforms, and canonical forms. Controllability and observability. Kalman decomposition. Balanced realization. State feedback. State estimation. Separation principle. Linear optimal control and Kalman filter design. Loop transfer recovery and Frequency Shaped LQ methods. Introduction to current topics.

ME 8287. Digital Control and Signal Processing. (4 cr; QP–5283; SP–5281; A-F only)
Fundamentals of discrete time systems. Sampling theorem. DFT and FFT. Z-transform. Analog and digital filter design. Discrete time equivalents of continuous time systems. Design of digital control systems using transform and state-space techniques. System identification. Optimal control.

ME 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

ME 8337. Experimental Methods in Heat Transfer. (3 cr; SP–[8341, 8343] or #; A-F only)
Planning experiments; uncertainty, qualification, visualization, analogies; temperature, pressure, heat flux, and flow measurements; signal processing and analysis.

ME 8339. Optical Diagnostics of Flow Systems. (3 cr; QP–Undergrad physics course; SP–IT grad student, undergrad physics course; A-F only)
Overview of ray, wave, and quantum principles of light; capabilities and limitations of various diagnostics. Propagation and imaging properties of lenses; interference phenomena; diffraction; light scattering; laser- and phase-Doppler anemometry; introduction to emission and absorption spectroscopy.

ME 8341. Thermal Conduction. (3 cr; QP–5342; SP–3322, IT grad student)
Physical fundamentals and mathematical formulations for conduction-dominated heat transfer processes in steady and unsteady states. Classical and non-classical solution methodologies. Conduction in single-phase media and in phase-changing media. Applications to thermal-based materials processing. Analogy between thermal conduction and mass diffusion.

ME 8343. Convective Heat Transfer. (3 cr; QP–5342, 8331; SP–3321, 3322 or equiv; A-F only)
Heat transfer in fluids flowing around bodies, in tubes and ducts. Forced and natural convection. Laminar and turbulent flow regimes. Turbulent transport and modeling, high-speed flows, viscous dissipation, and variable property effects. Application to heat exchange devices. Convective mass transfer.

ME 8344. Boiling Heat Transfer and Two-Phase Flow. (3 cr; QP–5342; SP–8341 or 8343)
Phenomena pertaining to ebullient heat transfer and two-phase flow; superheat, nucleation, bubble characteristics and dynamics, nucleate boiling, interfacial transport, critical heat flux, dryout, film boiling; flow patterns in two-phase flow, void fraction, pressure drop.

ME 8345. Computational Heat Transfer and Fluid Flow. (3 cr; QP–5342, 8351; SP–IT grad student)
Finite volume method for solution of governing equations for heat transfer and fluid flow. Mathematical models of turbulence. Construction of general computer program. Practical applications.

ME 8346. Radiation Heat Transfer. (3 cr; QP–5342; SP–5342, 8341, IT grad student; A-F only)
Fundamentals of processes and solution methods to selected radiation exchange problems. Specific applications include radiation exchange between surfaces, lighting, radiation transfer in semitransparent media and in participating media.

ME 8361. Introduction to Plasma Technology. (3 cr; QP–5342, 8360; SP–IT grad student; A-F only)
Methods for characterizing thermal plasmas by modeling and diagnostics. Several plasma applications described in detail.

ME 8362. Advanced Plasma Technology. (3 cr; QP–8360, 8361; SP–8361, IT grad student; A-F only)
Fundamentals of modern physics as they apply to understanding of thermal plasmas, including introduction to atomic theory, gaseous electronics, irreversible thermodynamics, plasma properties, and generation of plasmas.

ME 8381. Bioheat and Mass Transfer. (3 cr; SP–IT grad student, upper-division transport/fluids course; [physics, biology] recommended)
Analytical/numerical tools to analyze heat/mass transfer phenomenon in cryobiological, hyperthermic, other biomedically relevant applications.

ME 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

ME 8462. Turbomachinery. (3 cr; QP–3301; SP–IT grad student, 3321, 3322 or equiv or #; A-F only)
Thermodynamic analysis of energy transfer between fluid and rotor; dimensional analysis; principles of axial, mixed, and radial flow pumps, fans, compressors, and turbines; cascade performance; computer flow simulations; applications to propulsion systems and power plants.

ME 8641. Statistical and Non-Equilibrium Thermodynamics. (3 cr; QP–8310; SP–Undergrad thermodynamics course, grad IT student; A-F only)
Statistical approaches for calculating transport coefficients and deriving basic statistical laws. Statistical and probability theorems, kinetic gas theory, and distribution of molecular velocities; Boltzmann, Bose-Einstein, and Fermi-Dirac statistics and their applications. Chemical reactions and systems; irreversible thermodynamics.

ME 8646. Reacting Flows. (3 cr; SP–IT grad student or #; A-F only)
Introduction to simple methods for thermophysical data estimation, principles/application of chemical kinetics, simulation of homogeneous/heterogeneous kinetics, including transport. These principles are applied to problems in combustion and materials processing (CVD, plasma processing) through computer exercises employing CHEMKIN suite of programs.

ME 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

ME 8773. Graduate Seminar. (1 cr; SP–IT grad student; S-N only)
Recent developments.

ME 8774. Graduate Seminar. (1 cr; SP–8773; S-N only)
Recent developments.

ME 8775. Technical Communication. (1 cr; S-N only)
One-day workshop on presenting a seminar. Students deliver one-hour seminar on technical topic and attend nine other technical seminars.

ME 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

ME 8794. Mechanical Engineering Research. (1-6 cr [max 10 cr]; SP–#)
Directed research.

ME 8800. Modern Developments in Mechanical Engineering. (1 cr [max 2 cr]; SP–IT grad student; S-N only)
Seminars on topics in engineering science of importance to mechanical engineers. Invited scholars deliver five-lecture series on each topic; two to five topics each semester.

ME 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Medicinal Chemistry (MedC)

Department of Medicinal Chemistry
College of Pharmacy

MedC 5185. Principles of Biomolecular Simulation. (3 cr; QP–Chem 5521 or #; SP–Chem 3502 or #)
Molecular simulation for students in medicinal chemistry, pharmaceutics, biochemistry, and chemical physics

MedC 5200. The New Drug Development Process. (1 cr; S-N only)
New drug development process in the U.S. pharmaceutical industry.

MedC 5202. Research and Development Process of Pharmaceutical Products. (2 cr; S-N only)
New drug development process in the U.S. pharmaceutical industry

MedC 5245. Introduction to Drug Design. (3 cr; SP–Chem; A-F only)
Concepts that govern design/discovery of drugs. Physical, bioorganic, medicinal chemical principles applied to explain rational design, mechanism of action drugs.

MedC 5494. Advanced Methods in Quantitative Drug Analysis. (3 cr; QP–#; SP–#; A-F only)
Quantitative methods (HPLC, GC, TLC, and immunoassays) for analysis of drugs and metabolites in biological fluids. Advanced techniques such as capillary electrophoresis, supercritical fluid chromatography, GC-MS, LC-MS, and tandem mass spectrometry. Chromatographic theory and statistical approaches to method validation.

MedC 5495. Vistas in Medicinal Chemistry Research. (1 cr; S-N only)
Selected topics of contemporary interest in medicinal chemistry

MedC 5600. General Principles of Medicinal Chemistry. (3 cr; QP–Phcl 1009, BioC 5001; SP–MedC grad student or #; A-F only)
Fundamental principles of drug receptors as therapeutic targets, drug-receptor interactions, enzyme inhibitors, drug metabolism and disposition.

MedC 8100. Medicinal Chemistry Seminar. (1 cr [max 6 cr]; SP–Grad med chem major or #)
Current topics.

MedC 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

MedC 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

MedC 8500. Design of Chemotherapeutic Agents. (2 cr; QP–5600; SP–5600 or #; A-F only)
Modern aspects of designing chemotherapeutic agents. Strategies for enzyme inhibition and metabolic blocks in development of anticancer, antimicrobial, and antiviral agents.

MedC 8600. Chemical Aspects of Drug Metabolism and Bioactivation. (2 cr; QP–5600; SP–5600 or #; A-F only)
Chemical and enzymatic mechanisms of biotransformation and bioactivation of drugs and other xenobiotics. Reactivity and fate of bioactivated metabolites.

MedC 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

MedC 8700. Advanced Concepts in Drug Design. (2 cr; QP–5600; SP–5600 or #; A-F only)
Current approaches to rational design of drugs.

MedC 8760. Design of Peptidomimetics. (2 cr; QP–5600; SP–5600 or #; A-F only)
Current approaches to design and synthesis of mimetics of biologically active peptides. Structural and conformational rationale used in peptidomimetic design.

MedC 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

MedC 8800. Medicinal Chemistry Laboratory Techniques. (1-2 cr [max 4 cr]; SP–Grad med chem major or #; S-N only)
Experiential rotations in medicinal chemistry research laboratories.

MedC 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

MedC 8900. Research in Medicinal Chemistry. (1-4 cr [max 8 cr]; SP–Grad med chem major or #; A-F only)
Study and experimental investigation.

Medieval Studies (MeSt)

Center for Medieval Studies
College of Liberal Arts

MeSt 5610. Advanced Topics in Medieval Studies. (3-4 cr [max 15 cr]; SP–One yr work in some area of Middle Ages, reading knowledge of appropriate language, #)
From late antiquity through the end of the Middle Ages (circa 300-1500 A.D.). Current topics specified in *Class Schedule*.

MeSt 5993. Directed Studies in Medieval Studies. (3 cr [max 6 cr]; SP–One yr work in some area of Middle Ages, reading knowledge of appropriate language, #)
Directed study with one of the core faculty of medieval studies program.

MeSt 8010. Medieval Studies Colloquium. (1 cr [max 3 cr]; SP–#; S-N only)
Lectures by and discussions with faculty and visiting speakers.

MeSt 8110. Seminar in Medieval Studies. (3-4 cr [max 48 cr]; SP–Appropriate languages, #; A-F only)
Offered when feasible.

Microbiology, Immunology, and Cancer Biology (MICa)

Department of Microbiology
Medical School

MICa 5000. Practicum: Teaching. (1 cr [max 4 cr]; QP–MIMP grad major or #; SP–MIMP grad major or #; A-F only)
Supervised experience in lab instruction: development of skills in effective use of instructional materials, tests and measurement.

MICa 8001. Integrated Topics in Microbiology, Immunology, and Molecular Pathobiology. (3 cr; SP–#; A-F only)
Molecular, structural, and biochemical complexity of microbes; molecular mechanisms of disease; cell death and injury; adaptive immune responses, immunological tolerance.

MICa 8002. Structure, Function, and Genetics of Bacteria and Viruses. (4 cr; QP–Beginning biochem, cell biol, general biol, micro, organic chem; SP–8001 or #; A-F only)
Structure, function, and metabolism of microorganisms; microbial genetics; molecular virology.

MICa 8003. Immunity and Immunopathology. (4 cr; QP–§Path 8216, §Path 8217, §Path 8218, Biol 5001 or equiv, MicB 5218; SP–8001 or #)
Lymphocyte activation, signal transduction in lymphocytes, antigen receptor genetics, antigen presentation, lymphoid anatomy, adaptive immune responses to microbes, immunodeficiency, immunopathology, cytokines, transplantation, and autoimmunity.

MICa 8004. Cellular and Molecular Pathobiology. (4 cr; QP–[MdBc 5100, 5101] [or ¶MdBc 5100, ¶MdBc 5101], [CBN 5103, 5104] [or ¶CBN 5103, ¶CBN 5104]; SP–8001 or GCB 8132 or #; A-F only)
Fundamental concepts in cellular, molecular, and genetic basis of disease. Lecture topics range from molecular basis of inflammation and cancer metastasis to genetic basis for inherited disorders and gene therapy. Molecular mechanisms of pathogenesis.

MICa 8005. Topics in Microbiology, Immunology, and Molecular Pathobiology. (1-4 cr; SP–8001, two of 8002 or 8003 or 8004)
Colloquium format with in-depth readings and discussion on a specialized topic.

MICa 8006. Protein Sequence Analysis. (3 cr; QP–Biochem course, knowledge of UNIX operating system recommended; SP–Biochem course, knowledge of UNIX operating system recommended)
DNA and protein sequence and protein structure databases; protein sequence analysis; methods for display of sequence comparison and prediction results; Genetics Computer Group (GCG) sequence analysis programs; and current literature and research problems.

MICa 8007. Cell Biology and Biochemistry of the Extracellular Matrix. (3 cr; QP–MdBc 5100-5101 or equiv, Path 8108-8109-8110; SP–8002 or 8004 or #; A-F only)
Concepts in cell adhesion and tissue composition and importance of cell adhesion in tissue function and disease. Topics range from structure/function/ assembly of tissue components to cellular adhesion mechanisms.

MICa 8008. Mammalian Gene Transfer and Expression. (2 cr; SP–#; A-F only)
Current gene transfer technology. Applications of genetic modifications in animals, particularly transgenic animals and human gene therapy.

MICa 8009. Biochemical Aspects of Normal and Abnormal Cell Growth and Cell Death. (2 cr; QP–Path 8108, undergrad biochem, cell biol; SP–8004 or [BioC 3021, Biol 4004] or #)
Aspects of mechanisms involved in growth control at level of nuclear function. Neoplasia in hormonal cancers (such as prostate cancer) and role of protein phosphorylation in normal and abnormal growth. Mechanisms of cell death via apoptosis and its implications in normal and abnormal proliferation.

MICa 8094. Research in Microbiology, Immunology, and Molecular Pathobiology. (1 cr [max 5 cr]; SP–Grad MIMP major; S-N only)
To provide credit to first-year MIMP students for one-on-one research training from a faculty adviser during a laboratory rotation.

MICa 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

MICa 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

MICa 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

MICa 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

MICa 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

MICa 8910. Seminar: Faculty Research Topics. (1 cr [max 10 cr]; SP–Grad MIMP major or #; S-N only)
State-of-the-art information presented by scientific experts within and outside the University.

MICa 8920. Seminar: Student Research Topics. (1 cr [max 10 cr]; SP–Grad MIMP maj or #; S-N only)
Current thesis topics and other aspects of the field.

Microbial Engineering (MicE)

Graduate School

MicE 5309. Biocatalysis and Biodegradation. (3 cr; SP–Chem through organic chem, microbial or adv chem, knowledge of word proc, e-mail, WWW access; access to college-level sci library recommended)
Assessing validity of information on biocatalysis and biodegradation; fundamentals of microbial catabolic metabolism as it pertains to biodegradation of environmental pollutants; biocatalysis for specialty chemical synthesis; display of this information on the World Wide Web.

MicE 5355. Advanced Fermentation and Biocatalysis Laboratory. (3 cr; SP–[Biol 3301 or MicB 3301], [grad student in microbial engineering or upper-div major in [microbiology or chem engineering or biochemistry]], #; A-F only)
Methods in industrial microbiology, laboratory, and pilot scale fermentation/biocatalysis engineering. Laboratory experiments carried out in fermentation pilot plant. Operation of bench scale and pilot scale bioreactors, designing bioreactors, process optimization, process monitoring/control, scale-up experiments, experimental design, data analysis.

MicE 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

MicE 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

MicE 8920. Teaching Practicum. (1 cr [max 4 cr]; SP–Grad MicE major)
Supervised experience in classroom, laboratory, and/or recitation instruction; develops skills in effective use of instructional techniques, materials, tests, and measurements.

MicE 8990. Biotechnology Seminar. (1 cr [max 2 cr]; SP–First-yr students regis S-N, as they do not make a presentation; second-yr students regis A-F, as they present a seminar)
Student presentations of thesis research and presentations by invited speakers.

Microbiology (MicB)

Department of Microbiology
Medical School

MicB 5205. Microbiology and Immunology for Medical Students. (0-7 cr)
Basic/clinical human immunology, medical microbiology. Molecular/cellular basis of immune responses, tolerance. Immunologic disease, serology, antimicrobial agents, chemotherapy. Basic/medical bacteriology, parasitology, mycology, virology. Unifying principles governing pathogenesis. Diseases are grouped with organisms important in differential diagnosis.

MicB 5352. Applied Microbial Biochemistry. (3 cr; QP–Biol 3021 or BioC 5331 or MicB 5321, Biol 5013/MicB 5105 or #; SP–§BioC 5352; Biol/BioC 3021 or BioC 4331 or MicB 4111, MicB 3301 or #)
Biochemistry of microorganisms and enzymes of industrial interest. Heterologous peptide overproduction by microorganisms and yeasts; polymer, antibiotic, organic acid, and amino acid production; genetics of industrially useful microorganisms; biological systems useful for biotransformation and environmental remediation; introduction to fermentation technology.

Middle Eastern Languages and Cultures (MELC)

Institute of Linguistics, ESL, and Slavic Languages and Literatures

College of Liberal Arts

MELC 5311. Medieval Sages. (3 cr; SP–§CAS 5311; background in Iranian, Central Asian, or Islamic studies recommended)
Study and discussion of the intellectual life of the region from the rise of the Ghaznavids (A.D. 1000) to the fall of the Timurids (A.D. 1500). Ibn Sina (Avicenna), al-Biruni, al-Ghazali, Rumi, Sa'di, and Firdowsi are among the sages whose lives are examined.

MELC 5526. Islam and Communism. (3 cr; SP–§3526, §CAS 5526)
Development of medieval Islamic culture in Transoxiana; formation of Sufi orders; rise and development of Communist ideology; introduction of socialist principles into Central Asia; clash of Islamic principles with Communist dicta; Pan-Islamism; Pan-Turkism.

MELC 5532. Russia and Central Asia. (3 cr; SP–§3532, §CAS 5532)
Rise and fall of the Mongol Empire, formation of the Chaghatai Khanate and the Golden Horde. Russian expansion into Central Asia and rivalry with Britain. Russia and the Central Asian republics during and after the Soviet period.

MELC 5601. Fiction of Iran and Central Asia. (3 cr; SP–§3601, §CAS 5601)
Social, political, and religious thought of Iranian and (Soviet) Central Asian writers of fiction since the early years of the 20th century, emphasizing themes of tradition, modernization (Westernization and Sovietization), women's rights, and secularization.

MELC 5602. Persian Poetry. (3 cr; SP–§3602, §CAS 5602)
Major poetic works of Iran dealing with life at the medieval courts, Sufic poetry, and "new" poetry are studied. Rudaki, Khayyam, Rumi, Hafiz, Yushij, and Farrukhzad are among the poets whose works are examined.

MELC 5993. Directed Studies. (1-10 cr; SP–#, Δ, ❑)

MELC 5994. Directed Research. (1-10 cr; SP–#, Δ, ❑)

Molecular, Cellular, Developmental Biology and Genetics (MCDG)

Graduate School

MCDG 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

MCDG 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

MCDG 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

MCDG 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

MCDG 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

MCDG 8900. Student Research Seminar. (1 cr [max 10 cr]; SP–Grad MCDG major or D; S-N only)
Presentation and discussion of student thesis research.

MCDG 8910. Journal Presentations. (1 cr [max 2 cr]; SP–Grad MCDG major or Δ; S-N only)
Discussion of original scientific literature; for first-year graduate students.

MCDG 8920. Special Topics. (1-4 cr [max 8 cr]; SP–Grad MCDG major or Δ)

MCDG 8950. Teaching Practicum. (1 cr [max 2 cr]; SP–Grad MCDG major or Δ; S-N only)
Supervised experience in classroom, laboratory, and/or recitation instruction; development of skills in effective use of instructional techniques, materials, tests, and measurements.

MCDG 8993. Directed Studies. (1-5 cr [max 15 cr]; SP–MCDG grad student or #)
Directed Studies.

MCDG 8994. Research. (1-5 cr [max 10 cr]; SP–MCDG grad student or #; S-N only)
Independent research determined by student's interests, in consultation with faculty mentor.

Molecular Veterinary Bioscience (MVB)

Department of Veterinary Pathobiology

College of Veterinary Medicine

MVB 5200. Introductory Statistical Genetics and Genomics. (4 cr; QP–[Stat 3091 or equiv], [GCB 3022 or Biol 4004 or equiv]; A-F only)
Statistical issues in genomics. Gene detection, including statistical analysis/designs for linkage study and for mapping quantitative trait loci. Linkage analysis using pedigree data for codominant/dominant markers. Using radiation hybrid mapping/single cell typing. Design issues in linkage analysis, parentage testing, and marker polymorphism.

MVB 5594. Directed Research in Molecular Veterinary Biosciences. (1-4 cr [max 4 cr]; SP–Jr; A-F only)
Special project, addressing specific issue in veterinary medicine, under guidance of faculty member.

MVB 8100. Research Rotation in Molecular Veterinary Biosciences. (4 cr [max 8 cr]; SP–1st yr MVB grad student; A-F only)
Directed research laboratory rotations. Experimentation, supplemental reading, research presentations under guidance of faculty member who is potential thesis adviser. Taught by program faculty.

MVB 8201. Mechanisms of Animal Health and Disease I. (3 cr; SP–1st yr MVB grad student or approval of crse coordinator; A-F only)
Basic mechanisms of animal health. Innate/acquired immunity. Immune avoidance. Cellular basis for pathogenesis of animal diseases. Molecular/genetic mechanisms of host resistance. Host/pathogen interactions.

MVB 8202. Mechanisms of Animal Health and Disease II. (3 cr; SP–8201)
Basic mechanisms of animal health; innate and acquired immunity; immune avoidance; cellular basis for pathogenesis of animal diseases; molecular and genetic mechanisms of host resistance; host/pathogen interactions.

MVB 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

MVB 8335. Molecular Biology Techniques. (3 cr; SP–Biol 5001, Biol 5003 or equiv or #)
Basic theory and current methodologies of molecular biology and recombinant DNA technology. Lab work includes DNA and RNA hybridization, gene transfer, and polymerase chain reaction techniques. Primarily for students with limited exposure to molecular biology.

MVB 8351. Drug-Receptor Interactions. (2 cr; SP–[Chem 1011-1012 or equiv, CVM 6055 or equiv, calculus through differential equations] or #; A-F only)
Dynamics of interaction between drugs and their receptors. Historical development of drug-receptor theory, factors affecting drug concentration in receptor compartment, determination of agonist and antagonist activity, pharmacodynamics of recombinant receptors, and functional receptor classification.

MVB 8361. Neuro-Immune Interactions. (3 cr; SP–MicB 5218 or equiv, NSc 5111 or equiv)
Regulatory systems (neuroendocrine, cytokine, and autonomic nervous systems) linking brain and immune systems in brain-immune axis. Functional effects of bidirectional brain-immune regulation.

MVB 8394. Research in Comparative Biomedical Sciences. (1-6 cr [max 18 cr]; SP–Grad MVB major)
Directed research determined by student's interests, in consultation with faculty mentor.

MVB 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

MVB 8494. Research in Molecular Mechanisms of Disease. (1-6 cr [max 18 cr]; SP–Grad MVB major)
Directed research determined by student's interests, in consultation with faculty mentor.

MVB 8550. Molecular Veterinary Biosciences Seminar. (1 cr [max 8 cr]; SP–Biol sciences grad student; S-N only)
Student and faculty presentations of their own research or a directed topic.

MVB 8560. Research and Literature Reports. (1 cr [max 8 cr]; SP–Grad MVB major or #; S-N only)
Current developments in cellular and molecular mechanisms of animal health and disease.

MVB 8570. Animal Biomedical Seminar. (1 cr [max 8 cr]; SP–Biol sciences grad student; S-N only)
Weekly seminar by outside speakers discussing current issues.

MVB 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

MVB 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

MVB 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Museum Studies (MSt)

Graduate School

MSt 5011. Museum History and Philosophy. (3 cr; SP–#; A-F only)
Historical and philosophical roots of museum development in Europe and North America from the Renaissance to modern day museums and history centers. Emerging philosophical issues faced by museums today.

MSt 5012. Museum Practices. (3 cr; QP–8010; SP–5011 or #; A-F only)
Practical aspects of museum work. Standards, practices, responsibilities, and issues, all set in greater museum context. Curatorial and educational duties, collections management, security, funding, boards, public relations, installation, and budgeting.

MSt 5020. Internship. (1-4 cr [max 32 cr]; SP–5011, 5012, Δ; S-N only)
Students arrange to perform a professional-level task in a museum of good standing under close supervision of a member of the museum's professional staff. Instructor must approve a work plan and report.

MSt 8993. Directed Study in Museum Studies. (1-4 cr [max 16 cr]; QP–8012, 8013, #, Δ; SP–[5012 or ¶5012], #, Δ; A-F only)
Study by a student, largely self directed with consultation of a faculty member, on a topic not covered (or not covered in depth) by another course. Program of study is determined jointly by student and advising faculty member.

Music (Mus)

School of Music

College of Liberal Arts

Mus 5101. Piano Pedagogy I. (2 cr; SP–8 cr in MusA 1301 or MusA1401 or #)
Demonstration and discussion of teaching techniques, methods, and materials for group and individual instruction at the elementary, early intermediate, and late intermediate levels.

Mus 5102. Piano Pedagogy II. (2 cr; SP–8 cr in MusA 1301 or MusA 1401 or #)
Demonstration and discussion of teaching techniques, methods, and materials for group and individual instruction at the elementary, early intermediate, and late intermediate levels.

Mus 5111. Advanced Piano Pedagogy I. (2 cr; SP–5102 or grad piano major or #; A-F only)
Demonstration and discussion of teaching techniques, methods, and materials for group and individual instruction at the intermediate and early advanced levels.

Mus 5112. Advanced Piano Pedagogy II. (2 cr; SP–5101 or grad piano major or #; A-F only)
Demonstration and discussion of teaching techniques, methods, and materials for group and individual instruction at the intermediate and early advanced levels.

Mus 5120. Piano Pedagogy Practicum. (1 cr [max 4 cr]; SP–5101-5102 or 5111-5112 or #; A-F only)
Supervised teaching of a piano pupil or group of pupils for one semester (minimum 12 weeks for one half-hour per week). Supervising instructor will assist with selection of materials, periodic consultation, and observation (live or video taped) of selected lessons.

Mus 5131. Advanced Keyboard Skills I. (2 cr; SP–3502, sr or grad; A-F only)
Diatonic and chromatic harmony at the piano. Realization of figured basses of the 17th and 18th centuries. Performance of choral, orchestral, and chamber music of the 17th to 20th centuries, from open score using all clefs.

Mus 5132. Advanced Keyboard Skills II. (2 cr; SP–3502, sr or grad; A-F only)
Diatonic and chromatic harmony at the piano. Realization of figured basses of the 17th and 18th centuries. Performance of choral, orchestral, and chamber music of the 17th to 20th centuries, from open score using all clefs.

Mus 5141. Piano Literature. (2 cr; SP–12 cr of MusA 1301 or MusA 1401 or #; A-F only)
Introductory survey of representative keyboard literature from the Baroque to the mid-20th century. Study of typical forms, style features, technical issues, and performance practice for each period.

Mus 5150. Body Awareness in Activity: The Alexander Technique for Musicians. (2 cr [max 4 cr])
Alexander technique with specific applications to music performance. Emphasis on body/mind awareness to promote technical ease and freedom.

Mus 5151. Organ Literature I. (3 cr; SP–3502, 3603, sr or grad or #; A-F only)
Organ literature from the 14th century to the mid-18th century. Influence of organ design of various periods and national schools on the literature and its performance.

Mus 5152. Organ Literature II. (3 cr; SP–3502, 3603, sr or grad or #; A-F only)
Organ literature of J. S. Bach and of other 19th- and 20th-century composers. Influence of organ design of various periods and national schools on the literature and its performance.

Mus 5160. Instrumental Accompanying Skills and Repertoire. (2 cr [max 4 cr]; SP–Accomp major; A-F only)
Performance class in accompanying skills particular to orchestral reductions and non-sonata instrumental accompanying. Repertoire to include, but not be limited to, classical and romantic string concerti, and "encore" pieces.

Mus 5170. Vocal Accompanying Skills and Repertoire. (2 cr [max 4 cr]; SP–French, German and Italian diction, accomp or grad vocal major; A-F only)
Performance class (Lieder, melodie, opera) with emphasis on coaching techniques and performance skills of pianists and singers.

Mus 5181. Advanced Piano Literature I. (2 cr; SP–grad piano maj or #; A-F only)
Literature for piano from late Baroque period to mid-20th century.

Mus 5182. Advanced Piano Literature II. (2 cr; SP–grad piano major or #; A-F only)
Literature for piano from late Baroque period to mid-20th century.

Mus 5230. Chorus. (1 cr [max 8 cr]; SP–Choral and/or instrumental music background; audition, #)
University Women's Chorus, Men's Chorus, Concert Choir and Choral Union. Choirs participate in a variety of programs exploring both Western and non-Western repertoire from the Middle Ages through the 20th century. Concerts include touring, and collaborative campus and community performances.

Mus 5240. Chamber Singers. (1 cr [max 8 cr]; SP–Audition, #; A-F only)
Mixed chorus of about 24 voices. Performances each semester of works for small choirs.

Mus 5241. Vocal Literature I. (3 cr; SP–[12 cr in MusA 1304, grad music student] or #; A-F only)
Vocal literature of major/minor composers from 17th century to present. Structure, style, performance practice.

Mus 5242. Vocal Literature II. (3 cr; SP–12 cr in MusA 1104 or MusA 1304, grad music major or #; A-F only)
Vocal literature of major and minor composers from 17th century to present; structure, style, and performance practice.

Mus 5250. Opera Workshop and Ensemble. (1 cr [max 8 cr]; SP–Audition, #; A-F only)
Preparation and performance of operatic arias, choruses, and scenes. Participation in fully staged or workshop productions of music theatre repertoire.

Mus 5260. Stage Movement and Acting for Singers. (1 cr [max 4 cr]; QP–Audition, #; SP–Audition, #; A-F only)
Basic techniques of stage movement and acting styles, application to various forms of music theatre.

Mus 5270. Voice Practicum. (1 cr [max 2 cr]; SP–Undergrad sr vocal major or #)
Teaching voice class or individual students with peer and faculty feedback. Assist in class voice instruction or teach two students weekly in conjunction with two one-hour observation labs. May be taken for two semesters.

Mus 5271. Diction for Singers I. (2 cr; SP–12 cr of MusA 1304 or grad music major or #; A-F only)
Principles and techniques of singing in English, Italian, Spanish, German, and French. International Phonetic Association alphabet used.

Mus 5272. Diction for Singers II. (2 cr; SP–12 cr MusA 1304 or grad music major or #; A-F only)
Principles and techniques of singing in English, Italian, Spanish, German, and French. International Phonetic Association alphabet used.

Mus 5275. Vocal Pedagogy I. (3 cr; SP–Sr vocal major or #)
Advanced study of mind/body preparations for singing, anatomy, and physiology of the vocal mechanism. Voice use and care, historical and comparative pedagogy, learning theories, models and guidelines for teaching, instructional techniques, and diagnosing and solving vocal problems.

Mus 5276. Vocal Pedagogy II. (2 cr; SP–Sr vocal major or #; A-F only)
History of solo vocal performance; selection and preparation of beginning level solo vocal repertoire; development of vocal performance skills (interpretation, expression, artistry), recital programming, and vocal career counseling.

Mus 5277. Vocal Workshop. (1 cr; SP–Music major or #; A-F only)
Short term vocal workshops address specific topics including voice science, pedagogy, and performance of vocal repertoire. One workshop focuses on class voice instruction.

Mus 5279. Group Voice: Performance/Pedagogy. (2-3 cr; SP–Performance only track: 2 cr per sem; performance/pedagogy track: 3 cr per sem; [upper div student or grad student], #; A-F only)
Foundations/fundamentals of speech/singing. Vocal production, anatomy, physiology, terminology. Application of vocal techniques in learning/performing repertoire. Teaching methods, including voice/motion exercises.

Mus 5280. Opera Theatre. (2 cr [max 16 cr]; SP–Audition, #; A-F only)
Preparation and performance of fully-staged operatic production. Major involvement in singing, acting, and technical aspects of opera.

Mus 5283. Choral Conducting Technique. (1 cr; SP–#; A-F only)
Choral conducting, rehearsal techniques, interpretation of music.

Mus 5284. Choral Conducting I: Gregorian Chant Through Baroque Era. (3 cr; SP–#; A-F only)
Techniques and rehearsal procedures. Focus on music before 1750 including works by Lassus, Schutz, Bach, and Handel.

Mus 5285. Choral Conducting II: Classical Era to the Present. (3 cr; SP–#; A-F only)
Technique and rehearsal procedures. Focus on music after 1750 including works by Mozart, Haydn, Beethoven, Mendelssohn, Brahms, and Stravinsky.

Mus 5300. Jazz Rhythm Section Techniques. (1 cr [max 8 cr]; SP–#; A-F only)
Study and function of instruments in the jazz rhythm section. Bass line construction, voicings for piano and guitar, and style patterns for percussion.

Mus 5336. Jazz Arranging. (3 cr; SP–3502 or #; A-F only)
Beginning techniques of arranging for jazz combo and jazz ensemble; vocal and instrumental.

Mus 5340. Jazz Ensemble. (1 cr [max 6 cr]; SP–Audition, #; A-F only)
A 20-member performing organization covering significant jazz compositions and arrangements written specifically for this medium.

Mus 5341. Jazz Pedagogy. (2 cr; SP–#; A-F only)
Teaching methods of vocal and instrumental jazz improvisation, basic arranging techniques, and jazz history; bibliographies and materials.

Mus 5342. Jazz Theory. (2 cr; SP–3502 or #; A-F only)
Beginning techniques for basic chord construction, extended chords, and nomenclature in jazz idiom.

Mus 5390. Jazz Singers. (1 cr [max 10 cr]; SP–Audition, #; A-F only)
Study and performance of representative vocal jazz literature.

Mus 5410. University Wind Bands. (1 cr [max 8 cr]; SP–Audition, #; A-F only)
Wind ensemble and symphony bands perform standard and contemporary literature; concerts and tour appearances. Players from all colleges may participate.

Mus 5415. Literature for Band and Wind Ensemble. (2 cr; A-F only)
Ensemble literature for winds and percussion; analysis and study of repertoire from classical period to the present.

Mus 5420. Orchestra. (1 cr [max 8 cr]; SP–Audition, #; A-F only)
Symphony orchestra performs standard repertory and major works with chorus; concerts and tour appearances. Players from all colleges may participate.

Mus 5421. Suzuki Violin Pedagogy I. (2 cr; SP–Violin major or #; A-F only)
Philosophy and teaching techniques of Japanese pedagogue Shinichi Suzuki and their applications in Western culture. Discussion, playing experience, and observation of children's lessons in the MacPhail Center Suzuki Program.

Mus 5422. Suzuki Violin Pedagogy II. (2 cr; SP–5421 or #; A-F only)
Philosophy and teaching techniques of Japanese pedagogue Shinichi Suzuki and their applications in Western culture. Discussion, playing experience, and observation of children's lessons in the MacPhail Center Suzuki Program.

Mus 5423. Suzuki Pedagogy Practicum. (1 cr [max 1 cr]; SP–[[¶5424 or ¶5425], grad music student] or #; A-F only)
Supervised teaching of both individual and group lessons. Instructor provides periodic critiques from observation of live or videotaped lessons.

Mus 5424. Advanced Suzuki Violin Pedagogy I. (2 cr; SP–5422 or #; A-F only)
Intensive examination of Suzuki techniques for intermediate and advanced violin students in Western society. Discussion, playing experience, observation of children's lessons in the MacPhail Center Suzuki Program, and practical teaching experience.

Mus 5425. Advanced Suzuki Violin Pedagogy II. (2 cr; SP–5424 or #; A-F only)
Intensive examination of Suzuki techniques for intermediate and advanced violin students in Western society. Discussion, playing experience, observation of children's lessons in the MacPhail Center Suzuki Program, and practical teaching experience.

Mus 5426. Final Project in Suzuki Pedagogy. (1 cr; SP–Grad music student in Violin Performance and Suzuki Pedagogy Program; A-F only)
Research project.

Mus 5427. Violin Pedagogy I. (2 cr; SP–Violin or viola major or #; A-F only)
Private teaching of violin students at beginning, intermediate, and advanced levels. Discussion and demonstrations of pedagogical techniques.

Mus 5428. Violin Pedagogy II. (2 cr; SP–Violin or viola major or #; A-F only)
Private teaching of violin students at beginning, intermediate, and advanced levels. Discussion and demonstrations of pedagogical techniques.

Mus 5430. Concerto Grosso Ensemble. (1 cr [max 8 cr]; SP–Audition, #; A-F only)
Study and performance of string orchestra and small chamber orchestra literature.

Mus 5440. Chamber Ensemble. (1 cr [max 8 cr]; SP–Audition, #; A-F only)
Performance of chamber music; duos, trios, quartets, quintets, and other ensemble combinations for instruments and/or voices.

Mus 5450. Orchestral Repertoire. (1 cr [max 3 cr]; SP–#; A-F only)
Investigation of practical and performance problems in standard orchestral repertoire with regard to style and interpretation.

Mus 5464. Cello Pedagogy. (2 cr; A-F only)
Concentrated study of cello teaching methods. Provides students with the strategies for teaching cello privately, develops analytical skills, and increases knowledge of cello repertoire. For practical application in conjunction with string technique course.

Mus 5466. Guitar Pedagogy. (2 cr; SP–Guitar principal or major or #; A-F only)
Historical survey of methods and etudes from late 18th century to present, reflecting variety of content and approach. Works by Aguado, Sor, Giuliani, Tarrega, Segovia, Carlevaro, Duncan, Iznaola, Dodgson, and Brindle.

Mus 5470. Woodwind Chamber Ensemble. (1 cr [max 8 cr]; SP–Audition, #; A-F only)
Chamber music performance using homogeneous or mixed combinations of woodwind instruments.

Mus 5471. Woodwind Literature and Pedagogy I. (3 cr; SP–Music major or #; A-F only)
A study of the major teaching materials for the five woodwind instruments including methods, duets, and solos used primarily for pedagogical reasons.

Mus 5472. Woodwind Literature and Pedagogy II. (3 cr; SP–Music major or #; A-F only)
A study of chamber music involving one or more woodwind instruments. May include additional instruments such as piano, strings, and/or voice.

Mus 5473. History and Acoustics of Single Reed Instruments. (2 cr; SP–Music major or #; A-F only)
Study of clarinet and saxophone history and literature, mechanical design and development, acoustics, modern schools of performance, selected teaching and performance techniques.

Mus 5480. University Brass Choir. (1 cr [max 8 cr]; SP–Audition, #)
The University Brass Choir is an ensemble of 16 brass and percussion players exploring unique literature that spans 400 years. From the rich antiphonal music of Giovanni Gabrieli (1557-1612) to the works of the 20th century. The Brass Choir performs in Twin Cities churches and concert halls.

Mus 5481. Trumpet Pedagogy. (2 cr; SP–Sr or grad in music or #)
Principles of trumpet pedagogy. Discussion of literature, history, and current teaching aids.

Mus 5485. Transcription for Winds. (2 cr; SP–3502 or #)
Principles of music manuscript and examination of transcription examples. Transcription projects with score and parts. Smaller projects that involve arrangements and original compositions.

Mus 5490. Percussion Ensemble. (1 cr [max 10 cr]; SP–#; A-F only)
Practice and performance of standard and contemporary compositions for percussion instruments in various combinations.

Mus 5491. Percussion Literature I. (2 cr; SP–Jr or sr or grad or #; A-F only)
Repertoire derived from orchestral and band literature for snare drum, timpani, mallet instruments, and various percussion accessories. Major works of the 20th century written for solo percussion, percussion ensemble, and chamber groups of percussion and non-percussion instruments.

Mus 5492. Percussion Literature II. (2 cr; SP–Jr or sr or grad or #; A-F only)
Repertoire derived from orchestral and band literature for snare drum, timpani, mallet instruments, and various percussion accessories. Major works of the 20th century written for solo percussion, percussion ensemble, and chamber groups of percussion and non-percussion instruments.

Mus 5501. Intensive Theory and Analysis of 20th-Century Music. (4 cr; SP–3502 or #; A-F only)
Designed for music majors only, the course is comprised of an intensive introduction to the theory and analysis of art music in various styles developed during the 20th century.

Mus 5533. Music Since 1945. (3 cr; SP–3502, #; A-F only)
Examine procedures and techniques of music composed since 1945. Integral serialism, sound mass, electronic music, indeterminancy, improvisation, and minimalism in the works of Babbitt, Ligeti, Davidovsky, Oliveros, Cage, Riley, and Reich.

Mus 5541. Counterpoint I. (3 cr; SP–3501, 3511 or #; A-F only)
Practice writing in polyphonic styles of Renaissance and Baroque; species counterpoint, canonic and fugal, and other imitative procedures. Study representative forms: motets, inventions, fugues, and chorale-based idioms. Analysis of works by Lassus, Palestrina, Victoria, Purcell, Buxtehude, Fischer, and Bach.

Mus 5542. Counterpoint II. (4 cr; SP–5541; A-F only)
Advanced writing in three and more voice polyphonic styles of Renaissance and Baroque. Analyze works of such composers as Lassus, Palestrina, and Bach; emphasis on canonic and fugal procedures.

Mus 5550. Composition. (2 cr [max 8 cr]; SP–3502 or equiv, 3551 or grad, #; A-F only)
Original works in various forms. Development of individual compositional style in a post-tonal idiom. Exploration of a variety of forms, performing forces, and techniques.

Mus 5561. Orchestration I. (3 cr; SP–3502; A-F only)
Scoring techniques for ensembles in combination and full orchestra; year-long sequence. Score study of representative works from 18th through 20th centuries.

Mus 5562. Orchestration II. (3 cr; SP–5561; A-F only)
Scoring techniques for ensembles in combination and full orchestra; year-long sequence. Score study of representative works from 18th through 20th centuries.

Mus 5571. Schenkerian Analysis for Performers. (3 cr; SP–3502; A-F only)
Theory/analysis of tonal music using principles developed by Henrich Schenker. Basic concepts/notation, their application to excerpts/short pieces from 18th/19th centuries.

Mus 5572. Chromaticism in Tonal Music. (3 cr; SP–3502)
Exploration of chromatic tonal practices through analysis of selected repertoire, completion of written exercises (figured bass, harmonization of melodies, model composition), ear-training, and keyboard exercises.

Mus 5591. Electronic Music: History, Literature, Principles. (3 cr; SP–#, at least jr; A-F only)
In-depth survey of electroacoustic music repertoire, from tape/analog music through computer-generated compositions. Basic principles of acoustics, electronic sound generation/manipulation, digital signal processing techniques. Programming languages for digital sound synthesis. Work with editing software, MIDI applications.

Mus 5592. Digital Music Synthesis and Processing Techniques. (3 cr; SP–5591 or #; A-F only)
Study of specific dsp topics such as filtering, formant synthesis, reverberation techniques, and additive synthesis. Work with interactive MIDI applications.

Mus 5597. Music and Text. (3 cr; SP–3502; A-F only)
Designed for music majors only, this course gives an introduction to the analysis of music with texts such as art song and opera.

Mus 5611. Resources for Music Research. (3 cr; SP–3603; A-F only)
Development of skills in identifying, locating, and evaluating resources for research in music. Computer-searching techniques, acquaintance with basic reference sources in the field, preparation of the music research paper.

Mus 5620. Topics in Opera History. (3 cr [max 6 cr]; SP–grad music major or #; A-F only)
Through the study of specific operas, students will examine the ways in which intersections of geography, politics, and musical style influenced and perpetuated operatic production within specific geographical and chronological boundaries. Periods/countries will vary each semester.

Mus 5644. Music in 20th-Century American Culture. (3 cr; SP–3603, 5501 or #; A-F only)
Stylistic and cultural bases of cultivated and vernacular traditions and their intersections. Topics include folk and ethnic musics, ragtime, city blues and jazz, rock, musical theater, impact of technology, modernism, nationalism, new accessibility.

Mus 5647. 20th-Century European/American Music. (3 cr; SP–3603 or equiv, 5501 or equiv, 12 undergrad cr in music history)
Emphasizes major artistic movements, stylistic turning points, social roles of music. Interactions between high art, popular, ethnic musics; contributions of men and woman as composers and performers.

Mus 5658. History of the Symphony in the 20th Century. (3 cr; SP–3603, 5501 or #; A-F only)
History of symphony (and related genres) in Europe and America, ca. 1890 to present. Changing aesthetic concerns, structural, harmonic, and timbral innovations. Sociocultural contexts; analysis and criticism.

Mus 5666. Stravinsky. (3 cr; SP–5502, 12 cr music history; A-F only)
Analysis and criticism of representative works; aesthetic concerns as expressed in writings of Stravinsky and others; influence upon European and American composers; biographical issues and contributions to artistic life, particularly the ballet.

Mus 5668. Beethoven's Symphonies. (3 cr; SP–3603, #; A-F only)
Analytical overview of selected movements from Beethoven's 9 symphonies. Principles of sonata analysis (norm and deformation); introduction to wider contexts of interpretation and understanding (generic, expressive, social).

Mus 5804. Folk and Traditional Musics: Selected Cultures of the World. (3 cr; SP–1801 or 1804 or music grad or #; A-F only)
A study of selected music traditions from 5 to 7 world cultures. Genres, social institutions, concepts, styles, instruments, and usages.

Mus 5950. Topics in Music. (1-4 cr [max 15 cr])
Each offering focuses on a single topic. Topics specified in *Class Schedule*.

Mus 5993. Directed Studies. (1-4 cr [max 12 cr]; SP–#, Δ, ❑)
Guided individual reading or study.

Mus 8110. Sonata Seminar. (2 cr [max 8 cr]; SP–Accompanying emphasis, strings and winds by audition, #; A-F only)
Performance in standard Baroque, Classical, and Romantic sonatas for piano and violin, cello, viola, flute, clarinet, or oboe.

Mus 8112. Instrumental Repertoire: Reduction and Realization. (2 cr; SP–Grad student in accompanying/conducting; A-F only)
Reducing orchestra scores, representing orchestral reductions at piano, working with conductors. Conductors join course in mid-semester.

Mus 8132. Pedagogy of Sight-Reading for Pianists. (1 cr; A-F only)
Pedagogy of sight-reading. Theoretical literature/methods books reviewed/critiqued. Methods of observation, evaluation, and instruction. In-class demonstrations use teacher/student pairings, videotape recording/playback.

Mus 8170. Advanced Vocal Accompanying Skills and Repertoire. (2 cr [max 8 cr]; SP–[French, German, Italian diction], accompanying or DMA voice emphasis or MM voice emphasis by audition; A-F only)
Advanced performance (Lieder, melodie, opera) emphasizing coaching techniques and performance skills of pianists and singers.

Mus 8171. Song Repertoire and Performance for Pianists and Singers: German Lieder. (2 cr; SP–[Grad student with major in vocal performance or in accompanying or in piano], #; A-F only)
Surveys standard German-language song repertoire: Mozart, Schubert, Schumann, Brahms, Strauss, Wolf.

Mus 8172. Song Repertoire and Performance for Pianists and Singers: French Melodies. (2 cr; SP–[Grad student with major in vocal performance or in accompanying or in piano], #; A-F only)
Surveys standard French melodies: Faure, Chausson, Duparc, Debussy, Ravel, Poulenc, Caplet, Roussel, Satie.

Mus 8173. Song Repertoire and Performance for Pianist and Singers: 20th Century. (2 cr; SP–[Grad student with major in vocal performance or in accompanying or in piano], #; A-F only)
Surveys standard 20th-century songs; non-traditional notation, "avant garde" compositions.

Mus 8174. Song Repertoire and Performance for Pianists and Singers: Italian and English Song. (2 cr; SP–[Grad student with major in vocal performance or in accompanying or in piano], #; A-F only)
Surveys standard English songs from Elizabethan Age to present, Italian songs, "bel canto" tradition.

Mus 8175. Song Repertoire and Performance for Pianists and Singers: Russian, Spanish, and Other Languages. (2 cr; SP–[Grad student with major in vocal performance or in accompanying or in piano], #; A-F only)
Surveys standard songs in Russian, Spanish, and other languages: Turina, Obradors, Granados, Nin, Rodrigo, Monstsalvatge, Guridi, Tchaikovsky, Rachmaninoff, Prokofiev, Stravinsky, Shostakovich. International Phonetic Alphabet.

Mus 8181. Operatic Accompaniment Skills and Repertoire. (2 cr; SP–Grad student with major in accompanying or in conducting; A-F only)
Development of skills required in operatic accompanying/coaching work. Standard opera arias, cultivation of orchestral sound at the piano, stylistic traditions, working with conductors.

Mus 8237. Score Study: Choral. (3 cr; SP–#; A-F only)
Analysis of various choral scores ranging from Renaissance through 20th century. Reading of choral and choral/orchestral scores at piano, including scores with C clefs and transposing instrument.

Mus 8255. Choral Literature: Baroque Era to the Present. (3 cr; SP–#; A-F only)
Survey of sacred and secular choral works.

Mus 8299. Performance in Choral Conducting. (3 cr; SP–#; A-F only)
Preparation and performance of choral conducting recital, with supporting paper.

Mus 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Mus 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

Mus 8470. Wind Ensemble/Band Conducting (Wind Conducting). (4-12 cr [max 12 cr]; SP–#; A-F only)
Seminar in wind ensemble/band conducting techniques. Work with diverse wind repertoires of differing styles/periods.

Mus 8471. Wind Ensemble/Band Conducting I. (4 cr; SP–Wind conducting emphasis or #; A-F only)
Seminar in wind band repertory of 18th, 19th, and 20th centuries emphasizing stylistic and period practices; techniques of score study, analysis, and interpretation. Practical conducting experience.

Mus 8472. Wind Ensemble/Band Conducting II. (4 cr; SP–Wind conducting emphasis or #; A-F only)
Seminar in study of music for small wind ensembles and Harmoniemusik tradition; rehearsal techniques and strategies. Music since 1960; contemporary notation systems; rehearsal techniques and strategies. Practical conducting experience.

Mus 8479. Performance and Document: Wind Ensemble/Band Conducting. (2 cr; SP–8472, #; A-F only)
Preparing and performing full wind ensemble or band conducting program with supporting document.

Mus 8480. Orchestral Conducting. (4 cr [max 16 cr]; SP–#; A-F only)
Seminar in orchestral conducting techniques, including work with diverse orchestral, operatic, choral, and dance repertoires of differing styles and periods; 17th century to present.

Mus 8489. Performance and Document: Orchestral Conducting. (3 cr; SP–#; A-F only)
Preparing and performing full orchestral conducting program with supporting document.

Mus 8490. Choral Conducting. (4-12 cr [max 12 cr]; SP–#; A-F only)
Prepare students for careers in conducting. Students study musical scores and conducting/rehearsal techniques.

Mus 8501. Music Theory Pedagogy. (3 cr; SP–Undergrad music degree or #; A-F only)
Comparison of pedagogical philosophies/methods in music theory; examination of pedagogical literature; practice teaching; curriculum design.

Mus 8550. Composition. (3 cr [max 12 cr]; SP–#; A-F only)
Creation of original musical works in various instrumental and vocal forms; advanced development of writing and realization of musical ideas.

Mus 8560. Readings in Music Theory. (3 cr [max 12 cr]; SP–#; A-F only)
Seminars on major theoretical text or group of interrelated texts. Pre-tonal, tonal, post-tonal, or non-Western focus in individual offerings.

Mus 8565. Text Setting. (3 cr; SP–Emphasis in composition or choral conducting or voice or accompanying or music education, #; A-F only)
Techniques for many mediums (from jungle to art song to choral settings) through analysis of repertoire and original compositions. Emphasizes sense and sound aspects of language, nature of specific text, and special considerations in writing creatively for voice.

Mus 8570. Seminar in Composition. (2 cr [max 4 cr]; SP–Composition emphasis or #; A-F only)
Aesthetic and professional issues in composition. Survey of professional activities, including r[e]sum[e] and grant writing and concert production.

Mus 8571. Composers' Laboratory. (3 cr [max 12 cr]; SP–8570; A-F only)
Preparing original music composition to specification for possible radio/TV/theatre/film use. Analytic projects based on research into current practice of music criticism/music journalism. Philosophical and sociological research into creative process.

Mus 8575. Women Composers. (3 cr; SP–#; A-F only)
Contributions by women composers to development of European-American art music, primarily from 17th through 20th centuries. Historical and current issues affecting women's access to professional music sphere. Music analysis, listening list, research, and performance components.

Mus 8580. Topics in Tonal Analysis. (3 cr [max 12 cr]; SP–Grad music major who has completed all undergrad requirements in tonal theory and analysis.; A-F only)
Seminar. Sample topics: string quartets of Beethoven, chamber music of Brahms, and significant works by other tonal composers.

Mus 8581. Schenkerian Theory and Analysis I. (3 cr; SP–#; A-F only)
Analysis and critical readings pertaining to theory of tonal music developed by Heinrich Schenker. Application of his method to representative repertoire from 18th and 19th centuries. Contrapuntal writing modeled after presentation in Schenker's [Counterpoint].

Mus 8582. Schenkerian Theory and Analysis II: 18th Century. (3 cr; SP–8581 or #; A-F only)
Application of Schenkerian theory to 18th-century music, coordinated with critical study of major music treatises from that era.

Mus 8583. Schenkerian Theory and Analysis III: 19th Century. (3 cr; SP–8581 or #; A-F only)
Application of Schenkerian theory to music from 19th century, coordinated with critical study of major music treatises from that era.

Mus 8590. Topics in 20th-Century Analysis. (3 cr [max 12 cr]; SP–Grad music major, #; A-F only)
Seminar explores literatures of 20th-century art music.

Mus 8631. Seminar: Music in Medieval Europe. (3 cr; SP–Undergrad music degree; A-F only)
Selected genres of polyphonic and monophonic music, 9th-14th centuries, for analysis and cultural criticism. Social roles of music and performance traditions; current musicological issues.

Mus 8632. Seminar: Music in Early Modern Europe. (3 cr; SP–Undergrad music degree; A-F only)
Transformation of chanson, madrigal, mass, and motet from 1400 to 1580. Analysis and cultural criticism; social roles of music and performance traditions; current musicological issues.

Mus 8640. Seminar in Musicology. (3 cr [max 12 cr]; SP–Musicology or theory emphasis or #; A-F only)
Topics vary; readings, research, strategies, and methods.

Mus 8644. Seminar: Advanced Research in Historical Musicology. (3 cr; SP–Undergrad music degree; A-F only)
Major reference and research materials in musicology and related disciplines, including databases. Historical methods and historiography. Locating and interpreting primary sources of music and archival documents. Developing research strategies for degree papers and theses. Forms of documentation and historical writing.

Mus 8645. Current Musicology: Readings. (3 cr; SP–Musicology or theory emphasis or #; A-F only)
Readings and topics in recent scholarly and analytical work.

Mus 8647. Seminar: The Critical Editing of Early Music—Method and Practice. (3 cr; SP–Undergrad music degree; A-F only)
Preparation of critical editions from primary sources of vocal and instrumental music (partbooks and tablatures). Nature of musical sources, both manuscripts and prints. Stemmatic filiation, editorial judgment and method, presentation of text.

Mus 8651. Sonata Theory. (3 cr; SP–#; A-F only)
Principles of the classic sonata: norms, types, and deformations. Structural analysis, analytical methodologies, and fundamentals of sonata hermeneutics.

Mus 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Mus 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Mus 8864. Current Issues in Ethnomusicology. (3 cr; SP–#; A-F only)
Ethnomusicological methods, theorizing, and research practice. Current issues in monographs, journals, and anthologies. Fieldwork practicum.

Mus 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Mus 8994. Directed Research. (1-3 cr [max 12 cr]; SP–#; A-F only)
Directed research.

Mus 8999. Recital Credits: Doctoral. (4 cr [max 20 cr]; SP–D.M.A. student, #; A-F only)
Registration for recital credits coincides with performance of D.M.A. recital (five recitals for 20 credits).

Music Applied (MusA)

School of Music

College of Liberal Arts

Note: MusA 5101 through MusA 5123 are private instruction and the prerequisites are (2 cr [max 8 cr]; SP–Audition, Δ; A-F only).

MusA 5101. Piano—Elective.

MusA 5102. Harpsichord—Elective.

MusA 5103. Organ—Elective.

MusA 5104. Voice—Elective.

MusA 5105. Violin—Elective.

MusA 5106. Viola—Elective.

MusA 5107. Cello—Elective.

MusA 5108. Double Bass—Elective.

MusA 5109. Flute—Elective.

MusA 5111. Oboe—Elective.

MusA 5112. Clarinet—Elective.

MusA 5113. Saxophone—Elective.

MusA 5114. Bassoon—Elective.

MusA 5115. French Horn—Elective.

MusA 5116. Trumpet—Elective.

MusA 5117. Trombone—Elective.

MusA 5118. Euphonium—Elective.

MusA 5119. Tuba—Elective.

MusA 5121. Percussion—Elective.

MusA 5122. Harp—Elective.

MusA 5123. Guitar—Elective.

Note: MusA 5401 through MusA 5423 are private instruction and the prerequisites are (2-4 cr [max 24 cr]; SP–Audition, Δ; A-F only).

MusA 5401. Piano—Secondary.

MusA 5402. Harpsichord—Secondary.

MusA 5403. Organ—Secondary.

MusA 5404. Voice—Secondary.

MusA 5405. Violin—Secondary.

MusA 5406. Viola—Secondary.

MusA 5407. Cello—Secondary.

MusA 5408. Double Bass—Secondary.

MusA 5409. Flute—Secondary.

MusA 5411. Oboe—Secondary.

MusA 5412. Clarinet—Secondary.

MusA 5413. Saxophone—Secondary.

MusA 5414. Bassoon—Secondary.

MusA 5415. French Horn—Secondary.

MusA 5416. Trumpet—Secondary.

MusA 5417. Trombone—Secondary.

MusA 5418. Baritone—Secondary.

MusA 5419. Tuba—Secondary.

MusA 5421. Percussion—Secondary.

MusA 5422. Harp—Secondary.

MusA 5423. Guitar—Secondary.

Note: MusA 8301 through MusA 8324 are private instruction and the prerequisites are (2-4 cr [max 48 cr]; SP–Audition, Δ; A-F only).

MusA 8301. Piano—Major.

MusA 8302. Harpsichord—Major.

MusA 8303. Organ—Major.

MusA 8304. Voice—Major.

MusA 8305. Violin—Major.

MusA 8306. Viola—Major.

MusA 8307. Cello—Major.

MusA 8308. Double Bass—Major.

MusA 8309. Flute—Major.

MusA 8311. Oboe—Major.

MusA 8312. Clarinet—Major.

MusA 8313. Saxophone—Major.

MusA 8314. Bassoon—Major.

MusA 8315. French Horn—Major.

MusA 8316. Trumpet—Major.

MusA 8317. Trombone—Major.

MusA 8318. Euphonium—Major.

MusA 8319. Tuba—Major.

MusA 8321. Percussion—Major.

MusA 8322. Harp—Major.

MusA 8323. Guitar—Major.

MusA 8324. Accompanying/Coaching.

Note: MusA 8501 through MusA 8524 are private instruction and the prerequisites are (2-4 cr [max 8 cr]; SP–#; A-F only).

MusA 8501. Piano: Beyond Requirement.

MusA 8502. Harpsichord: Beyond Requirement.

MusA 8503. Organ: Beyond Requirement.

MusA 8501. Piano: Beyond Requirement.

MusA 8502. Harpsichord: Beyond Requirement.

MusA 8503. Organ: Beyond Requirement.

MusA 8504. Voice: Beyond Requirement.

MusA 8505. Violin: Beyond Requirement.

MusA 8506. Viola: Beyond Requirement.

MusA 8507. Cello: Beyond Requirement.

MusA 8508. Double Bass: Beyond Requirement.

MusA 8509. Flute: Beyond Requirement.

MusA 8511. Oboe: Beyond Requirement.

MusA 8512. Clarinet: Beyond Requirement.

MusA 8513. Saxophone: Beyond Requirement.

MusA 8514. Bassoon: Beyond Requirement.

MusA 8515. French Horn: Beyond Requirement.

MusA 8516. Trumpet: Beyond Requirement.

MusA 8517. Trombone: Beyond Requirement.

MusA 8518. Euphonium: Beyond Requirement.

MusA 8519. Tuba: Beyond Requirement.

MusA 8521. Percussion: Beyond Requirement.

MusA 8522. Harp: Beyond Requirement.

MusA 8523. Guitar: Beyond Requirement.

MusA 8524. Accompanying/Coaching: Beyond Requirement.

Music Education (MuEd)

School of Music
College of Liberal Arts

MuEd 5011. Music in the Elementary Classroom Curriculum. (2 cr; SP–Mus 1001, elem ed major grad)
Overview of the fundamentals of music, methods, and materials for incorporating singing, rhythmic activities, classroom instruments, movement, listening, appreciation, and creation into the context of classroom curriculum.

MuEd 5112. Research in Music Education: Techniques. (3 cr; SP–Grad music ed major or #; A-F only)
Methods and techniques employed in investigating and reporting music education problems; proposal development; bibliographic skills involved in conducting a significant review of related research.

MuEd 5115. Research in Music Education: Measurement. (3 cr; A-F only)
Assessment of music behaviors, including test design, interpretation of test results, and evaluation and reporting of student achievement; published tests in music; uses of assessment and measurement in the classroom and in research.

MuEd 5211. Foundations of Music Education. (3 cr; A-F only)
An overview of the historical, philosophical, and psychological foundations of music education.

MuEd 5313. Youth Music: Preferences, Influences, and Uses. (2 cr; A-F only)
Youth music preferences and their determinants; how music influences youth behavior; students' and teachers' uses of commercial styles. Particularly appropriate for educators and parents.

MuEd 5433. Techniques and Materials: Choral Ensembles. (2 cr; SP–Music or music ed major or #; A-F only)
Research and literature on vocal and choral music education; choral curriculum issues; repertoire selection; rehearsal techniques.

MuEd 5606. Movement-Based Methods for Music Education. (2 cr; SP–Music or music ed major or #; A-F only)
Participation in movement activities; study of Dalcroze philosophy and techniques; applications of movement to music education; examination of research.

MuEd 5611. Teaching Music With Related Arts. (2 cr; A-F only)
Methods and materials for teaching music in cultural context including other art forms.

MuEd 5647. Teaching the Percussion Instruments. (2 cr; A-F only)
Contemporary approaches for teaching percussion in the schools; development of curricular materials and practice in performance techniques.

MuEd 5655. New Dimensions in Music Education. (2 cr; A-F only)
Analysis of recent curricular trends and current issues.

MuEd 5664. Teaching Music on the Internet. (3 cr; A-F only)
Home page development techniques, investigation of software and materials, audio and video utilities, and research applications.

MuEd 5667. Computer-Based Music Instruction. (3 cr; SP–Music or music ed major or #; A-F only)
Design and development of computer applications for the music classroom. Creating interactive audio and video presentations for music theory, ear training, composition, analysis, music history, and appreciation.

MuEd 5668. Computerized Music Notation. (3 cr [max 6 cr])
Fundamentals of music notation and printing utilizing the computer, MIDI keyboards, and Finale software program. Preparation of instrumental and vocal scores, part extraction and page layout. Basic techniques for sequencing and transcription.

MuEd 5750. Topics in Music Education. (1-4 cr [max 8 cr]; A-F only)
Each offering focuses on a single topic. Topics specified in *Class Schedule*.

MuEd 5991. Independent Study. (1-4 cr [max 8 cr]; SP–Music ed or music therapy major or grad, #, Δ; A-F only)
Independent study project organized by the student in consultation with the appropriate instructor.

MuEd 8281. Seminar: Philosophical Issues. (3 cr; SP–Master's degree in music or music ed or #; A-F only)
Issues in philosophical foundations of music education. Required for doctoral students with music education emphasis.

MuEd 8282. Seminar: Historical Issues. (3 cr; SP–Master's degree in music or music ed or #; A-F only)
Issues in historical foundations of music education. Required for doctoral students with music education emphasis.

MuEd 8283. Seminar: Psychological Issues. (3 cr; SP–Master's degree in music or music ed or #; A-F only)
Issues in psychological foundations of music education.

MuEd 8284. Seminar: Research and Scholarly Issues. (3 cr; SP–Ph.D. student in music ed or #; A-F only)
Scholarly and professional expectations of music educators and music therapists in academia and other positions of leadership; writing for a variety of professional purposes and publications.

MuEd 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

MuEd 8880. Master's Research Project. (1-5 cr [max 5 cr]; SP–Grad music ed major, #; A-F only)
Individual Plan B projects.

MuEd 8994. Directed Research. (1-8 cr [max 8 cr]; SP–#; A-F only)

Natural Resources and Environmental Studies (NRES)

Department of Forest Resources
College of Natural Resources

NRES 5000. Colloquium: Natural Resources and Environmental Studies. (1 cr [max 6 cr]; A-F only)
Lectures from experts. Readings/discussion of current environmental topics/issues. Topics vary. Meets with 3000.

NRES 5001. Colloquium: Perspectives on Treaty Rights. (2 cr [max 4 cr])
Readings, class discussion about treaty rights reserved by indigenous Americans with respect to use of natural resources. Emphasizes Midwest issues. Web-assisted course. Meets with 3001.

NRES 5002. Colloquium: Restoration of Aquatic Systems. (1 cr)
Key concepts/techniques. Common factors in restoration projects. Threats to health of aquatic ecosystems.

NRES 5021. Plant Resource Management and the Environment. (3 cr; QP–Grad student; SP–§3021; grad student)
World vegetation management practices, extent, implications. Emphasizes forest management, agriculture, agroforestry. Historical, current, prospective practices. Environmental/societal implications.

NRES 5202. Social Change: Dispute Resolution, Leadership, and Partnerships. (3 cr; QP–Grad student or #; SP–Grad student or #; A-F only)
Philosophy, art, science, practice of leadership; its relationship to management, environmental ethics. Leadership models, traits, behaviors, style, group process. Development of personal leadership philosophy.

NRES 5241. Natural Resource Policy and Administration. (3 cr; QP–[[ApEc 1101 or Econ 1101], grad student] or #; SP–§3241; [[ApEc 1101 or Econ 1101], grad student] or #)
Basic concepts of political/administrative processes for natural resource policy and program development. Policy process, participants in policy development and in public programs. Case studies.

NRES 5245. Recreation Policy and Landscape-Level Planning. (3 cr; QP–Grad student or #; SP–§3245; grad student or #; A-F only)
Broad themes of recreational land-use policy/planning in the United States. Selected historical/contemporary policy issues. Policy as product of social conflict over use of public resources. Landscape-level planning as means to implement policy, resolve social conflict.

NRES 5261. Economics and Natural Resources Management. (3 cr; QP–[[ApEc 1101 or Econ 1101], grad student] or #; SP–§3261; [[ApEc 1101 or Econ 1101], grad student] or #; A-F only)
Economic concepts/tools for natural resources management. Financial/economic valuation, assessment methods, links to planning/management. Cash flow analysis, benefit cost analysis methods/examples.

NRES 5461. Water Quality: The International Dimension. (3 cr; QP–Water resource course; SP–Water resource course)
How culture drives water quality management. How/why management varies among countries. Multinational river basin compacts, policies for international management. Active learning approaches.

NRES 5480. Topics in Natural Resources. (1-4 cr [max 6 cr]; SP–Sr or grad student)
Lectures by visiting scholar or regular staff member. Topics specified in *Class Schedule*.

NRES 5575. Wetlands Conservation. (3 cr; QP–Sr or grad student or #; SP–§3575; sr or grad student or #)
Freshwater wetland classification, wetland biota, current/historic status of wetlands, value of wetlands. National, regional, Minnesota wetlands conservation strategies. Ecological principles used in wetland management.

NRES 5703. Agroforestry: Role in Watershed Management. (2 cr)
Agroforestry practices, what they are, their purpose. Production/watershed protection benefits derived from such practices. Role of agroforestry in sustainable development. Agroforestry examples/case studies presented from North America, developing countries.

Neuroscience (NSc)

College of Biological Sciences

NSc 5031W. Perception. (3 cr; QP–Psy 3031 or Psy 3051 or #; SP–Psy 3031 or Psy 3051 or #)
Cognitive, computational, and neuroscience perspectives on visual perception. Topics include color vision, pattern vision, image formation in the eye, object recognition, reading, and impaired vision.

NSc 5034. Psychobiology of Vision. (3 cr; QP–Psy 3031 or grad or #; SP–Psy 3031 or #)
Analysis of the properties and biological bases of visual perception in humans and animals. Emphasis on color vision, visual sensitivity and adaptation, nerve cells and circuits in the eye, structure and function of the visual brain.

NSc 5037. Psychology of Hearing. (3-4 cr; QP–Psy 3031 or #; SP–Psy 3031 or #)
Biological and physical aspects of hearing, auditory psychophysics, theories and models of hearing, perception of complex sounds including music and speech, clinical and other applications.

NSc 5201. Computational Neuroscience I: Membranes and Channels. (3 cr; SP–Calculus through differential equations)
Comprehensive examination of membrane and ion channels using UNIX workstations to simulate their properties. Hodgkin-Huxley model, nonlinear dynamic systems, voltage- and ligand-gated ion channels, impulse propagation.

NSc 5202. Computational Neuroscience II: Neural Systems and Information Processing. (3 cr; QP–Phsl 5201 or equiv, understanding of UNIX; SP–Phsl/NSc 5201 or equiv, understanding of UNIX)
Comprehensive investigation of computational properties of single neurons and locally connected cell networks. Linear cable theory; compartmental modeling of single neuron properties; spatio-temporal interactions between synaptic inputs and neuronal dendritic trees; computational properties of passive and active dendritic spines and spine clusters; quantitative interpretation of whole-cell voltage-clamp data; and dynamics of locally connected cell networks.

NSc 5461. Cellular and Molecular Neuroscience. (4 cr; SP–#)
A contemporary cellular and molecular approach to the study of the nervous system. Includes problem sets designed to teach important physiological concepts and discussion of original research papers. Required for first-year neuroscience students and appropriate for other graduate students.

NSc 5462. Neuroscience Principles of Drug Abuse. (2 cr; QP–#; SP–#)
Current research on drugs of abuse; their mechanisms of action, characteristics shared by various agents, and neural systems affected by them.

NSc 5481. Invertebrate Neurobiology. (2 cr; SP–§Ent 5480)
Fundamental principles and concepts underlying cellular bases of behavior and "systems" neuroscience. Particular invertebrate preparations discussed.

NSc 5551. Itasca Cell and Molecular Neurobiology Laboratory. (4 cr; SP–Neuroscience grad or #; A-F only)
Intensive lab introduction to cellular and molecular aspects of research techniques in contemporary neurobiology; held at Itasca Biological Station. Electrophysiological investigations of neuronal properties, neuropharmacological assays of transmitter action, and immunohistochemical studies in experimental preparations.

NSc 5561. Systems Neuroscience. (4 cr; SP–¶5461; A-F only)
Advanced principles of neural systems organization. Lecture/lab.

NSc 5661. Behavioral Neuroscience. (3 cr; QP–NSc major or minor or #; SP–NSc major or minor or #; A-F only)
The neural coding and representation of movement parameters, and the neural mechanisms underlying higher order processes such as memorization, memory scanning, and mental rotation. Emphasis on experimental psychological studies in human subjects, single cell recording experiments in subhuman primates, and artificial neural network modeling.

NSc 8026. Neuro-Immune Interactions. (3 cr; SP–5111 or equiv, MicB 5218 or equiv)
Regulatory systems (neuroendocrine, cytokine, and autonomic nervous systems) linking brain and immune systems in brain-immune axis. Functional effects of bidirectional brain-immune regulation.

NSc 8031. Seminar: Visual Perception. (2 cr; SP–Psy 5031 or #)
Cognitive, psychological, and neurophysiological determinants of visual perception. Current research.

NSc 8124. Recent Advances in Chemoreception Science. (1 cr; SP–#)
Current issues addressed comparatively through directed reading/discussion of current literature. Primarily for advanced students studying neural basis of taste, smell, and the common chemical sense. All aspects of chemoreception from molecular biology to behavior.

NSc 8207. Seminar: Psychopharmacology. (1 cr; SP–#; S-N only)
Faculty and postdoctoral fellows interested in psychotropic drugs and chemicals participate. Some seminars devoted to biomedical ethics. Neurochemistry, pharmacology, and behavior as antecedent or consequential variables.

NSc 8211. Developmental Neurobiology. (3 cr)

NSc 8216. Selected Topics in Autonomic and Neuroendocrine Regulation. (1 cr; QP–CBN 5111 or Phsl 5112 or equiv or #; SP–8002 or #; S-N only)
Advanced seminar.

NSc 8217. Systems and Computational Neuroscience. (2 cr; SP–CBN 5111 or #; S-N only)
Advanced seminar.

NSc 8221. Neurobiology of Pain and Analgesia. (2 cr; SP–#)

NSc 8222. Central Regulation of Autonomic Function. (3 cr; SP–CBN 5111; A-F only)
Neural and hormonal sensory pathways affecting central autonomic nuclei involved in maintenance of homeostasis. Current research on physiological control systems at cellular, organ, and integrative levels.

NSc 8247. Anatomy and Physiology of Hearing and Balance. (3 cr; SP–#)
Structure/function of auditory/vestibular systems. Network analysis of middle/inner ear mechanics, hair cell biophysics, auditory nerve/CNS electrophysiology, information processing, neural mechanisms subserving balance/gaze, cellular morphology, and computer models.

NSc 8248. Directed Readings in Auditory Physiology. (1-2 cr; SP–#)
Current research on biophysics and physiology of auditory system; topics selected for each student. Written reviews prepared and discussed.

NSc 8320. Readings in Neurobiology. (1-4 cr [max 4 cr]; SP–#)
Topics in neurobiology and neurophysiology.

NSc 8333. FTE: Master's. (1 cr; SP–Master's student, adviser approval, ❑)

NSc 8334. Laboratory Neuroscience. (1-3 cr [max 10 cr]; SP–Grad NSc major; S-N only)
Guided research.

NSc 8401. Neurobiology of Disease. (2 cr; SP–[5461, CBN 5111] or #)
Major neurological diseases, pathogenic mechanisms, potential applications of basic neuroscience to human disease.

NSc 8411. Teaching in Neuroscience. (1 cr [max 4 cr]; SP–#; S-N only)
Grad students serve as primary instructors in 4151 and work with fellow students and faculty mentors to design curriculum, classroom sessions, exams, and course evaluations.

NSc 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

NSc 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

NSc 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr])

NSc 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Neuroscience Department (NSci)

Department of Neuroscience
Medical School

NSci 5110. Dental Neuroscience for Graduate Students. (2 cr; SP–BioC 3021, Biol 4004, #; intended for grad students who require a comprehensive grad-level neuroscience course; A-F only)
Structure/function of human nervous system. Lectures and reading assignments emphasize topics pertinent to dentistry.

NSci 5111. Medical Neuroscience for Graduate Students. (4 cr; SP–BioC 3021, Biol 4004, #; intended for grad students who require a comprehensive medically-oriented neuroscience course; A-F only)
Survey of molecular, cellular, and systems neuroscience as related to medicine. Lecture/lab.

Neurosurgery (NSu)

Department of Neurosurgery
Medical School

NSu 8305. Neurosurgical Diagnosis. (3 cr; S-N only)
Neurosurgical diagnosis.

NSu 8308. Neurosurgical Problems and Management. (3 cr; S-N only)
Neurosurgical problems and management.

NSu 8311. Operative Neurosurgery. (3 cr; S-N only)
Operative neurosurgery.

NSu 8316. Neurosurgical Research. (4 cr; S-N only)
Neurosurgical research.

NSu 8318. Neuroradiological Conference. (1 cr; S-N only)
Neuroradiological conference.

NSu 8320. Neurosurgical Conference. (1 cr; S-N only)
Neurosurgical conference.

NSu 8324. Readings in Neurobiology. (1-15 cr; SP–8104, ❑)

NSu 8330. Neurosurgery Literature Seminar. (1 cr; S-N only)
Neurosurgery literature seminar.

Nursing (Nurs)

School of Nursing

Nurs 5141. Ethical Issues in Health Care of Elders. (3 cr; SP–Grad student or nursing sr or #)
Health care related ethical issues that confront elders, their families, health care providers, and society.

Nurs 5170. Research Topics. (1-16 cr [max 16 cr]; QP–#; SP–#)
Exploration of research topic to meet individual student needs.

Nurs 5171. SPSS Programming and Data Analysis. (2 cr; QP–Inferential statistics, [[grad or professional] student] or #]; SP–Inferential statistics, [[grad or professional] student] or #])
Skills needed to collect/analyze data using SPSS for Windows. Review of statistical methods.

Nurs 5172. Decision Making in Health Care. (2 cr; QP–Grad student, #; SP–Grad student, #)
Selected classical conceptual models of decision making, their particular perspectives/limitations/usefulness for decision making about health care issues. Models/components used to assess, evaluate, teach, or help healthy people, patients, families, health care professionals, or policy making groups in making health care decisions.

Nurs 5200. Holistic Health Assessment and Therapeutics for Advanced Practice Nurses. (3 cr; SP–#)
Health assessment knowledge/skills for advanced nursing practice with patients across age span, including pregnancy. Selected nursing interventions, complementary therapies examined for application to specific populations/illnesses.

Nurs 5202. Introduction to Complementary Healing Practices. (3 cr)
Historical and cultural context of the allopathic and complementary healing traditions. Philosophies and paradigms of selected complementary therapies and culturally based healing traditions; descriptions of selected interventions.

Nurs 5204. Population Focused Assessment and Intervention. (2 cr; SP–[Grad Nursing major, 8242] or #)
Population focused assessment in health planning. Models of assessment for communities, organizations, other aggregates. Skill development in conducting/analyzing/using assessment in planning population focused interventions.

Nurs 5222. Advanced Physiology. (3 cr; SP–Grad nursing major or #)
Systems approach to human physiology/pathophysiology. Physiologic changes across life span. Emphasizes clinical application using population-specific content related to various specialty areas in advanced practice nursing.

Nurs 5223. Assessment of Psychopathology for Advanced Practice Psychiatric/Mental Health Nursing. (4 cr; SP–Nurs grad or #)
Advanced concepts from nursing theory and research, social sciences, neuropsychology, and neurophysiology used in the assessment of psychiatric symptoms and disorders across the age continuum. During clinical, develop proficiency in the assessment of psychopathology in clients with psychiatric symptoms.

Nurs 5224. Clinical Pharmacotherapeutics. (3 cr; QP–Grad, #; SP–Grad, #)
Advanced practice nurses in primary care get a foundation in pharmacotherapeutics across the life span. Topics include pharmacodynamics/kinetics/epidemiology, client patterns of medication use, selection of appropriate drugs for selected client conditions, and prescriptive writing privileges for advanced practice nurses.

Nurs 5225. Psychopharmacology for Advanced Practice Psychiatric/Mental Health Nursing. (3 cr; QP–#; SP–Grad student or RN [with master's degree] or #)
Advanced concepts in neuroscience, psychopharmacology, and clinical management related to psychopharmacologic treatment of psychiatric disorders/symptoms. Application to problems in various clinical settings.

Nurs 5300. Health Behavior Intervention: Theory and Application. (3 cr; SP–Grad or #)
Interdisciplinary course examines theoretical foundations and research base of intervention strategies to promote health behavior acquisition, behavioral change, and maintenance for adults (individuals and groups). Critical examination of health behavior and patterns and health risk assessment; approaches to program creation.

Nurs 5340. Group as a Health-Care Intervention. (2 cr; SP–Grad or #)
Theoretical concepts and research findings from the areas of group therapy and dynamics are applied in the development of a model for using group as an intervention for various client populations.

Nurs 5501. Professional Issues in Nurse-Midwifery. (1-2 cr; QP–Nurs grad major; SP–Nurs grad major, #)
Analysis of professional issues that confront and impact the practice of certified nurse-midwives. History and development of the professional organization including certification, legislation, ethical dimensions, public policy, and clinical practice issues.

Nurs 5520. Women's Issues: A Health Perspective. (3 cr; QP–Upper div or grad student or #; SP–Upper div or grad student)
Multidisciplinary exploration and analysis of a broad range of women's health issues: physiological, developmental, historical, sociocultural, feminist, nursing and medical. Topics include health promotion and reproductive health issues across the life span.

Nurs 5601. School Nursing in the Educational System and the Community. (1-3 cr; QP–3 yrs of college level courses; SP–3 yrs of college level courses; A-F only)
School health problems, assessment/intervention strategies. Integration of research findings. Applications with individuals, families, communities.

Nurs 5604. Advanced Health Assessment and Interventions with Adolescents. (1-3 cr; QP–#; SP–CPsy 5303 or equiv or #)
Development of one-on-one health assessment and intervention strategies appropriate for working with teenagers. Integrates knowledge from nursing, public health, health behavior, and adolescent development as a framework for clinical assessment and intervention approaches.

Nurs 5800. Nursing Topics. (1-4 cr [max 8 cr]; SP–#)
Course allows students to study a topic not included in regular courses, or for faculty to offer a course to determine interest in a topic.

Nurs 5801. Policymaking, Health Policy, Political Action and Nursing. (3 cr; QP–Nurs grad student)
Analysis of sociocultural values, public policymaking, health care policy, and the relationship to the health care delivery system. The impact of health care policy on the profession and practice of nurses, and on consumers. Enhanced participation of nurses in policymaking and political action.

Nurs 5802. Spirituality and Nursing Practice. (2 cr; QP–For undergrad cr: nurs sr or RN; for grad cr: RN with baccalaureate; SP–For undergrad cr: nurs sr or RN; for grad cr: nurs grad student or #)
Exploration of the concept of spirituality as integral to the whole person. Discussion of spiritual nursing care interventions.

Nurs 5803. Transcultural Nursing: Theories and Issues. (2 cr; QP–Cultural anth course, nurs undergrad or grad student or RN; SP–Cultural anth course or #)
Study of cultural factors that influence theories, issues, and nursing care practices in diverse cultures and subcultures. Emphasis on nursing within international systems of health care and nursing practices related to various health-illness systems in this country and worldwide.

Nurs 5804. Therapeutic Healing Touch: Research and Practice. (2 cr; SP–[Upper div or grad] student in [health sciences or health care]; S-N only)
Therapeutic/Healing Touch as energetic based, biofield healing modality. Art/science of this modality. Research literature related to Therapeutic Touch/Healing Touch. Explanations for effects. Practice of Therapeutic Touch, intervention techniques.

Nurs 5805. The 'M' Technique. (1 cr; SP–Undergrad nursing student or grad student in health sciences or health professional; S-N only)
Scientific/theoretical foundations/practice of 'm' technique, a touch therapy for promoting relaxation by topically administering essential oils. Appropriate applications. Demonstration/practice of technique. Interdisciplinary course.

Nurs 5808. American Indian Health and Health Care. (2 cr; SP–Upper div or grad student or #)
Examines health of native nations in Minnesota within historical/cultural contexts. Epidemiology of major health conditions, health services, traditional Indian medicine, health beliefs. Opportunities for contact with Native American community.

Nurs 5809. Seminars in Critical Care. (2 cr)
Analyzes current research/developments in treatments, care delivery, and ethical issues affecting critically ill patients and their families. Students participate with team of multidisciplinary faculty from Center for Critical Care in critiquing/presenting literature and discussing applications to clinical practice.

Nurs 5830. Advanced Clinical Nursing. (1-6 cr; SP–Graduate nursing major or #)
Independent study or faculty seminar on special clinical topic.

Nurs 8100. The Discipline of Nursing. (3 cr; SP–Grad nurs major or #)
Knowledge structures used in nursing; theories, models, and conceptual frameworks. Articulation and evaluation of personal conceptual framework for advanced nursing practice.

Nurs 8110. Developing Nursing Knowledge. (2 cr; SP–Nurs Ph.D. student or #; S-N only)
Philosophical perspectives and research methodologies for developing nursing knowledge.

Nurs 8112. Theoretical Foundations of the Discipline. (3 cr; QP–8012 or equiv, knowledge of phil of sci; SP–8100 or equiv, knowledge of phil of sci)
Paradigms in nursing and related methods of inquiry, knowledge structures, and projection of needs for further knowledge development and testing.

Nurs 8113. Theory Development in Nursing. (3 cr; QP–8110; SP–8100 or equiv, 8112 or #; S-N only)
Strategies for theory development; synthesis of theoretical formulations in nursing using selected inductive and deductive theory development strategies.

Nurs 8120. Phenomenon of Health. (3 cr; SP–Grad nurs major, #)
Prevailing and emerging views of health from differing belief systems and methods of inquiry. Philosophical, theoretical, and methodological implications for development of a nursing paradigm based on evolving perspectives of "humanness."

Nurs 8121. Theoretical Foundations of Health-Related Behaviors. (2 cr; QP–Research course; SP–Research course, grad nurs major)
Research and theory related to development and modification of health behaviors and human responses to events disruptive to health; formulation of research hypotheses and selection of appropriate methodologies for studying hypotheses.

Nurs 8122. Stress, Coping, and Health. (2 cr; QP–8014 or equiv, psychology or behavioral med course, #; SP–Research course, grad nurs major, #)
Stress and coping theories and related research; adequacy and efficacy of stress-management interventions/programs; directions for future research.

Nurs 8123. Complementary Therapies: Theory and Research. (2 cr; QP–Research course; SP–Research course)
Scientific basis of selected complementary therapies such as therapeutic touch, imagery, music, and massage; hypotheses related to selected interventions; appropriate methodologies.

Nurs 8124. Family Health Theory. (3 cr; QP–8010; SP–8100, #)
Emerging theory in family nursing science, related theories, and research on family systems for structuring a systemic framework to examine clinical problems related to family healthcare. Applies family health theories to selected phenomena of interest in healthcare.

Nurs 8140. Moral and Ethical Positions in Nursing. (3 cr; SP–Grad nurs major or #)
Synthesis of ethical positions, from nursing perspective, on health-related issues at individual, group, population, and policy levels. Normative ethics, theoretical basis for positions taken, and contextual implications for subsequent action.

Nurs 8150. Moral and Ethical Development in Nursing Science. (3 cr; QP–8011 or equiv; SP–Grad nurs major, 8140 or #)
Interactions among research and theory in moral judgment and behavior, applied ethics, and nursing.

Nurs 8170. Research in Nursing. (3 cr; QP–Inferential stat course; SP–Grad descriptive/inferential stat course within past 2 yrs or ¶)
Research process/methods appropriate for problems relevant to nursing. Critique of research studies, proposal development.

Nurs 8171. Qualitative Research in Nursing and Healthcare. (3-4 cr; SP–8170, 8100 or equiv grad theory and research courses or #)
Characteristics of key qualitative research methods and nature of knowledge generated. Relevance to healthcare and development of nursing discipline; issues related to entry into the field, data collection, and analysis.

Nurs 8173. Principles and Methods of Implementing Research. (3 cr; QP–8114 or equiv, 2 grad stat courses; SP–8114 or other 8xxx grad research methods course, 2 grad stat courses)
Integrates scientific, statistical, and practical aspects of research. Inter-relationships among design, sample selections, subject access, human subjects requirements, instrument selection and evaluation, data management, analyses plans, grant writing, and research career issues. Field experiences required.

Nurs 8175. Advanced Nursing Research. (3 cr; QP–8014 or equiv, advanced inferential and nonparametric stat, comp sci course; SP–8170 or equiv, advanced inferential and nonparametric stat, comp sci course)
Interrelationships among types of knowledge and phenomenon, methods of scientific inquiry, generation of research questions, accepted conventions of stating and studying relationships; questions examined by reviewing writings of selected authors.

Nurs 8176. Research on Decision Making in Health Care. (3 cr; QP–One graduate-level research course, #; SP–One graduate-level research course, #)
Conceptual models/studies on decision making about health care. Formulating research proposals to investigate health care decisions by health care professionals, health care policy makers, patients/clients, or families.

Nurs 8177. Advanced Nursing Research Practicum. (1-4 cr; SP–Nurs Ph.D. student, #)
Students collaborate as a team in research experience providing opportunities to synthesize knowledge in an area of study and to design and/or implement research.

Nurs 8178. Methods for the Study of Family Health Phenomena. (3 cr; QP–5920, 8114 or equiv; SP–8124, 8100 or equiv or #)
Conceptual and methodological approaches in study of family health phenomena from nursing perspective. Research designs formulated to study questions in this area.

Nurs 8193. Special Topics in Nursing Research. (1-6 cr; SP–#)
Seminar and/or individual study of research design, methodologies, or instruments.

Nurs 8194. Problems in Nursing. (1-6 cr; SP–Grad nurs major, #; S-N only)
Individual study of a nursing problem or phenomenon. For Plan B projects, student must register S-N.

Nurs 8240. Advanced Practice Nursing: Roles and Issues. (2 cr; SP–Admission to advanced practice area of study or #)
Current most relevant professional/health care issues affecting diverse advanced practice nursing roles. Role theory, practice models, interdisciplinary team function, reimbursement, certification, scope of advanced nursing practice.

Nurs 8241. Health Care Leadership for a Changing World. (2 cr; SP–AHC grad student or #)
Application of leadership theory/research to strengthen students' capacity to facilitate change in health care delivery system.

Nurs 8242. Population Focused Health Care Delivery Systems. (2 cr; SP–Grad nurs student or #)
Health care organizations/delivery systems, their relation to health of diverse populations. Models of population focused care, use of research to improve health care delivery, effect of economic/social factors on health/health services.

Nurs 8300. Cancer Principles and Practice. (3 cr; SP–Grad nurs major or #)
Synthesis of personal and societal risk factors in carcinogenesis. Analysis of strategies to prevent cancer and reduce morbidity. Models of acute, chronic, and late effects of treatment. Comparative analysis of ethical, legal, and socioculture issues in cancer care.

Nurs 8301. Oncology Clinical I. (3 cr; QP–5954 or ¶5954, 5953; SP–¶8300, grad nurs major, Minnesota RN licensure)
Synthesis and clinical application of knowledge of cancer risk factors and advanced practice interventions to modify cancer risk behaviors of individuals, families, and communities. Use of research and clinical models to analyze, manage, and evaluate responses to cancer and treatment.

Nurs 8302. Advanced Practice Nursing for Acute Health Needs I. (3 cr; SP–5200, 5222, 8100, advanced pharmacology, [pathophysiology or immunobiology], inferential statistics)
Evaluation of theories/models/research in symptom management. Application of therapy/research supporting clinical decision making with adults experiencing alterations in exchange, sensory, and mobility phenomena. Emphasizes client outcomes related to advanced practice nursing interventions.

Nurs 8303. Research-based Clinical Reasoning and Management in Acute Care I. (4 cr; SP–5200, [5222 or pathophysiology or immunobiology], 8100, advanced pharmacology, inferential statistics)
Synthesis/utilization of knowledge/research in care of adults with acute/critical illness. Advanced clinical decision making. Management of responses to acute cardiac, renal, and sensory alterations.

Nurs 8304. Advanced Practice Nursing for Acute Health Needs II. (3 cr; SP–5200, 8100, [8170 or advanced physiology], 8302, [pathophysiology or immunobiology], advanced pharmacology)
Evaluation of theories/models/research in management of acute symptoms. Application of theory/research to support clinical decision making for adults experiencing alterations in metabolic, alimentary, and regulatory phenomena. Emphasizes client outcomes related to advanced practice nursing outcomes.

Nurs 8305. Research-based Clinical Reasoning and Management in Acute Care II. (4 cr; SP–5200, 5222, 8100, 8170, 8303, [advanced pharmacology or pathophysiology or immunobiology])
Synthesis/utilization of knowledge/research in care of adults with acute/critical illness. Advanced clinical decision making. Management of responses to acute alterations in metabolic, alimentary, and pulmonary functions.

Nurs 8306. Psychological and Immunological Responses in Cancer and Acute Care. (3 cr; SP–Grad nurs major or #)
Research-based evaluation and management of hematological and immunological responses to cancer and acute life-threatening illness. Exploration of theories and models used to explain and predict psychological adaptation in clients and their family members.

Nurs 8307. Oncology Clinical II. (3 cr; SP–8306 or ¶8306, grad nurs major, Minnesota RN licensure)
Synthesis of research and integration of knowledge in clinical management of complex physical and psychosocial care in cancer. Application of advanced practice and theoretical models to guide decision making and coping responses in clients and their families.

Nurs 8309. Research-based Clinical Reasoning and Management in Acute Care III. (4 cr; SP–5200, [5222 or pathophysiology or immunobiology], 8100, 8140, 8170, 8240, 8303, 8305, advanced pharmacology)
Synthesis/utilization of knowledge/research in care of adults with acute/critical illness. Advanced clinical decision making. Management of responses to acute alterations in immunological, hematological, and psychological functions.

Nurs 8311. Specialized Focus in Research-based Clinical Reasoning and Management in Acute Care. (3-4 cr; SP–5200, 5222, 8100, 8140, 8170, 8240, 8303, 8305, 8309, advanced pharmacology, [pathophysiology or immunobiology])
Synthesis/utilization of knowledge/research in care of adults with acute/critical illness. Participation (in a clinical area of interest) in advanced decision making and in management of clients requiring restorative care.

Nurs 8320. Multidisciplinary Seminar on Social Perspectives of Aging. (3 cr; SP–#)
Literature/policy on key social aspects of aging, emphasizing service, policy, and ethical implications; generation of research questions.

Nurs 8321. Advanced Nursing Care of the Elderly I. (6 cr; SP–Grad nurs major, core courses, #; A-F only)
Exploration of functional patterns of health, and evaluation of theories/research as related to physiological, psychological, and sociological aspects of aging. Comprehensive assessment and research-based advanced nursing interventions to promote, maintain, and restore health of the elderly.

Nurs 8322. Primary Health Care for Elders. (6 cr; QP–5940, 5941, 5943, 5810; SP–8321; A-F only)
Focuses on data-based primary care management of common acute and chronic conditions of the elderly and on physiological, psychosocial, and pharmacological interventions. Age-related, cultural, family and community variations will be incorporated into the analysis, implementation, and evaluation of interventions.

Nurs 8323. Advanced Nursing Care of the Elderly (II): For Nurse Practitioners. (5 6 cr; QP–5945, 5944, #; SP–8322, 8xxx advanced gerontological nurs course, grad nurs major, #; A-F only)
Synthesis and application of theory and research to effectively implement advanced gerontological nursing practice. Focuses on comprehensive primary care management across settings, evaluation of care, role analysis, and impact of contextual factors on health care services for the elderly.

Nurs 8324. Advanced Nursing Care of the Elderly II: For Clinical Nurse Specialists. (6 cr; QP–8xxx advanced gerontological nurs course, #; SP–Grad nurs major, #; A-F only)
Synthesis and application of theory and research to effectively implement as an advanced gerontological nurse. Comprehensive client care management across settings, evaluation of care, role implementation, and influences of contextual factors on health care services for the elderly.

Nurs 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Nurs 8340. Advanced Practice Psychiatric/Mental Health Nursing with Individuals and Their Families. (7 cr; QP–8011 or ¶8011, 8012; SP–5200, 5223, 5225, 8100, 8121, 8140, 8170)
Evaluation of theory and research; their application to advanced clinical management of biological, psychological, and social responses of individuals and families to psychiatric illness. Developing clinical expertise in assessment, diagnosis, treatment planning, and management of individuals and their families.

Nurs 8341. Advanced Practice Psychiatric/Mental Health Nursing in Groups and Community. (7 cr; SP–5340, 8340, ¶8240, ¶8242)
Application of theory and research to advanced practice psychiatric/mental health nursing with groups and community systems, including populations at risk. Clinical practicum provides experiences for developing advanced practice roles in variety of healthcare settings.

Nurs 8360. Advanced Clinical Nursing. (1-6 cr; SP–Grad nurs major, #)
Independent study or faculty seminar on special clinical topic when interest exists.

Nurs 8361. Special Topics in Nursing. (1-4 cr; SP–Grad nurs major, #)
Students select and study a topic of interest.

Nurs 8402. Primary Care: Assessment and Management of Health for Advanced Practice Nurses. (2-8 cr; QP–5810, 5933; SP–Admission to adv pract nurs area of study, 5200, 5222, 5224, 8140, courses in holistic health assessment and therapeutics for adv pract nurs, pharmacotherapeutics, pathophysiology, structure of the discipline, moral and ethical positions in nurs)
Data-based assessment and management of preventive health services and common acute and chronic conditions of primary care populations. Theoretical and research-based approach to clinical reasoning and decision making emphasized.

Nurs 8404. Family Practice Practicum I. (2 cr; SP–5200, 5222, 5224, 8402, 8601; A-F only)
Comprehensive advanced nursing assessment for acute/chronic health conditions of primary care population across life span. Synthesis/application of nursing theory/research in implementing/evaluating safe/effective nursing interventions to promote health and prevent illness.

Nurs 8405. Family Practice Practicum II. (2 cr; SP–5200, 5222, 5224, 8402, 8601; A-F only)
Synthesis of advanced practice nursing theory in data collection and in assessment of client in his/her environment. Implementation/evaluation of interventions for disease management in primary care setting. Nursing theory/research used in developing nursing practice models for health promotion, disease prevention, and intervention.

Nurs 8406. Health Care of Children for the Family Nurse Practitioner. (3 cr; SP–#; A-F only)
Application of midrange theories, models, concepts applicable to promotion, maintenance, restoration of health of infants, children, adolescents within context of their families/communities. Current research evaluated/used for designing age-specific interventions for children and their families.

Nurs 8407. Health Care of Children Practicum for the Family Nurse Practitioner. (2 cr; SP–5200, 5222, 5224, 8242, 8402; A-F only)
Synthesis of research-based nursing assessment/intervention of minor acute/chronic health conditions in primary care population across life span. Application of nursing theory, research from related disciplines, in evaluating/implementing interventions. Clinical practicum in pediatric primary care. Focuses on assessment, primary health care, of well children from birth to adolescence.

Nurs 8420. Childbearing-Childrearing Family Nursing. (4 cr; QP–8010, 8011; SP–8100, 8150, grad nurs major or #)
Maintenance, promotion, and restoration of health for clients in the childbearing-childrearing family. Theories and concepts related to parents, children, and families. Practicum includes conferences, written assignments, and use of grounded theory methods of investigation.

Nurs 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

Nurs 8450. Primary Care: Health Assessment and Care of Well Children. (3 cr; SP–5200, 5222, ¶8451)
Study of age-specific and family-centered assessment, prevention, and health promotion nursing interventions for infants through adolescents. Emphasis on theories and concepts related to comprehensive health supervision. Stresses the use of critical thinking for clinical decision making to implement and evaluate advanced practice nursing interventions.

Nurs 8451. Primary Care Practicum: Health Assessment and Care of Well Children. (3 cr; QP–5810, #; SP–5200, #)
Focus on age-specific, family-centered nursing assessment and interventions to promote wellness of children, infants through adolescence. Emphasis on compiling and evaluating advanced nursing interventions for disease prevention and health promotion of children and families. Practicum includes exposure to models of primary prevention.

Nurs 8452. Primary Care: Common Acute Health Conditions Affecting Children. (2 cr; QP–5923, 5924, ¶5925, #; SP–8501, 8451, ¶8453, #)
Research-based evaluation and management of common acute conditions affecting children from infancy through adolescence. Exploration of theories and models used to explain and predict physiologic and psychologic adaptation of children and their families.

Nurs 8453. Primary Care Practicum: Common Acute and Chronic Health Conditions Affecting Children. (3 cr; QP–8450, 8451; SP–8411, 8442, ¶8452, #)
Focus on age-specific, family-centered nursing assessment and intervention of minor acute and chronic conditions of children within family context. Emphasis on nursing intervention strategies include diagnostics, therapeutics, education, and follow-up evaluation of outcomes.

Nurs 8454. Primary Care Practicum: Synthesis of Advanced Nursing Practice for the Child, Family, Community. (4 cr; QP–5925, 5926; SP–8452, 8453)
Research-based knowledge synthesis to effectively intervene with common pediatric physical and psychosocial alternations in health. Role implementation issues and development of an effective theory-based nursing practice model for care of individuals, families, and communities.

Nurs 8455. Health Care for Children and Youth With Special Health-Care Needs. (2 cr; SP–8454)
Primary care of children and youth with special healthcare needs, emphasizing growth and development, pathophysiology, specific conditions, and holistic, family-centered, community-based, culturally competent, and coordinated approach to assessment and intervention.

Nurs 8456. Health Care for Children and Youth With Special Health-Care Needs Practicum. (3 cr; QP–5917, 5925, #; SP–8454, 8455, #)
Research-based evaluation and management of psychologic and physiologic responses to chronic illness. Developing theory-based holistic, family-centered, community-based, culturally competent, coordinated nursing interventions. Clinical seminars incorporate advanced practice nursing models of care and interdisciplinary collaboration strategies.

Nurs 8457. Assessment and Intervention Models in Families of Children With Special Health-Care Needs. (4 cr; QP–5917, 5920, #; SP–8124 or equiv, 8100, 8456, #)
In-depth, systemic, and theory-based study of family health assessment methods and intervention models. Practicum to assess, intervene, and evaluate intervention models related to patterns of functioning in families of children with complex health-care needs.

Nurs 8501. Reproductive Health Care for Women. (3-8 cr; QP–¶5835, 8030, [hlth assessment, reproductive physiology] courses; SP–5200, #)
Theory, current research underlying clinical practice in assessing/managing issues related to women's reproductive/sexual health throughout life cycle.

Nurs 8502. Reproductive Health Care for Women at Risk. (2-6 cr; QP–Physiology course; SP–!, 8503 or 8520)
Theoretical and research basis for advanced practice nursing care of women and infants at risk for medical and/or psychosocial problems. Selected high-risk perinatal and complicated gynecological and neonatal conditions.

Nurs 8503. Nurse-Midwifery Care of the Childbearing Family. (4-10 cr; QP–5834, 8030; SP–8501, #; A-F only)
Theoretical/research-based nurse-midwifery intrapartum care, management, support of women and their families. Labor, birth, immediate postpartum period, and newborn care. Development/implementation of nurse-midwifery care. Draws from research that provides basis for practice.

Nurs 8520. Advanced Concepts in Women's Health for the Nurse Practitioner. (3-8 cr; QP–5834, 8030; SP–!, 8501, #; A-F only)
Theoretical and research basis for women's healthcare nurse practitioner practice building on foundations of gynecological and antepartum care. Preparation of childbearing family for birth and selected complex health concerns for women.

Nurs 8600. Advanced Public Health Nursing. (2 cr; SP–Grad nursing major)
Conceptual frameworks for advanced public health nursing practice. Analysis of population-focused nursing research and of public health nursing management strategies.

Nurs 8601. Interventions for Health of Populations. (3 cr; SP–8040 or PubH 5733)
Synthesis of behavior formation/change, public health, and nursing models, theories, and research for critiquing and designing population-focused interventions. Developing, implementing, evaluating, and proposal writing for culturally competent public health interventions in community-based settings.

Nurs 8602. Public Health Nursing Intervention Practicum. (3 cr; SP–8242, 8601; S-N only)
Applying principles, theory, and research about epidemiology/public health/public health nursing interventions to population-focused health issues. Collaborating with community-based preceptors to achieve public health objectives.

Nurs 8603. Public Health Nursing Leadership Practicum. (3 cr; QP–5960, 5963, 8010, 8040, 8042; SP–8100, 8170, 8241, 8242, 8600; S-N only)
Synthesis of leadership and advanced public health nursing theories and research; their applicability within public health nursing leadership situations.

Nurs 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per sem/summer; doc student who has not passed prelim oral)

Nurs 8701. Nursing and Health-Care Systems Administration I. (4 cr; SP–#; A-F only)
Intensive study of nursing and healthcare administration and leadership. Application of nursing, organization, care delivery, and population health improvement theories to health systems administrative practice. Planning, organizing care systems, assembling, and developing material and human resources.

Nurs 8702. Nursing and Health-Care Systems Administration II. (4 cr; QP–8701, #; SP–8701, #; A-F only)
Intensive development of competencies associated with skilled administration of healthcare services. Application of organization, nursing, political, and economic theories in operationalizing and evaluating administrative and leadership practice of nurses in healthcare delivery systems.

Nurs 8720. Teaching and Learning Nursing. (3 cr; QP–8010, 8011, 8012, [EPsy 5112 or EPsy 5114 or EPsy 5115 or Psy 5012 or Psy 5013 or Psy 5014 or Psy 5015]; SP–5204, 8100, 8140, learning theory course)
Theories of curriculum, teaching, learning, nursing used to develop conceptual framework for teaching nursing. Framework is used as model for teaching students in simulated classroom situations.

Nurs 8721. The Nurse Educator in Higher Education. (4 cr; QP–8720, educational measurement class [e.g. EPsy 5220 or 5221]; SP–8241, 8242, 8720, educational measurement course, nurs Ph.D. student)
Teaching practicum: comprehensive implementation and evaluation of effectiveness of personal teaching models in classroom and clinical settings in an academic environment. Roles and responsibilities of faculty; issues affecting curriculum design and development.

Nurs 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Nurs 8800. Methods for the Study of Family Health Phenomena. (2 cr; QP–5920, 8114 or equiv or #; SP–8124, 8175 or equiv or #)
Exploration of conceptual and methodological approaches in study of family health phenomena from a nursing perspective. Formulation of research design to study questions in family health.

Nurs 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Nutrition (Nutr)

College of Agricultural, Food, and Environmental Sciences and College of Human Ecology

Nutr 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Nutr 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

Nutr 8610. Nutrition Graduate Seminar. (1 cr; SP–Nutr grad student, #; S-N only)
Presentation of thesis (M.S. or Ph.D.) or plan B project work in public seminar.

Nutr 8612. Advances in Nutrition: Diet and Chronic Disease. (2 cr [max 4 cr])
Recent research on relationship of diet to development/treatment of chronic diseases, including cancer, diabetes, and osteoporosis. Clinical, animal, and cell culture studies examined epidemiologically.

Nutr 8613. Advances in Nutrition: Lipoproteins, Cholesterol, and Atherosclerosis. (2 cr; SP–Grad student in nutr or related field)
Lipoprotein biochemistry and physiology, environmental and genetic factors influencing cholesterol metabolism, efficacy of diet therapy and lipid lowering in heart disease prevention, use of drugs in atherosclerosis, putative role of lipoprotein oxidation in atherosclerosis. Human studies and animal models in atherosclerosis research.

Nutr 8614. Advances in Nutrition: Advanced Energy Balance. (2 cr; SP–Grad student in nutr or related field)
Recent literature on energy balance and body composition in animals and humans.

Nutr 8615. Advances in Nutrition: Exercise Metabolism. (2 cr; SP–Grad student in nutr or related field.)
Review of research on effects of diet on exercise metabolism.

Nutr 8616. Advances in Nutrition: Free Radicals, Trace Elements, and Other Micronutrients. (2 cr; SP–Grad student in nutr or related field)
Free radical chemistry, cellular biology, and micronutrient nutrition considered in roles of pro-oxidants and antioxidants in human diseases and aging. Current understanding of biological action of free radicals and role of micronutrients in antioxidant protection in humans and animals.

Nutr 8617. Chemical Carcinogenesis and Chemoprevention. (3 cr; QP–[[BioC 3021, BioC 5331] or equiv], [Chem 3302 or equiv]; SP–[[BioC 3001, BioC 3021, BioC 4331] or equiv], [Chem 2302 or equiv]; A-F only)
Fundamental background in chemical carcinogenesis, carcinogen activation/detoxification, carcinogen-DNA adduct formation, cellular oncogenesis, cancer chemoprevention, nutrition/cancer. Topics integrated/interrelated.

Nutr 8620. Advances in Nutrition. (2-3 cr [max 6 cr]; SP–#)
Recent research or special topics (e.g., obesity, vitamin biochemistry, nutrition education).

Nutr 8621. Presentation Skills. (1 cr; SP–Δ; S-N only)
Orientation to nutrition graduate program. Presenting scientific seminars, using electronic presentation programs/equipment.

Nutr 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Nutr 8695. Independent Study: Nutrition. (1-4 cr [max 6 cr]; SP–#)
Written report for master's plan B project.

Nutr 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Nutr 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Nutr 8900. Advances in Nutrition: Advanced Lifestyle Nutrition. (2 cr; SP–§PubH 8900; Nutr grad major or Pub hlth nutr or Epi MPH or Epi or Food sci grad major)
Evaluation and discussion of research and research issues in nutrition during various stages of the life cycle. Methodological issues of applied human nutrition investigation, current status of knowledge, and implication of research results to public health policies, programs, and future research.

Occupational Therapy (OT)

Department of Physical Medicine and Rehabilitation

Medical School

OT 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

OT 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Operations and Management Science (OMS)

Department of Operations and Management Science

Curtis L. Carlson School of Management

OMS 5170. Simulation Modeling and Analysis. (4 cr; SP–MBA 6120 or BA 1550 or #; A-F only)
Techniques and application of computer simulation modeling and analysis. Includes animations of existing or proposed real-world facilities and processes. Experiments in simulation programming language and environment. Simulation models and animations demonstrating actual operation of models. Planning, analysis, and interpretation of simulation experiment results.

OMS 8651. Experimental Design. (3 cr; QP–8650 or MBA 8120 or equiv; SP–MBA 6120 or equiv or business admin Ph.D. student or #; offered alt yrs; A-F only)
Analysis of variance for one-way, two-way, and multi-way data. Basic concepts of statistical design and analysis of results. Randomized block, Latin square, cross-over, factorial designs, confounding, estimation and comparison of effects, response surfaces, and applications to management.

OMS 8652. Regression Analysis. (3 cr; QP–MBA 8120 or equiv; SP–MBA 6120 or equiv, business admin Ph.D. student or #; offered alt yrs; A-F only)
Regression and correlation models, inferences in simple and multiple regression, multicolinearity, indicator variables, variable selection techniques, treatment of assumption violations, applications to management problems, basic concepts of experimental design.

OMS 8661. Linear Programming. (3 cr; QP–5160 or equiv; SP–Business admin Ph.D. student or #; A-F only)
Revised simplex, primal-dual, and large-scale methods, including decomposition and partitioning and methods for bounded variables.

OMS 8671. Simulation Analysis. (3 cr; SP–Business admin Ph.D. student or #; offered alt yrs; A-F only)
A treatment of underlying probabilistic and statistical aspects of computer simulation. Random number generators, variate and process generation, statistical analysis of simulation output, ranking and selection of simulation models, and variance reduction techniques.

OMS 8672. Stochastic Modeling and Analysis. (3 cr; QP–Stat 5122; SP–Business admin Ph.D. student or #; offered alt yrs; A-F only)
Probabilistic modeling of dynamic processes, including Markov chains; Poisson, renewal, continuous-time Markov processes, and queuing models. Statistical estimation of selected models; applications to managerial problems, such as brand shift, industrial migration, manufacturing, and computer/communications networks.

OMS 8681. Queuing Theory: A Computational Approach. (3 cr; QP–8670; SP–8672, business admin Ph.D. student or #; A-F only)
Theory of Stochastic Service Systems (theory of queues) from an algorithmic point of view. Prepares students to model and analyze complex stochastic service systems via classical methods and algorithmic methods and approximations.

OMS 8711. Research in Operations Strategy. (3 cr; SP–Business admin Ph.D. student or #; offered alt yrs; A-F only)
Operations performance; competitive advantage; focused factory, product, and process innovation; and operations strategy implementation. Research results and methods.

OMS 8721. Management of Technological Operations. (3 cr; SP–Business admin Ph.D. student or #; offered alt yrs; A-F only)
Theories and models used to address problems of managing technological operations and operations in manufacturing and service firms. Technology strategy, economic/organizational perspectives on technology, productivity analysis, technology evaluation, project selection and evaluation, learning, etc.

OMS 8735. Operations Forecasting and Inventory Research. (3 cr; SP–Business admin Ph.D. student or #; offered alt yrs; A-F only)
Research on forecasting, inventory control, materials requirements planning, just-in-time manufacturing, aggregate planning, scheduling, routing, sequencing, and dispatching in manufacturing and service industries. Research papers and methods are discussed.

OMS 8745. Research on Quality Management. (3 cr; SP–Business admin Ph.D. student or #; offered alt yrs; A-F only)
Research literature, methods, and results. Research on quality strategy, economics of quality, statistical process control, vendor management, off-line quality, and quality practice.

OMS 8892. Readings in Operations and Management Science. (1-8 cr [max 16 cr]; SP–Business admin Ph.D. student or #)
Readings useful to student's individual program and objectives that are not available in regular courses.

OMS 8894. Graduate Research in Operations and Management Science. (1-8 cr [max 16 cr]; SP–Business admin Ph.D. student or #)
Individual research on an approved topic appropriate to student's program and objectives.

Oral Biology (OBio)

Department of Oral Sciences
School of Dentistry

OBio 5001. Methods in Research and Writing. (2 cr)
Skills necessary to begin a research project, including literature review, hypothesis formation, research design, and writing. Each student develops a research protocol.

OBio 8011. Oral Biology. (2 cr; SP–Dental specialist or oral research trainee; A-F only)
Salivary secretions, composition and function; orofacial development, anatomy and genetics; oral aspects of inflammation, wound healing, and immunology; plaque formation, composition, metabolism, and clinical control; biochemistry of connective and mineralized tissues; neurobiology and pathophysiology of orofacial pain and sensations.

OBio 8021. Oral Microbiology. (2 cr; SP–Dental specialist or oral research trainee or #)
Role of indigenous human oral microflora in health and disease. Colonization of oral cavity and role of specific pathogens in development of dental caries and periodontal diseases. Infections of dental pulp and periapical tissues, oral manifestations of viral and fungal infections, and microbial considerations in specialty areas of dental practice.

OBio 8022. Oral Neuroscience. (2 cr; SP–Dental specialist or oral research trainee or #)
Background lectures and student presentations on current research topics to evaluate questions in general motor and sensory function related to oral and nasal structures. Taste, smell, and other chemical senses as they relate to those structures.

OBio 8023. Physical Biology of the Oral Cavity. (2 cr; SP–Dental specialist or oral research trainee or #; A-F only)
Structure and function of load-bearing components of human masticatory system from biophysical point of view. Mandibular form and movement; infrastructure of hard tissues as related to occlusal wear and masticatory efficiency; role of saliva and salivary pellicle in reduction of interocclusal friction; and computer simulation of jaw mechanics.

OBio 8024. Genetics and Human Disease. (1 cr; SP–Dental specialist or oral research trainee or #)
Principles of medical genetics with emphasis on oral diseases. Twins, chromosomes, recombinant DNA, major gene traits, genes in populations, chromosomal abnormalities, complex traits, facial clefts, dental caries, periodontal diseases.

OBio 8025. Topics in Cariology. (2 cr; SP–Dental specialist or oral research trainee or #; A-F only)
Lectures, assigned readings, and discussions of basic epidemiological, biological, and chemical aspects of dental caries. Etiology, epidemiology, and pathogenesis of dental caries, and influence of dietary, salivary, plaque, and microbial factors on the caries process.

OBio 8026. Salivary Glands, Secretions, and the Secretory Immune System. (2 cr; SP–Dental specialist or oral research trainee or #; A-F only)
Salivary gland structure and development; mechanisms and control of macromolecule and electrolyte secretion; protein structure and function, interactions with bacteria, salivary pellicle, clinical studies, salivary gland disease. Secretory IgA origin, structure, and synthesis; sIgA induction and biological activity; role of sIgA in oral health.

OBio 8027. Structural and Biological Aspects of Dental Biomaterials. (1 cr; SP–Dental specialist or oral research trainee or #)
Relates composition and structure of dental biomaterials to their behavior in a biological environment. Fundamental questions: What is the effect of a material on the oral environment? What is the cause and mechanism of such effects? What materials can be used that have beneficial effects? Dental implantology and guided tissue regeneration.

OBio 8028. Molecular Basis of Cellular and Microbial Adhesion. (2 cr; SP–Dental specialist or oral research trainee or #; A-F only)
Biochemical basis of adhesion phenomena, focusing on cells of immune system, development of organs and tissue formation, and bacterial colonization of the human.

OBio 8030. Seminar. (1 cr [max 10 cr]; SP–Dental specialist or oral research trainee or #; S-N only)
Faculty and student discussion of current topics in oral biology.

OBio 8093. Tutorial in Oral Biology. (1-2 cr; SP–#; S-N only)
Semester-long apprenticeship with faculty members to familiarize students with faculty research interests. Individual study of selected topics.

OBio 8094. Directed Research. (1-10 cr; SP–#; S-N only)

OBio 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

OBio 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

OBio 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

OBio 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

OBio 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Otolaryngology (Otol)

Department of Otolaryngology
Medical School

Otol 5101. Introduction to the Basic Sciences in Otolaryngology I: Ear. (2 cr; SP–Otolaryngology major or #)
Multidisciplinary introduction to the basic sciences of the ear. Acoustics and psychoacoustics, temporal bone anatomy, external and middle ear mechanisms, cochlear physiology, auditory neurophysiology, ear embryology, ear biochemistry, immunology, fine structures, vestibular mechanisms and measurement. S-N grading option for nonmajors only.

Otol 5102. Introduction to the Basic Sciences in Otolaryngology II: Head and Neck. (2 cr; SP–Otol major or #)
Multidisciplinary introduction to the basic sciences of the head and neck. Laryngeal anatomy and physiology, nasal anatomy and physiology, immune biology, embryology of head and neck. S-N grading option for nonmajors only.

Otol 5993. Directed Studies. (1-12 cr [max 12 cr]; SP–#)
Directed readings and preparation of reports on selected topics.

Otol 8230. Clinical Otorhinolaryngology. (4 cr; SP–Grad otol major; A-F only)
Diagnostic and management instruction and experience in all phases of clinical otorhinolaryngology. Both inpatient and outpatient services are provided at Fairview-University Medical Center, St. Paul Ramsey Medical Center, Veterans Administration Medical Center, and Hennepin County Medical Center. Clinical practica and weekly special group conferences.

Otol 8231. Surgery of the Ear, Nose, and Throat. (3 cr; SP–Grad otol major; A-F only)
Surgical training and experience with broad scope of surgical problems encountered in otorhinolaryngology provided at Fairview-University Medical Center, St. Paul Ramsey Medical Center, Veterans Administration Medical Center, and Hennepin County Medical Center. Clinical practica and weekly special group conferences.

Otol 8232. Maxillofacial Surgery. (1 cr; SP–Grad otol major; A-F only)
Basic science and management principles of maxillofacial diseases. Problems of maxillofacial trauma. Experience with these problems in the hospitals of the training program, especially the county hospitals.

Otol 8233. Plastic and Reconstructive Surgery: Head and Neck. (1 cr; SP–Otol major; A-F only)
Otolaryngologic cosmetic surgery emphasizing rhinoplasty and otoplasty.

Otol 8234. Anatomy of the Head and Neck and Temporal Bone Dissection. (2 cr; SP–Grad otol major or #)
Head and neck anatomy studied from cadaver through programmed learning. Temporal bones dissected to learn anatomy and to practice otologic surgical procedures. S/N for nonmajors only.

Otol 8235. Roentgenology of the Head and Neck. (1 cr; SP–Grad otol major; A-F only)
Principles and procedures in roentgenology for otolaryngologic and head and neck problems.

Otol 8236. Pharmacology in Otolaryngology. (1 cr; SP–Grad otol major; A-F only)
Principles of pharmacology as they relate to otolaryngology.

Otol 8237. Endoscopy. (1 cr; SP–Grad otol major; A-F only)
Didactic and practical instruction in laryngoscopy, esophagoscopy, bronchoscopy, and mediastinoscopy. General management principles emphasized.

Otol 8238. Pathology of the Ear, Nose, and Throat. (1 cr; SP–Grad otol major; A-F only)
Gross pathology and histopathology of diseases of the ear, nose, throat, and related regions.

Otol 8239. Otoneurology. (1-2 cr; SP–Grad otol major or #)
Instruction and experience in diagnosis and management of otoneurologic problems, including training in electronystagmographic analysis of vestibular function.

Otol 8240. Allergy. (1 cr; SP–Grad otol major; A-F only)
Concepts and management of otolaryngologic allergy.

Otol 8241. Cancer of the Head and Neck. (1 cr; SP–Grad otol major; A-F only)
Clinical head and neck oncology; etiology, treatment (both surgical and nonsurgical), and other principles of management.

Otol 8242. Audiology and Speech Pathology. (2 cr; SP–Grad otol major or #)
Clinical audiology and speech-language pathology, including diagnosis and treatment of conductive, sensorineural, and central hearing loss; voice disorders; swallowing disorders; velopharyngeal insufficiency related to cleft lip/palate and craniofacial anomalies; alaryngeal speech; and speech disorders related to head and neck cancer.

Otol 8243. Introduction to Research Methodology. (1 cr; SP–Grad otol major or #)
Statistical methods, experimental design, and execution of otolaryngologic research. Ethics of research with human and animal subjects.

Otol 8244. Seminar: Current Literature. (1 cr; SP–Grad otol major or #)
Presentation and discussion of selected articles. Required for all otolaryngology graduate students.

Otol 8247. Anatomy and Physiology of Hearing and Balance. (3 cr; SP–#)
Structure and function of auditory and vestibular systems. Network analysis of middle and inner ear mechanics, hair cell biophysics, auditory nerve and CNS electrophysiology, information processing, neural mechanisms subserving balance and gaze, cellular morphology, and computer models.

Otol 8248. Directed Readings in Auditory Physiology. (1-2 cr; SP–#)
Current research on biophysics and physiology of auditory system; topics selected for each student. Written reviews prepared and discussed.

Otol 8249. Current Topics in Cochlear Anatomy. (1 cr; SP–#)
Review of current research papers concerning cochlear anatomy and pathology.

Otol 8250. Advanced Biochemistry of the Auditory System. (1 cr; SP–MdBc 6100, MdBc 6101 or equiv or #)
Review of recent progress in biochemical aspects of auditory end organs.

Otol 8262. Advanced Clinical Audiology. (2 cr [max 2 cr]; SP–Grad otol major, 8242 or #)
Comprehensive reading and practicum in auditory evaluation of patients. Assumes basic knowledge of clinical audiology. Each session devoted to aspect of auditory evaluation or aural rehabilitation, including behavioral audiometry, electrophysiologic evaluation, hearing aid selection, and cochlear implants.

Otol 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Otol 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

Otol 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Otol 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Otol 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Pharmaceutics (Phm)

Department of Pharmaceutics
College of Pharmacy

Phm 8100. Seminar: Pharmaceutics. (1 cr [max 4 cr]; SP–Grad Phm major; S-N only)

Phm 8110. Readings in Pharmaceutics. (1 cr [max 4 cr]; SP–Grad Phm major; S-N only)
Current literature.

Phm 8150. Pharmacokinetics Research Seminar. (1 cr [max 12 cr]; SP–Grad Phm major; S-N only)
Current concepts and literature review.

Phm 8295. Research Problems in Pharmaceutics. (1 cr [max 20 cr]; QP–#; SP–#; S-N only)
Experimental investigation of problems in pharmaceutics.

Phm 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Phm 8411. Stabilization of Pharmaceuticals. (3 cr; QP–Physical and organic chem survey courses; SP–Physical and organic chem survey courses)
Application of physicochemical principles (e.g., chemical kinetics) to elucidate and minimize stability problems in pharmaceutical systems.

Phm 8421. Advanced Pharmacokinetics. (4 cr; SP–#; A-F only)
Topics in kinetics of drug absorption, distribution, metabolism, and excretion.

Phm 8441. Solid-State Properties of Drugs. (2 cr; QP–Physical chem survey course; SP–Physical chem survey course or #; A-F only)
Physical and physicochemical properties of drugs in solid state as related to drug delivery.

Phm 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

Phm 8451. Industrial Pharmacy. (2 cr; SP–#)
Design, manufacture, and evaluation of modern pharmaceutical dosage forms and delivery. Preformulation studies; oral liquid and solid pharmaceutical dosage forms and optimization. Pulmonary, transdermal, and parenteral deliveries, including veterinary drug delivery systems.

Phm 8461. Solubility Behavior of Drugs and Other Organic Compounds. (3 cr; QP–Physical chem survey course; SP–Physical chem survey course or #; A-F only)
Thermodynamics and kinetics of solubility and partitioning. Intermolecular interactions in pure state and in solution. Measurement and prediction of solubility and partitioning behavior. Functional group contributions. Molecular complexation and ion-pairing in solution.

Phm 8471. Biological Approaches to Drug Targeting and Mechanisms of Drug Transport. (4 cr; QP–Survey courses in biochem, physical chem, cell biol, differential equations; SP–Survey courses in biochem, physical chem, cell biol, differential equations; A-F only)
Correlation of drug absorption with physiology and properties of drugs. Concept of drug targeting. Characteristics of site-specific drug delivery systems. Therapeutic applications and critical evaluation of major drug carrier systems.

Phm 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Phm 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Phm 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Pharmacology (Phcl)

Department of Pharmacology
Medical School

Phcl 5100. Pharmacology for Nursing Students. (3 cr; SP–[Biochemistry, human physiology] or #; A-F only)
Drug principles, mechanisms of action.

Phcl 5101. Pharmacology for Pharmacy Students. (3 cr; SP–Regis 2nd yr pharmacy student or #; A-F only)
Action/fate of drugs. Lectures, lab.

Phcl 5102. Pharmacology for Pharmacy Students. (2 cr; SP–5101 or #; A-F only)
Action/fate of drugs.

Phcl 5103. Pharmacology for Dental Students. (3 cr; QP–Regis dental student or #; SP–Regis dental student or #)
Pharmacological principles/actions of drugs.

Phcl 5109. Problems in Pharmacology. (1-18 cr; QP–Upper div or grad student or #; SP–Upper div or grad student or #)
Research projects and special problems by arrangement.

Phcl 5110. Introduction to Pharmacology. (2 cr [max 2 cr]; SP–Grad student or #; A-F only)
Basic principles of Pharmacology. Focuses on molecular mechanisms of drug action.

Phcl 5111. Pharmacogenomics. (3 cr; SP–Grad student or #; A-F only)
Human genetic variation, its implications. Functional genomics, pharmacogenomics, toxicogenomics, proteomics. Interactive, discussion-based course.

Phcl 5462. Neuropsychopharmacology of Abused Drugs. (3 cr; SP–§NSc 5208; 6112, Psy 5062 or #)
Principles of pharmacology and methodologies used to study relationships between drugs and biochemical, behavioral, and neurophysiological variables. Functional biogenic amine, peptidergic and other pathways; theories of tolerance of and/or dependence on stimulants, hallucinogens, depressants, and opiates.

Phcl 8110. Advanced Pharmacology I. (3 cr; SP–Biochem and physiology background, 6110 or ¶6111 or #; A-F only)
Supplement to Phcl 6110 and 6111. Contemporary research concepts and experimental approaches in the different areas of investigative pharmacology. Mechanisms of action of drugs on systems (whole animal), organ, and cellular levels.

Phcl 8111. Advanced Pharmacology II. (3 cr; SP–Biochem and physiology background, 6111 or ¶6112 or #; A-F only)
Supplement to Phcl 6111 and 6112. Contemporary research concepts and experimental approaches in the different areas of investigative pharmacology. Mechanisms of action of drugs on cellular and molecular levels.

Phcl 8200. Seminar: Selected Topics in Pharmacology. (1 cr [max 8 cr]; SP–6112 or #)
Student-presented seminars.

Phcl 8207. Seminar: Psychopharmacology. (1 cr; SP–#; S-N only)
For graduate students and postdoctorals interested in studies and research associated with psychotropic drugs and chemicals. Neurochemistry, pharmacology, and behavior as antecedent or consequential variables. Some seminars devoted to biomedical ethics.

Phcl 8217. Problems in Investigative Pharmacology. (1 cr; SP–#; S-N only)
Presentation and discussion of contemporary research problems, investigative approaches, and methodologies in experimental pharmacology. Related to cardiovascular, renal, endocrine, and autonomic pharmacology; neuropharmacology; psychopharmacology; chemotherapy; toxicology; and molecular pharmacology.

Phcl 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Phcl 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

Phcl 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Phcl 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Phcl 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Philosophy (Phil)

Department of Philosophy
College of Liberal Arts

Phil 5201. Symbolic Logic I. (4 cr; SP–1001 or #)
Study of syntax and semantics of sentential and first-order logic. Symbolization of natural-language sentences and arguments. Development of deductive systems for first-order logic. Metatheoretic proofs and methods, including proof by mathematical induction and proof of consistency and completeness.

Phil 5202. Symbolic Logic II. (4 cr; SP–5201 or #)
Elements of set theory, including the concepts of enumerability and nonenumerability. Turing machines and recursive functions; the results of Church, Godel, and Tarski and the philosophical significance of those results.

Phil 5211. Modal Logic. (3 cr; SP–5201 or #)
Axiomatic and semantic treatment of propositional and predicate modal logics; problems of interpreting modal languages.

Phil 5221. Philosophy of Logic. (3 cr; SP–5202 or #)
Attempts to answer, "What is logic?" Scope of logic. Disputes about alternative logics. Theories concerning logical truth (e.g., conventionalism: view that logical truths are contingent).

Phil 5222. Philosophy of Mathematics. (3 cr; SP–5202 or 5xxx math course)
Major philosophical questions arising in connection with mathematics: What is mathematics about? How do we know the mathematics we do? What is the relation between mathematics and the natural sciences. Selected readings of leading contributors such as Frege, Dedekind, Russell, Hilbert, Brunner, Godel, Quine.

Phil 5325. Biomedical Ethics. (3 cr; SP–# for undergrads)
A survey of major topics and issues in biomedical ethics including patients' rights and duties, informed consent, confidentiality, ethical issues in medical research, the initiation and termination of medical treatment, euthanasia, abortion, and the allocation of medical resources.

Phil 5415. Philosophy of Law. (3 cr; SP–1003 or 1004 or 3302 or social science major or #)
Analytical accounts of law and legal obligation.

Phil 5606. Philosophy of Quantum Mechanics. (3 cr)
Problems of interpretation in ordinary (nonrelativistic) quantum mechanics. Two-slit experiment, Schrödinger cat paradox (measurement problem), Einstein-Podolsky-Rosen paradox. Leading approaches to interpretation (Copenhagen, hidden variables, universal wave function) and their connections with philosophical issues.

Phil 5760. Selected Topics in Philosophy. (3 cr; SP–3 cr [3xxx-5xxx] in phil or #)
Philosophical problems on contemporary interest. Topics specified in *Class Schedule*.

Phil 5993. Directed Studies. (1-3 cr; SP–#, Δ, ❑)
Guided individual reading or study.

Phil 8010. Workshop in History of Philosophy. (1 cr; SP–¶4xxx hist of phil course)

Phil 8081. Seminar: History of Philosophy—Ancient Philosophers. (3 cr; SP–#)
Major developments in ancient Greek philosophic thought; methods and role of history of philosophy in discipline of philosophy.

Phil 8085. Seminar: History of Philosophy—Modern Philosophers. (3 cr; SP–#)
Major developments in modern philosophic thought; methods and role of history of philosophy in discipline of philosophy.

Phil 8090. Seminar: History of Philosophy. (3 cr)
Topics specified in *Class Schedule*.

Phil 8100. Workshop in Epistemology and Metaphysics. (1 cr; SP–¶4xxx epistemology or metaphysics course, #)

Phil 8110. Seminar: Metaphysics. (3 cr; SP–4101 or #)
Topics specified in *Class Schedule*.

Phil 8130. Seminar: Epistemology. (3 cr; SP–4105 or #)
Problems in the theory of knowledge. Topics specified in *Class Schedule*.

Phil 8131. Epistemology Survey. (3 cr)

Phil 8180. Seminar: Philosophy of Language. (3 cr; SP–4231 or #)
Topics specified in *Class Schedule*.

Phil 8182. Formal Semantics of Natural Language. (3 cr; QP–Phil 5201; SP–Phil 5201 or #; A-F only)
Truth-conditional model-theoretic semantics applied to treatment of opacity, intensionality, quantification, and related phenomena in natural language.

Phil 8200. Workshop in Logic and Philosophy of Mathematics. (1 cr; SP–[¶4xxx or ¶5xxx course in logic or phil of math], #)

Phil 8210. Seminar: Logical Theory. (3 cr; SP–5201, 5205 or #)
Topics specified in *Class Schedule*.

Phil 8220. Seminar: Philosophy of Mathematics. (3 cr; SP–5202 or [4xxx or 5xxx math course] or #)
Topics such as significance of limitative metatheorems (Gödel, et al.), assessment of major foundational programs (set theoretic, modern Hilbertian, constructivist), modal and structuralist alternatives to standard platonism.

Phil 8300. Workshop in Moral and Political Philosophy. (1 cr; SP–[¶4xxx moral or poli phil course], #)

Phil 8310. Seminar: Moral Philosophy. (3 cr; SP–4320 or 4330 or 4340 or #)
Systematic study of concepts and problems relating to ethical discourse.

Phil 8320. Seminar on Medical Ethics. (3 cr; SP–[4xxx or 5xxx ethics course] or #)
Patients' rights and duties, informed consent, confidentiality, ethical issues in medical research, initiation and termination of medical treatment, euthanasia, abortion, maternal/fetal conflicts, allocation of medical resources.

Phil 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Phil 8410. Seminar: Philosophy of Law. (3 cr; SP–5415 or #)
Primarily for law students and advanced political science, history, or sociology majors or minors.

Phil 8420. Seminar: Political Philosophy. (3 cr; SP–4414 or 4321 or #)

Phil 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

Phil 8500. Workshop in Aesthetics. (1 cr; SP–¶4xxx aesthetics course, #)

Phil 8510. Seminar: Aesthetics Studies. (3 cr)
Topics specified in *Class Schedule*.

Phil 8550. Seminar: Philosophy of Religion. (3 cr; SP–4521 or #)
Topics specified in *Class Schedule*.

Phil 8600. Workshop in the Philosophy of Science. (1 cr; SP–[¶4xxx or ¶5xxx phil of sci course], #)

Phil 8601. Seminar: Scientific Inquiry. (3 cr; SP–#)
Philosophical theories of the nature of scientific methods for evaluating scientific hypotheses, of role of experimentation in science, and of how hypotheses come to be accepted within a scientific community.

Phil 8602. Seminar: Scientific Representation and Explanation. (3 cr; SP–#)
Contemporary issues concerning representation and explanation of scientific facts.

Phil 8605. Seminar: History of the Philosophy of Science. (3 cr; SP–#)
Historical development of logical empiricism from its European origins in first half of 20th century to its emergence as nearly universal account of science in post-war Anglo-American philosophy.

Phil 8606. Seminar: Philosophy of Medicine and the Biomedical Sciences. (3 cr; SP–#)
Aims and goals of medicine; concepts of health, illness, and disease; nature of reasoning in clinical medicine; theoretical evolution in medicine; and role of values in practice of medicine and healthcare.

Phil 8610. Seminar: Philosophy of the Physical Sciences. (3 cr; SP–#)
Topics specified in *Class Schedule*.

Phil 8620. Seminar: Philosophy of the Biological Sciences. (3 cr; SP–#)
Topics specified in *Class Schedule*.

Phil 8640. Seminar: Philosophy of the Cognitive Sciences. (3 cr; SP–#)

Phil 8660. Seminar: Social and Cultural Studies of Science. (3 cr; SP–#)
Review of recent work; analysis of theoretical and methodological differences among practitioners; selected responses from historians and philosophers of science.

Phil 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Phil 8670. Seminar: Philosophy of Science. (3 cr; SP–#)
Topics specified in *Class Schedule*.

Phil 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Phil 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Phil 8993. Directed Study. (1-3 cr; SP–#)

Phil 8994. Directed Research. (1-3 cr; SP–#)

Physical Medicine and Rehabilitation (PMed)

Department of Physical Medicine and Rehabilitation

Medical School

PMed 5058. Anatomy for Physical Therapy. (5 cr; A-F only)
Study of gross human anatomy, and surface anatomy, for practice of physical therapy. Cadaver dissection of extremities, head, neck, back, abdomen, thoracic, and pelvic regions. Correlation to clinical conditions. Lecture, laboratory.

PMed 5100. Seminar I: Overview of Rehabilitation Science. (2 cr; SP–#; A-F only)
History and future of physical rehabilitation, health-care models, epidemiology of physical disorders, research on treatment outcomes, measurement issues, clinical evaluation of traditional vs. nontraditional rehabilitation strategies.

PMed 5121. Issues in Mental Health. (1 cr; QP–One course gen psych, one course abnorm psych; SP–One course gen psych, one course abnorm psych; S-N only)
Psychiatric/neuropsychological assessment/treatment. Issues related to medical/community management and to roles of OT/PT with respect to clients with mental health needs. Interaction between physical/mental health and disability.

PMed 5122. Descriptive Neurology. (1 cr [max 2 cr]; QP–OT or PT or #; SP–OT or PT or #; A-F only)
Relates neuroanatomical/neurophysiological principles to neurological conditions commonly seen in occupational/physical therapy practice.

PMed 5135. Pathokinesiology. (2 cr; SP–#; A-F only)
Lecture and lab emphasizing anatomical, physiological, and biomechanical aspects of normal and pathological human motion, including analysis techniques.

PMed 5161. Theory of Physical Medicine and Rehabilitation Applied to Medical Sciences. (3 cr [max 3 cr]; QP–Regis OT or PT student or #; SP–Regis OT or PT student or #; A-F only)
Clinical science lectures focusing on diagnostic procedures and medical, surgical, and rehabilitation management of patient problems in orthopedics, surgery, pediatrics, dermatology, medicine, cancer, and speech. Includes correlation to current practice and presentation of patients.

PMed 5182. Functional Neuroanatomy/ Neurophysiology. (4 cr; QP–Regis OT or PT student or #; SP–Regis OT or PT student or #; A-F only)
Neuroanatomic structures as functional systems and basic neurophysiologic concepts with emphasis on applications for understanding and treating physical dysfunctions.

PMed 5215. Clinical Practice of Physical Therapy I. (2 cr; SP–Regis PT student; S-N only)
First of three-course sequence. Emphasizes sensitivity to needs of patients, families, and health-care coworkers. Patient handling techniques, communication skills, awareness of cultural differences, psychological aspect of disability, and use of community resources.

PMed 5216. Clinical Practice of Physical Therapy II. (1 cr; SP–Regis PT student; S-N only)
Second of three-course sequence. Emphasizes sensitivity to needs of patients, families, and health-care coworkers. Patient handling techniques, communication skills, awareness of cultural differences, psychological aspect of disability, and use of community resources.

PMed 5217. Clinical Practice of Physical Therapy III. (2 cr; SP–Regis PT student; S-N only)
Third of three-course sequence. Emphasizes sensitivity to needs of patients, families, and health-care coworkers. Patient handling techniques,

communication skills, awareness of cultural differences, psychological aspect of disability, and use of community resources.

PMed 5221. Therapeutic Procedures. (3 cr; SP–Regis PT student; A-F only)
Theory and techniques, therapeutic massage, ultraviolet radiation, medical and athletic bandaging, asepsis and isolation, thermotherapy, hydrotherapy, positive pressure devices, volumetric measurements.

PMed 5223. Electrotherapy and Electrophysiological Testing. (2 cr; SP–Regis PT student; A-F only)
Theory and technique of movement analysis and treatment using electrophysiological testing and therapeutic devices.

PMed 5231. Biomechanics. (3 cr; SP–Regis PT student; A-F only)
Forces and structures internal and external to the body responsible for both normal and abnormal human movement, including analysis techniques and independent assignments. Muscle function, palpation, posture, and gait of normal individuals with analysis to detect deviation from the norm.

PMed 5255. Clinical Internship I. (3 cr; SP–Regis PT student; S-N only)
Five-week, full-time internship. Select and perform physical therapy evaluation techniques, interpret results, define rationale for physical therapy service, develop a care plan, implement treatment program, and communicate patient/client care process as a physical therapy professional.

PMed 5260. Professional Issues in Physical Therapy. (3 cr; SP–Regis PT student; A-F only)
Current professional issues, dilemmas, and trends in health care. Evaluation and treatment skills in physical therapy specialty areas.

PMed 5281. Therapeutic Exercise I. (3 cr; SP–Regis PT student; A-F only)
Principles of skeletal muscle, connective tissue, and collagen physiology, physics, and neurology as basis for therapeutic exercise. Exercise physiology and related microanatomy of the musculoskeletal and respiratory systems as they relate to rehabilitation problems. Tissue response to treatment for loss of mobility and endurance and strength training.

PMed 5282. Therapeutic Exercise II. (3 cr; SP–Regis PT student; A-F only)
Principles of neurophysiology, neurology, motor control, and motor learning as basis for therapeutic intervention in motor dysfunction.

PMed 5283. Musculoskeletal I. (4 cr; SP–Regis PT student; A-F only)
First of two-course sequence. Problem-solving approach to evaluating, treating, and preventing selected musculoskeletal conditions across the life span. Chart review, history taking, strength testing, functional testing, gait and posture examination, special orthopedic tests. Therapeutic exercises, orthopedic ambulation, joint mobilization, splinting, patient education.

PMed 5284. Musculoskeletal III. (4 cr; SP–Regis PT student; A-F only)
Problem-solving approach to evaluating, treating, and preventing selected musculoskeletal conditions across life span. Chart review, history taking, strength testing, functional testing, gait/posture examination, special orthopedic tests. Therapeutic exercises, orthopedic ambulation, joint mobilization, splinting, patient education. Second of two-course sequence.

PMed 5287. Neurorehabilitation I. (4 cr; SP–Regis PT student; A-F only)
Assessment and rehabilitation of patients with neurological conditions (e.g., cerebral vascular disease traumatic brain injury, multiple sclerosis, Parkinson's disease, amyotrophic lateral sclerosis). Using treatment procedures, orthotics, and equipment to improve function and prevent, stabilize, or decrease impairments.

PMed 5288. Neurorehabilitation II. (4 cr; SP–Regis PT student)
Assessment and rehabilitation of patients with neurological, immunological, and vascular conditions.

PMed 5290. Administration and Teaching Practicum. (4 cr; SP–Regis PT student; A-F only)
Learning experiences and special assignments related to physical therapy administration.

PMed 5293. Research Design in Physical Therapy. (3 cr; SP–Regis PT student; A-F only)
Predictive research, elementary statistical concepts, analysis of scientific literature, research proposal.

PMed 5294. Independent Study in Physical Therapy. (1-3 cr; SP–Regis PT student; A-F only)

PMed 5295. Clinical Education. (12 cr; SP–Regis 3rd-yr PT student; S-N only)
Students must demonstrate proficiency in communication skills, team participation, and evaluation and treatment skills; predict outcomes and manage a variety of patient diagnoses/problems consistently with good and safe judgment; and have successfully completed all previous clinical education experiences.

PMed 5300. Concepts for Occupational Therapy Practice. (4 cr; QP–Regis OT student or #; SP–Regis OT student or #; A-F only)
Critical thinking, ethics, professional resources/organizations, patient-therapist relationship. Level I fieldwork experience.

PMed 5313. Therapeutic Occupation. (4 cr; QP–Regis OT student or #; SP–Regis OT student or #; A-F only)
Occupational therapy philosophy, history, and frames of reference. Activity analysis applied to purposeful, therapeutic activities for individuals and groups.

PMed 5340. Human Growth and Development. (2 cr; SP–Regis PT student; A-F only)
Development process throughout the life span, including physical, social, cognitive, and personality development and how they may be influenced by genetic and environmental factors.

PMed 5341. Introduction: Evaluation and Intervention I. (4 cr; QP–5393 or #; SP–5393 or #; A-F only)
Assessment concepts/techniques. Application to patient populations with both mental health/physical disabilities. Treatment planning/documentation.

PMed 5342. Compensatory Rehabilitation: Evaluation and Intervention II. (4 cr; QP–5300, 5370 or #; SP–5300, 5313 or #; A-F only)
Assessment of daily living performance areas; adaptation techniques to compensate for performance deficits. Level I fieldwork experience.

PMed 5343. Specialty Topics: Evaluation and Intervention III. (4 cr; QP–5342 or #; SP–5342 or #; A-F only)
Applies critical thinking model to assessment/intervention of selected patient populations with mental/physical problems requiring specialized approaches. Focus on habilitation/rehabilitation of populations with multiple performance component deficits. Fieldwork.

PMed 5344. Neurorehabilitation: Evaluation and Intervention IV. (5 cr; QP–5343 or #; SP–5343 or #; A-F only)
Assessment/intervention related to perception, cognition, reflexes, sensory integration, and motor control. Application to individuals with multiple performance component deficits.

PMed 5360. Dynamics of Group Models. (2 cr; QP–5312 or #; SP–5313 or #; A-F only)
Application of group/team dynamics in diverse professional settings.

PMed 5370. Theory of Occupation. (1 cr; SP–Regis OT student or #; A-F only)
Occupational therapy frames of reference, role of activity, and historical development of profession.

PMed 5375. Community Resources and Health-Care Issues. (2 cr; QP–[5300, 5342] or #; SP–[5300, 5342] or #; A-F only)
Analysis of community health-care systems, including cultural/family influences on individual health and decision making. Students identify current trends in health care and determine responses to them at social, political, or legislative level.

PMed 5376. Adult Education and Planning. (1 cr; QP–[5311, 5312] or #; SP–5313 or #; A-F only)
Skills needed to plan, implement, and evaluate adult educational programs/materials for patient/family education, peer/professional education, and education of others in order to carry out therapeutic interventions. Student teaching unit, community based activity.

PMed 5380. Management of Occupational Therapy Services. (3 cr; QP–[5360, 5375, 5376] or #; SP–[5360, 5375, 5376] or #; A-F only)
Administration/management of occupational therapy services within managed care environment. Issues in Medicare, HMOs, TQM, consultation, human resources, promotion of profession. Emphasizes program development in current organizational structures.

PMed 5391. Occupation Across the Life Span. (3 cr; QP–[5375, 5376] or #; SP–[5375, 5376] or #; A-F only)
The well elderly, school therapy, work-related injuries/industrial rehabilitation. Fieldwork.

PMed 5392. Research in Occupational Therapy. (3 cr; QP–5370 or #; SP–5313 or #; A-F only)
Analysis of scientific literature, development of research proposals.

PMed 5393. Functional Anatomy and Kinesiology. (4 cr; QP–Regis OT student or #; SP–Regis OT student or #; A-F only)
Gross human anatomy emphasizing skeletal, muscular, circulatory, and peripheral nervous systems of the extremities and trunk. Includes cadaver lab prosections. Analyzing functional human movement from a biomechanical perspective.

PMed 5394. Orthotics. (3 cr; QP–5341 or #; SP–5341 or #; A-F only)
Analysis, design, and construction of orthotic devices.

PMed 5395. Independent Study in Occupational Therapy. (1-4 cr [max 16 cr]; QP–Regis OT student or #; SP–Regis OT student or #)

PMed 5813. Cardiopulmonary Physical Therapy. (2 cr; SP–Regis PT student; A-F only)
Theory and techniques of cardiopulmonary evaluation and treatment. Principles of exercise response and adaptations to training.

PMed 5814. Age, Exercise, and Rehabilitation. (2 cr)

PMed 5841. Rehabilitation Science Instrumentation and Methodology. (4 cr; SP–Phys 1031, Phys 1032 or equiv, #; A-F only)
Theory and application of kinesiological EMG and other common instruments used to measure human motion.

PMed 8101. Seminar II: Issues in Musculoskeletal Rehabilitation. (2 cr; SP–#; A-F only)
Science of musculoskeletal rehabilitation; associated research methodologies.

PMed 8102. Seminar III: Issues in Neurorehabilitation. (2 cr; SP–#; A-F only)
Problems in neurorehabilitation; associated research methodologies.

PMed 8103. Physical Therapy Clinic. (1-4 cr; SP–Physical therapist; A-F only)
Adult and pediatric rehabilitation.

PMed 8130. Current Literature Seminar. (1 cr; SP–Grad PT major or #; A-F only)
Critical review of the literature to evaluate efficacy of selected physical therapy interventions.

PMed 8131. Research Seminar in Physical Therapy I. (1 cr; SP–Grad PT major; A-F only)
Introduction to scientific thinking in physical therapy and to preparation needed to execute a research project. Comprehension and critical analysis of current literature in physical rehabilitation.

PMed 8132. Research Seminar in Physical Therapy II. (1 cr; SP–Grad PT major; A-F only)
Small group discussion of journal readings focused in selected research area. Demonstration of and experience with experimental procedures. Development of research proposal.

PMed 8135. Advanced Kinesiology. (2 cr; SP–#; A-F only)
Functional anatomy emphasizing anatomical, physiological, and biomechanical aspects of normal and pathological human motion. Lecture with lab to include various techniques for analysis.

PMed 8170. Special Topics in Physical Therapy. (1 cr; SP–Grad PT major; A-F only)
Topics vary by semester. Papers required.

PMed 8185. Problems in Physical Therapy. (1-3 cr; SP–5293 or 8192 or #; A-F only)
Research practicum on selected topic designed to make students familiar with systematic literature search, critical analysis of scientific literature, specific measurement systems, data collection and data reduction methods of on-going or new research projects, preparing and defending research reports.

PMed 8188. Teaching Practicum. (1-5 cr; SP–#; A-F only)
Supervised practical experience in classroom/laboratory teaching.

PMed 8192. Research Design in Physical Therapy. (3 cr; SP–Grad PT major; A-F only)
Critical appraisal of current medical literature. Fundamentals of research design, data analysis, and medical writing.

PMed 8193. Research Problems in Physical Therapy. (1-4 cr [max 4 cr]; SP–Grad PT major or #; A-F only)
Designing a research project to answer scientific question in physical therapy, collecting data, analyzing data, interpreting results, and defending the work to an examining committee.

PMed 8200. Physical Medicine and Rehabilitation Service. (1-15 cr; SP–Enrolled in PMed residency training program)

PMed 8207. Basic and Applied Psychiatry. (1 cr; SP–Enrolled in PMed residency training program)

PMed 8210. Research in Physical Medicine. (1-15 cr; SP–Enrolled in PMed residency training program)

PMed 8212. Electromyography. (1-15 cr; SP–Enrolled in PMed residency training program)

PMed 8214. Readings in Electromyography. (1-3 cr; SP–Enrolled in PMed residency training program)

PMed 8220. Seminar: Physical Medicine and Rehabilitation. (1-15 cr; SP–Enrolled in PMed residency training program)

PMed 8282. Problems in Human Movement. (4 cr; SP–Registered Ph.D. grad student in [rehabilitation science or field related to rehabilitation], #; A-F only)
Mechanisms of pathology/recovery associated with neurologically based problems in human movement (e.g., paralysis, spasticity, tremor).

PMed 8300. Research Seminar in Occupational Therapy. (1 cr; QP–5392 or #; SP–5392 or #; S-N only)
Critical review of research literature in occupational therapy. Issues related to ethical/successful conduct/publication of research. Development of Plan B project outline.

PMed 8310. Research Problems in Occupational Therapy. (1-4 cr [max 4 cr]; QP–5392; SP–Plan B student, 5392 or #; S-N only)
Individual, concentrated study of a problem in occupational therapy. Completion of Plan B project. Note: Students register for PMed 8310 for 2 credits in fall and 2 credits in spring for a total of 4 credits.

PMed 8320. Fieldwork Education in Occupational Therapy I. (6 cr; QP–5343, 5344, 5380 or #; SP–5343, 5344, 5380 or #; S-N only)
Supervised clinical practice in affiliated hospitals and community agencies. Students apply critical thinking through supervised application of theory and skills.

PMed 8321. Fieldwork Education in Occupational Therapy II. (6 cr; QP–5343, 5344, 5380 or #; SP–5343, 5344, 5380 or #; S-N only)
Supervised clinical practice in affiliated hospitals and community agencies. Students apply critical thinking through supervised application of theory and skills.

PMed 8322. Fieldwork Education in Occupational Therapy III: Optional. (1-6 cr; QP–5343, 5344 or #; SP–5343, 5344 or #; S-N only)
Optional fieldwork experience involving supervised practice in clinic or community agency with specialty focus. Sample topics: hand therapy, school therapy, clinical research. Students apply critical thinking through supervised application of theory and skills.

Physical Therapy (PT)

Department of Physical Medicine and Rehabilitation

Medical School

PT 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

PT 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Physics (Phys)

School of Physics and Astronomy

Institute of Technology

Phys 5001. Quantum Mechanics I. (4 cr; QP–[[5102 or equiv], adv calc] or #; SP–4101 or equiv)
Schrodinger equation: bound state and scattering problems in one dimension. Spherically symmetric problems in three dimensions, angular momentum and the hydrogen atom. Approximation methods for stationary states. Time-dependent perturbation theory. Operators and state vectors: general formalism of quantum theory.

Phys 5002. Quantum Mechanics II. (4 cr; QP–5151 or equiv; SP–5001 or equiv)
Symmetry in quantum mechanics, space-time symmetries and the rotation group, Clebsch-Gordan coefficients and the Wigner-Eckart theorem. Scattering theory. Method of second quantization with elementary applications. Relativistic wave equations including Dirac equation.

Phys 5011. Classical Physics I. (4 cr; QP–5022, 5024, adv calc or #; SP–4001, 4002 or #)
Classical mechanics: Lagrangian and Hamiltonian mechanics, orbital dynamics, rigid body motion, special relativity.

Phys 5012. Classical Physics II. (4 cr; QP–5051; SP–5011 or #)
Classical electromagnetism: electrostatics, magnetostatics, Maxwell's equations, electromagnetic waves, radiation, interaction of charged particles with matter.

Phys 5041. Analytical and Numerical Methods of Physics I. (4 cr; QP–two 5xxx Math courses; SP–Grad or #)
Survey of mathematical techniques, both analytic and numerical, needed for physics. Application to physical problems.

Phys 5042. Analytical and Numerical Methods of Physics II. (4 cr; QP–#; SP–5041 or #)
Survey of mathematical techniques, both analytic and numerical, needed for physics. Application to physical problems.

Phys 5071. Physics for High School Teachers: Experimental Foundations and Historical Perspectives. (3 cr; QP–Gen physics, #; no cr for physics grad or grad physics minor; SP–Gen physics, #; no cr for physics grad or grad physics minor)
In-depth examination of a conceptual theme in physics, its experimental foundations and historical perspectives. Kinematics and dynamics from Aristotle through Einstein; nature of charge and light; energy and thermodynamics; electricity, magnetism, and quantized fields; structure of matter.

Phys 5401. Physiological Physics. (4 cr; QP–General phys, calculus; SP–1301 or 1401)
Musculoskeletal system, circulatory system/membrane transport, biological control systems, propagation/action potential in nervous system, biomagnetism, electromagnetism at cellular level.

Phys 5402. Radiological Physics. (4 cr; QP–General phys, calculus; SP–1302 or 1402)
Signal analysis, medical imaging, medical X-rays, tomography, radiation therapy, nuclear medicine, MRI, and similar topics.

Phys 5701. Solid-State Physics for Engineers and Scientists. (4 cr; QP–1254, 3512, grad or advanced undergrad in physics or engineering or the sciences or #; SP–Grad or advanced undergrad in physics or engineering or the sciences)
Crystal structure and binding; diffraction; phonons; thermal and dielectric properties of insulators; free electron model; band structure; semiconductors.

Phys 5702. Solid State Physics for Engineers and Scientists. (4 cr; QP–5231 or #; SP–5701 or #)
Diamagnetism and paramagnetism; ferromagnetism and antiferromagnetism; optical phenomena; lasers; superconductivity; surface properties; ferroelectricity.

Phys 5950. Colloquium Seminar. (1 cr; QP–Grad or advanced undergrad in physics, Δ; SP–Grad or advanced undergrad in physics, Δ)

Phys 5980. Introduction to Research Seminar. (1 cr [max 3 cr]; QP–Grad or upper div phys major; SP–Grad or upper div phys major; S-N only)
Introduction to the research activities of the School of Physics and Astronomy.

Phys 5993. Directed Studies. (1-5 cr [max 15 cr]; QP–#, Δ; SP–#, Δ)
Independent, directed study in physics in areas arranged by the student and a faculty member.

Phys 5994. Directed Research. (1-5 cr [max 15 cr]; QP–Jr, Δ; SP–Jr, Δ)
Problems, experimental or theoretical, of special interest to students. Written reports.

Phys 8001. Advanced Quantum Mechanics. (3 cr; QP–Phys 5153; SP–Phys 5002 or #)
Topics in non-relativistic quantum mechanics; second quantization. Introduction to Diagrammatic and Green's function techniques and to relativistic wave equations. Application of relativistic perturbation theory to particle interactions with electromagnetic field. Invariant interactions of elementary particles.

Phys 8011. Quantum Field Theory I. (3 cr; QP–8123; SP–8001 or #)
Second quantization of relativistic wave equations: canonical quantization of the free scalar and Dirac fields. Fields in interaction: interaction picture. Quantum electrodynamics: quantization of the electromagnetic field, propagators and Feynman rules, tree-level processes. Higher-order processes and renormalization.

Phys 8012. Quantum Field Theory II. (3 cr; QP–8381; SP–8011 or #)
Aspects of general theory of quantized fields, including space-time and discrete transformation properties, the CPT theorem, and the spin-statistics connection. Introduction to functional and path-integral methods. Renormalization group and asymptotic freedom. Semi-classical methods and instantons in gauge theories.

Phys 8013. Special Topics in Quantum Field Theory. (3 cr; QP–8382; SP–8012 or #)
Includes non-perturbative methods in quantum field theory, supersymmetry, two-dimensional quantum field theories and their applications, lattice simulations of quantum fields, topological quantum field theories, quantum field theory methods applied to condensed matter physics, and string theory.

Phys 8100. Seminar: Problems of Physics Teaching and Higher Education. (1 cr [max 3 cr]; SP–#)
Lectures and informal discussions of courses and curricula, techniques, and materials important in undergraduate physics instruction; relation to general problems of higher education.

Phys 8301. Symmetry and Its Application to Physical Problems. (3 cr; QP–5153; SP–5002 or #)
Fundamental invariance principles obeyed by laws of physics. Group theory as tool for using symmetry and invariance to help understand behavior of physical systems. Applications made to atomic, molecular, nuclear, condensed-matter, and elementary particle physics.

Phys 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Phys 8401. Atomic and Molecular Structure. (3 cr; QP–5153; SP–5002 or #)
Understanding behavior of atoms and molecules in terms of basic interactions between electrons and nuclei and electromagnetic radiation. Applications made to condensed-matter physics, astrophysics, biophysics, and physical chemistry.

Phys 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

Phys 8500. Plan B Project. (4 cr; SP–#; may be taken once to satisfy Plan B master's project requirement; no cr toward Ph.D.)
Project topic arranged between student and instructor. Written report required.

Phys 8501. General Relativity and Cosmology I. (3 cr; QP–5053; SP–5012 or #)
Tensor analysis and differential geometry. Special relativity leading to formulation of principles of general relativity and Einstein's equations. Tests of general relativity and thorough discussion of various black hole solutions, including Schwarzschild, Reisner-Nordstom, and Kerr solutions.

Phys 8502. General Relativity and Cosmology II. (3 cr; QP–8081; SP–8501 or #)
Gravitational radiation. Applications of general relativity to stellar structure of white dwarfs and neutron stars, action principle, and symmetric spaces. Big-bang cosmology, strongly emphasizing particle physics.

Phys 8600. Seminar: Space Physics. (1 cr [max 6 cr]; SP–#; S-N only)
Current topics in space physics and plasma physics.

Phys 8601. Plasma Physics I. (3 cr; QP–5162; SP–4621, 5012 or #)
Theory of plasma waves and instabilities in plasmas, magnetohydrodynamics, nonlinear waves in plasmas, wave propagation in inhomogeneous plasmas.

Phys 8602. Plasma Physics II. (3 cr; QP–8163; SP–8601 or #)
Theory of plasma waves and instabilities, collisions, radiation, transport, nonlinear wave-particle and wave-wave interactions, instabilities in inhomogeneous plasmas.

Phys 8611. Cosmic Ray and Space Physics. (3 cr; QP–5102 or 5053; SP–5012 or #)
Properties of energetic particles in heliosphere and in astrophysical environments; solar physics, including radiation and magnetic effects; solar wind and magnetospheric physics; physics of radiation belts.

Phys 8650. Advanced Topics in Space and Plasma Physics. (3 cr [max 9 cr]; QP–5022, 5024; SP–8602 or 8611 or #)
Topics in plasma waves and instabilities, solar physics, cosmic ray physics, atmospheric physics or planetary physics.

Phys 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Phys 8700. Seminar: Condensed Matter Physics. (1 cr [max 6 cr]; SP–#; S-N only)
Current research.

Phys 8701. Statistical Mechanics and Transport Theory I. (3 cr; QP–8121; SP–5002 or #)
Equilibrium properties of macroscopic classical and quantum systems. Phase transitions and Renormalization Group. Transport theory. Applications to soft condensed matter systems.

Phys 8702. Statistical Mechanics and Transport Theory II. (3 cr; QP–8121; SP–8701 or #)
Equilibrium properties of macroscopic classical and quantum systems. Phase transitions and Renormalization Group. Transport theory. Applications to soft condensed matter systems.

Phys 8711. Solid-State Physics I. (3 cr; QP–¶5152-53, Phys 5211; SP–4211, 5002 or #)
Fundamental properties of solids. Electronic structure and transport in metals and semiconductors. Properties of disordered materials.

Phys 8712. Solid-State Physics II. (3 cr; QP–¶5152-53, 5211; SP–8711 or #)
Fundamental properties of solids. Electronic structure and transport in metals and semiconductors. Properties of disordered materials.

Phys 8750. Advanced Topics in Condensed Matter Physics. (3 cr [max 9 cr]; QP–8222; SP–8712 or #)
Sample research topics: magnetism, superconductivity, low temperature physics, superfluid helium.

Phys 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Phys 8800. Seminar: Nuclear Physics. (1 cr [max 6 cr]; SP–#; S-N only)
Current research topics.

Phys 8801. Nuclear Physics I. (3 cr; QP–5151 or ¶5151; SP–5001 or ¶5001)
Properties of nuclei based on hadronic and quark-gluon degrees of freedom. Relativistic field theory at finite temperature and density applied to many-body problems, especially nuclear matter and quark-gluon plasma. Applications to lepton and hadron scattering, nucleus-nucleus collisions, astrophysics and cosmology.

Phys 8802. Nuclear Physics II. (3 cr; QP–5152 or ¶5152; SP–8801 or #)
Properties of nuclei based on hadronic and quark-gluon degrees of freedom. Relativistic field theory at finite temperatures and density applied to many-body problems, especially nuclear matter and quark-gluon plasma. Applications to lepton and hadron scattering, nucleus-nucleus collisions, astrophysics and cosmology.

Phys 8850. Advanced Topics in Nuclear Physics. (3 cr [max 9 cr]; SP–8802 or #)
Research topics.

Phys 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Phys 8900. Seminar: Elementary Particle Physics. (1 cr [max 6 cr]; SP–#)
Elementary particle physics, high energy physics, particle astrophysics and cosmology.

Phys 8901. Elementary Particle Physics I. (3 cr; QP–8122 or #; SP–8001 or #)
Types of fundamental interactions. Exact and approximate symmetries and conservation laws. Gauge quanta: gluons, photons, W and Z bosons, gravitons. Fundamental fermions: leptons and quarks. Isotopic and flavor SU(3) symmetries of strong interaction. Heavy hadrons. Amplitudes and probabilities. Quantum chromodynamics.

Phys 8902. Elementary Particle Physics II. (3 cr; QP–8371 or #; SP–8901 or #)
Deep inelastic scattering. Weak interactions of leptons. Semileptonic and nonleptonic weak processes with hadons. Oscillations of neutral Kaons. Violation of CP symmetry in Kaons. Neutrino masses and oscillations. Standard model of the electroweak interaction. Grand unification. Unitarity of the S matrix. Properties of soft pions.

Phys 8950. Advanced Topics in Elementary Particle Physics. (3 cr [max 9 cr]; SP–8902 or #)
Research topics.

Phys 8994. Research in Physics. (1-12 cr [max 24 cr]; SP–#)
Research under faculty direction.

Physiology (Phsl)

Department of Physiology

Medical School

Phsl 5061. Principles of Physiology for Biomedical Engineering. (4 cr; QP–Biomedical engineering grad, one yr college chem and physics and math through integral calculus; SP–Biomedical engineering grad, one yr college chem and physics and math through integral calculus)
Human physiology with emphasis on quantitative aspects. Organ systems (circulation, respiration, renal, gastrointestinal, endocrine, muscle, central and peripheral nervous systems), cellular transport processes, and scaling in biology.

Phsl 5094. Research in Physiology. (1-5 cr [max 20 cr]; QP–3055, 3056, physiology undergrad, #; SP–#)
Independent lab research project in physiology, supervised by physiology faculty.

Phsl 5095. Problems in Physiology. (1-5 cr [max 20 cr]; QP–3055, 3056, physiology undergrad, #; SP–#)
Individualized study in physiology. Students address selected problem through library or lab research, supervised by physiology faculty.

Phsl 5101. Human Physiology. (5 cr; SP–Grad student in biomedical sciences; A-F only)
Survey of human physiology. Muscle, cardiovascular, respiratory, gastrointestinal, renal physiology. Integrative, systems approach. Emphasizes normal function.

Phsl 5201. Computational Neuroscience I: Membranes and Channels. (3 cr; QP–Calculus through differential equations; SP–Calculus through differential equations)
Neural excitation (ion channels, excitation models, effects of neural morphology) using UNIX workstations to simulate empirical results. Includes the Hodgkin-Huxley model, nonlinear dynamic systems analysis, voltage and ligand gated ion channels, ion transport theories, and impulse initiation and propagation.

Phsl 5202. Computational Neuroscience II: Neural Systems and Information Processing. (3 cr; QP–Understanding of UNIX, Phsl/NSc 5201 or equiv; SP–Understanding of UNIX, Phsl/NSc 5201 or equiv)
Quantitative examination of information processing by networks based on experimental data and theoretical models. Neural codes, neural network models and information processing, neural control systems, computational maps.

Phsl 5444. Muscle. (3 cr; QP–§BioC 5444, §MDBC 5444, §VPB 5444; 3052 or BioC 3021 or BioC 5331 or #; SP–§BioC 5444, §MDBC 5444 §VPB 5444; 3061 or 3071 or 5061 or BioC 3021 or BioC 4331 or #)
Muscle membranes: structures, mechanisms, and physiological roles of channels/pumps. Muscle contraction: force generation by actin/myosin.

Phsl 5510. Advanced Cardiac Physiology and Anatomy. (2-3 cr; SP–#)
Fundamental concepts, advanced topics related to clinical/biomedical cardiac physiology. Lectures, laboratories, workshops, anatomical dissections. Intense, one week course.

Phsl 5511. Advanced Neuromuscular Junction Physiology. (2-3 cr; SP–#)
Fundamental concepts and advanced topics related to clinical/biomedical aspects of neuromuscular junction physiology. Lectures, laboratories, workshops, anatomical dissections. Intense, one week course.

Phsl 8294. Research in Physiology. (1-18 cr; SP–Grad cellular and integrative phsl major, #)
Directed laboratory research.

Phsl 8310. Advanced Topics in Cellular Physiology. (1 cr [max 4 cr]; SP–#)
Discussion of primary research publications. Topics vary by semester.

Phsl 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Phsl 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

Phsl 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Phsl 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Phsl 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Plant Biology (PBio)

Department of Plant Biology

College of Biological Sciences

PBio 5109. Current Questions in Fungal Biology. (2 cr; QP–Biol 5003 or GCB 3022; SP–Biol 4003 or GCB 3022; A-F only)
Diversity of fungi and their interactions with other organisms. Pathogenic and mutualistic interactions with animals and plants. Use of fungal systems for drug discovery and understanding pathogenicity, signal transduction, morphogenesis, and evolution.

PBio 5221. Molecular Evolution. (2 cr; QP–Biol 5003 or GCB 3022; SP–Biol 4003 or GCB 3022; A-F only)
Molecular basis of evolutionary change. Current ideas of selection and neutral evolutionary processes. Construction of phylogenies as determined from DNA sequence data. Evolution of multigene families, organelle genomes, novel gene function, and their relationship to development and organismal evolution.

PBio 5301. Plant Genomics. (3 cr; SP–[Intro course in genetics, intro course in biochemistry] or #)
Introduction to genomics. Emphasizes plants and relevant model organisms. DNA marker/sequencing technology, comparative genomics, whole genome sequencing, DNA chips/microarrays, EST libraries and SAGE analysis, gene-knockout systems, genome databases, sequence comparison/clustering algorithms, visualization tools.

PBio 5412. Plant Physiology. (3 cr; QP–Biol 1103 or Biol 3012 or Biol 3812, Biol 5001 or BioC 3021 or BioC 5331; SP–Biol 2022 or Biol 3002 or Biol 3007, Biol/BioC 3021 or BioC 4331)
Physiological and biochemical bases of plant systems with emphasis on higher plants.

PBio 5414. Plant Cell and Molecular Biology. (3 cr; QP–Biol 1103 or Biol 3012 or Biol 3812, BioC 3021 or Biol 5003 or GCB 3022; SP–Biol 2022 or Biol 3007 or Biol 3002, Biol/BioC 3021 or Biol 4003 or GCB 3022)
Aspects of recombinant DNA technology and other technologies in cell and molecular biology. Appropriate for those without extensive background in these areas but who wish to understand the potential uses of current cell and molecular technologies in the plant sciences.

PBio 5416. Plant Morphology, Development, and Evolution. (4 cr; QP–Biol 1103 or Biol 3012 or Biol 3812; SP–Biol 2022 or Biol 3002 or Biol 3007)
Evolutionary history of land plants. Morphological changes in vegetative and reproductive structures. Morphology of green algal ancestors, nonvascular land plants, and spore bearing and seed bearing vascular plants are analyzed in an evolutionary framework.

PBio 5640. Discussions in Plant Molecular Biology. (2 cr [max 4 cr]; QP–Biol 3012, Biol 5003, ¶GCB 5034; SP–§PBio 5414; Biol 3002, Biol 4003, GCB 5034 or ¶GCB 5034)
Selected topics in plant molecular biology for students with a strong interest in the subject. Classical and recent papers that have led to current understanding of transposable elements, genomic structure and function, mechanisms of hormone action and gene regulation.

PBio 5960. Special Topics. (1-3 cr [max 6 cr]; QP–Biol 1103 or Biol 3012 or Biol 3812; SP–Biol 2022 or Biol 3002 or Biol 3007)
In-depth treatment of specialized topics in plant biology.

PBio 8081. Current Topics in Plant Biology: Molecular Biology-Physiology-Cell Biology. (1 cr; A-F only)
Background information and review of selected current literature. For first-year students in plant biological sciences and other biological science graduate programs.

PBio 8082. Current Topics in Plant Biology: Structure-Evolution-Ecology. (1 cr; A-F only)
Background information and review of selected current literature. For first-year students in plant biological sciences and other biological science graduate programs.

PBio 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

PBio 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

PBio 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Doctoral student who has not passed prelim oral)

PBio 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr])

PBio 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr])

PBio 8900. Seminar. (1 cr [max 4 cr]; S-N only)
Current scientific research.

PBio 8910. Journal Club. (1 cr [max 4 cr]; S-N only)
Critical evaluation of selected current literature.

Plant Pathology (PlPa)

Department of Plant Pathology

College of Agricultural, Food, and Environmental Sciences

PlPa 5003. Diseases of Forest and Shade Trees. (3 cr)
Diseases of trees in urban and forested areas. Biology, ecology, and control of tree diseases. Identifying disease agents, integrated control procedures. Laboratory.

PlPa 5090. Issues in Plant Pathology. (2-4 cr)
See *Class Schedule* or department for current offerings.

PlPa 5102. Epidemiology and Genetics of Host-Parasite Interactions. (3 cr; QP–[5201 or equiv], GCD 3022; SP–[5201 or equiv], GCD 3022; A-F only)
Concepts/methodology in study of plant disease epidemics, host plant resistance, and host-parasite genetics. Disease assessment, epidemic progress models, environmental influences, crop loss assessment, disease forecasting, ecology of host-parasite. Environmentally sound management strategies. Use of resistance for disease control.

PlPa 5103. Physiological and Molecular Plant-Microbe Interactions. (3 cr)
Genetics, physiology, molecular biology of plant-microbe interactions. Communication between plant/microbes, signal transduction, control of gene expression, symbiosis/parasitism, plant host response mechanisms, plant disease physiology.

PlPa 5201. Biology of Plant Diseases. (4 cr; QP–Biol 1009 or equiv; SP–Biol 1009 or equiv)
Principles and concepts of plant disease caused by selected viruses, bacteria, fungi, nematodes, and environmental factors. Pathogen biology, interaction of pathogens and the environment; epidemiology and control measures appropriate to plant disease.

PlPa 5202. Field Plant Pathology. (2 cr; QP–#; SP–#)
Characteristics of a variety of plant diseases. Field trips to observe symptoms and effects of diseases, and to learn about prevention and control of diseases in field, forest, golf course, greenhouse, nursery, orchard, and urban environments.

PlPa 5203. Biology and Ecology of Fungi. (3 cr; QP–Biol 1009 or equiv; SP–Biol 1009 or equiv)
Major groups of fungi, their roles in ecosystems and human society, environmental and nutritional needs, and modes of dissemination and survival. Representative species of fungi observed and manipulated.

PlPa 5204. Plant Disease Management. (3 cr; SP–3001 or 3002; A-F only)
Principles of crop/pathogen biology, epidemiology, crop ecology, crop management practices that influence occurrence of plant disease. Interaction of crop management practices with plant disease. Strategies for controlling plant disease through management practices illustrated by examples from agronomic, horticultural, forest crops.

PlPa 5301. Plant Genomics. (3 cr; QP–Intro course in genetics or #; SP–Intro course in genetics or #)
Introduction to genomics. Emphasizes plants and relevant model organisms. DNA marker/sequencing technology, comparative genomics, whole genome sequencing, DNA chips/microarrays, EST libraries and SAGE analysis, gene-knockout systems, genome databases, sequence comparison/clustering algorithms, visualization tools.

PlPa 5999. Special Workshop in Plant Pathology. (1-4 cr)
Workshops on a variety of topics in plant pathology offered at locations other than the Twin Cities campus. See *Class Schedule* or department for current offerings.

PlPa 8005. Supervised Classroom or Extension Teaching Experience. (2 cr; SP–#; S-N only)
Teaching experience in one of the following departments: Biosystems and Agricultural Engineering; Agronomy and Plant Genetics; Horticultural Science; Soil, Water, and Climate; or Plant Pathology. Discussions about effective teaching to strengthen skills and develop a personal teaching philosophy.

PlPa 8090. Advanced Procedures and Research in Plant Pathology. (1-8 cr)
Special assignment in lab and field problems in pathological research.

PlPa 8101. Causal Organisms of Plant Disease. (4 cr; QP–5201 or equiv; SP–5201 or equiv)
Laboratory-based intensive examination of bacteria, viruses, and nematodes as causal agents of plant disease.

PlPa 8102. Epidemiology and Genetics of Host-Parasite Interactions. (3 cr; QP–5201, GCD 3022; SP–5201, GCD 3022; A-F only)
Disease assessment, analysis in time/space, models for epidemic progress, environmental influences, crop loss assessment, disease forecasting, ecology of host-parasite interactions. Mendelian, populational, and

molecular genetic aspects of host-parasite interactions. Modes of variability in pathogen populations, strategies for disease resistance.

PlPa 8103. Physiological and Molecular Plant-Microbe Interactions. (3 cr; SP–Intro course in biochem or plant physiology or equiv)
Genetics, physiology, and molecular biology of plant-microbe interactions. Communication between plants and microbes, signal transduction, control of gene expression, symbiosis and parasitism, plant host response mechanisms, and plant disease physiology.

PlPa 8200. Seminar. (1-2 cr; A-F only)
Critical review and presentation of current problems and progress in plant pathology.

PlPa 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

PlPa 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

PlPa 8500. Perspectives in Plant Pathology. (2 cr [max 4 cr]; SP–#; S-N only)
Integrative overview of the field. For Ph.D. students nearing end of formal classroom experience.

PlPa 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

PlPa 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

PlPa 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Polish (Plsh)

Institute of Linguistics, ESL, and Slavic Languages and Literatures

College of Liberal Arts

Plsh 5900. Topics. (1-4 cr)
Topics specified in *Class Schedule*.

Plsh 5993. Directed Readings. (1-3 cr)
Guided individual reading or study in Polish language, literature, and culture.

Political Science (Pol)

Department of Political Science

College of Liberal Arts

Pol 5210. Topics in Political Theory. (3 cr; SP–§4210; ¶3210, Δ, grad; A-F only)

Pol 5251. Greeks, Romans, and Christians: Ancient and Medieval Political Thought. (4 cr; SP–§3251)
Politics and ethics in Greece, Rome, Christendom: Thucydides, Socrates, Plato, Aristotle, Cicero, Augustine, Aquinas, Marsilius.

Pol 5252. Renaissance, Reformation, and Revolution: Early Modern Political Thought. (4 cr; SP–§3252)
Thinkers, themes, and discourses from the Renaissance to the French Revolution. Renaissance Humanists; Machiavelli; More; Reformation; Luther; Calvin; Natural Law; Grotius; Divine Right; Common Law; Bacon; English Revolutionaries; Hobbes; Locke; Astell; Enlightenment; Rousseau; French Revolutionaries; Hume; Burke; Wollstonecraft.

Pol 5253. Modernity and its Discontents: Late Modern Political Thought. (4 cr; SP–§3253)
Theoretical responses to and rival interpretations of Western economy, society, politics, and democratic culture in the modern age; theories of history; class struggle; end of metaphysics and death of God; technology and bureaucracy; psychology of culture in Hegel, Marx, Tocqueville, Mill, Nietzsche, Weber, Freud.

Pol 5275. Contemporary Political Thought. (3-4 cr; SP–§4275; grad student; 1201 recommended)
20th-century crisis of Western humanism in major works of contemporary political thought from World War II to present. Force and freedom. Ideology and truth. Authority and resistance. Thinkers may include Arendt, Camus, Beauvoir, Fanon, Foucault, Habermas, Rawls, Sartre, Said. Ideas may include communitarianism, feminism, postcolonialism, postmodernism, socialism.

Pol 5280. Topics in Political Theory. (3-4 cr [max 8 cr]; SP–§4280; grad student)
Topics in historical, analytical, or normative political theory. Topics vary, see *Class Schedule*.

Pol 5303. American Democracy in Crisis. (3-4 cr; SP–§4303; [1001 or equiv], [non-pol sci grad major or #])
Compares performance of American political system with promises of democracy. Interpretations of democratic government and American national governing process.

Pol 5306. Presidential Leadership and American Democracy. (3-4 cr; SP–§4306; [1001 or equiv], [non-pol sci grad major or #])
Examines whether president's political and constitutional powers are sufficient to satisfy citizens' high expectations and whether president should be expected to dominate American politics.

Pol 5308. Congressional Politics and Institutions. (3-4 cr; SP–§4308; [[1001 or 1002], non-pol sci grad major] or #)
Origin/development of U.S. congressional institutions, parties, committees, leaders, lobbying/elections, and relations between Congress/executive branch. Relationship of campaigning/governing, nature of representation, biases of institutional arrangements.

Pol 5309. Justice in America. (3 cr; SP–§4309; [1001 or 1002], [non-pol sci grad major or equiv or #])
American judiciary, selection of judges, how/why these individuals/institutions behave the way they do. What influences judicial decisions. What impact decisions have. Why people comply with them.

Pol 5310. Topics in American Politics. (3 cr; SP–§4310; 1001 or equiv or grad student or #)
See *Class Schedule* for description.

Pol 5315W. State Governments: Laboratories of Democracy. (4 cr; SP–§4315W; [[1001 or equiv], non-pol sci grad major] or #)
Political behavior, governmental institutions, and public policies in American states. Comparison among states, between state and national government. Emphasizes Minnesota.

Pol 5322. Rethinking the Welfare State. (3-4 cr; SP–§4322; grad student)
Competing arguments about welfare states in advanced industrial countries. Whether welfare states result from sectional interests, class relations, or citizenship rights. Compares American social policy with policies in other western countries.

Pol 5327. Politics of American Cities and Suburbs. (3 cr; SP–§4327; [[1001 or 1002], [non-pol sci grad major or equiv]] or #)
Development/role of American local government. Forms and structures. Relationships with states and federal government. Local politics and patterns of power/influence.

Pol 5331. Thinking Strategically in Domestic Politics. (3-4 cr; SP–§4331; grad student)
Applications of rational-choice and game theories to important features of domestic politics in the United States and elsewhere.

Pol 5410. Topics in Comparative Politics. (3 cr; SP–§4410; grad student)
Topics of current analytical or policy importance. Topics vary, see *Class Schedule*.

Pol 5441. Environmental Policy. (3 cr; SP–§3441; non-pol-sci grad student or #)
How American political system deals with environmental issues. How third world countries deal with environmental protection/economic growth. How international community deals with global environmental problems.

Pol 5461W. European Government and Politics. (4 cr; SP–§4461W; 1054 or 3051 or non-political science grad student or #)
European political institutions in their social settings. Power and responsibility. Governmental stability. Political decision making. Government and economic order.

Pol 5467. Politics and Market in Contemporary Japan. (3-4 cr; SP–§4467, §EAS 4467; 1054 or 3051 or non-pol sci grad student or #)
How Japan combined rapid economic development and social stability in postwar period. Strengths/weaknesses of Japanese model of capitalism, particularly in today's new "globalized" world.

Pol 5471. After Communism: Russia and the Commonwealth of Independent States. (3-4 cr; SP–§4471; 1054 or 3051 or non-pol sci grad student or #)
Politics of newly independent states of former Soviet Union, particularly Russia. Political transformation, sources of political stability/instability, economic reform, problems of multinational state.

Pol 5473. Chinese Politics. (3 cr; SP–§4473, §EAS 4473; grad student)
Fundamental conflicts in Chinese society. Democracy movement, human rights, class divisions, gender struggles, environmental issues, capitalist vs socialist development strategies. Secondary topics include Chinese foreign relations and domestic/foreign political issues in Taiwan.

Pol 5477. Struggles and Issues in the Middle East. (3-4 cr; SP–§4477; 1054 or 3051 or non-pol sci grad student or #)
Turkey, Iran, Israel, and selected Arab states. Domestic politics of religious/secular, ethnic, economic, environmental, and other policy/identity issues. Regional politics of water access, Israeli/Palestinian/Arab world relationships, oil and Persian/Arabian Gulf, human rights.

Pol 5478. Contemporary Politics in Africa and the Colonial Legacy. (3-4 cr; SP–§4478; 1054 or 3051 or non-pol sci grad student or #)
How current politics in mainly, though not exclusively, sub-Saharan Africa have been shaped by pre-colonial/colonial processes. Reality of independence, recurrent political/economic crises. Global context and prospects for effective democracy.

Pol 5479. Latin American Politics. (3-4 cr; SP–§4479, §LAS 4479; 1054 or 3051 or non-pol sci grad student or #)
Overview of Latin American politics and political economy. Authoritarianism, human rights, redemocratization. Development and economic policy. Social movements. Ethnicity and race. Religion. Revolution. U.S.-Latin American relations.

Pol 5481. Governments and Markets. (3-4 cr; SP–§4481; 1054 or 3051 or non-pol sci grad student or #)
Connection between democracy and markets. Focuses on countries in North America, Europe.

Pol 5483. Grassroots Politics. (3-4 cr; SP–§4483; grad student)
Politics of daily life, powerlessness, workplace politics, everyday resistance, local organizing, protest, rebellion, and social movements.

Pol 5485. Human Rights and Democracy in the World. (3-4 cr; SP–§4485; [at least one 1xxx or 3xxx course in pol sci, non-pol sci major] or #)
History of ideas about human rights and democracy. Economic, political, psychological, and ideological explanations for repression.

Pol 5487. Struggle for Democratization and Citizenship. (3-4 cr; SP–§4487; non-pol sci grad student)
History of democratic movement from its earliest moments in history to present. Attempts to draw balance sheet. Emphasizes how disenfranchised fought to become included.

Pol 5501. Supreme Court and Constitutional Interpretation. (3 cr; SP–§4501; 1001 or 1002 or equiv or non-pol sci grad student or #)
Historical/analytical approaches to Court's landmark decisions. Theory/techniques of judicial review. Court's authority related to wider political/social context of American government.

Pol 5523. Politics of Regulatory Process. (3 cr; SP–§4523; [1001 or 1002 or equiv or #], [4309 or 4501 or sr or non-pol sci grad student])
Operations of regulatory agencies in political/legal environment. Principles of federal administrative law, informal procedures, interest group activity. Philosophy of regulation. Politics/processes of deregulation.

Pol 5525. Federal Indian Policy. (3 cr; SP–§4525, §AmIn 4525; grad student; A-F only)
Formulation, implementation, evolution, comparison of Indian policy from pre-colonial times to self-governance of new millennium. Theoretical approaches to federal Indian policy. Major federal Indian policies. Views/attitudes of policy-makers, reactions of indigenous nations to policies. Effect of bodies of literature on policies.

Pol 5561. Comparative Legal Systems. (3 cr; SP–§4561; jr or sr or non-pol sci grad student)
Survey of principal legal systems of Western world. Role of legal system in relation to various political/economic systems. Contrast between common law and civil law traditions.

Pol 5737. American Political Parties. (3-4 cr; SP–§4737; [[1001 or equiv], grad student] or #)
American two-party system. Party influence in legislatures/executives. Decline of parties, their future.

Pol 5766. American Political Culture and Values. (3-4 cr; SP–§4766; 1001 or equiv or non-pol sci grad student or #)
Individualism, freedom, equality. Dominant beliefs about democratic principles, materialism, capitalism, citizenship, patriotism/heroism.

Pol 5767. Public Opinion and Voting Behavior. (3-4 cr; SP–§4767; [[1001 or equiv], grad student] or #)
Major factors influencing electoral decisions. Political attitude formation/change. Data analysis lab required.

Pol 5810. Topics in International Politics and Foreign Policy. (3-4 cr [max 8 cr]; SP–§4810; grad student)
Selected issues in contemporary international relations. Topics vary, see *Class Schedule*.

Pol 5832. Defending America: U.S. Security Policy. (3-4 cr; SP–§4832; grad student)
History of U.S. security doctrine. Major issues in present U.S. security policy (e.g., future of NATO, nuclear strategy in absence of a clear enemy, nuclear/chemical international arms control). Political/bureaucratic process of making U.S. defense policy.

Pol 5833. The United States in the Global Economy. (3-4 cr; QP–3835 recommended; SP–§4833; grad student; 3835 recommended)
Domestic/international politics of United States. Foreign economic policy (trade, aid, investment, monetary, migration policies). Effects of policies and international economic relations on U.S. economy/politics.

Pol 5836. Making Foreign Policy: Perceptions and Decisions. (3-4 cr; SP–§4836; non-pol sci grad student)
Foreign policy decision making beyond the "to serve the national interest" cliche. Culture, political psychology, organizational theory, democratic theory, bureaucratic politics, game theory, and political economy. Decision making in cross-cultural settings.

Pol 5872. Global Environmental Politics. (3 cr; SP–§3872; non-pol sci grads only)
Emergence of the environment as a key aspect of the global political agenda. Non-governmental and governmental international organizations. Politics of protection of the atmosphere, rain forests, seas and other selected issues. International security and the environment.

Pol 5881. International Law. (3-4 cr; SP–§4881; 3835 or non-pol sci grad student or #)
How international law matters for world politics. War crimes, human rights. Law of the sea and of the environment. International crime. Lectures, discussions, simulations of cases.

Pol 5883. Global Governance. (3 cr; SP–§4883; 3835 or non-pol sci grad student or #)
Rise/role of inter-governmental organizations such as United Nations, non-governmental organizations. Peacekeeping, trade, development, human rights, security and arms control, self-determination, refugees, health, environment. Seminar discussions, class simulations.

Pol 5885. International Conflict and Security. (3-4 cr; SP–§5885; grad student)
Alternative theories of sources of militarized international conflict. Theories applied to past conflicts. Theories' relevance to present.

Pol 5887. Thinking Strategically in International Politics. (3 cr; SP–§4887; grad student; A-F only)
Applications of game theory to international politics. Conflict/cooperation, global environmental commons, deterrence/reputation.

Pol 5889. Governments and Global Trade and Money. (3-4 cr; SP–3835 or non-pol sci grad or #)
Study the politics of international trade and monetary affairs including north-south and east-west relations

Pol 5970. Individual Reading and Research. (1-4 cr [max 1 cr]; SP–#, Δ, ❑)
Guided individual reading or study.

Pol 8101. Introduction to Political Science. (3 cr; SP–Grad pol sci major or #; A-F only)
History, scope, and methods of political science as a discipline; current subfields; major research programs (including statism, pluralism, institutionalism, realism, behavioralism, rational choice, and critical theory); problems of theory, interpretation, concept-formation, comparison, measurement and experimentation; designs for research.

Pol 8104. Professional Development I. (1 cr [max 2 cr]; QP–Pol student, ABD status; SP–Pol student, ABD status; S-N only)
Research ethics. Completion of dissertation prospecti or early dissertation chapters.

Pol 8105. Professional Development II. (1 cr [max 2 cr]; QP–Pol student, ABD status; SP–Pol student, ABD status; S-N only)
Research ethics. Skills for teaching undergraduate courses in political science. Completion of dissertation prospecti or early chapters.

Pol 8122. Positive Theory. (3 cr; SP–Grad pol sci major or #)
Survey of positive political theory and rational-choice models. Information and transaction costs; institutions; models of elections, voting, coalitions.

Pol 8123. Introduction to Quantitative Political Research. (3 cr; SP–Pol sci grad student or #; A-F only)
Principles of regression analysis, use of regression model in political science.

Pol 8124. Game Theory. (3 cr; SP–[8122, pol-sci grad student] or #)
Application of noncooperative game theory in political science. Equilibrium concepts, bargaining, repeated games, games of incomplete information, signaling games, reputation, learning in games.

Pol 8125. Dynamic Analysis. (3 cr; SP–Pol sci grad student or #)
Time series method, its application in political science.

Pol 8126. Qualitative Methods. (3 cr; SP–Grad pol sci major or #)
Broad introduction to qualitative methods in social science. Practical, hands-on training through fieldwork projects devised and carried out during the semester. Interviewing, participant observation, narrative interpretation, ethical problems, and issues of gender and race in fieldwork.

Pol 8131. Advanced Methods and Models. (3 cr; SP–Grad pol sci major, 6 cr 81xx seminars or #)
Intersection of statistical methodology and deductive modeling; issues in merging inductive and deductive research. Sample topics: parties and elections, probabilistic voting, strategic modeling of international relations.

Pol 8160. Topics in Models and Methods. (3 cr; SP–Grad pol sci major or #)
Seminars on selected topics.

Pol 8201. Understanding Political Theory. (3 cr; SP–Grad pol sci major or Δ)
Key concepts and major approaches.

Pol 8215. Philosophy of Political Inquiry. (3 cr; SP–Grad pol sci major or #)
Major schools in philosophy of science as applied to political inquiry: pragmatism, positivism, hermeneutics, critical rationalism, critical theory, realism. Themes of political inquiry: explanation, interpretation, theory, criticism. Political issues raised by philosophy of science: liberalism, democracy, control, multiculturalism.

Pol 8225. American Political Thought. (3 cr; SP–Grad pol sci major or #)
Colonial era to present: Puritans, American Revolution, Constitution, rise of individualism, pro- and anti-slavery arguments, civil war and reconstruction, industrialism, westward expansion, Native Americans, immigration, populism, socialism, social Darwinism, growth of corporations and unions; Great Depression; growth of American power at home and abroad.

Pol 8235. Democratic Theory. (3 cr; SP–Grad pol sci major or #)
Competing models of democracy: classical, republican, liberal, radical, Marxist, neo-Marxist, pragmatist, populist, pluralist, postmodern, participatory. Domestic and international struggles over meaning of "democracy"; social science models of and findings on democracy.

Pol 8251. Ancient and Medieval Political Thought. (3 cr; SP–Grad pol sci major or #)
Politics and ethics in Greece, Rome, Christendom: Thucydides, Socrates, Plato, Aristotle, Cicero, Augustine, Aquinas, Marsilius.

Pol 8252. Early Modern Political Thought. (3 cr; SP–Grad pol sci major or #)
Theorists and texts from Renaissance to French Revolution. Selectively includes Machiavelli, More, Calvin, Luther, Grotius, Bodin, Hobbes, Winstanley, Harrington, Locke, Montesquieu, Rousseau, Hume, Smith, Burke, and Wollstonecraft; key debates over liberty, law, power, and knowledge.

Pol 8253. Late Modern Political Thought. (3 cr; SP–Grad pol sci major or #)
Theoretical responses to and rival interpretations of Western economy, society, politics, and democratic culture in the modern age; theories of history; class struggle; the end of metaphysics and the death of God; technology and bureaucracy; psychology of culture, in Hegel, Marx, Tocqueville, Mill, Nietzsche, Weber, Freud.

Pol 8260. Topics in Political Theory. (3 cr [max 6 cr]; SP–Grad pol sci major or #)
Readings and research in special topics or problems.

Pol 8275. Contemporary Political Thought. (3 cr; SP–Grad pol sci major or #)
From approximately World War II to the present. Survey of range of texts or intensive focus on such authors as Adorno, Arendt, Derrida, Foucault, Habermas, Horkheimer, Rawls, Said. Sample topics: feminism, postmodernism, communitarianism, Frankfurt School, postcolonialism.

Pol 8301. American Politics. (3 cr; SP–Grad pol sci major or #)
Seminar on main themes of theory and research in American politics, institutions, law, and policy. Major works on individual, mass, elite, and institutional behavior and their relationship to each other. Foundation for advanced seminars in American politics.

Pol 8302. Public Opinion and Political Participation. (3 cr; SP–Grad pol sci major or #)
Major theoretical perspectives and research on political participation, voting behavior, and public opinion. Voter turnout, importance of party identification, effects of campaigns, long-term change in public opinion, and designing and conducting research.

Pol 8303. Political Parties. (3 cr; SP–Grad pol sci major or #)
Party systems and subsystems; party organizational characteristics, goals, and incentives; distribution of power and authority within the party; chief party functions; party as an organizer of governmental power; determinants of party structure and role.

Pol 8305. Interest Groups. (3 cr; SP–Grad pol sci major or #)
Theoretical approaches to study of interest groups; scope of group universe; lobbying; role of interest groups in a democracy.

Pol 8307. Proseminar in Political Psychology I. (1 cr; SP–Grad pol sci major or pol psych minor or #; S-N only)
Readings, discussion, and guest speakers. Topics vary by semester.

Pol 8308. Proseminar in Political Psychology II. (1 cr; SP–Grad pol sci major or pol psych minor or #; S-N only)
Readings, discussion, and guest speakers. Topics vary by semester.

Pol 8311. Political Psychology and Socialization. (3 cr; SP–Grad pol sci major or pol psych minor or #; A-F only)
Introduction to political psychology. Personality and politics; political cognition, emotion, and political behavior; political expertise; media and politics; aggression, authoritarianism, and political behavior; altruism and politics.

Pol 8312. Legislative Process. (3 cr; SP–Grad pol sci major or #)
Introduction to study of legislative politics; theories of legislative institutions and individual behavior; congressional elections; congressional committees, parties, and leaders.

Pol 8313. Executive Process. (3 cr; SP–Grad pol sci major or #)
Tension between leadership and democracy in context of American presidency in terms of President's relationship with federal bureaucracy, Congress, and making of diplomatic and military policy.

Pol 8314. Judicial Process. (3 cr; SP–Grad pol sci major or #)
Judicial systems and roles; selection of judges; organizing and supporting litigation; influences on judicial decisions; impact and enforcement of judicial decisions; courts and other institutions of government.

Pol 8321. Urban Politics. (3 cr; SP–Grad pol sci major or #; A-F only)
Selection of local leadership; relationship of political system to governmental forms and social institutions; role and impact of political institutions; policymaking at local level; studies in policy problems; the emerging metropolis.

Pol 8325. State Politics and Intergovernmental Relations. (3 cr; SP–Grad pol sci major or #)
Theoretical approaches to comparative study of state politics; study of political culture and behavior, governmental institutions, and public policy at state level; federalism.

Pol 8331. Constitutional Law. (3 cr; SP–Grad pol sci major or #)
Overview of substantive and theoretical debates in American constitutional law; role of law and constitutional interpretation in shaping American political institutions and American politics.

Pol 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Pol 8335. Public Policy. (3 cr; SP–Grad pol sci major or #)
Theoretical approaches: incrementalism, innovation and policy learning, comparative policy outputs, policy process models, interest groups, and selected areas of public policy.

Pol 8337. Welfare State Theories and American Social Policy. (3 cr; SP–Grad pol sci major or #)
Rival theoretical explanations for cause and nature of welfare state development in context of four American social policies: social security, welfare, education, and healthcare.

Pol 8360. Topics in American Politics. (1-3 cr [max 3 cr]; SP–Pol-sci graduate student or #)
Readings/research in special topics or problems.

Pol 8401. International Relations. (3 cr; SP–Pol-sci graduate student or Δ)
Basic theories/approaches to study of international politics. Surveys representative work/central issues of scholarship.

Pol 8402. Conflict Dynamics and Security. (3 cr; SP–Grad pol sci major or #)
Introduction to contending theories of international conflict and national security.

Pol 8403. International Norms and Institutions. (3 cr; SP–Grad pol sci major or #)
Origins, roles, and effectiveness of international norms and institutions; theoretical explanations and debates. Institution of sovereignty; rational choice versus constructivist perspectives; role of international law, international organizations, and non-governmental organizations; and international society and transnational cultural norms.

Pol 8404. International Hierarchy. (3 cr; SP–Grad pol sci major or #)
Asymmetric structures and processes of international relations; systemic conditions and implications of informal empire and structures of hegemony; cultural productions of difference and inequality.

Pol 8405. International Political Economy. (3 cr; SP–Grad pol sci major or #; A-F only)
Theoretical and policy issues in international economic relations. Different approaches for understanding outcomes in international economy. Trade, finance, labor markets, creation and maintenance of international regimes, and "globalization" of economic liberalism.

Pol 8406. Politics of International Finance. (3 cr; SP–Grad pol sci major or #)
Relationship between workings of the international political system and that of international markets for currency and capital.

Pol 8407. Morality in World Politics. (3 cr; SP–Grad pol sci major or #)
Approaches to normative theorizing and empirical research on moral norms in world politics. Theoretical topics: realism, communitarianism, consequentialism, constructivism, postmodernism, cultural relativism. Substantive issue areas: famine and foreign aid, just war theory, nuclear weapons, moral implications of technology, case study on war (Gulf War).

Pol 8408. International Relations of the Environment. (3 cr; SP–Grad pol sci major or #)
Theory and practice of international environmental politics. Emergence of environment as major issue of international relations. Diversities of agendas and politics. Imperatives, templates, resistance in global efforts to forge an applied politics of environmental sustainability. Selected cases.

Pol 8411. Political Psychology and Foreign Policy. (3 cr; SP–Grad pol sci major or #)
Foreign policy theories about decision makers and audiences. Impact of human nature, formal institutions, cultural and cross-cultural settings, and kinds of issues on foreign policy choice, control, and justification.

Pol 8412. American Foreign Policy. (3 cr; SP–8410 or #)
U.S. policy toward foreign states and peoples: heritage, motivations, policy processes, what the public generally knows and wants, specific policies. Rise of intermestic issues and decline of enemy-focused internationalism; implications for process and content of U.S. foreign policy.

Pol 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

Pol 8460. Topics in International Relations. (3 cr [max 6 cr]; SP–Grad pol sci major or #)
Readings and research in advanced topics or problems. Recent topics: global environmental issues, morality in world politics, and norms and institutions in world politics.

Pol 8601. Introduction to Comparative Politics. (3 cr; SP–Grad pol sci major)
Main theoretical approaches and issues: comparative method, the state and class; political culture; development, democratization, rational choice, social movements.

Pol 8603. European Government and Politics. (3 cr; SP–Grad pol sci major or #; A-F only)
Main theories and approaches used to interpret European politics. Many of these theories have broad relevance for comparative politics, for example, theories about the state, cleavages and coalitional bases, parties and social movements, and constitutional structures and institutions have broad relevance for the field of comparative politics.

Pol 8605. Government and Politics in Africa. (3 cr; SP–Grad pol sci major or #; A-F only)
Theoretical and methodological approaches to study of African politics, focusing on pre-colonial and colonial legacies for post-colonial reality. Local politics, social construction of identities, political economy of peasantry and working class, political development and decay, social movements, and prospects for democracy.

Pol 8608. Government and Politics of Russia and the Commonwealth of Independent States. (3 cr; SP–Grad pol sci major or #; A-F only)
Framework for understanding politics of change underway in the former Soviet Union. Roots of current transformation, including causes and legacy of the Russian revolution and creation of the Soviet Union. Issues in current transformation, including nationalism, economic reform, and democratization. Prior knowledge of basic Soviet politics is assumed.

Pol 8611. Chinese Politics. (3 cr; SP–Grad pol sci major or #)
Major issues since 1949: democratization, dissent, violence, gender, capitalist and socialist development strategies, inequality, effect of culture on politics, status of Taiwan. Current scholarly debates on Chinese politics. Professional methods for research on contemporary China.

Pol 8615. The Political Economy of Contemporary Japan. (3 cr; SP–Grad pol sci major or #)
Major political and economic issues confronting the Japanese system; situation of Japanese case within comparative politics literature concerning role of the state in formulating economic and social policy making. Review of literature. Deregulation in key industries, welfare reform, tax reforms.

Pol 8619. Latin American Politics. (3 cr; SP–Grad pol sci major or #)
Major bodies of theory on development, democracy and redemocratization, social movements, civil society, the state, and transnational linkages.

Pol 8633. Comparative Sociopolitical Change. (3 cr; SP–Grad pol sci major or #)
Critical evaluation of literature and theoretical perspectives; comparative examination of social and political change and interrelationship between both processes; structure/agency nexus.

Pol 8637. Comparative Political Economy. (3 cr; SP–Grad pol sci major or #)
Connections between democracy and markets, emphasizing experiences of countries in North America and Europe.

Pol 8641. Comparative Mass Political Behavior. (3 cr; SP–Grad pol sci major or #; A-F only)
Examined from a cross-national perspective. Development of political participation, mobilization and its effects, development of political cleavages and political parties as vehicles of conflict, modes of political behavior under varied systems of representation and varied party systems.

Pol 8643. Comparative Political Institutions. (3 cr; SP–Pol sci grad student or #; A-F only)
Structure/operation of various political institutions in different settings. Theoretical approaches, comparative frameworks. Introduction to literature on political institutions. Preparation for comparative research on political institutions.

Pol 8660. Topics in Comparative Politics. (1-3 cr [max 6 cr]; SP–Grad pol sci major or #)
Readings in advanced topics or problems; supervised research and research training.

Pol 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Pol 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Pol 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Pol 8990. Directed Readings and Research in Political Science. (1-7 cr [max 7 cr]; SP–16 cr 8xxx pol sci courses, #, Δ)

Portuguese (Port)

Department of Spanish and Portuguese
College of Liberal Arts

Port 5520. Portuguese Literary and Cultural Studies. (3 cr [max 9 cr]; SP–#)
Study of origins and development of modern Portuguese nation (late 15th to 20th century) using literature, cultural and literary criticism, history, sociology) and various media (film, art, music, Internet). Main cultural problematics pertaining to Portugal as well as fundamental literary texts.

Port 5530. Brazilian Literary and Cultural Studies. (3 cr [max 9 cr]; SP–#)
Study of origins and development of modern Brazilian nation (late 16th to 20th century) using literature, cultural and literary criticism, history, sociology) and various media (film, art, music, Internet). Main cultural problematics pertaining to Brazil as well as fundamental literary texts.

Port 5540. Literatures and Cultures of Lusophone Africa. (3 cr [max 9 cr]; SP–#)
Origins/development of Lusophone Africa (Angola, Mozambique, Cape-Verde, Guinea-Bissau, São Tomé, Príncipe) using literature, cultural/literary criticism, history, sociology, and various media (film, art, music, Internet).

Port 5910. Topics in Lusophone Cultures. (3 cr [max 9 cr]; SP–#)
Cultural manifestations in Portuguese-speaking world (Portugal, Brazil, Lusophone Africa): literature, history, film, intellectual thought, critical theory, popular culture. Topics include: Portuguese colonialism; postcolonial nation in Lusophone world; Lusophone women writers; Luso-Brazilian (post)modernity.

Port 5920. Figures in Lusophone Literatures. (3 cr [max 9 cr]; SP–#)
One Portuguese, Brazilian, or other major Portuguese-speaking writer or group of writers whose work has had impact on thought, literature, or social problems (e.g., Machado de Assis, Fernando Pessoa, Clarice Lispector). Figures specified in *Class Schedule*.

Port 5930. Topics in Brazilian Literature. (3 cr [max 9 cr]; SP–#)
Major issues of Brazilian literature; focuses on important authors, movements, currents, genres. Problems, socioeconomic questions, literary techniques related to Brazilian themes. Topics specified in *Class Schedule*.

Port 5970. Directed Readings. (3 cr [max 9 cr]; SP–M.A. or Ph.D. candidate, #, Δ, ❑)
Lusophone studies (Portuguese-speaking Africa, Brazil, Portugal). Areas not covered in other courses. Students submit reading plans for particular topics, figures, periods, or issues.

Port 5990. Directed Research. (1-4 cr [max 9 cr]; SP–#, Δ, ❑)
Graduate-level research in literatures and cultures of the Portuguese-speaking world. Topics vary.

Port 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Port 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Port 8920. Seminar: Lusophone Literatures and Cultures. (3 cr [max 9 cr])
Problems pertaining to Portuguese, Brazilian, and/or Lusophone African cultures and literatures. Topics specified in *Class Schedule*.

Psychology (Psy)

Department of Psychology
College of Liberal Arts

Psy 5012W. Psychology of Conditioning and Learning. (4 cr; QP–3011 or 4011 or grad student or #; SP–3011 or 4011 or grad student or #)
Review/evaluation of key questions, methods, theories, data about classical conditioning, instrumental learning, elementary cognitive processes. Emphasizes animal models.

Psy 5013. Laboratory in Conditioning and Learning. (4 cr; QP–[[1005 or grad student], [3011 or 5012]] or #; SP–[[3005 or grad student], [4011 or 5012]] or #)
Exercises exploring forms of animal conditioning/learning. Combines prepared/independent exercises.

Psy 5014. Psychology of Human Learning and Memory. (3 cr; SP–3011 or 3051, except honors, grads)
Survey of basic methods and findings of research on human learning, memory, and cognition. Emphasis on major factors influencing human encoding or acquisition of information and skill, retention, and retrieval. Theoretical perspectives on underlying processes of encoding, retention, and retrieval.

Psy 5015. Cognition, Computation, and Brain. (3 cr; QP–[3051 or 5014] [except for honors/grad students]; SP–3051 [except for honors/grad students])
Human cognitive abilities (perception, memory, attention) from different perspectives (e.g., cognitive psychological approach, cognitive neuroscience approach).

Psy 5031W. Perception. (3 cr; SP–3031 or 3051 or #)
Cognitive, computational, and neuroscience perspectives on visual perception. Topics include color vision, pattern vision, image formation in the eye, object recognition, reading, and impaired vision.

Psy 5034. Psychobiology of Vision. (3 cr; SP–3031 or #)
Analysis of the properties and biological bases of visual perception in humans and animals. Emphasis on color vision, visual sensitivity and adaptation, nerve cells and circuits in the eye, structure and function of the visual brain.

Psy 5036. Computational Vision. (3 cr; QP–[[3031 or 3051], [Math 1272 or equiv]] or #; SP–[[3031 or 3051], [Math 1272 or equiv]] or #)
Applications of psychology, neuroscience, computer science to design principles underlying visual perception, visual cognition, action. Compares biological/physical processing of images with respect to image formation, perceptual organization, object perception, recognition, navigation, motor control.

Psy 5036W. Computational Vision. (3 cr; QP–[[3031 or 3051], Math 1272] or #; SP–[[3031 or 3051], Math 1272] or #)
Applications of psychology, neuroscience, computer science to design principles underlying visual perception, visual cognition, action. Compares biological/physical processing of images with respect to image formation, perceptual organization, object perception, recognition, navigation, motor control.

Psy 5037. Psychology of Hearing. (3 cr; QP–3031 or #; SP–3031 or #)
Biological and physical aspects of hearing, auditory psychophysics, theories and models of hearing, perception of complex sounds including music and speech, clinical, and other applications.

Psy 5038W. Introduction to Neural Networks. (3 cr; QP–[[3061 or NSc 3102], Math 2243] or #; SP–[[3061 or NSc 3102], Math 2243] or #)
Parallel distributed processing models in neural/cognitive science. Linear models, Hebbian rules, self-organization, non-linear networks, optimization, representation of information. Applications to sensory processing, perception, learning, memory.

Psy 5051W. Psychology of Human-Machine Interaction. (3 cr; SP–3031 or 3051 or #)
Psychological perspectives on human-machine interaction and factors that limit performance. Cognitive and perceptual aspects of computer, use, telepresence, and design and evaluation of sensory aids.

Psy 5054. Psychology of Language. (3 cr; QP–3011 [except for honors/graduate students]; SP–[3005 or #] [except for honors/graduate students])
Theories/experimental evidence in past/present conceptions of psychology of language.

Psy 5061. Biological Psychology. (3 cr; QP–§3061; 1005 or Biol 1009 or #; SP–§3061; 3005 or Biol 1009 or #)
Physiological/neuroanatomical mechanisms underlying behavior of animals, including humans. Neural basis of learning/memory, sleep, wakefulness, and attention processes. Effects of drugs on behavior.

Psy 5062. Cognitive Neuropsychology. (3 cr; QP–3031 or 3051; SP–3031 or 3051)
Consequences of different types of brain damage on human perception/cognition. Neural mechanisms of normal perceptual/cognitive functions. Vision/attention disorders, split brain, language deficits, memory disorders, central planning deficits. Emphasizes function/phenomenology. Minimal amount of brain anatomy.

Psy 5064. Brain and Emotion. (3 cr; QP–3061 or 5061 or #; SP–3061 or 5061 or #; A-F only)
Introduction to affective neuroscience. Focuses on how brain promotes emotional behavior in animals/humans. Biological theories of emotion reviewed in historical, current theoretical contexts. Research related to specific "basic" emotions, including brain substrates for fear, sadness, pleasure, attachment. Implications for understanding emotional development, vulnerability to psychiatric disorders.

Psy 5101. Personality Psychology. (3 cr; QP–§3101; 5862 or honors or grad student; SP–§3101; 3005, [honors or grad student])
Theories and major issues/findings on personality functioning, personality structure, and personality assessment. Historically important and currently influential perspectives.

Psy 5121. History and Systems of Psychology. (3 cr; QP–8 cr of 5xxx courses in psychology or equiv or grad or #; SP–6 cr of 5xxx courses in psychology or #)
Survey of the history, methods, and content of modern psychological theory, research, and application. Schools of psychology (e.g., structuralism, functionalism, behaviorism, Gestalt psychology) and central theories of psychology reviewed in their historical and philosophical context.

Psy 5135. Psychology of Individual Differences. (3 cr; QP–§3135; [[3801 or equiv], 5862] or #; SP–§3135; [[4801 or equiv], 5862] or #)
Differential methods in study of human behavior. Overview of nature of psychological traits. Influence of age, sex, heredity, and environment in individual/group differences in ability, personality, interests, and social attitudes.

Psy 5136. Human Abilities. (3 cr; QP–3135 or 5135, 5862 or equiv or #; SP–3135 or 5135, 5862 or equiv or #)
Theory, methods, and applications of research in human abilities. Topics include intelligence, aptitude, achievement, specific abilities, information processing/learning and intelligence, aptitude/treatment interactions, and quantitative measurement issues.

Psy 5137. Introduction to Behavioral Genetics. (3 cr; QP–3135 or 5135 or #; SP–4801 or equiv or #)
Overview of genetic methods for studying human and animal behavior. Emphasis on the nature and origin of individual differences in behavior. Twin and adoption methods as well as more modern methods like cytogenetics, molecular genetics, and linkage and association studies.

Psy 5138. Psychology of Aging. (3 cr; QP–3801; SP–3005 or equiv)
Theories/findings concerning age-related changes in mental health, personality, cognitive functioning, productivity are reviewed/interpreted within context of multiple biological, social, psychological changes that accompany age.

Psy 5202. Attitudes and Social Behavior. (3 cr; QP–3201 or #; SP–3201 or #)
Theory/research in social psychology, other fields in psychology of attitudes, beliefs, values. These fields' relationship to social behavior. Principles/theories of persuasion.

Psy 5204. Psychology of Interpersonal Relationships. (3 cr; QP–3201 or # except for students in honors sequence and grads; SP–3201 or #; A-F only)
Introduction to interpersonal relationship theory and research findings, with emphasis on conceptual and methodological issues in relationship research.

Psy 5205. Applied Social Psychology. (3 cr; QP–3201 or grad student or #; SP–3201 or grad student or #)
Applications of social psychology research/theory to domains such as physical/mental health, education, the media, desegregation, the legal system, energy conservation, public policy.

Psy 5206. Social Psychology and Health Behavior. (3 cr; QP–3201 or grad student or #; SP–3201 or grad student or #; A-F only)
Survey of social psychological theory/research pertaining to processes by which people develop beliefs about health/illness. Relationship between these beliefs, adoption of health-relevant behavior. Effect of psychological factors on physical health.

Psy 5207. Personality and Social Behavior. (3 cr; QP–3101 or 3201 or honors or grad student or #; SP–3101 or 3201 or honors or grad student or #; A-F only)
Conceptual/methodological strategies for scientific study of individuals and their social worlds. Applications of theory/research to issues of self, identity, and social interaction.

Psy 5501. Vocational and Occupational Health Psychology. (3 cr; QP–3801 or #; SP–3005 or #)
Survey of concepts, theories, methods, findings of vocational psychology. History. Individual differences. Vocational development, device, adjustment. Vocational assessment/counseling.

Psy 5604H. Abnormal Psychology. (3 cr; QP–§3604; honors or grad student or #; SP–§3604; honors or grad student or #)
Comprehensive review of psychopathological disorders. Etiology, diagnostic criteria, clinical research findings.

Psy 5606. Clinical Psychophysiology. (3 cr; SP–3005 or equiv, 3061 or 5061, 3604 or 5604 or #)
How psychophysiological methods such as autonomic and central nervous system recording are used in the study of major psychopathological disorders.

Psy 5701. Organizational Staffing and Decision Making. (3 cr; QP–3801, 8 cr in psy; SP–[[3005 or 4801 or equiv], 3711] or #)
Application of psychological research/theory to issues in personnel recruitment/selection and to measurement of job performance. Applying principles of individual differences, psychological measurement to decision making in organizations (recruitment, selection, performance appraisal).

Psy 5702. Psychological Foundations of Individual Behavior in Organizations. (3 cr; QP–3801, 8 cr in psychology; SP–[[3005 or 4801 or equiv], 3711] or #)
Theory/research on human behavior/performance in organizations. Organizational socialization processes across career span, leadership styles/processes, work team structures/characteristics. Problem-solving, decision-making processes. Group dynamics, inter-group relations.

Psy 5703. Psychology of Organizational Training and Development. (3 cr; SP–3711, 4801 or equiv or #)
Theories, methods, and research pertaining to improving performance of individuals at work through learning and instruction: training-needs analysis, models of instructional design, aptitude-treatment interactions, measurement of training outcomes, training evaluation, knowledge structures, specific training programs designed for critical training problems.

Psy 5705. Psychology of Work Motivation. (3 cr; QP–3801 or equiv; 3711 or #; SP–4801 or equiv, 3711 or #)
Motivation issues related to the behavior and performance of individuals in organizational settings. Contemporary work motivation theories and practices that relate person factors and environmental factors to skill acquisition, job performance, organizational citizenship behavior, and job satisfaction.

Psy 5862. Psychological Measurement: Theory and Methods. (3 cr; QP–3801 or equiv; SP–4801 or equiv)
Types of measurements (tests, scales, inventories) and their construction. Theory/measurement of reliability/validity.

Psy 5865. Advanced Psychological and Educational Measurement. (4 cr; QP–5862 or #; SP–5862 or #)
Topics in test theory. Classical reliability/validity theory/methods, generalizability theory. Linking, scaling, equating. Item response theory, methods for dichotomous/polytomous responses. Comparisons between classical, item response theory methods in instrument construction.

Psy 5960. Topics in Psychology. (1-4 cr; QP–1001; SP–1001, [jr or sr or grad student])
Special class or seminar. Topics in psychology office.

Psy 8004. Philosophical Psychology. (2 cr; QP–Logic or phil course; SP–Logic or phil course, psych or phil Ph.D. student or #; S-N only)
Selected philosophical and methodological problems.

Psy 8010. Advanced Topics in Learning. (2 cr; QP–5012-5013; SP–5012 or #; S-N only)
Contemporary topics in learning and behavior theory.

Psy 8020. Seminar in Conditioning and Learning. (2 cr; QP–5011 or 5012; SP–5012 or grad psych major or #; S-N only)
Review and discussion of ongoing research and prospectives on future research.

Psy 8026. Neuro-Immune Interactions. (3-23 cr; QP–§NSc8026, §PNI 8026, §VMic 8026, MicB 5218 or equiv, NSc 5111 or equiv; SP–§NSc 8026, MicB 4131 or equiv, NSc 5111 or equiv)
Regulatory systems (neuroendocrine, cytokine, and autonomic nervous systems) linking brain and immune systems in brain-immune axis. Functional effects of bidirectional brain-immune regulation.

Psy 8031. Seminar: Visual Perception. (1-2 cr [max 3 cr]; QP–#; SP–#)
Cognitive, psychological, neurophysiological determinants of visual perception. Current research.

Psy 8036. Topics in Computational Vision. (3 cr [max 12 cr]; SP–5031 or 5036 or equiv or #)
Recent research in visual psychophysics, visual neuroscience, and computer vision.

Psy 8037. Psychophysics and Audition. (3 cr; QP–#; SP–#)
Modern/classical psychophysics. Psychophysical/physiological correlates of audition. Theories of hearing.

Psy 8055. Seminar: Cognitive Neuroscience. (1-4 cr; SP–5015 or #)
Recent advances in analysis of neural bases of cognitive functions.

Psy 8056. Seminar: Psychology of Language. (3 cr; QP–5054; SP–Grad psych major or #; A-F only)
Selected topics in psycholinguistics.

Psy 8060. Seminar: Neural Substrates of Mental Processes. (3 cr [max 12 cr]; QP–5012 or 5061 or 5062 or 5064 or NSci 5661 or 8010 or CPsy 8301 or NSci 8401 or #; SP–5012 or 5061 or 5062 or 5064 or NSci 5661 or 8010 or CPsy 8301 or NSci 8401 or #; S-N only)
Neurobiological substrates of psychological processes such as memory, attention, and emotion. Neurobiological substrates of mental dysfunction.

Psy 8070. Seminar: Psychopharmacology. (1-3 cr [max 12 cr]; SP–#)
Basic issues, contemporary research. Lectures, student presentations.

Psy 8107. Cross-Cultural Study of Personality. (3 cr; QP–5101, 5604 or equiv; SP–5101, 5604 or equiv or #; A-F only)
Methodological issues and status of current research.

Psy 8111. Psychopathology I. (4 cr; SP–Psychology grad student or #; A-F only)
Descriptive psychopathology. Theory/research. Evaluation of current experimentation in various behavior disorders.

Psy 8112. Psychopathology II. (3 cr; QP–[8111, psych grad student] or #; SP–[8111, psych grad student] or #; A-F only)
Descriptive psychopathology. Theory/research. Evaluation of current experimentation in various behavior disorders.

Psy 8201. Social Cognition. (3 cr; SP–Psych Ph.D. candidate; A-F only)
Theory and research in stereotyping, social inference, and person memory.

Psy 8202. Close Relationships. (3 cr; SP–5204 or #; A-F only)
Recent theory and research.

Psy 8203. Impression Management. (3 cr; QP–8208 recommended; SP–Grad psych major, #; 8208 recommended)
Classic and contemporary theory and research concerning interpersonal strategies of impression management and interplay between private and public self.

Psy 8205. Proseminar: Research in Social Psychology. (2 cr [max 8 cr]; SP–Psych Ph.D. student; A-F only)
Contemporary theoretical positions and related research.

Psy 8206. Proseminar: Research in Social Psychology. (2 cr [max 6 cr]; SP–Psych Ph.D. student, 8205; A-F only)
Contemporary theoretical positions and related research.

Psy 8207. Social Psychology History and Systems. (3 cr; SP–Psych Ph.D. candidate in soc psych or #; A-F only)
Classic theories and research that have shaped contemporary social psychology.

Psy 8208. Social Psychology: The Self. (3 cr; SP–Psych background especially in personality and soc psych; A-F only)
Social psychological theory and research concerning the self and social behavior.

Psy 8209. Research Methods in Social Psychology. (3 cr; QP–5202 or 8201; SP–Grad psych major; A-F only)
Experimental and quasi-experimental methods suitable for research in social psychology. Statistical, interpretive, operational, and ethical issues.

Psy 8211. Proseminar in Political Psychology I. (1 cr; SP–Grad pol psych minor; S-N only)
Readings, discussion, and guest speakers. Topics vary each semester.

Psy 8212. Proseminar in Political Psychology II. (1 cr; SP–Grad pol psych minor; S-N only)
Readings, discussion, and guest speakers. Topics vary each semester.

Psy 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Psy 8410. Perspectives in Learning, Perception, and Cognition. (1 cr [max 12 cr]; SP–#)
Lectures and discussions in cognitive sciences by local and visiting faculty.

Psy 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

Psy 8501. Counseling Psychology: History and Theories. (3 cr; SP–Counseling psych grad student or #)
Introduction to history of counseling psychology and to primary theoretical orientations used by counseling psychologists. For each theory: basic principles, application to counseling practice, and research support.

Psy 8502. Assessment in Counseling Psychology. (3 cr; SP–Counseling psych grad student or #)
Principles and practice. Emphasizes psychometric assessment. History, foundations in measurement, basic methods, survey of instruments, test interpretation evaluation, ethics.

Psy 8503. Interviewing and Intervention. (3 cr; QP–8501, 8502; SP–8501, 8502 or #)
Skills-based course: conceptualization of counseling process, stages of counseling, development of counseling skills, and strategies for behavior change.

Psy 8510. Counseling Psychology Beginning Practicum: General. (1-6 cr; SP–Counseling psych grad student, 8501, 8502, 8503 or equiv, #; S-N only)
Beginning applied experiences in counseling psychology settings.

Psy 8511. Counseling Psychology Beginning Practicum: General. (1-6 cr [max 18 cr]; QP–[[8501, 8502, 8503] or equiv], counseling psych grad student, #; SP–[[8501, 8502, 8503] or equiv], counseling psych grad student, #; S-N only)
Beginning applied experiences in counseling psychology settings.

Psy 8512. Counseling Psychology Beginning Practicum: General. (1-6 cr [max 18 cr]; SP–Counseling psych grad student, 8501, 8502, 8503 or equiv, #; S-N only)
Beginning applied experiences in counseling psychology settings.

Psy 8514. University Counseling Practicum I. (4-6 cr; QP–8501, 8502, 8503 or equiv; SP–Counseling psych grad student, 8501, 8502, 8503 or equiv, #; S-N only)
Integrates science with supervised practice in University Counseling and Consulting Services (UCCS) involving career, academic, and personal counseling clientele.

Psy 8515. University Counseling Practicum II. (4-6 cr; QP–8501, 8502, 8503 or equiv; SP–Counseling psych grad student, 8501, 8502, 8503 or equiv, 8514, #; S-N only)
Integrates science with supervised practice in University Counseling and Consulting Services (UCCS) involving career, academic, and personal counseling clientele.

Psy 8541. Seminar: Multicultural Issues in Counseling Psychology. (2 cr; SP–Counseling psych grad student or #; S-N only)
Increases counselors' sensitivity to cultural biases they bring to their work, including those that derive from professional training. Counseling strategies for diverse populations. Lectures, guest speakers, videos, group discussions, oral and written presentations; includes professional development action plan.

Psy 8542. Ethics in Psychology. (3 cr; SP–Counseling or clinical psych grad student or #; S-N only)
Ethical principles and codes of conduct for psychologists. Ethical dilemmas faced by researchers, practitioners, and teachers.

Psy 8544. Counseling Psychology: Research Seminar I. (3 cr; SP–Counseling psych grad student, 8501, 8502, 8503 or equiv, #; S-N only)
Research problems specific to special populations, vocational research, assessment and testing, and findings in these areas useful to counseling psychology practice.

Psy 8545. Counseling Psychology: Research Seminar II. (3 cr; QP–8544; SP–Counseling psych grad student, 8501, 8502, 8503 or equiv, #; S-N only)
Introduction to methods and content domains, including research design, methodological issues, analogue research, and process and outcome research.

Psy 8550. Assessment: WAIS-III. (2 cr; SP–Counseling psych grad student, #; S-N only)
Skills acquisition for administering, scoring, summarizing results of Wechsler Adult Intelligence Scale—Revised (WAIS-R).

Psy 8554. Assessment: Vocational Interest and Career Instruments. (3 cr; SP–Counseling psych grad student, #; S-N only)
History and development of vocational interest inventories and measures related to career development; scale construction methodology; research applications; interpretation and use of instruments.

Psy 8560. Counseling Psychology Advanced Practicum I: General. (1-6 cr; SP–[[[[8501, 8502, 8503] or equiv], [[8510, 8511] or [8514, 8515] or equiv]], counseling psych grad student] or #; S-N only)
Applied practice experience in counseling psychology settings and seminars. May include guest speakers, readings, and student presentations.

Psy 8561. Counseling Psychology Advanced Practicum II: General. (1-6 cr; SP–Counseling psych grad student, 8501-8502-8503 or equiv, 8510-8511 or 8514-8515 or equiv, #; S-N only)
Applied practice experience in counseling psychology settings and seminar that may include guest speakers, readings, and student presentations on topics relevant to clients and settings of practice experiences.

Psy 8562. Counseling Psychology Advanced Practicum III: General. (1-6 cr; SP–Counseling psych grad student, 8501-8502-8503 or equiv, 8510-8511 or 8514-8515 or equiv, #; S-N only)
Applied practice experience in counseling psychology settings and seminar that may include guest speakers, readings, and students presentations on topics relevant to clients and settings of practice experiences.

Psy 8564. Vocational Counseling for Work Adjustment. (3 cr; SP–Counseling psych grad student or #; S-N only)
Topics and problems. Research, operationalization, and application of theory of work adjustment to vocational counseling.

Psy 8565. Counseling Psychology Advanced Practicum I: Vocational Assessment Clinic. (1-6 cr; SP–[[[8501, 8502, 8503] or equiv], [[8514, 8515] or equiv], counseling psych grad student] or #; S-N only)
Applied practice experience in vocational assessment clinic of Department of Psychology. Career/vocational testing, assessment, decision making.

Psy 8566. Counseling Psychology Advanced Practicum II: Vocational Assessment Clinic. (1-6 cr; QP–8501, 8502, [8503 or equiv], 8514, [8515 or equiv], counseling psych grad student, #; SP–8501, 8502, [8503 or equiv], 8514, [8515 or equiv], counseling psych grad student, #; S-N only)
Applied practice experience in Vocational Assessment Clinic of Department of Psychology. Career/vocational testing, assessment, decision making.

Psy 8567. Counseling Psychology Advanced Practicum III: Vocational Assessment Clinic. (1-6 cr; SP–Counseling psych grad student, 8501, 8502, 8503 or equiv, 8514, 8515 or equiv, #; S-N only)
Applied practice experience in Vocational Assessment Clinic of Department of Psychology. Career and vocational testing, assessment, and decision making.

Psy 8570. Counseling Psychology Internship I. (1-12 cr [max 36 cr]; SP–Counseling psych Ph.D. candidate, #; S-N only)
First part of counseling psychology internship.

Psy 8571. Counseling Psychology Internship II. (1-12 cr [max 36 cr]; SP–Counseling psych Ph.D. candidate, #; S-N only)
Second part of counseling psychology internship.

Psy 8572. Counseling Psychology Internship III. (1-12 cr [max 36 cr]; SP–Counseling psych Ph.D. candidate, #; S-N only)
Third part of counseling psychology internship.

Psy 8611. Assessment I. (5 cr; SP–Clinical psych grad student; A-F only)
Theory and practice in clinical application of assessment techniques and interviewing. Lab: observations, administration, scoring, interpretation.

Psy 8612. Assessment II. (5 cr; SP–8611, clinical psych grad student; A-F only)
Theory and practice in clinical application of assessment techniques and interviewing. Lab: observations, administration, scoring, interpretation.

Psy 8620. Clinical Psychology Practicum. (1-6 cr [max 36 cr]; SP–Clinical psych grad student; S-N only)
Field experience in professional work in clinical settings.

Psy 8621. Clinical Intervention I. (1-3 cr; SP–Clinical psych grad student; A-F only)
Professional methods in clinical psychology. Individual and group treatment techniques. Lectures and demonstrations of contemporary theories of methods of intervention with adults and children.

Psy 8622. Treatment I. (3 cr; QP–8621; SP–8621, clinical psych grad student; A-F only)
Theories of intervention, applications of clinical methods.

Psy 8640. Research Seminar. (2 cr; SP–Clinical psych grad student; S-N only)
Current topics for first-year clinical psychology graduate students.

Psy 8660. The Psychopathic Personality: Theory and Research. (1 cr; SP–#)
Research-oriented consideration of nature and etiology of psychopathic behavior.

Psy 8664. Personality Assessment. (3 cr; SP–#)
Concepts and issues concerning individual differences in personality and their assessment; content, reality, and significance of personality traits; alternative classifications of personality traits; major alternative approaches to personality scale development.

Psy 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Psy 8701. Seminar in Industrial and Organizational Psychology I. (3 cr; SP–#; A-F only)
Application of research and theory in psychological measurement and individual differences to problems in job analysis, personnel selection and classification, and individual training.

Psy 8702. Seminar in Industrial and Organizational Psychology II. (3 cr; QP–#; SP–#; A-F only)
Determinants of behavior, performance, job satisfaction that can be influenced after an individual enters an organization. Application of research/theory in motivation, social psychology, human factors to enhancement of job performance/satisfaction.

Psy 8703. Seminar in Industrial and Organizational Psychology III. (3 cr; SP–#; A-F only)
Developing issues and trends in current research, research methodological advances, and implementation practices. Recent important and controversial developments.

Psy 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Psy 8881. Seminar: Psychometric Methods. (1 cr; SP–#)
Reviews and individual research on current topics in psychological measurement, statistics.

Psy 8882. Seminar: Psychometric Methods. (1 cr; QP–5862, 5865, #; SP–5862, 5865, #)
Reviews. Individual research on topics in psychological measurement, statistics.

Psy 8884. Factor Analysis and Latent Variable Models. (3 cr; SP–Stat 5302, PubH 5450, PubH 5452, #)
Common factor model, major methods of estimation. Analytic rotation algorithms, number of factors problem, evaluation of model fit. Recent developments in restricted factor analysis.

Psy 8886. Hierarchical Models. (3 cr; QP–#; SP–#)
Methods for repeated measures and longitudinal data. Linear mixed-effects model. Treatment of missing data and unbalanced designs. Extensions to conditionally linear/nonlinear models. Exercises with software such as HLM and SAS PROC MIXED.

Psy 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Psy 8935. Readings in Behavioral Genetics and Individual Differences Psychology. (1 cr [max 10 cr]; SP–5135, 5137 or #; S-N only)
Each week participants read and discuss one or two primary research articles.

Psy 8937. Seminar in Human Behavioral Genetics. (3 cr [max 9 cr]; SP–5137 or #)
Advanced topics vary with each offering. Sample topics: gene identification in complex human traits, behavioral genetics of alcoholism, twin-family methodology.

Psy 8965. Seminar: Well-Being. (3 cr)
Various issues in emerging field of well-being research. Conceptual issues, measurement, judgmental processes, goals/values, adaptation, close relationships, culture, psychophysiology, temperaments/personality.

Psy 8993. Directed Studies: Special Areas of Psychology and Related Sciences. (1-6 cr [max 6 cr]; QP–#; SP–#)
Special area of psychology or a related science.

Psy 8995. Research Problems. (1-6 cr [max 36 cr])
Research problems.

Public Affairs (PA)

Hubert H. Humphrey Institute of Public Affairs

PA 5001. Intellectual Foundations of Public Action. (1.5 cr; SP–Major in publ aff or publ policy or sci, tech, and environ policy or urban and regional planning or publ hlth or #; A-F only)
Evolution of intellectual approaches that underlie public planning, management, and policy analysis as strategies for public action. How public decision making is shaped by knowledge and values; role of rationality. Conceptual approaches to public action along descriptive/normative lines and structure/process lines.

PA 5002. Introduction to Policy Analysis. (1.5 cr; SP–Major in publ aff or publ policy or sci, tech, and environ pol or urban and regional planning or publ hlth or #; A-F only)
Process of public policy analysis from problem structuring to communication of findings. Commonly used analytical methods. Alternative models of analytical problem resolution.

PA 5003. Introduction to Financial Analysis and Management. (1.5 cr; SP–Major in publ aff or publ policy or sci, tech, and environ pol or urban and regional planning or publ hlth or #; A-F only)
Basic finance and accounting concepts and tools used in public and nonprofit organizations. Fund accounting, balance sheet and income statement analysis, cash flow analysis, and public sector and nonprofit sector budgeting processes. Lectures and discussions, as well as cases and examples from nonprofit and public sector organizations.

PA 5004. Introduction to Planning. (3 cr; SP–Major in [publ aff or publ policy or [sci, tech, and environ policy] or [urban and regional planning] or publ hlth] or #; A-F only)
History, institutional development of urban planning as a profession. Intellectual foundations, planning theory. Roles of urban planners in U.S./international settings. Scope, legitimacy, limitations of planning and of planning process. Issues in planning ethics and in planning in settings of diverse populations/stakeholders.

PA 5011. Organizational Analysis, Management, and Design. (3 cr; SP–Major in publ aff or publ policy or sci, tech, and environ policy or urban and regional planning or publ hlth or #; A-F only)
Survey course examines challenges facing higher-level managers in public and nonprofit organizations in a mixed economy and democratic republic. Uses lectures and case discussions to explore distinctive features of public and nonprofit management, skills necessary for effective management, and manager's role as a creator of public value.

PA 5012. The Politics of Public Affairs. (3 cr; SP–Major in publ aff or publ policy or sci, tech, and environ policy or urban and regional planning or publ hlth or #; A-F only)
Stages of policy making from agenda setting to implementation. Role and behavior of political institutions (courts, legislatures, executives, and bureaucracies) and citizens, social movements, and interest groups. Concepts of political philosophy. Theories of the state. Team taught interdisciplinary course with small discussion sections.

PA 5013. Law and Urban Land Use. (1.5 cr; SP–Major in publ aff or publ policy or sci, tech, and environ policy or urban and regional planning or publ hlth or #; A-F only)
Role of law in regulating and shaping urban development, land use, environmental quality, and local and regional governmental services. Interface between public and private sector.

PA 5021. Economics for Policy Analysis and Planning I. (3 cr; SP–Major in publ aff or publ policy or sci, tech, and environ policy or urban and regional planning or publ hlth or #; A-F only)
Introduction to a selection of tools useful for public policy: intermediate microeconomics, rudiments of macroeconomics, and central concepts of international trade.

PA 5022. Economics for Policy Analysis and Planning II. (3 cr; QP–5011 or equiv, major in publ aff or planning or sci and tech policy or publ hlth or #; SP–5021 or equiv, major in publ aff or publ policy or sci, tech, and environ policy or urban and regional planning or publ hlth or #; A-F only)
Application of economic reasoning to a variety of public policy issues that may vary by section. Includes cost-benefit analysis, nonmarket valuation, and tax analysis.

PA 5031. Empirical Analysis I. (3 cr; SP–Major in publ aff or publ policy or sci, tech, and environ policy or urban and regional planning or publ hlth or #; A-F only)
Basic statistical tools for empirical analysis of public policy alternatives. Frequency distributions, descriptive statistics, elementary probability and probability distributions, statistical inference, estimation and hypothesis testing, cross-tabulation and chi-square distribution, analysis of variance, correlation, simple and multiple regression analysis.

PA 5032. Intermediate Regression Analysis. (1.5 cr; QP–5021 or equiv, major in publ aff or planning or sci and tech policy or publ hlth or #; SP–5031 or equiv, major in publ aff or publ policy or sci, tech, and environ policy or urban and regional planning or publ hlth or #; A-F only)
Bivariate and multivariate models of regression analysis and assumptions behind them. Problems using these models when such assumptions are not met.

PA 5033. Multivariate Techniques. (1.5 cr; QP–5021 or equiv, major in publ aff or planning or sci and tech policy or publ hlth or #; SP–5031 or equiv, major in publ aff or publ policy or sci, tech, and environ policy or urban and regional planning or publ hlth or #; A-F only)
Examines public affairs topics using maximum likelihood estimation approaches.

PA 5034. Community Analysis and Planning Techniques. (1.5 cr; QP–5021 or equiv, major in publ aff or planning or sci and tech policy or publ hlth or #; SP–5031 or equiv, major in publ aff or publ policy or sci, tech, and environ policy or urban and regional planning or publ hlth or #)
Data analysis techniques for practitioners in fields of planning, management, and policy analysis who work at community and regional levels. Population analysis and forecasting techniques relevant for small geographic areas. Techniques for regional and local economic analysis, such as shift-share analysis, economic base, and location quotient analysis.

PA 5035. Survey Research and Data Collection. (1.5 cr; QP–5021 or equiv, major in publ aff or planning or sci and tech policy or publ hlth or #; SP–5031 or equiv, major in publ aff or publ policy or sci, tech, and environ policy or urban and regional planning or publ hlth or #; A-F only)
Introduction to survey research methods emphasizing applications to policy and applied research. Research design choices (e.g., descriptive, experimental, case studies), sampling, variable specification and measurement, conducting interviews, mailed questionnaires, qualitative techniques.

PA 5101. Management and Governance of Nonprofit Organizations. (1.5 cr; SP–Grad or #)
Draws on theories, concepts, and real world examples to explore critical managerial challenges. Governance systems, strategic management practices, effect of different funding environments, management of multiple constituencies. Different types of nonprofits using economic/behavioral approaches.

PA 5102. Organization Design and Change. (1.5 cr; SP–Grad or #)
Basic concepts related to organizational design decisions. Managerial challenges associated with organizational change in context of public sector agencies and nonprofit organizations. Major forces for change, kinds of change, management of change. Case-based analysis/discussion.

PA 5111. Financial Management in Public and Nonprofit Organizations. (3 cr; SP–[5003, grad] or #)
Design, installation, and use of accounting/control systems in public/nonprofit organizations. Public accounting standards/practices, financial administration/reporting, debt management, budgeting, contract/procurement management systems. Lecture, discussion, case analysis.

PA 5112. Public Budgeting. (4 cr; SP–Grad or #)
Budget processes in legislative/executive branches of federal, state, and local government. Program planning evaluation/administration. Techniques of budget/program analysis. Use of budget as policy/management tool. Analysis of fund flows within/among governments.

PA 5113. State and Local Public Finance. (3 cr; SP–Grad or #)
Theory/practice of financing. Providing public services at state/local level of government. Emphasizes integrating theory/practice, applying materials to specific policy areas, and documenting wide range of institutional arrangements across/within the 50 states.

PA 5115. State and Local Public Services and Finance. (3 cr; QP–ApEc 3001 or equiv; SP–ApEc 3001 or equiv; A-F only)
Organization, delivery, economic analysis, and finance of state and local public services and functions.

PA 5121. Intergovernmental Relations. (3 cr; SP–Grad or #)
Theory/practice of intergovernmental relations in the United States. Historical, political, and economic roots of contemporary institutions. Intergovernmental dimensions of specific policy areas: education, economic development, metropolitan affairs, social welfare, and other areas of student interest.

PA 5122. Law and Public Affairs. (3 cr; SP–Grad or #)
Overview of evolution of American legal system. Role of courts, legislatures, and political actors in changing law. How law is used to change public policy.

PA 5123. Financial and Development Strategies for Nonprofit and Public Organizations. (1.5 cr; SP–Grad or #)
Nonprofit/public sector financial/development strategies, political strategies used to obtain funding, philanthropy's historical role in public affairs. Guest speakers.

PA 5131. Conflict Management: Readings in Theory and Practice. (3 cr; SP–Grad or #)
Current theory. Review of conflict resolution strategies. Aspects of interpersonal, group, organizational, and systemic conflict.

PA 5132. Mediation Training. (3 cr; SP–Grad student or #)
Creating an arena for mediation. Skills/expectations needed to mediate disputes between individuals, among groups: balanced (peer or colleague), imbalanced (power differentials). Role playing, group debriefing, critique. Cases.

PA 5133. Conflict Management Proseminar. (1 cr; SP–Grad student or #)
Topics in conflict management research/practice. Theoretical implications, practical applications from the perspectives of participants. National/international issues.

PA 5134. Conflict Management Proseminar. (1 cr; SP–Grad student or #)
Topics in conflict management. Theoretical implications, practical applications from the perspectives of participants. National/international issues.

PA 5190. Topics in Public and Nonprofit Leadership and Management. (1-3 cr [max 9 cr]; SP–Grad student or #)
Selected topics.

PA 5201W. American Cities I: Population and Housing. (4 cr; SP–Grad or #)
Emergence of North American cities. Residential building cycles, density patterns. Metropolitan housing stocks, supply of housing services. Population/household types. Neighborhood-level patterns of housing use. Housing prices. Intraurban migration. Housing submarkets inside metro areas. Emphasizes linking theory, method, and case studies.

PA 5202W. American Cities II: Land Use, Transportation, and the Urban Economy. (4 cr; SP–Grad student or #)
Urban economy, its locational requirements. Central place theory. Transportation and urban land use, patterns/conflicts. Industrial/commercial land blight. Real estate redevelopment. Historic preservation. Emphasizes links between land use, transportation policy, economic development, and local fiscal issues. U.S.-Canadian contrasts.

PA 5203W. Geographical Perspectives on Planning. (4 cr; SP–§Geog 3605, §Geog 5605; grad student or #)
Includes additional weekly seminar-style meeting and bibliography project on topic selected in consultation with instructor.

PA 5211. Introduction to Land Use Planning. (3 cr; SP–[[Course in spatial analysis or work experience demonstrating knowledge of field], grad student] or #)
Physical/spatial basis for community/regional development. Role of public sector in guiding private development processes. Issues in design of settlements. Applied case studies examine public regulatory frameworks.

PA 5212. Managing Urban Growth and Change. (3 cr; SP–Grad student or #)
Theory/practice of planning, promoting, and controlling economic growth/change in urban areas. Economic development tools available to state/local policymakers, historic context of their use in the United States. legal, social, and economic implementation constraints. Interactions among economic, social, and demographic trends.

PA 5221. Private Sector Development. (3 cr; SP–Grad student or #)
Roles of various participants in land development. Investment objectives, effects of regulation. Overview of development process from private/public perspective.

PA 5231. Transit Planning and Management. (3 cr; QP–Grad student or #; SP–Grad student or #)
Principles/techniques related to implementing transit systems. Historical perspective, characteristics of travel demand, demand management. Evaluating/benchmarking system performance. Transit-oriented development. Analyzing alternative transit modes. System design/finance. Case studies, field projects.

PA 5241. Environmental Planning. (3 cr; SP–Grad student or #)
Relationship between natural resources, ecology, and urban development; planning design principles in balancing these. Legal/regulatory context of environmental planning. Methods of environmental impact analysis.

PA 5251. Strategic Planning and Management. (1.5 cr; SP–Grad student or #)
Theory/practice of strategic planning/management for governments, public agencies, and nonprofit organizations. How to promote strategic thinking/acting by policy-making bodies and management teams. Determining what an organization should do, how it should do it, and why. Lectures, case discussions.

PA 5252. Strategy and Tactics in Project Planning and Management. (1.5 cr; SP–Grad student or #)
Planning, analysis, evaluation, and implementation of short-term plans/projects. Technical analyses, interactional elements of completing projects within budget/time constraints. Strategic/tactical choices in planning. Case examples.

PA 5253. Participatory Management and Public Involvement Strategies. (3 cr; SP–Grad student or #)
Survey of strategies, techniques, and tools for involving groups members, teams, organizations, and stakeholders (including public at large) in problem definition, policy/plan formulation, decision making, and implementation. Emphasizes public/nonprofit organizations, citizen involvement.

PA 5261. Housing Policy. (3 cr; SP–Grad student or #)
Institutional/environmental setting for housing policy in the United States. Competing views of solving housing problems through public intervention in the market. Federal/local public sector responses to housing problems.

PA 5290. Topics in Planning. (1-3 cr [max 9 cr]; SP–Grad student or #)
Selected topics.

PA 5301. Population Methods and Issues for the United States and Third World. (3 cr; SP–Grad student or #)
Basic demographic measures/methodology. Demographic transition, mortality, fertility. Diverse perspectives on nonmarital fertility, marriage, divorce, and cohabitation. Cultural differences in family structure, aging, migration, refugee movements, population policies. Discussion of readings on population growth and environment.

PA 5311. Program Evaluation. (3 cr; SP–Grad student or #)
Principal methods, primary applications of evaluation research as applied to policies/programs in health/human services, education, or the environment. Conducting evaluations. Becoming a critical consumer of studies.

PA 5390. Topics in Advanced Policy Analysis Methods. (1-4 cr [max 9 cr]; SP–Grad student or #)
Topics in advanced policy analysis methods.

PA 5401. Poverty, Inequality, and Public Policy. (3 cr; SP–Grad student or #)
Nature/extent of poverty/inequality in the United States, causes/consequences, impact of government programs/policies. Extent/causes of poverty/inequality in other developed/developing countries.

PA 5411. Child Welfare Policy. (3 cr; SP–Grad student or #)
Intersection of conceptual orientations of developmental psychology with policies that affect children/families. Demographic, historical, social trends that underlie assumptions driving policies directed at women/children. Projections of future policies.

PA 5412. Aging and Disability Policy. (3 cr; SP–Grad student or #)
Policy debates concerning populations that are aging or disabled. Students learn/practice analyses in context of important health, social, and economic policy debates. Readings on current theory/evidence.

PA 5421. Racial Inequality and Public Policy. (3 cr; SP–Grad student or #)
Historical roots of racial inequality in American society. Contemporary economic consequences. Public policy responses to racial inequality. Emphasizes thinking/analysis that is critical of strategies offered for reducing racism and racial economic inequality.

PA 5431. Public Policies on Work and Pay. (3 cr; SP–[[PA 5031 or equiv], grad student] or #)
Public policies affecting employment, hours of work, and institutions in labor markets. Public programs impacting wages, unemployment, training, collective bargaining, job security, and workplace governance. Policy implications of the changing nature of work.

PA 5441. Education Policy and the State Legislature. (3 cr; SP–Grad student or #)
How Minnesota legislature decides K-12 issues. Implications for higher education. How to increase one's influence in process. Discussions with persons who influence statewide educational policy. Presentations. Field trip to state legislature.

PA 5442. Policy Design for Education and Human Development. (3 cr; SP–Grad student or #)
Designing effective educational policies. Using interdisciplinary approaches to identify/understand core variables (economic, psychological, etc). Work on policy design.

PA 5490. Topics in Social Policy. (1-4 cr [max 9 cr]; SP–Grad student or #)
Selected topics.

PA 5501. Economic Development I. (2 cr; SP–Grad student or #)
Economic development theories/strategies at national/regional levels in developing countries and the United States. Redistributive and basic needs strategies, institutional approaches, dependency/Neo-Marxist approaches, gender and development, sustainable development, effects of globalization on workers/communities, public policy responses.

PA 5502. Economic Development II. (2 cr; QP–[[5502 or equiv], grad student or publ hlth student or adult spec student] or #; SP–[[5501 or equiv], grad student] or #; A-F only)
Economic development from macroeconomic/open-economy perspective. Sources of economic growth. Agricultural development. Import-substitution industrialization. Endogenous growth models. Population, migration, and human development. Policy reform/adjustment.

PA 5511. Community Economic Development. (3 cr; SP–Grad student or #)
Contexts/motivations behind community economic development activities. Alternative strategies for organizing/initiating economic development projects. Tools/techniques for economic development analysis/planning (market analysis, feasibility studies, development plans). Implementation at local level.

PA 5521. Development Planning and Policy Analysis. (3 cr; QP–[[5021 or equiv], [5502 or equiv], [grad student or publ hlth student or adult spec student]] or #; SP–[[5031 or equiv], [5501 or equiv], grad student] or #)
Techniques/assumptions of development planning and policy analysis at national, regional, and project levels. Direct/indirect effects of external shocks and government interventions on national/regional economies. Macroeconomic modeling, input-output analysis, social accounting matrices/multipliers, project appraisal/evaluation techniques.

PA 5522. Economic Development Policies in Latin America. (3 cr; QP–[5011, [5502 or equiv], [grad student or publ hlth student or adult spec student]] or #; SP–[[5021 or equiv], [5502 or equiv], grad student] or #)
Evolution of economic development policies from import-substituting industrialization policies of 1950s/1960s through beginning of reform in 1970s, economic crisis of 1980s, and reform into 1990s. Emphasizes privatization, economic integration, exchange rate/trade, and domestic/adjustment policies.

PA 5531. Strategies for Sustainable Development: Theory and Practice. (1.5 cr; SP–[Microecon course, grad student] or #)
Economic, environmental, and social aspects of sustainable development. Strategies, methods of implementation, and applications of sustainable development in different economic systems of industrialized/developing countries. Special attention to countries in transition.

PA 5590. Topics in Economic and Community Development. (1-3 cr [max 9 cr]; SP–Grad student or #)
Selected topics.

PA 5601. Survey of Women, Law, and Public Policy in the United States. (3 cr; SP–Grad student or #)
Gendered nature of public policy. Historical analysis of welfare, single motherhood, and protective legislation. How laws structure public policy. How courts are arenas for policy making. Emphasizes employment discrimination and reproductive rights. Differences among women. Intersection of oppression based on class/race/sexual orientation.

PA 5611. Feminist Economics. (3 cr; QP–[5010, [grad student or publ hlth student or adult spec student]] or #; SP–[5021, grad student] or #)
Feminist philosophy, methodology, and economic practice. Feminist perspectives on development and the global economy, work/family. Heterodox traditions in economics.

PA 5690. Topics in Women and Public Policy. (1-3 cr [max 9 cr]; SP–Grad student or #)
Selected topics.

PA 5701. Science and State. (3 cr; SP–Grad student or #)
Relationship between science and contemporary society. Nature of science: its values, processes, and ways of knowing. How science has influenced U.S. political institutions and political/judicial processes. Issues in current debate over U.S. science policy.

PA 5711. Science and Technology Policy. (3 cr; SP–Grad student or #)
Effect of science/technology on global economy, politics, environment, security. Role of national science/technology policies in development, diffusion, and adoption of technologies nationally/internationally. Issues related to technology, technology policy, technological development, impact of technology, international cooperation.

PA 5721. Energy and Environmental Policy. (3 cr; SP–Grad student or #)
Impact of energy production/consumption choices on environmental quality, sustainable development, and other economic/social goals. Emphasizes public policy choices for energy/environment, linkages between them.

PA 5722. Environmental and Resource Economics Policy. (3 cr; SP–[Intermediate microeconomics, intermediate policy analysis, grad student] or #)
Public policy associated with natural resource use and environmental protection. Develops/applies economic concepts/methodologies/policy mechanisms. Principles of environmental/resource economics. Issues related to renewable/nonrenewable resources and environmental pollution. Focuses on scientific/political aspects of policy.

PA 5790. Topics in Science, Technology, and Environmental Policy. (1-3 cr [max 9 cr]; SP–Grad or #)
Selected topics.

PA 5801. U.S. Foreign Policy: Process and Analysis. (3 cr; SP–Grad student or #)
U.S. general diplomacy, foreign economic policy. Emphasizes analysis. Broad security strategy. Policy towards specific geographic regions. Trade, investment, monetary policy. Immigration policy. Environmental cooperation.

PA 5811. Public Policy Problems of Globalization. (3 cr; SP–Grad student or #)
Policy problems facing national and subnational decision makers. Problems caused by increasing international mobility of goods, services, capital, persons, and ideas.

PA 5812. Open Economy Models: an Assessment. (3 cr; SP–[Intermediate macroeconomics, trade theory, grad student] or #)
Open economics, implications for policy making/implementation. Issues at level of international/domestic economies.

PA 5890. Topics in Foreign Policy and International Affairs. (1-3 cr [max 9 cr]; SP–Grad student or #)
Selected topics.

PA 5901. Computer Applications in Public Affairs. (0.5-3 cr [max 6 cr]; SP–#; S-N only)
Introduction to computer systems/applications in public affairs practice.

PA 5902. Computer Applications in Public Affairs. (0.5-3 cr [max 6 cr]; SP–#; S-N only)
Introduction to computer systems/applications in public affairs practice.

PA 5903. Introduction to Computers and Applications at the Humphrey Institute. (2 cr; SP–International HHH fellow; S-N only)
Computers/applications. Basic skills. Software such as MS Word, Excel, Powerpoint, Access. Using Internet, e-mail, search engines (for research), HTML (through Web page creation software).

PA 5931. Role of the Media in Public Affairs. (3 cr; SP–Grad student or #)
Historical/contemporary role of news media in defining/shaping public opinion/policy, primarily in the United States. Emphasizes critical research, professional skills in three forms of journalism: hard news coverage, investigative reporting, documentaries. Field experience, practice in governmental public relations.

PA 5941. Leadership for the Common Good. (4 cr; SP–#)
Personal, team, organizational, visionary, political, and ethical aspects of leadership. Emphasizes building/experiencing a learning community.

PA 5951. Global Commons Seminar. (3 cr [max 6 cr]; QP–International Hubert H. Humphrey Fellows; SP–International Hubert H. Humphrey Fellows; S-N only)
Meets specific needs of International Humphrey Fellows. Topics vary each year depending on the interests and needs of the fellows.

PA 5990. Topics: Public Affairs—General Topics. (1-3 cr [max 9 cr]; SP–Grad student or #)
General topics in public policy.

PA 8001. Synthesis Seminar. (4 cr; SP–Grad PA major or #; A-F only)
Development of interdisciplinary understanding of one or more policy areas through explorations of theory, readings, cases, and model-building exercises. This understanding is then used to articulate possible policy or system improvements, along with leadership implications for formulating and implementing them.

PA 8002. Synthesis Workshop. (4 cr; SP–[8001, grad PA major] or #; A-F only)
Development of public policy to advance public interest, common good. Recommendations flow from interdisciplinary understanding of problem, stakeholder analyses, modeling/analysis. Political feasibility, marketing, entrepreneurship, advocacy.

PA 8081. Capstone Workshop. (3 cr; SP–[Grad major in [public policy or [urban and regional planning] or [science, technology, and environment policy]], completion of core courses] or #; A-F only)
Project external client on issue agreed upon by student, client, and instructor. Students apply interdisciplinary methods, approaches, and perspectives studied in core courses to the issue. Written report includes analysis of issue and policy recommendations. Oral presentation of major findings. Concentration/topic vary term-to-term.

PA 8082. Capstone Seminar. (3 cr; SP–[Grad major in [public policy or [urban and regional planning] or [science, technology, and environment policy]], completion of core courses] or #; A-F only)
Facilitates completion of research paper on current issue in public affairs. Student applies interdisciplinary methods, approaches, and perspectives studied in core courses to the issue. Written report includes analysis of issue and policy recommendations. Oral presentation of major findings. Concentration/topic vary term-to-term.

PA 8105. Human Resources and Organizational Performance. (2 cr; QP–5022, 5012 or equiv; SP–5032, 5022 or equiv)
Impact of human resource policies and practices on organizational productivity and effectiveness. Role of government, unions, and private sector institutions on organizational effectiveness.

PA 8183. Managing Collaborations. (3 cr; A-F only)
Management challenges of operating within multiparty (combination of nonprofit, for-profit, and public enterprises) collaborations formed to deal with a social problem. Combines in-class discussions of conceptual materials with application in community. Student teams work for half a semester with local collaborations on management problems.

PA 8186. Public Services Redesign. (3 cr; A-F only)
Theory, strategy, politics, and some practical mechanics required to adapt public service system given constraints on resources and continuing pressure for effectiveness and equity. In-class and out-of-class interviews with persons involved in redesign. Student papers on current redesign issues.

PA 8187. Leadership for Public Policy and Planning. (3 cr; A-F only)
Introduction to major theoretical perspectives on leadership in public affairs. Role of leadership in policy change, governance, planning, and management. Personal, team, organizational, visionary, political, and ethical aspects of leadership. Students develop their own theory of leadership-in-action. Cases employed.

PA 8190. Advanced Topics in Public and Nonprofit Leadership and Management. (1-3 cr [max 6 cr])
Selected topics.

PA 8201. Environment and Infrastructure Planning. (4 cr; SP–[Urban and regional planning] grad student or #; A-F only)
Relationship between infrastructure, human settlement design. Natural resource systems as foundation of infrastructure provision. Environmental basis of, and political/legal/institutional frameworks for, land-use planning. Parallel computer lab, practicum assignment.

PA 8202. Networks and Places: Transportation, Land Use, and Design. (4 cr; SP–[Urban and regional planning] grad student or #; A-F only)
Relationship between land use, transportation. Developing synthetic design skills for linking land use transportation in urban/regional settlements. Economic, political, legal, institutional frameworks for planning. Parallel computer lab, practicum assignment.

PA 8203. Neighborhood Revitalization Strategies and Theories. (4 cr; SP–[Urban and regional planning] grad student or #; A-F only)
Policymaking/politics of planning in housing, community development, social policy. Connecting policy to local/regional politics. Role of institutional decision-making structures on policy outcomes. Importance of citizens, social movements, interest groups in policymaking process.

PA 8204. Regional, Economic, and Workforce Development Planning. (4 cr; SP–5021 or 5202, ¶5034; A-F only)
Provides a rigorous foundation in the evolution and current state of regional development planning in the United States and abroad; in theories of regional and local economic development, linked to various techniques of analysis and implementation; and in workforce development planning at the regional and local level.

PA 8286. International Urban Planning. (3 cr; A-F only)
Urbanization process and planning responses in cities of developing world. Urban sustainability, migration, housing, transportation, employment, and urban service delivery. Phenomena such as squatter settlements and informal economy that normally proceed unplanned and without formal government control.

PA 8290. Advanced Topics in Planning. (1-3 cr [max 6 cr])
Selected topics.

PA 8311. Case Studies in Policy Analysis. (3 cr)
Topics in microeconomics applied to systems problems of government. Market and nonmarket resource allocation; cost-effectiveness and cost-benefit analysis. Case method employed.

PA 8312. Analysis of Discrimination. (3 cr)
Introduces students of policy analysis and other applied social sciences to tools for measuring and detecting discrimination in market and nonmarket contexts. Application of modern tools of labor econometrics and race relations research to specific problems of market and nonmarket discrimination.

PA 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

PA 8386. Research Methods in Social and Labor Policy. (3 cr; SP–5032 or 5033, 5022 or equiv; A-F only)
Use of social science research methods in analyzing and developing public policies.

PA 8390. Advanced Topics in Advanced Policy Analysis Methods. (1-3 cr [max 6 cr])
Selected topics.

PA 8486. Work and Family in the United States and the Third World. (3 cr; A-F only)
Topics based on students' interests. Topics must relate to formal and informal labor force work, household work, child care, child labor, youth employment, education, training, or their interrelationships. Data collection and measurement issues; economic and demographic theories of work and education decisions in context of the family.

PA 8490. Advanced Topics in Social Policy. (1-3 cr [max 6 cr])
Selected topics.

PA 8583. Capstone Workshop on Economic and Community Development. (3 cr; A-F only)
Comprehensive overview of state, local, community-based economic development strategies. Processes involved in producing broadly conceived economic development strategy. Institutional structures/processes to deal with economic change, new political realities.

PA 8590. Advanced Topics in Economic and Community Development. (1-3 cr [max 6 cr])
Selected topics.

PA 8686. Feminist Organizations. (3 cr; A-F only)
Uses social movement literature and histories of U.S. second-wave feminism to study feminist organizations. Recurring issues and conflicts within organizations and movements examined through comparative studies of feminism in Latin America, Eastern Europe, Britain, and Italy. Methods and sources for studying feminism.

PA 8690. Advanced Topics in Women and Public Policy. (1-3 cr [max 6 cr])
Selected topics.

PA 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

PA 8790. Advanced Topics in Science, Technology, and Environmental Policy. (1-3 cr [max 6 cr])
Selected topics.

PA 8811. Strategic Issues in International Economic Policy. (3 cr)
Compares/contrasts experiences of industrial/developing countries in trade, investment, exchange rates, and immigration.

PA 8821. National Security Policy. (3 cr)
Politics and economics of national security policy. Defense policy, military strategy, and weapons procurement. While emphasis is on the United States, other countries also discussed.

PA 8890. Advanced Topics in Foreign Policy and International Affairs. (1-3 cr [max 6 cr])
Selected topics.

PA 8991. Independent Study. (1-3 cr [max 6 cr]; SP–#)

Public Health (PubH)

School of Public Health

PubH 5003. Fundamentals of Alcohol and Drug Abuse. (1.5 cr; QP–§5023; ed student or #; SP–§5023; ed student or #)
Lecture, discussion, and special readings on scientific, sociocultural, attitudinal aspects of alcohol and other drug abuse problems. Emphasizes incidence, high risk populations, prevention, and intervention.

PubH 5004. Field Instruction in Public Health. (1-15 cr; QP–#; SP–#)
Generalized, function- or discipline-oriented community experience under academic and professional supervision. Emphasis on applying acquired knowledge and skills to relevant health issues and problems.

PubH 5005. Topics in Public Health. (1-10 cr [max 20 cr]; QP–Advanced proposal, #; SP–Advanced proposal, #)
Directed instruction, including discussion on selected readings.

PubH 5010. Public Health Interventions for AIDS. (3 cr; QP–Upper div or grad student or professional school student or #; SP–Upper div or grad student or professional school student or #)
Survey of HIV infection from public health perspective. Emphasizes intervention.

PubH 5017. Culture and Health Behavior. (2 cr; QP–Grad or professional school student or #; SP–Grad or professional school student or #)
Heightens cultural sensitivity regarding public health practice and individual health behaviors. Cultural diversity and its impact on health behaviors; etic (universal) and emic (culture-specific) approaches.

PubH 5020. Fundamentals of Social and Behavioral Science. (3 cr; SP–Public health or #)
Four major approaches to public health problems: psychosocial, economic, community, policy. Lectures provide overview of theory/implementation. Small groups provide opportunity to practice skills.

PubH 5030. Prevention of High-Risk Behavior Among Adolescents. (2 cr; QP–[Grad-level behavioral sci course [5050 preferred], [CHE or MCH or PubH Nutr or Epi MPH or Epi grad]] or #; 2nd-yr master's student recommended; SP–[Grad-level behavioral sci course [5050 preferred], [CHE or MCH or PubH Nutr or Epi MPH or Epi grad]] or #; 2nd-yr master's student recommended; A-F only)
Definitions/etiology of high-risk behaviors among adolescents. Intervention programs. Review of current literature. Students design prevention program overview based on theory/etiological data using health education/behavior change methods.

PubH 5034. Program Evaluation for Public Health Practice. (3 cr; QP–Che major or #; SP–Che or MCH major or #)
Developing useful program evaluations. Emphasizes skills for program administrators, planners. Needs assessments, evaluability assessments, formative evaluation, implementation studies, outcome evaluations. Quantitative/qualitative data collection methods. Ethical considerations.

PubH 5035. Applied Research Methods. (3 cr; QP–[5414 or 5450 or equiv], [5806 or 5852 or equiv], [che or pub hlth nutr major or #]; 5420 recommended; SP–[5414 or 5450 or equiv], [5034 or 5806 or equiv], [che or pub hlth nutr major or #]; 5420 recommended)
Complements master's project work using forms, questionnaires, interviews. Literature searching, questionnaire development, scale construction, item analysis, data coding, entry/analysis, report writing. Use of computer software package to develop questionnaire and analyze data.

PubH 5040. Dying and Death in Contemporary Society: Implications for Intervention. (2 cr; QP–Upper div or grad student or professional school student or #; SP–Upper div or grad student or professional school student or #)
Concepts, attitudes, ethics, and lifestyle management related to dying, death, grief, and bereavement. Emphasizes preparing community health and helping professionals/educators for educational activities in this area.

PubH 5049. Legislative Advocacy Skills for Public Health. (3 cr; QP–5398, #; SP–5398, #; A-F only)
State legislature as arena for public health practice; develops skills necessary to operate in that arena. Analyzes emergence, development, and resolution of legislative issues of public health importance.

PubH 5050. Community Health Theory and Practice I. (3 cr; QP–Che major or #; SP–Che major or #)
Socioenvironmental factors influencing health-related behavior. Role of groups, institutions, social structures in encouraging healthy, unhealthy behavior. Role of interventions affecting social environment; barriers to effective interventions. Individual behavior change theories, models targeting psychosocial approaches; application of theories in practice.

PubH 5051. Community Health Theory and Practice II. (3 cr; QP–Che major or #; SP–Che major or #)
Conceptualizing, planning, and implementing community health education programs and interventions. Examines health education/promotion organizations; how organizational factors shape health education practice. Focuses on planning health education/promotion efforts. Students gain experience in developing a hypothetical community health intervention.

PubH 5055. Social Inequalities in Health. (2 cr; SP–Hlth sci professional school student or hlth sci or soc work or pub affairs grad student or #)
Extent and causes of social inequalities in health; degree to which our understanding of these inequalities is hampered by methodological limitations in health research. Focuses on individual, community, and policy approaches to reducing social inequalities in health.

PubH 5061. Community Health Education in Health Care Settings. (2 cr; SP–Public health student or #)
Scope/effectiveness of and barriers to health education in clinical settings. Role of public health professional in implementing/maintaining health education guidelines. Emphasizes health education for risk factor modification.

PubH 5084. Internship in Health Education Practice I. (1-10 cr; QP–Che major or #; SP–Che major, #)
Supervised health education internship in a health or public health setting under academic/professional supervision. Applying community health education knowledge/skills to health issues/problems.

PubH 5085. Internship in Health Education Practice II. (1-10 cr; QP–Che major or #; SP–Che major, #)
Supervised health education internship in a health or public health setting under academic/professional supervision. Applying community health education knowledge/skills to health issues/problems.

PubH 5090. Research Topics in Health Education. (2-8 cr; QP–Che major or #; SP–Che major, #)
Review of health education research/experience in selected area.

PubH 5096. Community Health Education Master's Research Project. (1-10 cr; QP–Che major or #; SP–Che major, #)
Original research in, or secondary analysis of, data sets related to health education.

PubH 5100. Topics in Environmental and Occupational Health. (1-4 cr [max 999 cr]; QP–Eh major or #; SP–Eh major or #; may be repeated for cr)
Selected readings. Discussion of problems.

PubH 5101. Environmental and Occupational Health Master's Project. (1-3 cr; QP–Eh major, #; SP–Eh major, #; S-N only)
Directed projects or examination.

PubH 5102. Field Experience in Environmental and Occupational Health. (1-5 cr; QP–Eh major, #; SP–Eh major, #; S-N only)
Directed practicum.

PubH 5103. Exposure to Environmental Hazards. (3 cr; QP–Eh major or #; SP–Eh major or #; A-F only)
Nature, effects, regulation of exposure to biological, physical, chemical hazards in the environment, in context of inter-/multi-disciplinary scientific field of environmental health as essential component of public health.

PubH 5104. Environmental Health Effects: Introduction to Toxicology. (2 cr; QP–Eh or #; SP–Eh or #; A-F only)
Identifying mechanisms/effects on human health of environmental agents. Chemical, biological, physical, and psychological agents.

PubH 5105. Environmental and Occupational Health Policy. (3 cr; QP–Eh major or #; SP–Eh major or #; A-F only)
Students develop an understanding of environmental and occupational health policies, laws, key concepts and principles, proposals and approaches for regulatory reform, approaches to policy analysis, and overall phases and issues in the policy-making process.

PubH 5110. Environmental and Worker Protection Law. (4 cr)
Law protecting public health and conserving the environment: 1) common law that evolved as courts settled private disputes; 2) public law made by legislatures and administrative agencies. Students research legal issues underlying public health and environmental policies, analyze court opinions, review statutes, and participate in negotiation exercise.

PubH 5111. Preventing Pollution: Innovative Approaches to Environmental Management. (3 cr; QP–Pub hlth or grad or honors undergrad student or #; SP–Pub hlth or grad or honors undergrad student or #)
Interdisciplinary approach to pollution problems, including sustainability, pollution prevention, risk assessment, regulatory reform, and strategic environmental management.

PubH 5112. Risk Analysis: Application to Risk-Based Decision Making. (3 cr; QP–Pub hlth or grad student or #; SP–Pub hlth or grad student or #)
Introduction to risk in context of regulatory decision making.

PubH 5113. Public Policy and Risk: Strategies for Effective Decisions and Discourse. (3 cr; QP–Pub hlth or grad student or #; SP–Pub hlth or grad student or #)
Introduction to policy making in public health, environment characterized by substantial risk/uncertainty. Basic mathematics of decision making under risk/uncertainty. Cognitive psychology of how people react to risk. Methods of risk communication.

PubH 5120. Injury Prevention in the Workplace, Community, and Home. (2 cr)
Injury epidemiology: analyses of major injury problems affecting the public in the workplace, community, and home using epidemiologic model and conceptual framework; emphasis on strategies/program development for prevention and control.

PubH 5121. Topics: Injury Prevention in the Workplace, Community, and Home. (1-2 cr [max 2 cr]; QP–5194 or 5120, 5320, #; SP–5194 or 5120, 5320, #)
Selected projects.

PubH 5122. Seminar: Safety in the Workplace. (1 cr)
Realm of and potential risk factors for occupational safety problems; strategies for prevention and control.

PubH 5123. Violence Prevention and Control: Theory, Research, and Application. (2 cr)
Analysis/critique of major theories and of epidemiological research pertinent to violence, including characteristics of violence and relevant risk factors, reporting/treatment protocols, and current/potential intervention efforts and prevention initiatives. Emphasizes interdisciplinary contributions to violence prevention/control.

PubH 5130. Occupational Medicine: Principles and Practice. (3 cr; QP–Eh major or #; SP–Eh major or #)
Pathogenesis of diseases caused by occupational hazards; evaluating work-related illnesses; overall regulatory framework governing occupational health and safety.

PubH 5140. Occupational and Environmental Epidemiology. (2 cr; QP–Basic course in [epi, biostats]; SP–Basic course in [epi, biostats])
Principles/concepts in identifying health effects in workplace. Strategies for identifying excess risk, evaluating strengths/weaknesses of research techniques, assessing bias/confounding.

PubH 5150. Interdisciplinary Evaluation of Occupational Health and Safety Field Problems. (3 cr; QP–Eh major or #; SP–Eh major or #)
Guided evaluation of potential health and safety problems at the work site, recommendations and design criteria for correction, and evaluation of occupational health and safety programs.

PubH 5160. Physiological Disposition of Xenobiotics. (3 cr; QP–1 course in biochem, mol biol, org chem or #; SP–1 course each in biochem, mol biol, org chem or #)
Pharmacokinetics/toxicokinetics and xenobiotic metabolism. Mechanisms by which phase I and phase II enzymes bioactivate and detoxify xenobiotics. Implications of these biochemical reactions for human health.

PubH 5161. Regulatory Toxicology. (2 cr; QP–General environ toxicology course; SP–General environ toxicology course; A-F only)
In-depth introduction to laws (and associated regulations) of U.S. federal regulatory agencies, such as CPSC, EPA, FDA, OSHA, and DOT, that both require and use toxicological data/information in their mission of protecting human and environmental health.

PubH 5170. Introduction to Occupational Health and Safety. (3 cr; QP–Eh or #; SP–Eh or #)
Introduction to major concepts/issues in occupational health/safety. Application of public health principles/decision-making process in preventing injury/disease, promoting health of adults, and protecting worker populations from environmental hazards. Observational visit to manufacturing facility.

PubH 5171. Properties, Behavior, and Measurement of Airborne Contaminants. (3 cr; QP–[Eh major, [industrial hygiene specialty or equiv]] or #; SP–[Eh major, [industrial hygiene specialty or equiv]] or #; A-F only)
Airborne contaminants in outdoor/indoor environments. Emphasizes workplace environments. General physical properties of matter in gaseous/aerosol forms. Measurement/characterization of airborne concentrations of pollutants, human exposures to them. Setting of health-related environmental standards.

PubH 5172. Industrial Hygiene Applications. (2 cr; QP–Eh major, 5170 or #; SP–Eh major, 5170 or #)
Recognition, evaluation, and control of occupational health and safety hazards. Practice application to specific industrial hygiene problems related to gases/vapors, aerosols, and physical agents.

PubH 5173. Hazard-Related Exposure to Physical Agents in the Environment. (3 cr; QP–Eh major, [industrial hygiene specialty or equiv or #]; SP–Eh major, [industrial hygiene specialty or equiv or #])
Nature, health effects, monitoring, and control of physical agents in working/living environments, ionizing/non-ionizing radiations (e.g., lasers/ultraviolet, visible, and infrared light), noise/vibration, heat/cold stress. Dose, response, and engineering interventions.

PubH 5174. Control of Exposure to Physical and Chemical Hazards. (3 cr; QP–[Eh major, [industrial hygiene specialty or equiv]] or #; SP–[Eh major, [industrial hygiene specialty or equiv]] or #)
Hierarchy of options for controlling human exposures to airborne contaminants, both gaseous and aerosol.

Science/practice of process control and exhaust ventilation in workplaces and other indoor air spaces and in air cleaning. Control of emissions to ambient environment.

PubH 5175. Industrial Hygiene Measurements Laboratory. (2 cr; SP–5171 or #)
Broad treatment of occupational health field. Role of industrial hygienist. Emphasizes practical application of industrial hygiene concepts/methods. Lectures/demonstrations, lab exercises, project.

PubH 5176. Hazardous Materials and Wastes Management. (3 cr; SP–5170, courses in chemistry [including organic or equiv])
Generation, control, disposal of hazardous materials/wastes. Recognizing, evaluating, controlling, preventing hazards from chemicals that threaten occupational/environmental health. Lectures, case studies, workshops, field trips.

PubH 5180. Environmental Microbiology. (4 cr; QP–MicB 3103 or equiv or #; SP–MicB 3103 or equiv or #)
Survival, dissemination, significance, and monitoring of microbes in the human environment. Principles of biological safety, including risk assessment, lab design and operation, lab animals, shipping and transport, and sterilization, disinfection, and decontamination.

PubH 5190. Environmental Chemistry. (3 cr; QP–1 course each in gen chem, org chem or #; SP–1 course each in gen chem, org chem or #)
Overview air, water, and soil chemistry; pertinent environmental problems; human and ecological multimedia exposures to chemicals in the environment.

PubH 5200. Environmental Health. (2 cr)
Principles of environmental health relating to macro- and micro-environments and to products consumed or used by people.

PubH 5201. Issues in Environmental and Occupational Health. (2 cr; QP–Pub hlth student or #; SP–Pub hlth student or #)
The field, current issues, and principles and methods of environmental and occupational health practice.

PubH 5202. Special Topics in Environmental and Occupational Health. (1-2 cr)
Selected readings and discussion of problems in environmental and occupational health taught through the Midwest Center for Occupational Health and Safety Institute.

PubH 5220. Introduction to Occupational Safety. (1 cr)
Emphasis on developing a practical foundation in industrial safety. Safety program development and management; roles of OSHA/Workers' Compensation.

PubH 5240. Introduction to Occupational Epidemiology. (2 cr)
Basic epidemiologic principles and methods; emphasis on evaluation of health effects of occupational exposures. Exposure assessment, study design and application, measures of disease occurrence and association, sources of bias in studies, and causal inference.

PubH 5270. Survey of Industrial Hygiene. (2 cr)
For non-industrial hygienists. Overview of science and art of recognizing, evaluating, and controlling health hazards in the workplace.

PubH 5272. Introduction to Health Risk Assessment. (1 cr)
Fundamental steps in risk assessment; emerging trends and advances in the field.

PubH 5273. Ventilation Control of Occupational Hazards. (2 cr; S-N only)
Designing, modifying, testing, and troubleshooting local exhaust systems.

PubH 5301. Perspectives: Interrelationships of People and Animals in Society Today. (2 cr; SP–§3301, §UC 4301, §CVM 6050)
Social, psychological, economic, and health consequences of people/animal relationships. Diversity of cultural perspectives on human/animal relationships. Animals and people sharing an urban environment. Hunting and wildlife conservation. Biomedical research. Animal rights and human/animal bond.

PubH 5320. Fundamentals of Epidemiology. (3 cr; QP–Pub hlth or grad student or #; SP–Pub hlth or grad student or #)
Basic concepts and knowledge of epidemiology, a methodology used to study the etiology, distribution, and control of diseases in human populations.

PubH 5330. Epidemiology I. (4 cr; QP–Epi major or #; SP–Epi major or #)
Basic epidemiologic principles applicable to infectious and noninfectious disease; host-agent environment complex; factors underlying spread of infectious disease; laboratory applications of statistical and epidemiologic methods.

PubH 5333. Principles of Human Behavior I. (2 cr; QP–Che or epi major or #; SP–Che or epi major or #; A-F only)
Theoretical perspective on etiology/modification of health behavior in individuals/communities.

PubH 5334. Human Behavior II. (2 cr; SP–[5333, Epi grad student in behavioral track] or #; A-F only)
Critical evaluation of major behavioral public health intervention research. Experience in research designs/methods in health behavior intervention.

PubH 5335. Epidemiology and Control of Infectious Diseases. (2 cr; QP–Epi major or #; SP–Epi major or #)
Principles and methods. Strategies for disease control and prevention, including immunization. Relevance of modes of transmission of specific agents for disease spread and prevention. Public health consequences of infectious diseases at local, national, and international levels.

PubH 5336. Advanced Seminar in Infectious Disease Epidemiology. (1 cr [max 2 cr]; QP–5330, 5335, #; SP–5330, 5335, #; S-N only)
How infectious disease epidemiologic principles are applied in the "real world" to contemporary or controversial issues, including development of prevention and control strategies.

PubH 5337. Analysis of Infectious Disease Data. (2 cr; SP–5330, 5340, 5335, [EPI or MPH or EPI] grad student, #; A-F only)
Methods to analyze/model infectious disease data. Emphasizes critical understanding of methods, statistical analysis specific to infectious disease areas. Infection models, surveillance/epidemic modeling, transmission models, pathogenesis models.

PubH 5340. Epidemiology II. (4 cr; QP–5330, 1 biostats course or #; SP–5330, 1 biostats course or #)
Measures of disease occurrence; strategies and design principles for etiologic and evaluative studies. Measurement of problems, interactions, sensitivity and precision, validity, and need for data specification and control of variables.

PubH 5345. Epi Methods: Data Collection. (2 cr; QP–[5240, 5330, 5450, epi MPH major] or #; SP–[5330, 5450, [Epi MPH or clin research student]] or #)
Methods/techniques for collecting/managing epidemiologic research data. Practical aspects of sampling, response rates/bias, forms design, selecting/training interviewers. Data preparation, entry, cleaning, management. Ethical issues in research.

PubH 5348. Writing Research Grants. (2 cr; QP–Epi grad student or postdoc student or #; SP–Epi grad student or postdoc student or clin res student or #; S-N only)
Focuses on NIH-type grants. Mechanics of grant development/writing, principles of informed consent, budget development, grant-review process, identifying funding sources.

PubH 5351. Molecular Epidemiology. (2 cr; SP–PubH 5330, at least one college-level general biology course, [Epi MPH or Epi grad student or #]; A-F only)
Introduction to molecular epidemiology. Sample collection, processing, methodology. Biomarkers used in cancer, cardiovascular disease, and infectious epidemiologic studies.

PubH 5365. Epidemiology of Aging. (2 cr; SP–Grad or professional school student, 5330 or equiv or #)
Major concepts and issues. Emphasizes methodological issues unique to studies of older populations with measurement of epidemiologic characteristics especially important. Scope of epidemiologic studies of older populations; most prevalent health conditions.

PubH 5370. Alcohol and Other Drugs: Epidemiology, Prevention, and Control. (3 cr; QP–Eh or epi grad major or pub hlth or biol or dent or nurs grad or med school or pharm student or #; SP–Eh or epi grad major or pub hlth or biol or dent or nurs grad or med school or pharm student or #)
Population patterns regarding who uses which drugs, why they use them, and health consequences of alcohol and other drug use. Does not focus on treatments, care, rehab, or exploration of personal attitudes, practices regarding alcohol or other drug use.

PubH 5379. Epidemiology Master's Project Seminar. (1 cr; QP–Epi major or #; SP–Epi major or #; S-N only)
Students present their MPH master's projects and give and receive feedback. Projects should be either underway or near completion.

PubH 5381. Genetic Epidemiology. (3 cr; QP–5330, 5450 or equiv, college coursework in genetics, hlth sci grad or professional school student or #; SP–5330, 5450 or equiv, college coursework in genetics, hlth sci grad or professional school student or #)
Etiology, distribution, and control of diseases in groups of relatives; inherited causes of disease in populations. Associations (case-control family studies), concordance (twin studies), disease transmission (segregation analysis), gene localization (gene mapping), and applications in studies of disease etiology.

PubH 5383. Pathobiology of Human Diseases. (3 cr; QP–Pub hlth or biol or dent or eh or epi or nurs or pharm or med school or grad student or #; SP–Pub hlth or biol or dent or eh or epi or nurs or pharm or med school or grad student or #)
Basic cell biology and pathology of human diseases, including cardiovascular, cancer neurodegenerative, immunologic, and infectious diseases. Current concepts of pathobiology, risk factors, and markers described for each disease.

PubH 5384. Human Physiology. (3 cr; QP–Epi major or pub hlth nutr major or #; SP–Epi major or #)
Basic human physiologic, chemical, and biologic principles. Emphasizes homeostasis as unifying concept. Cellular, organ, and organ systems function. Health applications, "clinical" problem solving. Physiologic information presented as background knowledge for critically assessing biologic research.

PubH 5386. Public Health Aspects of Cardiovascular Disease. (2 cr; QP–[5330, 5450] or equiv; SP–[5330, 5450] or equiv; students in 2-yr program take course in yr 2)
Detailed perspective on well-established risk factors for CVD, prevention of CVD, and national recommendations for treatment/prevention. Introduces emerging risk factors and current controversies in CVD.

PubH 5387. Cancer Epidemiology. (2 cr; QP–5330, 5340, hlth sci grad and professional school student or #; SP–5330, 5340, hlth sci grad and professional school student or #)
Epidemiologic aspects of cancer, including theories of carcinogenesis, incidence, site-specific risk factors, and issues of cancer control and prevention.

PubH 5389. Nutritional Epidemiology. (2 cr; QP–5330 or #; SP–5330 or #)
Study of nutrition/disease relationships through application of epidemiologic methods. Characterization of various exposures to food and nutrient intakes, biological basis for nutrition/disease relationships, studies of specific chronic diseases and nutritional intake, design and interpretation of studies using nutritional measures.

PubH 5390. Smoking Intervention. (2 cr; QP–[Che or epi MPH] or epi grad student or #; SP–[Che or MCH or epi MPH] or epi grad student or #)
Impact of smoking on U.S. public health. Review of research on onset/prevention. Factors maintaining dependence, cessation/intervention strategies. Public health campaigns. Public policies, second-hand smoking controversies. International issues.

PubH 5393. Design and Analysis of Group-Randomized Trials in Epidemiology. (3 cr; QP–5340, 5452, epi MPH or epi grad major, #; SP–5340, 5452, epi MPH or epi grad major, #)
Community, school-based, and work-site trials and trials involving randomization of other identifiable groups to study conditions. Experimental and quasi-experimental designs and threats to their validity.

PubH 5394. Mass Communication and Public Health. (2 cr; SP–[Pub hlth or Jour] grad student or #; [background or coursework] in [social or behavioral] science recommended)
Role, functions, effects of mass media on public health. Planned/unplanned effects. Review of literature on how theories, models, assumptions of mass communication research relate to public's health.

PubH 5395. Obesity and Eating Disorders. (2 cr; QP–Grad or professional school student or #; SP–Grad or professional school student or #)
Definition, measurement, and prevalence; social, behavioral, physiological causes; health consequences; treatment, prevention.

PubH 5398. Public Health Policy as a Prevention Strategy. (2 cr; QP–[Epi or che or pub hlth nutr MPH or epi] grad student or #; SP–[CHE or MCH or PubH Nutr or Epi MPH or Epi] grad student or #)
Philosophical, ethical, economic, political, efficacy rationale for policy approach to prevention. Historical/current application of prevention policy to public health problems.

PubH 5399. Seminar: Topics in Epidemiology. (1-4 cr; SP–Epi MPH or epi grad major or #)
One or more topics of current interest.

PubH 5414. Biostatistical Methods I. (3 cr; QP–§5450; pub hlth or hlth sci grad student or #; SP–§5450; pub hlth or hlth sci grad student or #)
Descriptive statistics, graphical methods. Use of Excel. Proportions, relative risk, odds ratios. Random sampling. Estimates of mean, medians, measures of variability. Normal distribution, t-/chi-square tests. Confidence intervals. Correlation/regression. Inference/causality.

PubH 5415. Biostatistical Methods II. (3 cr; SP–PubH 5414)
Statistical computing using SAS. Multiple regression. Data transformations. Relative risk, odds ratio estimation. Logistic regression. Survival analysis. Kaplan-Meier tables, survival curves.

PubH 5420. Statistical Computing I: Using Statistical Packages. (1 cr; QP–[[5450 or ¶5450], hlth sci grad student] or #; SP–Health science grad student or #)
Use of SAS for analysis of biomedical data. Data manipulation, description. Basic statistical analyses (t-tests, chi-square, simple regression).

PubH 5421. Statistical Computing II: Advanced Computational and Graphical Methods. (2 cr; QP–5465, C or FORTRAN or #; SP–5465, C or FORTRAN or #)
UNIX-workstation-based computing and graphical methods for biostatistical analysis. Linear systems, numerical integration and differentiation, optimization, Monte Carlo methods, design and analysis of simulation studies. Familiarity with a programming language (preferably C or FORTRAN) is assumed.

PubH 5450. Biostatistics I. (4 cr; QP–[[Math 1111 or Math 1201], hlth sci grad student] or #; SP–[[Math 1111 or Math 1201], hlth sci grad student] or #)
Basic descriptive statistics/graphics. SAS computing, normal distribution. Correlation and simple linear regression. Inference, causation, observational studies versus experiments, Central Limit Theorem, confidence intervals, hypothesis testing. Two-way tables and odds ratios. t-test. Type I and Type II errors. Multiple regression. One-way ANOVA and nonparametric tests.

PubH 5452. Biostatistics II. (4 cr; QP–[5450, competence in SAS through 5420] or equiv or grade of at least B in [5414, 5415]; SP–[5450, competence in SAS through 5420] or equiv or grade of at least B in [5414, 5415])
Two-way ANOVA, interactions, repeated measures, general linear models. Logistic regression for cohort and case-control studies. Log linear models, contingency tables, Poisson regression, survival data, Kaplan-Meier methods, proportional hazards models.

PubH 5456. Proseminar for the Biostatistician. (2 cr; QP–5466, biostats major or #; SP–5466, biostats major or #)
Professional roles and responsibilities of the practicing biostatistician as consultant and collaborator in health sciences research.

PubH 5462. Clinical Trials: Design, Implementation, and Analysis. (3 cr; QP–5452 or 5466 or #; SP–5452 or 5466 or #)
Introduction to and methodology of randomized clinical trials: design issues, sample size, operational details, interim monitoring, data analysis issues, and overviews.

PubH 5465. Biostatistics: Regression. (4 cr; QP–§5450, §5452; [[Stat 5101 or ¶Stat 5101], biostats major] or #; SP–§5450, §5452; [[Stat 5101 or ¶Stat 5101], biostats major] or #)
T-tests, confidence intervals, power, type I/II errors. Exploratory data analysis. Simple linear regression, regression in matrix notation, multiple regression, diagnostics. Ordinary least squares, violations, generalized least squares, nonlinear least squares regression. Introduction to General linear Model. SAS and S-Plus used.

PubH 5466. Biostatistics: ANOVA and Design. (4 cr; QP–§5450, §5452; [[Stat 5102 or ¶Stat 5102], biostats major] or #; SP–§5450, §5452; 5465, [[Stat 5102 or ¶Stat 5102], biostats major] or #)
Single factor ANOVA, diagnostics, classical non-parametrics, multifactor ANOVA, multiple comparisons, power and sample size determination, calculating expected mean squares, random/mixed effects models. ANOVA in regression notation. Randomized block designs, nested designs, repeated measures designs, cross-over designs. SAS and S-Plus used.

PubH 5467. Analysis of Categorical Data. (3 cr; QP–[5466 or ¶5466 or equiv], Stat 5101; SP–[5466 or equiv], Stat 5102)
Contingency tables, odds ratio, relative risk, chi-square tests, log-linear models, logistic regression, conditional logistic regression, Poisson regression, matching, generalized linear models for independent data. SAS/S-Plus used throughout.

PubH 5470. Topics in Biostatistics. (1-4 cr; QP–#; SP–#)
Special topics for graduate students.

PubH 5494. Biostatistics Master's Project. (1-3 cr [max 3 cr]; QP–#; SP–#; S-N only)
Directed study toward completion of a master's or Plan B project in biostatistics.

PubH 5501. Fundamentals of Clinical Research. (3 cr; SP–Clinical research student or #)
Concepts of clinical research design/implementation. Concepts that aid in applied investigation in epidemiology/biostatistics.

PubH 5502. Clinical Research Literature Review Seminar. (1 cr; SP–Clinical research grad student or #)
Students review clinical research literature, critique: hypotheses/goals, methodology of population selection, study design, subject measurement.

PubH 5503. Clinical Research Project Seminar. (2 cr; SP–[5502, clinical research grad student, master's project/thesis paper [underway or near completion]] or #)
Students to present their master's project/thesis, give/receive feedback.

PubH 5510. Topics in Clinical Research. (1-8 cr [max 8 cr]; SP–Clinical research masters or #)
Topics in clinical research.

PubH 5515. Directed Study in Clinical Research. (1-8 cr [max 8 cr]; SP–Clinical research grad student, #)
Directed research or independent study or field practice in clinical research.

PubH 5517. Readings in Clinical Research. (1-8 cr [max 8 cr]; SP–Clinical Research grad student, #)
Current readings in clinical research.

PubH 5605. Reproductive and Perinatal Health. (2 cr; QP–Pub hlth or grad student or #; SP–Pub hlth or grad student or #; A-F only)
Issues, programs, services, and policies. Social, cultural, psychological, physiologic, environmental, economic, and political factors that affect reproductive health, pregnancy, and childbearing.

PubH 5606. Health of Children. (2 cr; QP–Pub hlth or grad student or #; SP–Pub hlth or grad student or #)
Overview of public health issues related to children in the United States. Focus on identifying and planning effective public health strategies, policies, and programs to improve the health of infants and children.

PubH 5607. Adolescent Health: Issues, Programs, and Policies. (2 cr; QP–Pub hlth or grad student or #; SP–Pub hlth or grad student or #)
Major public health issues of adolescents in the United States. Emphasis on prevention and health promotion strategies and on effectiveness of programs and policies.

PubH 5610. Principles of Maternal and Child Health. (2 cr; QP–Pub hlth or grad student or #; SP–Pub hlth or grad student or #)
For MCH students and others interested in learning about the needs of children and families. Examines MCH activities in the context of "Healthy People 2000," including the history and organization of programs, policies, and advocacy activities.

PubH 5613. Chronic Illness and Disability in Childhood: Principles, Programs, and Policies. (2 cr; QP–Pub hlth or grad student or #; SP–Pub hlth or grad student or #)
Principles, policies, programs, and practices for identifying and meeting the needs of children and adolescents with chronic health conditions and of their families. Skills emphasized: needs assessment, program development/evaluation, family empowerment, interdisciplinary team building, integrated/coordinated service delivery, advocacy.

PubH 5614. Field Experience in Maternal and Child Health. (2-4 cr; QP–Mch major, #; SP–Mch major, #; S-N only)
Field experiences selected by student to meet career goals.

PubH 5622. Women's Health: Issues and Controversies. (3 cr; QP–Sr or grad or professional school student preferred; SP–Sr or grad or professional school student preferred.)
Women's health concerns, health status, and health care today. Historical, socioeconomic, and gender perspectives; public health principles; access parameters; and multidisciplinary aspects. Roles of women as consumers and providers.

PubH 5627. Sexuality Education: Criteria, Curricula, and Controversy. (1 cr; SP–Prefer public health student or grad student or professional in public health or in education; 5 seats reserved for UC students)
Issues/controversies affecting K-12 sexuality education. Current research/guidelines for effective, responsible education and curricula selection. Various curricula being used in the United States. Challenges in teaching sensitive issues inherent in sexuality education.

PubH 5628. Seminar: Race, Class, and Family Formation. (1 cr; SP–Public health student or grad student or #; S-N only)
Impact of race/class on family formation, family dynamics, and family resiliency/maintenance. Explores whether traditional approaches in family intervention are effective among individuals who are not engaged in traditional social institutions.

PubH 5630. Research Methods in the Health Assessment of Women and Children. (2 cr; QP–Pub hlth or grad student, 5330 or ¶5330 or #; SP–Pub hlth or grad student, 5330 or ¶5330 or #; A-F only)
Elements essential for evaluating and conducting research on health of women and children, including hypothesis generation, development of study design, variable operationalization and measurement, selection of analytic models, and dissemination of results.

PubH 5631. Program Evaluation in Maternal and Child Health. (2 cr; QP–§5852; 5623 or 5806 or #, mch or pha major or #; SP–Research course, mch or pha major or #)
Introduction to models and applications of program evaluation in public health; design strategies and methods for collecting and analyzing evaluative information; and consideration of social context and ethical and political forces that shape evaluation design, implication, and utilization.

PubH 5633. Qualitative Research Methods. (2 cr; QP–Pub hlth or grad student, 5806 or 5631 or #; SP–Pub hlth or grad student, 5806 or 5631 or #)
Overview of qualitative methods used in research and evaluation; emphasis on public health issues of children, youth, families, and communities. Understanding the application of qualitative methods and developing data analysis skills.

PubH 5634. Advocating for Change for Children. (2 cr; QP–Pub hlth or grad student or professional in [pub hlth or ed]; SP–Pub hlth or grad student or #)
Strategies for changing systems, building skills in public policy research, information/perception management, coalition building, personal persuasion, advocacy.

PubH 5639. Prevention: Theory, Practice, and Application in Public Health Service. (3 cr; QP–Grad or professional school student or professional in hlth-related discipline preferred; SP–Grad or professional school student or professional in hlth-related discipline preferred)
Current issues and controversies around prevention and how it relates to health services. History, prevention as an idea, terminology, lifestyle intervention, programs and legislative issues, education, roles and implications for societal action.

PubH 5640. Public Health and Medical Care Organization. (2 cr; QP–Pub hlth or grad student or #; SP–Pub hlth or grad student or #)
Structure and operation of public health and medical care systems in the United States; determinants of community health and characteristics of successful interventions, particularly with high risk children, youth, and families.

PubH 5645. Families and Health: An Ecosystems Approach. (2 cr; QP–Pub hlth or grad student or #; SP–Pub hlth or grad student or #)
Interrelationships between individual, family, and community health. Family theories and research and the impact of the sociocultural context, public policies, and community structures on health. Primary and secondary prevention strategies for promoting family health.

PubH 5647. Independent Study in Maternal and Child Health. (1-5 cr; QP–Pub hlth or grad student, #; SP–Pub hlth or grad student, #)
Independent study with direction from a maternal and child health faculty member.

PubH 5648. Topics in Maternal and Child Health. (1-4 cr [max 5 cr]; QP–#; SP–#)
New course offerings.

PubH 5649. Maternal and Child Health Master's Project. (2-3 cr; QP–Mch major, #; SP–Mch major, #; S-N only)
Students work with their adviser to complete one of three types of master's projects: research, critical literature review, technical report.

PubH 5650. Teenage Pregnancy and Parenting: Models for Intervention. (1 cr)
Understanding adolescent pregnancy, parenting, and sexual decision making from developmental and public health perspectives. Critical examination of best prevention practices, programs and policies for individual counseling, school-based interventions, youth-serving community organizations, and government.

PubH 5651. Critical Reading of Scientific Literature in Adolescent Health. (1 cr; QP–Pub hlth or grad student, 5414 or 5450 or equiv or #; SP–Pub hlth or grad student, 5414 or 5450 or equiv or #)
Critical examination of empirical research in adolescent health across disciplines. Enhances skills in understanding theory, methods, measurement, sampling design, statistical analysis, structure of research articles, peer review process, and ethical responsibilities of researchers in reporting research findings.

PubH 5654. Adolescent Sexual Identity: Teen Risk and Professional Responsibility. (1 cr; QP–Professional in pub hlth or medicine or ed or soc work or counseling or youth service; SP–Professional in pub hlth or medicine or ed or soc work or counseling or youth service)
Issues that gay, lesbian, and bisexual adolescents and their families face in coming to terms with sexual orientation. Helpful ways to work with this hidden population and their families. One-day workshop.

PubH 5655. Sexual Orientation Issues for Adolescents. (2 cr; QP–Baccalaureate degree or employment in ed or hlth or soc service field; SP–Baccalaureate degree or employment in ed or hlth or soc service field)
Adolescent sexual orientation from perspective of individual identity; impact of the community and response of the community toward gay, lesbian, bisexual, and transgender youth; and interventions/roles of professionals in the school and community.

PubH 5661. Community Organizing for Public Health. (2 cr; QP–Pub hlth or grad student or #; SP–Pub hlth or grad student or #)
Introduces students to principles of community organizing and identifies challenges and strategies for public health professionals engaged in community organizing. Decreasing barriers to community participation; encouraging leadership; building coalitions and alliances; sustaining community organizing efforts.

PubH 5663. Cross-Cultural Health Issues. (2 cr; QP–Pub hlth or grad student or #; SP–Pub hlth or grad student or #)
Health issues and "health culture" of ethnic communities in Minnesota, including Hmong, Hispanic, African American, and Native American. Cultural factors that influence health and health services.

PubH 5693. Grant Writing for Public Health. (1 cr; QP–Mch or pha major or #; SP–Mch or che or pubh nutr or epi major or #)
Hands-on workshop. Focuses on children, youth, and families. Identifying successful elements of a grant application. Grant review process. Critiquing a grant. Writing an application.

PubH 5700. Foundations of Public Health Administration Practice. (2 cr; QP–Pha major or #; SP–Pha major or #)
Planning, organization, and administration of public health agencies at the state level; how these agencies function in relation to public health at federal and local levels. Interaction with practicing public health administrators and specialists.

PubH 5701. Public Health Administration. (2 cr; QP–Pha major or #; SP–Pha major or #)
Issues, administrative problems, activities, structure, organization, supervision, and direction of state, local, federal, and nonprofit public health agencies.

PubH 5702. Policy Issues in Public Health Administration. (2 cr; QP–Pha major or #; SP–Pha major or #)
Policy development and implementation in public health-related agencies and organizations.

PubH 5705. Community Health Assessment. (2 cr; QP–[Grad epi course, [pha or mch] major] or #; SP–[Grad-level epidemiology course, [public health or grad] student] or #)
Two of three core functions of public health: health assessment, assurance. Lectures, group activities, individual presentations.

PubH 5708. Analysis of Administrative Data. (3 cr; SP–Public health or grad student or #)
How to use data for various research designs. Origin, quality, strengths, limitations of data. Files based on Medicare/Medicaid data are used for hands-on learning. Emphasizes broad concepts/skills.

PubH 5711. Public Health Law. (2 cr; QP–Pub hlth student or #; SP–Pub hlth student or #)
Basic concepts of the law, legislative process, legal bases for the existence and administration of public health programs, legal aspects of current public health issues and controversies, and regulatory role of government in the health services system.

PubH 5720. Management Communication. (2 cr; QP–Pha major; SP–Pha major)
Role of communication in health services administration. Emphasis on development of skills in presentational speaking, interviewing, and written communications. Case study analysis of communication problems in public health organizations.

PubH 5724. The Health Care System and Public Health. (3 cr; SP–Public health or grad student or #)
Overview of health care delivery, finance systems within public health context. Components of health care system: financing, role of employers/public programs, health care delivery system, managed care. Collaborative interventions between managed care, public health.

PubH 5726. Medical Device Industry: Business and Public Policy. (3 cr; SP–Public health or grad student or #)
Business, public policy, regulatory, technology management issues concerning medical device/biotechnology industries. Nature/effects of private-public sector interactions. Involvement by leaders in Minnesota organizations.

PubH 5727. Health Leadership and Effecting Change. (2 cr; QP–Pub hlth or grad student or #; SP–Pub hlth or grad student or #)
Applications of a broad theoretical base in planned change to solve managerial and organizational problems in students' future roles as leaders in the health professions.

PubH 5729. Seminar on Medical Ethics. (2 cr; SP–4xxx or 5xxx ethics course or #)
Patients' rights/duties, informed consent, confidentiality, ethical issues in medical research, initiation/termination of medical treatment, euthanasia, abortion, maternal/fetal conflicts, allocation of medical resources.

PubH 5731. Public Health Program Planning and Grant Writing. (3 cr; QP–Pha or mch major or #; SP–Pha or mch major or #)
Provides knowledge and skills necessary for planning health promotion and disease prevention programs and writing grants to fund these programs. Uses PRECEDE-PROCEED Model as a framework for program planning.

PubH 5733. Interventions for Health of Populations. (3 cr; QP–§Nurs 8040; 5330 or #; SP–§Nurs 8601; 5330 or #)
Synthesis of life cycle developmental approach and public health perspective with nursing and behavior change conceptual models to develop intervention models that are effective in addressing priority public health problems across the life span.

PubH 5735. Public Ethics/Politics and Public Health. (2 cr; QP–Pub hlth or grad student or #; SP–Pub hlth or grad student or #)
Systematic examination of ethical/value aspects related to decision making in public health interventions. Responsibilities of the state in relation to health, politics as public ethics, and distributive justice in a pluralistic society.

PubH 5740. Organizational Behavior. (2 cr; QP–Pha major or #; SP–Pha major or #)
Human behavior in organizations; motivation, leadership, influence of organizational structure, informal group behavior, interpersonal relations, supervision. Preventing and solving problems among individuals and groups in organizations.

PubH 5742. Ethics in Public Health: Practice, Policy, and Research. (2 cr; SP–Public health or grad student or #)
Basic skills of ethical analysis. Recognizing, researching, analyzing issues arising in public health and in public health research.

PubH 5743. Ethics in Health Care Administration. (2 cr; QP–Pha major or MHA or #; SP–Pha major or MHA or #)
Ethical perspectives in managing health-care organizations, components of decision-making framework, applying framework to selected ethical issues, institutional mechanisms for dealing with ethical problems.

PubH 5751. Principles of Management in Health-Services Organizations. (2 cr; SP–[Grad or professional school] student)
Role of health-care services administrators, principles of management, administrative process. Lectures, case studies.

PubH 5759. Health-Care Financial Management (Private Sector Emphasis). (3 cr; QP–5756, 5757, pha major or MHA student or #, knowledge of computerized spreadsheets; SP–5756, 5757, pha major or MHA student or #, knowledge of computerized spreadsheets)
Basic principles of corporate finance and selected insurance concepts integrated and applied to health care with private sector emphasis. NPV; CAPM; capital and operating budgets; Medicare PPS and RBRVS; risk-adjusted capitation; health-care reform.

PubH 5770. Topics: Hospital and Healthcare Administration. (2 cr; SP–#; S-N only)
Selected readings in hospital/health care administration. Discussions based on readings.

PubH 5771. Health-Care Financial Management (Public Sector Emphasis). (3 cr; QP–3-cr college-level accounting course or #; knowledge of computerized spreadsheets recommended; SP–2-cr college-level accounting course or #; knowledge of computerized spreadsheets recommended)
Basic principles of finance and selected insurance concepts integrated and applied to health care with public sector emphasis. NPV; public financing; capital and operating budgets; Medicare PPS and RBRVS; risk-adjusted capitation; health-care reform.

PubH 5777. Master's Project: Public Health Administration. (3 cr; QP–Pha major, #; SP–Pha major, #; S-N only)
Major research paper to fulfill the master's project requirement.

PubH 5780. Topics: Public Health Administration. (2-3 cr; QP–Pha major or #; SP–Pha major or #)
Topics of interest to public health administration students, or new public health administration courses.

PubH 5790. Sociology of Medicine and Health Care: An Introduction to Medical Sociology. (3 cr; QP–§Soc 5855; SP–§Soc 5855)
Social and psychological components of health and medical care. Organization and delivery of health-care services, their problems and perspectives; focus on patient, care provider, and environment within which health-care services are dispersed.

PubH 5791. Independent Study: Public Health Administration. (1-8 cr [max 8 cr]; QP–Pha major, #; SP–Pha major, #)
Independent study, under tutorial guidance, of selected problems and current issues.

PubH 5796. Field Experience: Public Health Administration. (3 cr; QP–Pha major, #; SP–Pha major, #; S-N only)
Supervised field experience at a management level in selected community or public health agencies and institutions.

PubH 5801. Principles of Research and Program Evaluation. (4 cr; QP–Pub hlth or grad student or #; SP–Pub hlth or grad student or #)
Introduction to research in public health, including formulation of research question, methodological design, sampling designs, data collection techniques, instrument validity and reliability, role of statistical analysis, and ethics.

PubH 5806. Principles of Public Health Research. (2 cr; QP–Pub hlth or grad or professional school student or #; SP–Pub hlth or grad or professional school student or #)
Evaluation of public health research literature and planning for independent research projects. Formulation of research question, research design, sampling techniques, use of research concepts, and data analysis. Data collection techniques, including questionnaires, interviews, and data analysis.

PubH 5812. Managed Care. (3 cr; QP–Pha or hsrp&a major or MHA student or #; SP–Pha or hsrp&a major or MHA student or #; A-F only)
Development and organization of HMOs; risk sharing; provider contracts; utilization management; quality improvement; marketing and new product development; employer relations; Medicare and Medicaid contracting; budgeting; financial performance; pricing; regulation.

PubH 5852. Program Evaluation in Health and Mental Health Settings. (3 cr; QP–#; SP–#)
Overview of evaluation, models of evaluation, objectives of an evaluative study, sampling of subjects, methods of data collection, methodological designs, interpretation of data, preparation of final report, and ethical and political considerations.

PubH 5861. Health Insurance. (2 cr; QP–Microecon theory course or #; SP–Microecon theory course or #; A-F only)
Financing personal health care: theory of insurance, health insurance markets, cost sharing, HMOs, PPOs, public and catastrophic health insurance, and the uninsured. Emphasis on public policy.

PubH 5862. Cost-Benefit, Cost-Effectiveness, and Decision Analysis in Health Care. (3 cr; QP–Intermediate econ course; SP–#; introductory econ course recommended)
Government regulations. New technologies. Diagnosis/treatment protocols. Strengths, limitations, appropriateness of different approaches.

PubH 5863. Understanding Health-Care Quality. (2 cr)
Introduction to assessing and assuring quality of care. Emphasizes both process and outcomes approaches, paralleling interest in the appropriateness and effectiveness of care. Issues around creating needed behavioral changes.

PubH 5864. Conducting Health Outcomes Research. (3 cr; SP–Intro crse in [epidemiology or health services research methods] or #)
Major concepts/principles in conducting health outcomes research that evaluates medical care. Developing study designs matched to research questions. Frequently used study designs. Evaluating health outcomes. Analytical approaches.

PubH 5870. Survey Research and Sample Design in Health-Services Research. (2 cr; A-F only)
General, technical, and theoretical context of survey research in health-services research. Survey and sample design issues, with extensive use of case examples.

PubH 5871. Managing Health Information. (3 cr; SP–Grad student or public health student or #)
Sources/types of health information, their quality. Relational database methods for organizing/using information. SAS/SQL skills necessary to manage information data.

PubH 5881. Topics in Health-Services Research and Policy. (1-4 cr [max 16 cr]; QP–#; SP–#)
New course offerings, selected readings, or individualized directed instruction.

PubH 5893. Economics of the Health-Care System. (3 cr; QP–Microecon theory course or #; SP–Microecon theory course or #; A-F only)
Economic analysis of U.S. health-care sector, emphasizing problems of pricing, production, and distribution. Health-care services as one factor contributing to nation's health.

PubH 5894. Health-Services Policy. (2 cr; QP–Pha or hsrp&a major or MHA or pub aff student or #; SP–Pha or hsrp&a major or MHA or pub aff student or #)
Social, political, and economic context within which U.S. health-care system developed; influence of these contextual elements on public policies guiding and regulating organization and delivery of health services.

PubH 5900. Public Health Nutrition: Principles and Programs. (2 cr; QP–Pub hlth nutr major or #; SP–Pub hlth nutr major or #)
Principles of public health nutrition, roles and functions of public health nutritionists, programs and delivery mechanisms for promoting nutritional status of populations. Students explore their beliefs and competencies in relation to principles and philosophy of public health nutrition.

PubH 5902. Maternal and Infant Nutrition. (2 cr; QP–3xxx nutr course or equiv or #; SP–3xxx nutr course or equiv or #)
Nutritional needs of childbearing women and of infants. How to meet these needs through programs/services.

PubH 5905. Human Nutrition and Health. (2 cr; QP–Jr or sr or grad or professional school student; SP–Jr or sr or grad or professional school student)
Broad range of nutrition topics of contemporary interest. Concepts and facts about science of human nutrition in relation to personal and community nutrition problems and concerns. Applied, introductory graduate-level course with labs.

PubH 5906. Field Experience: Public Health Nutrition. (1-8 cr [max 10 cr]; QP–Pub hlth nutr major; SP–Pub hlth nutr major; S-N only)
Placement in an approved agency with opportunity for experience in nutrition-related activities of public health programs.

PubH 5907. Assessment of Dietary Intake. (1 cr; QP–Pub hlth nutr major or #; SP–Pub hlth nutr major or #)
Methods for assessing dietary intake of populations and individuals; appropriate uses of dietary assessment methods in public health, clinical, and research settings; evaluation and interpretation of dietary data.

PubH 5908. Anthropometric Assessment of Nutritional Status. (1 cr; QP–5450 or 5414 or equiv, grad or professional school student; SP–5450 or 5414 or equiv, grad or professional school student)
Anthropometry as used to assess nutritional status; training and experience in taking basic measurements; practical experience in anthropometry; conceptual rationales and interpretation of anthropometric data.

PubH 5909. Topics: Public Health Nutrition. (1-12 cr [max 12 cr]; QP–Pub hlth nutr major or #; SP–Pub hlth nutr major or #)
Independent study with faculty guidance in research topic.

PubH 5910. Critical Review of Research in Public Health Nutrition. (1 cr; QP–Pub hlth nutr or mch major, grad-level course each in research, biostats, epi or #; SP–Pub hlth nutr or mch major, grad-level course each in research, biostats, epi or #)
Applying principles of nutrition, epidemiology, and biostatistics to evaluate scientific research on topics of

significance in public health nutrition. Interactive seminar format with lecture, discussion, and student presentations.

PubH 5911. Biochemical Assessment. (1 cr; QP–Grad or professional school student, 5450 or 5414 or equiv or #; SP–Grad or professional school student, 5450 or 5414 or equiv or #)
Use of biochemical measurements for evaluation of nutritional status. Biochemical measurement methods, data analysis, and application of reference data; protein, vitamin, and mineral status.

PubH 5914. Community Nutrition Intervention. (3 cr; QP–Grad or professional school student or #; SP–Grad or professional school student or #)
Nutrition intervention strategies used in health programs. Selecting appropriate strategies, applying them to specific target audiences, and evaluating their usefulness in relation to program objectives.

PubH 5919. Public Health Nutrition Master's Research Project. (1-6 cr; QP–Pub hlth nutr major or #; SP–Pub hlth nutr major or #)
Independent research.

PubH 5920. Public Health Aspects of Nutrition Policy. (2 cr; QP–Pub hlth nutr or che or epi MPH or epi or nutr grad major or #; SP–Pub hlth nutr or che or epi MPH or epi or nutr grad major or #)
Nutrition policy formulation and effects on public health. Role of policy approaches in context of nutrition; how these approaches differ from other prevention strategies.

PubH 5929. Independent Study in Public Health Nutrition. (1-8 cr [max 8 cr]; SP–[Pub hlth nutrition or nutrition] grad student, #)
Arranged with public health nutrition faculty member.

PubH 5932. Nutrition: Adults and the Elderly. (2 cr; QP–Grad or professional school student or #; SP–Grad or professional school student or #; A-F only)
Current literature and research on nutrition needs and factors affecting nutritional status of adults and the elderly.

PubH 5933. Nutrition: Health/Disease Relationships. (2 cr; QP–5330, FScN 5622 or MdBc 5201 or equiv or #; SP–5330, FScN 5622 or MdBc 5201 or equiv or #)
Issues in nutrition and public health; biological and epidemiologic bases for public health dietary recommendations. Relation of nutrition to heart disease, cancer, hypertension, obesity, and other conditions.

PubH 5935. Child and Adolescent Nutrition. (2 cr; QP–Grad or professional school student or #; SP–Grad or professional school student or #)
Current issues and literature. Major nutrition issues of youth; biological, cultural, and psycho-social factors influencing food behaviors; and strategies for improving nutritional health.

PubH 8100. Topics in Environmental and Occupational Health Research. (1-6 cr [max 20 cr]; SP–#; S-N only)
Selected readings and discussion of research topics.

PubH 8101. Research: Environmental and Occupational Health. (1-6 cr [max 6 cr]; SP–Eh grad or MPH major)
Opportunities to pursue research in environmental and occupational stresses on human health.

PubH 8120. Occupational Injury Epidemiology and Control Program (OIECP) Research Seminar. (1 cr [max 12 cr]; QP–5120, 5320, 5450; SP–Eh grad major, OIEC specialty or equiv, 5120, 5320, 5450 or #)
Facilitates student research efforts in occupational injury epidemiology and control through roundtable discussions and interdisciplinary involvement.

PubH 8140. Validity Concepts in Epidemiologic Research. (2 cr; QP–5320, 5340 (with grade of B or better), 5452; SP–5320, 5340 (with grade of B or better), 5452)
In-depth examination of conceptual basis for validity in observational epidemiologic research. Recognizing, evaluating, preventing, and correcting for confounding specification error, measurement-error bias, and selection/follow-up bias.

PubH 8160. Advanced Toxicology. (2 cr [max 12 cr]; QP–One course each in biochem and molecular biol, 5160; SP–One course each in biochem and molecular biol, 5160 or #)
Cellular and molecular mechanisms by which xenobiotics cause toxicity; investigative approaches to current research problems in toxicology and carcinogenesis. Apoptosis, cell cycle regulation, genetic toxicology, molecular mechanisms of chemical carcinogenesis, and genetic basis for susceptibility to environmental toxicants.

PubH 8161. Current Literature in Toxicology. (1 cr [max 3 cr]; SP–5104; S-N only)
Modern methods in toxicology, critical thinking skills. Topics vary each semester. Students read/discuss toxicological literature.

PubH 8170. Advanced Industrial Hygiene Applications. (2 cr; QP–5170; SP–5170, eh grad major; A-F only)
Recognition, evaluation, and control of occupational health and safety hazards; application of concepts to specific industrial hygiene problems related to gases/vapors, aerosols, physical agents.

PubH 8330. Research in Epidemiology. (1-8 cr [max 12 cr]; SP–[Epi grad student or MPH major], #)
Research through School of Public Health/cooperating organizations.

PubH 8331. Field Practice in Epidemiologic Investigations. (1-8 cr [max 10 cr]; SP–[Epi grad student or MPH major], #; S-N only)
Supervised participation in epidemiologic investigations under auspices of health agencies or faculty of School of Public Health.

PubH 8332. Readings in Epidemiology. (1-4 cr [max 12 cr]; SP–[Epi grad student or MPH major], #)
Readings in current research articles.

PubH 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

PubH 8350. Advanced Epidemiologic Theory. (2 cr; SP–Epi Ph.D. major or #; S-N only)
Integrates concepts from PubH 5330, 5340—Epidemiology I, II. Critical discussion of current theoretical paradigms of epidemiology, philosophy of causal inference in epidemiology, and estimation of causal parameters.

PubH 8377. Seminar: Chronic Disease and Behavioral Epidemiology. (1 cr [max 2 cr]; SP–Epi grad major or #; S-N only)
Readings, presentations, classroom discussions, and exercises provide experience in epidemiologic research methods in chronic diseases and behaviorally based diseases other than infectious and cardiovascular diseases and cancer.

PubH 8378. Advanced Seminar in Epidemiology. (1-3 cr [max 12 cr]; SP–Epi grad major or #; S-N only)
Discussion of one or more major research areas of current interest.

PubH 8379. Seminar in Epidemiology. (2 cr; SP–Epi grad or MPH major or #; S-N only)
Discussion of selected current problems.

PubH 8388. Special Topics and Issues in Epidemiology. (1 cr [max 3 cr]; SP–Epi grad major or #; A-F only)
Intensive three-week immersion experience in study of epidemiologic topics and issues not treated in regular Ph.D. courses. Students explore emerging issues with faculty members who are developing or expanding a specific research area.

PubH 8389. Seminar: Topics in Epidemiology. (3 cr; SP–Epi grad or epi or che MPH major or #)
Current theoretical measurement and research issues. Topics drawn from infectious and chronic disease epidemiology, epidemiologic methodology, and biostatistical applications.

PubH 8390. Teaching Practicum in Epidemiology. (2 cr; SP–Epi grad major or #; S-N only)
Instruction and hands-on experience in teaching methods at the graduate level.

PubH 8420. Survival Analysis. (3 cr; QP–5466 or equiv, Stat 5102; SP–5466 or equiv, Stat 5102)
Statistical methodologies in analysis of survival data, including Kaplan-Meier estimator, Cox's proportional hazards multiple regression model, time-dependent covariates, analysis of residuals, and multiple failure outcomes. Typical biomedical applications, including clinical trials and person-years data.

PubH 8422. Modern Nonparametrics. (2 cr; QP–5466, Stat 5102; SP–5466, Stat 5102, MPH or grad student or #)
Classical nonparametric inference, exact tests and confidence intervals, robust estimates, the jackknife, bootstrap and cross-validation, nonparametric smoothing and classification trees. Variety of models and applications; formal development sufficient for understanding statistical structures and properties. Substantial computing.

PubH 8429. Probability Models for Biostatistics. (3 cr; QP–8420, 8421, Stat 5102; SP–8420, 8421, Stat 5102, advanced biostats or stats major or #)
Three basic models used for stochastic processes in the biomedical sciences: point processes (with emphasis on Poisson processes), Markov processes (with emphasis on Markov chains), and Brownian motion. Probability structure and statistical inference studied for each process.

PubH 8430. Sequential Analysis. (2 cr; QP–8420, 8429, Stat 5102; SP–8420, 8429, Stat 5102, advanced biostats or stats major or #)
Probability theory underlying sequential analysis, including stopping times, Brownian motion, comparison of frequentist and Bayesian approaches. Biomedical applications, including monitoring clinical trials, laboratory quality control, sequential design and allocation, inference following sequential design.

PubH 8431. Bayesian Decision Theory and Data Analysis. (4 cr; QP–5421 or programming exper with FORTRAN or C and S+, Stat 5102, Stat 8311; SP–5421 or programming exper with FORTRAN or C and S+, Stat 5102, Stat 8311, advanced biostats or stats major or #)
Bayes and empirical Bayes methods in a decision-theoretic framework for biostatistical analysis, including advanced data analytic and computing issues.

PubH 8433. Advanced Longitudinal Data Analysis. (3 cr; QP–[Stat 5101, Stat 8311, experience with [SAS or S+], advanced [biostat or stat] student] or #; SP–[Stat 5101, Stat 8311, experience with [SAS or S+], advanced [biostat or stat] student] or #)
Methods of inference for outcome variables measured repeatedly in time or space. Linear/nonlinear models with either normal or non-normal error structures. Random effects. Transitional/marginal models with biomedical applications.

PubH 8434. Advanced Survival Analysis. (2 cr; QP–8420, 8429, Stat 5102; SP–8420, 8429, Stat 5102, advanced biostats or stats major or #)
Martingale methods and counting process theory as applied to survival data, including martingale foundations, statistical tests for comparing survival among groups, Cox proportional hazards model, diagnostics and analysis of residuals, multivariate survival data, and extensions to event history analysis.

PubH 8436. Spatial Biostatistics. (2 cr; QP–8420, 8421, programming exper with statistical computing packages such as BMDP or SAS; SP–8420, 8421, programming exper with statistical computing packages such as BMDP or SAS)
Introduces statistical methodologies for analyzing spatial data. Tests for spatial autocorrelation, spatial prediction through kriging, random spatial processes, and tests for disease clustering.

PubH 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

PubH 8470. Topics in Biostatistics. (1-4 cr; QP–#; SP–#)

PubH 8494. Research in Biostatistics. (1-4 cr; SP–#; S-N only)
Directed research.

PubH 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

PubH 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

PubH 8801. Health-Services Policy Analysis: Theory. (3 cr; SP–Hsrp&a grad major or #; A-F only)
Integrated overview of U.S. health-services policy; theoretical and empirical literature related to this field. Analysis of alternative policy-making models and political and philosophical underpinnings of those models.

PubH 8802. Health Services Policy Analysis: Applications. (2 cr; SP–Hsrp&a grad major or #; A-F only)
Emphasizes relationships between health services research and policy, and uses case studies to examine how research influences policy and vice versa.

PubH 8803. Long-Term Care: Principles, Programs, and Policies. (2 cr; QP–Grad-level health-care policy course; SP–Grad-level health-care policy course or #)
Long-term care policy for functionally impaired persons, particularly the elderly. Team taught from healthcare and social services perspective; grounded in research literature on evidence of program effects. Innovative programs addressing current fragmentation of services.

PubH 8805. Sociology of Health and Illness. (3 cr; SP–Hsrp&a grad major or #; A-F only)
Affect of social structure on health outcomes/behaviors. Current/historical events/issues from perspective of sociological/social psychological theories. Students apply theories to a topic they identify.

PubH 8806. Sociology of Health Occupations and Organizations. (3 cr; SP–Hsrp&a grad major or #)
Sociological theories of occupations/organizations as applied to health care. Functional, conflict, evolutionary theories applied to health care reorganization such as managed care, technology on organization of work/occupations. Emphasizes application of theories to develop hypotheses.

PubH 8810. Seminar: Research Studies in Healthcare. (4 cr; QP–Stat 5121, Stat 5122, Stat 5302; SP–Hsrp&a grad major or Stat 4101, Stat 4102, Stat 5302 or #; A-F only)
Review and appraisal of design, measurement, analysis, and findings of contemporary studies.

PubH 8811. Research Studies in Healthcare. (3 cr; QP–8810; SP–8810 or #; A-F only)
Research methods commonly used in analysis of health services research and health policy problems.

PubH 8813. Measurement of Health-Related Social Factors. (3 cr; QP–Intro stat course, understanding of simple correlations; SP–Intro stat course, understanding of simple correlations or #; A-F only)
How social factors such as innovativeness, compliance, religiosity, and stress are measured and tested for reliability and validity. Relationships between theory, concepts, variables, data.

PubH 8820. Health Economics I. (3 cr; QP–One course each in intermediate microeconomics, calculus, intro to linear algebra; SP–One course each in intermediate microeconomics, calculus, intro to linear algebra; A-F only)
Application of microeconomic theory to healthcare decisions of consumers and producers under different assumptions about market structure and behavior.

PubH 8821. Health Economics II. (3 cr; QP–8820; SP–8820 or #; A-F only)
Examines application of microeconomic theory to health services research through selected reading from published and unpublished health economics literature.

PubH 8830. Research Project in Health Care. (1 cr; SP–Hsrp&a grad major or #; A-F only)
Development and articulation of a research proposal.

PubH 8831. Research Project in Health Care. (1 cr; QP–8830; SP–8830 or #; A-F only)
Development and articulation of a research proposal.

PubH 8861. Topics in Theory and Principles of Health Services Research, Policy, and Administration. (1-3 cr; SP–Hsrp&a grad major or #)
Topic at discretion of faculty member. Usually students and faculty agree upon an area they feel could enhance the advanced doctoral students educational experience.

PubH 8880. Directed Research. (1-8 cr; SP–Hsrp&a grad major or #)

PubH 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

PubH 8900. Seminar: Advanced Life Cycle Nutrition. (2 cr; SP–Pub hlth nutr or epi MPH or epi or food sci or nutr grad major or #)
Critical evaluations and in-depth discussions of research and research issues in nutrition during various stages of the life cycle. Methodological issues of applied human nutrition investigation, current status of knowledge, and implication of research results for public health policies, programs, and future research.

Radiology (Rad)

Department of Radiology
Medical School

Rad 8100. Gastrointestinal Roentgenology. (1-15 cr)

Rad 8101. Urologic Roentgenology. (1-15 cr)

Rad 8102. Neurological Roentgenology. (1-15 cr)

Rad 8103. Cardiovascular Roentgenology. (1-15 cr)

Rad 8104. Pediatric Roentgenology. (1-15 cr)

Rad 8105. Pulmonary Roentgenology. (1-15 cr)

Rad 8150. Research: Roentgenology. (1-15 cr)

Rad 8200. Nuclear Medicine. (1-15 cr)

Rad 8210. Fundamentals of Nuclear Medicine. (1 cr; SP–1st-yr resident)

Rad 8250. Research: Nuclear Medicine. (1-15 cr)

Rad 8450. Research: Radiation Biology. (1-15 cr)

Rad 8550. Research: Radiological Physics. (1-15 cr)

Recreation, Park, and Leisure Studies (Rec)

School of Kinesiology and Leisure Studies
College of Education and Human Development

Rec 5101. Foundations of Recreation. (3 cr; QP–M.Ed. or grad student or #; SP–M.Ed. or grad student or #; A-F only)
Investigation of the rational, sociological, psychological, and philosophical foundations of the recreational use of leisure in contemporary society. Includes a survey of leisure services.

Rec 5111. Sports Facilities. (3 cr; QP–§Kin 5111; Kin or rec major or #; SP– §Kin 5111; Kin or rec major or #; A-F only)
Steps in planning and building facilities for athletics, physical education, and sport for college, professional, and public use.

Rec 5161. Recreation Land Policy. (3 cr; QP–1500 or 5100 or #; SP–1501 or 5101 or #; A-F only)
Historical development of recreational land policy in the United States and related contemporary issues in policy, management, interpretation, and research.

Rec 5191. Commercial Recreation and Tourism. (3 cr; QP–3550 or #; SP–3551 or #; A-F only)
Scope and development of profit-oriented recreation agencies, including an emphasis on the tourism industry.

Rec 5211. Introduction to Therapeutic Recreation. (3 cr; QP–1520 or ¶5100, rec major or #; SP–1501 or ¶5101, rec major or #; A-F only)
Purposeful intervention; roles of specialist/recreation therapists in meeting cognitive, physical, emotional, social needs of people with disabling conditions through recreation services; roles of specialist/recreation therapists changing societal attitudes toward illness and disability and the self-concepts of individuals with impairments.

Rec 5215. Assess and Monitor Patient/Client Functioning in Recreation Therapy. (3 cr; SP–TR major or academic health professional or #; majors A-F only)
Selecting appropriate techniques/tools, analysis of individual p/c supports/deficits. Monitoring/recording progress in RT and in collaborative services: standard notes; team meetings; on-line reporting for quality assurance, referral, augmentation/termination of services.

Rec 5221. Comprehensive Therapeutic Recreation Services Development and Management. (4 cr; QP–5210 or #, rec major; SP–5211 or #, rec major)
Guided development of written plans including development of protocols and critical pathways, intervention programs/activities, individual treatment plans and standards for appropriate placement of individuals in group intervention, and management of patient/client service delivery, record keeping, and administrative responsibilities.

Rec 5231. Therapeutic Recreation and Diagnostic Groups. (3 cr; QP–5210 or #; SP–5211 or #; A-F only)
Definitions, philosophies, methodologies regarding therapeutic recreation services for persons in diagnostic groups of cognitive, physical, sensory, communication, and psychiatric impairments/disabilities. Lectures, group discussion. Presentations by parents, professionals, and self-advocates. Clinical or community practicum assignment.

Rec 5241. Functional Intervention: Recreation Therapy in Geriatric Care. (3 cr; SP–3541 or 5111 or #; A-F only)
Role of leisure in maintenance of mental, physical, social-emotional health/functioning. Issues relative to prevention of impairment/disability. Rehabilitation, support of vital life involvement, effect on design/delivery of recreation services.

Rec 5271. Community Leisure Services for Persons With Disabilities. (3 cr; QP–1520, rec major, or #; SP–1501, rec major, or #; A-F only)
Exploration and application of concepts and techniques of normalization and least restrictive environment strategies to leisure service delivery in inclusive community settings for a range of individuals with disabilities.

Rec 5288. Grant Writing in Human Services. (3 cr; A-F only)
Identify, develop, and procure financial assistance for programs in human services, including education, recreation, and social programs. Skills and strategies for preparing and evaluating competitive proposals for grant support through federal agencies and private foundations or corporations.

Rec 5301. Wilderness and Adventure Education. (4 cr; QP–3150; A-F only)
Rationale for, methods in applying wilderness/adventure education programs in education, recreation, corporate, human service settings. Emphasizes adventure/wilderness program management.

Rec 5311. Programming Outdoor and Environmental Education. (3 cr; A-F only)
Methods, materials, and settings for developing and conducting environmental and outdoor education programs.

Rec 5461. Foundations of Sport Management. (3 cr; QP–§Kin 5460; kin or rec major or #; SP–§Kin 5461; kin or rec major or #; A-F only)
Theories/techniques in administering/managing sport enterprises. Organizational theory/policy. Practical examples of sport management skills/strategies.

Rec 5511. Women in Sport and Leisure. (3 cr; QP–§Kin 5510; SP–§Kin 5511; A-F only)
Critically examines women's involvement in/contributions to sport, physical activity, and leisure.

Rec 5801. Legal Aspects of Sport and Recreation. (4 cr; QP–3550 or #; SP–§Kin 5801; 3551 or 5461 or #; A-F only)
Legal issues related to recreation, park, and sport programs/facilities with public/private sectors.

Rec 5900. Special Topics: Contemporary Issues in Leisure Services. (1-12 cr [max 12 cr])
Contemporary issues emphasizing administrative and supervisory functions for recreation and allied professionals; individual offerings, to be determined by faculty, focus on special issues and professional groups.

Rec 5981. Research Methodology in Kinesiology and Leisure Studies. (3 cr; QP–§Kin 5980; M.Ed. or grad student or #; SP–§Kin 5981; M.Ed. or grad student or #; A-F only)
Defines and reviews various types of research in exercise and sport science, physical education, and recreation studies. Covers qualitative research, field studies, and methods of introspection as alternate research strategies instead of relying on traditional scientific paradigm.

Rec 5992. Readings: Recreation. (1-3 cr [max 9 cr]; QP–M.Ed. or grad student or #; SP–#)
Independent study under tutorial guidance by a faculty member in leisure studies. Intended as an opportunity to conduct in-depth study and reading on particular topic(s) not covered in regular coursework.

Rec 5995. Problems in Recreation, Park, and Leisure Studies. (1-12 cr [max 30 cr]; QP–M.Ed. or grad student or #; SP–M.Ed. or grad student or #)
Independent study of leisure service programs, systems, facilities, or policies; focus on conduct of recreation programs. Intended for scholarly projects (e.g., library or field research) or demonstration projects in the field of leisure studies and services. Not intended for additional fieldwork, practicum, or programming experience.

Rec 8310. Seminar: Leisure Services. (3 cr; SP–Rec M.Ed. or grad student or #; A-F only)
Critical study and special problems in recreation, park, and leisure services and in therapeutic recreation.

Rec 8320. Seminar: Theoretical Perspectives in Leisure Behavior. (3 cr; QP–5100; SP–5101 or #; A-F only)
Major theoretical paradigms and empirical findings, where appropriate, from leisure studies in particular and social sciences in general.

Rec 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Rec 8390. Seminar: Administrative Problems in Leisure Services and Therapeutic Recreation. (3 cr; QP–3550 or equiv; SP–Rec MEd or grad student or #; A-F only)
Administrative and management issues and problems in leisure services and therapeutic recreation.

Rec 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Rec 8980. Graduate Research Seminar in Recreation, Park, and Leisure Studies. (1-3 cr; SP–5981, EPsy 5261 or #; S-N only)
Analyzing, designing, and reporting on research problems in leisure studies.

Rec 8995. Research Problems in Recreation, Park, and Leisure Studies. (1-4 cr [max 16 cr]; QP–5980; SP–#; S-N only)
Conducting individual scholarly research. Intended for M.A., Ph.D., or other graduate-level students with a major emphasis in recreation, park, and leisure studies. Not for working on an M.A. Plan A or Ph.D. thesis.

Rehabilitation Science (RSc)

Department of Physical Medicine and Rehabilitation

Medical School

RSc 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

RSc 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

RSc 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

RSc 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

RSc 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Religions In Antiquity (RelA)

Department of Classical and Near Eastern Studies

College of Liberal Arts

RelA 5013. Biblical Law and Jewish Ethics. (3 cr; SP–§3013, §JwSt 3013, §JwSt 5013)
Significance of religious law in Judaism. Babylonian background of biblical law. Biblical creation of the person as a legal category. Rabbinic transformations of biblical norms. Covenant in Christianity/Islam. Contemporary Jewish literature/philosophy.

RelA 5070. Topics in Ancient Religion. (3 cr; SP–RelA 3071 or 3072 or 3073 or 5071 or 5073 or any RelS course or #)
Study of a specific aspect of religion in Classical and Near Eastern antiquity such as healing cults, magic and divination, Gnosticism, or prophecy and authority. Topics specified in *Class Schedule*.

RelA 5071. Greek and Hellenistic Religions. (3 cr; SP–§3071, §3171)
Greek religion from the Bronze Age to Hellenistic times. Sources include literature, art, and archaeology. Homer and the Olympian deities; ritual performance; prayer and sacrifice; temple architecture; oracles; death and the afterlife; mystery cults; philosophical religion; Near Eastern salvation religions. Meets with 3071.

RelA 5072. The New Testament. (3 cr; SP–§3072, §3172)
Early Jesus movement in its cultural, historical setting. Origins in Judaism; Jesus traditions. Apostle Paul, his controversies and interpreters. Questions of authority, religious practice, structure; emergence of the canon. Contemporary methods of New Testament study; biblical writings as history and narrative. Meets with 3072.

RelA 5073. Roman Religion and Early Christianity. (3 cr; SP–§3073)
Etruscan, Republican religion. Appeal of non-Roman cults. Ruler worship. Christians in Asia Minor, Egypt, and the West. Popular piety, Christian and non-Christian. Rabbinic Judaism. Varieties of Christianity in 2nd and 3rd centuries. Influence of Greco-Roman culture on emerging church. Constantine and Julian. Meets with 3073.

RelA 5080. New Testament Proseminar. (3 cr; SP–RelA 1082 or 3072 or equiv)
Discussion seminar. Study of some specific aspect of the New Testament and related literature. Topics specified in *Class Schedule*.

RelA 5088. Archaeology in Biblical Lands I: Old Testament Period. (3 cr; SP–§3088)
Archaeological data relevant to the Old Testament; major sites in the Holy Land and other areas of the Mediterranean and Near East. Evidence of pottery, inscriptions, manuscripts, and coins. Excavation methods. Archaeology as a tool for study of ancient religions. Meets with 3088.

RelA 5089. Archaeology in Biblical Lands II: New Testament Period. (3 cr; SP–§3089)
Archaeological data relevant to Jewish scriptures and New Testament; major sites in the Holy Land and other areas of the Mediterranean and Near East. Evidence of pottery, inscriptions, manuscripts, and coins. Excavation methods. Archaeology as a tool for study of ancient religions. Meets with 3089.

RelA 5503. History and Development of Israelite Religion I. (3 cr; SP–§RelA 3503)
Survey of the evolution of Israelite religion. Cultic practices, law and religion, prophecy, religion and historiography. Relationship to surrounding religious systems.

RelA 5504. Development of Israelite Religion II. (3 cr)
Ancient Judaism from the Persian restoration (520 B.C.E.) to Roman times (2nd century C.E.). Religious, cultural, and historical developments are examined to understand Jewish life, work, and worship under a succession of foreign empires: Persian, Greek, Roman.

RelA 5993. Directed Studies. (2-4 cr [max 10 cr])
Guided individual reading or study.

Religious Studies (RelS)

Department of Classical and Near Eastern Studies

College of Liberal Arts

RelS 5111. Problems in Historiography and Representation of the Holocaust. (3 cr; SP–JwSt 3521/RelS 3521 (formerly 3541) History of the Holocaust or #)
An advanced course focusing on issues connected with the Holocaust. Inclusiveness of other groups, Holocaust versus "Shoah," historiographical conflicts about perpetrators, an examination of the problems of representation in literature and art, problems of narrative theology after Auschwitz.

RelS 5993. Directed Studies. (1-4 cr [max 24 cr])
Directed studies in religion. Credits may vary from term to term to a limit of nine.

Rhetoric (Rhet)

Department of Rhetoric

College of Agricultural, Food, and Environmental Sciences

Rhet 5111. Message Design: Theory and Practice I. (3 cr; SP–Grad student or #; A-F only)
Audience analysis, media selection, message design through various theoretical perspectives, including cognitive/schema, social construction, feminist, intercultural theories. Usability testing, contextual inquiry as means to study effectiveness of messages.

Rhet 5112. Message Design: Theory and Practice II. (3 cr; SP–5111; A-F only)
Political, economic, social, and technical aspects of media selection and message design. Media analyses, scripts, budgets, treatments, project-design plans, interactive screens. On-line design project.

Rhet 5196. Internship in Scientific and Technical Communication. (3-6 cr [max 6 cr]; QP–STC grad or #; SP–STC grad or #; S-N only)
Internship sites may include the University, industry, or government agencies. An internship proposal, progress report, internship journal (optional), and final report with a letter from the internship supervisor are required.

Rhet 5258. Information-Gathering Techniques in Scientific and Technical Communication. (3 cr; A-F only)
Questionnaire development, informational interviewing, focus group interviewing. Guides, schedules, questioning techniques, communication theories in employment cycle interviews. Descriptive statistics used to analyze data.

Rhet 5270. Special Topics. (1-3 cr [max 3 cr]; QP–[[STC or RSTC] [major or grad student]], #; SP–[[STC or RSTC] [major or grad student]], #; A-F only)
Topics specified in *Class Schedule*.

Rhet 5291. Independent Study. (1-3 cr [max 3 cr]; QP–#, Δ; SP–#)
Supervised reading and research on advanced projects not covered in regularly scheduled offerings.

Rhet 5511. Research in Scientific and Technical Communication. (3 cr; A-F only)
Experimental/survey research techniques for quantitative/qualitative methodologies in scientific/technical communication. Face-to-face, phone, focus group interviewing. Questionnaire development, contextual inquiry. Using rating, ranking, q-sort methods. Ethics, experimental bias, inferential statistical analysis.

Rhet 5531. Scientific and Technical Communication Course Development and Pedagogy I. (3 cr; QP–Grad or sr or #; SP–Grad; A-F only)
Pedagogical philosophy/methodology in beginning writing, speaking, and technical communication class. Introduction to theories underlying teaching/tutoring with technology.

Rhet 5532. Scientific and Technical Communication Course Development and Pedagogy II. (3 cr; QP–5531 or #; SP–5531 or #; A-F only)
Pedagogical philosophy/methodology in advanced writing, technical communication, distance education courses. Introduction to theories of teaching in scientific/technical communicating/teaching with multimedia.

Rhet 5533. Scientific and Technical Communication Course Development: Teaching Seminar. (1 cr; QP–5531, 5532; SP–5531 or 5532; A-F only)
Mentor with faculty, usually concurrently with student's first teaching assignment. Students shares observations, solves teaching problems in seminar setting. Issues facing new teachers, developing a philosophy of teaching. Focuses on evaluating work in classroom.

Rhet 5534. Designing Technical Training for Intercultural Audiences. (3 cr; A-F only)
Select and research a training topic, write learning objectives and outcomes, set the conditions for learning, complete a comprehensive course outline, and one training module.

Rhet 5562. Theory and Practice in International Business Communication. (3 cr; QP–3562; SP–3562 or equiv; A-F only)
Theories and practice in international and intercultural scientific, technical, and business communication. Examine cultural differences by studying cultural metaphors and research studies, by interviewing people from other cultures including international business managers, and through case studies.

Rhet 5664. Science Writing for Popular Audiences. (3 cr; QP–3562 or #; SP–3562 or #; A-F only)
How science is "translated" for popular audiences. Rhetorical theory used to critique popularized articles. Developing a heuristic for writing articles. Controversial issues surrounding movement from science as "science" to science as "popular."

Rhet 5775. Major Figures in Rhetorical Tradition: Classical Period. (3 cr; A-F only)
Classical theories of rhetoric. Epistemological status of rhetoric. Ethical implications of persuasion. Emphasizes "Aristotle's Rhetoric" as founding document. Other figures (e.g., Plato, Isocrates, Cicero, Quintilian).

Rhet 5776. Major Figures in Rhetorical Tradition: Modern Era. (3 cr; A-F only)
Aristotelian rhetoric in modern era. Fancis Bacon, scientific revolution. George Campbell, rise of human sciences. Kenneth Burke, semiotics in twentieth century. Perelman/Olbrechts-Tyteca, reconciliation with philosophy.

Rhet 8011. Research Methods in Rhetoric and Scientific and Technical Communication. (3 cr; SP–STC/RSTC grad or #; A-F only)
Quantitative/qualitative research methods. Theoretical perspectives that demonstrate/test analytical approaches to scientific/technological rhetoric.

Rhet 8012. Applied Research Methods in Scientific and Technical Communication. (3 cr; SP–STC/RSTC grad student or #; A-F only)
Methodological choices, arguments, and uses of data in case studies. Students design/conduct a pilot study and review/apply research methods, survey research, ethnographics, rhetorical/textual analysis, archival research, genre analysis, observational research, interviews, and descriptive statistics. Review responsibilities of conducting research.

Rhet 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Rhet 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

Rhet 8505. Design Project. (5 cr; SP–STC/RSTC grad student; A-F only)
Extended problem-solving situation in business, government, or industry. Student acts as consultant to explore problem, identify possible solutions, introduce solution, apply it.

Rhet 8510. Topics in Rhetorical Theory, History, and Criticism. (3 cr [max 12 cr]; SP–5775 or equiv; A-F only)
Rhetorical theory in context of culture influenced by science/technology. Topics vary. See *Class Schedule*.

Rhet 8520. Topics in Science and Rhetoric. (3 cr [max 12 cr]; A-F only)
Doctoral seminar concerning relationship between rhetoric and science. Topics vary. See *Class Schedule*.

Rhet 8530. Topics in Feminist Theory in Science, Technology, and Communication. (3 cr [max 12 cr]; A-F only)
Doctoral seminar on interaction of gender with science/technology. Topics vary. See *Class Schedule*.

Rhet 8540. Topics in Scientific and Technical Communication Pedagogy. (3 cr [max 12 cr]; A-F only)
Doctoral seminar on theories of pedagogy/research studies that inform technical/scientific classroom/workplace. Topics vary. See *Class Schedule*.

Rhet 8550. Topics in Technology and Culture. (3 cr [max 12 cr]; A-F only)
Doctoral seminar on computer-mediated communication, democracy/technology, controversies over digital communication, privacy/ethical issues. Topics vary. See *Class Schedule*.

Rhet 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Rhet 8775. Classical Rhetorical Theory. (3 cr [max 12 cr]; A-F only)
Aristotle's "Rhetoric" in context of its times and of Aristotle's other works, especially "The Ethics" and "The Politics."

Rhet 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Rhet 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Rhet 8995. Special Problems in Rhetoric and Scientific and Technical Communication. (1-3 cr [max 3 cr]; SP–#)
Research and readings on special problems or projects.

Russian (Russ)

Institute of Linguistics, ESL, and Slavic Languages and Literatures

College of Liberal Arts

Russ 5104. Introduction to Literary Analysis. (3 cr; SP–3002 or equiv)
Reading and analysis of poetry and prose selections to understand rudiments of studying Russian literature. Readings are in Russian.

Russ 5105. Russian Poetry and Prose. (3 cr; SP–3002 or equiv)
Appreciation of literary values through stylistic analysis and literary interpretation; analysis of humanistic elements. Readings in Russian.

Russ 5211. Modern Russian Literature in Translation. (3 cr)
Literary, cultural, and political significance of modern Russian literary works.

Russ 5404. Tolstoy in Translation. (3 cr; SP–§3404)
Novels, stories, and philosophical writings of Leo Tolstoy.

Russ 5407. Stories and Plays of Anton Chekhov in Translation. (3 cr; SP–§3407)
Study of literary devices and themes in selected stories and major plays using the intrinsic approach.

Russ 5409. 19th-Century Russian Novel. (3 cr; SP–§3409)
The Russian realistic novel from origin to decline; social, political, and intellectual circumstances that led to its emergence as the dominant genre of the "age of realism" in Russia.

Russ 5411. Dostoevsky in Translation. (3 cr; SP–§3411)
Novels, stories, and other writings of Fyodor Dostoevsky.

Russ 5421. Literature: Middle Ages to Dostoevsky in Translation. (3 cr; SP–§3421)
Russian literature from about 1000 A.D. to mid-19th century; emphasizing writers of the first half of the 19th century.

Russ 5422. Literature: Tolstoy to the Present in Translation. (3 cr; SP–§3422)
Survey of Russian literature from mid-19th century to the present: realism, modernism, feminism and other trends.

Russ 5601. Methods of Translating Fiction From Russian to English. (3 cr; SP–§3601, 3102 or equiv)
Learning to appreciate a variety of literary styles through the experience of translation.

Russ 5900. Topics in Russian Language, Literature, and Culture. (1-4 cr; SP–1102 for language topics)
Variable topics in Russian language, literature, and culture.

Russ 5993. Directed Studies. (1-4 cr; SP–#, Δ, ❑)
Guided individual study.

Russian Area Studies (RAS)

Institute of International Studies

College of Liberal Arts

RAS 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

RAS 8777. Thesis Credits: Masters. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Sanskrit (Skt)

Department of Classical and Near Eastern Studies
College of Liberal Arts

Skt 5001. Beginning Sanskrit. (3 cr)
Introduction to the classical language of ancient India.

Skt 5002. Beginning Sanskrit. (3 cr; SP–5001 or equiv)
Introduction to the classical language of ancient India.

Skt 5201. Intermediate Sanskrit. (3 cr; SP–5002 or equiv)
Readings in Sanskrit literature.

Skt 5202. Intermediate Sanskrit. (3 cr)
Readings in Sanskrit literature.

Skt 5710. Topics: Language and Literature. (3 cr; SP–#)
Selected reading and/or study of linguistic problems in Sanskrit.

Skt 5992. Directed Readings. (3 cr; SP–5202 or equiv)
Guided individual reading or study.

Skt 8993. Directed Studies. (1-12 cr [max 30 cr])

Scandinavian (Scan)

Department of German, Scandinavian, and Dutch
College of Liberal Arts

Scan 5202. Scandinavian Romanticism. (3 cr)
Study of Scandinavian literature (poetry, drama, and prose), 1800 -1870. Texts in the original languages.

Scan 5501. Scandinavian Mythology. (3 cr)
Study of Scandinavian mythology based on primary sources represented by *Saxo Grammaticus*, Snorri Sturluson's *Edda and Ynglinga Saga*, and the *Poetic Edda*. Myths are analyzed using contemporary critical approaches. All readings in translation.

Scan 5502. The Icelandic Saga. (3 cr)
Study of the sagas written in 13th-century Iceland. Discussion includes cultural and historical information about medieval Iceland and analysis of a selection of saga texts using contemporary critical approaches. All readings in translation.

Scan 5613. Contemporary Scandinavian Literature. (3 cr)
An investigation of issues which emerged as extremely important after 1945 in Scandinavia, as articulated by writers and analyzed by researchers in social sciences. All readings in translation.

Scan 5615. Ibsen and the Beginnings of Modern Drama. (3 cr)
Close reading of Ibsen's "modern tragedies" from *A Doll's House* (1879) to *When We Dead Awaken* (1899). Focus is on the dialectics between Ibsen and his society, and dramatic structure and staging conventions in the context of modern theater. Readings in English for nonmajors.

Scan 5616. Strindberg and the Drama in Revolt and Change. (3 cr)
Strindberg as the master of naturalistic drama and the precursor of modernity in European and American theater. Close reading of plays with emphasis on dramatic structure and staging conventions in the context of modern theater. All readings in English for nonmajors.

Scan 5670. Topics in Scandinavian Studies. (3 cr [max 9 cr])
Topic may focus on a specific author, group of authors, genre, period, or subject matter. Topics specified in *Class Schedule*. Readings in English for nonmajors. May meet with 3670.

Scan 5701. Old Norse Language and Literature. (3 cr)
Acquisition of a reading knowledge of Old Norse; linguistic, philological and literary study of Old Norse language and literature.

Scan 5702. Old Norse Saga Reading and Analysis. (3 cr; SP–5701 or equiv reading knowledge of Old Norse)
Reading and analysis of Old Norse prose narratives, including close reading and discussion of the critical literature about the prose narratives and medieval Icelandic culture. All primary texts read in Old Norse.

Scan 5703. Old Norse Poetry. (3 cr; SP–5701 or equiv reading knowledge of Old Norse)
Reading and analysis of either eddic poetry from the *Poetic Edda* or skaldic poetry. Texts read in Old Norse.

Scan 5704. History of the Scandinavian Languages. (3 cr)
Investigation of the development of the Scandinavian languages from the earliest periods to the present.

Scan 5711. Structure of the Scandinavian Languages. (3 cr; SP–introductory course in linguistics or #)
Investigation of the philological, grammatical, and lexical systems of the Scandinavian languages.

Scan 5993. Directed Studies. (1-4 cr [max 12 cr]; SP–#, Δ, ❑)
Guided individual reading and study.

Scan 8002. Introduction to Scandinavian Studies. (3 cr)
Introduction to history of Scandinavian studies, to field of Scandinavian studies as an integral area with particular disciplines, and to study of Scandinavian languages, literatures, and cultures. Integrated sections on Scandinavian bibliography.

Scan 8500. Seminar in Medieval Scandinavian Languages and Literature. (3 cr [max 9 cr])
Sample topics: *Volsunga Saga*, studies in Snorri Sturluson's *Edda*, dialogue analysis in the Icelandic saga.

Scan 8510. Seminar in Scandinavian Linguistics. (3 cr [max 9 cr])
Selected problems in synchrony and diachrony of the Scandinavian languages (e.g., history or structure of Scandinavian languages).

Scan 8610. Seminar in Scandinavian Drama. (3 cr [max 9 cr])
Sample topics: dilemma of representation in modern drama, epic theater.

Scan 8630. Seminar in Scandinavian Criticism. (3 cr [max 9 cr])
Sample topics: feminist theory in Scandinavia, writing literary history in Scandinavia.

Scan 8702. Philological Proseminar II: History of Germanic Philology. (3 cr; A-F only)
Introduction to history and development of Germanic philology from 1800 to the present. See Ger 8701.

Scan 8975. Scandinavian Immigrant Languages and Literatures. (3 cr)
Introduction for graduate students in Scandinavian and related fields to research opportunities. Sources and methodology.

Scan 8994. Directed Research. (1-3 cr [max 12 cr]; SP–#, Δ; may be taken as tutorial with #)

Scientific Computation (SciC)

Graduate School

SciC 8001. Parallel High-Performance Computing. (3 cr; SP–Undergrad degree in field using sci comp or #)
Interdisciplinary overview of computer science aspects of scientific computation, both hardware and techniques. Parallel computing, architectures, programming, and algorithms; restructuring compilers and data structures.

SciC 8011. Scientific Visualization. (3 cr; SP–Undergrad degree in field using sci comp or #)
Basic issues in scientific visualization, visualization software, graphics, representation of scientific data, modeling, hardware for visualization, user interface techniques, output, commonly used algorithms and techniques for visualization, animation, information visualization, higher dimensional data, case studies, and examples of successful visualizations.

SciC 8021. Advanced Numerical Methods. (3 cr; SP–Undergrad degree in field using sci comp or #)
Interdisciplinary overview of advanced numerical methods of scientific computation, emphasizing computational aspects. Approximation methods for partial differential equations, numerical linear algebra, sparse matrix techniques, iterative methods, solution of eigenvalue problems, and case studies.

SciC 8031. Modeling, Optimization, and Statistics. (3 cr; SP–Undergrad degree in field using sci comp or #)
Interdisciplinary overview of mathematical modeling, optimization, and statistics techniques for scientific computation. Nonlinear equations and nonlinear optimization, statistics, control theory, modeling, and simulation.

SciC 8041. Computational Aspects of Finite Element Methods. (3 cr; SP–Undergrad degree in field using sci comp or IT grad student or #)
Fundamental concepts and techniques of finite element analysis. Variational equations and Galerkin's method; weak formulations for problems with nonsymmetric differential operators; Petrov-Galerkin methods; examples from solid and fluid mechanics; properties of standard finite element families, implementation.

SciC 8095. Problems in Scientific Computation. (1-3 cr [max 9 cr]; SP–Undergrad degree in field using sci comp or #)
Selected topics in interdisciplinary aspects of scientific computing.

SciC 8190. Supercomputer Research Seminar. (1 cr [max 3 cr]; SP–Undergrad degree in field using sci comp or #)
Series of seminars by distinguished lecturers.

SciC 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

SciC 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

SciC 8594. Scientific Computation Directed Research. (1-4 cr [max 9 cr]; SP–Undergrad degree in field using sci comp or #)

SciC 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

SciC 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

SciC 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Slavic (Slav)

Institute of Linguistics, ESL, and Slavic Languages and Literatures

College of Liberal Arts

Slav 5900. Topics in Slavic Languages and Literatures. (3 cr)
Topics specified in *Class Schedule*.

Social, Administrative, and Clinical Pharmacy (SACP)

College of Pharmacy

SACP 8333. FTE: Master's. (1 cr; SP–Master's student, adviser approval, DGS approval)
Directed research

SACP 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser approval, DGS approval)
Directed research

SACP 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Doctoral student who has not passed prelim oral)
SACP 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Plan A)
SACP 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr])

Social and Administrative Pharmacy (SAPh)

Department of Pharmacy Practice

College of Pharmacy

SAPh 8054. Advanced Studies in Pharmaceutical Care Practice. (4 cr; A-F only)
Analyzing practice/implementation of pharmaceutical care. Student confront their assumptions about pharmacy profession, pharmacy practice, and pharmaceutical care. Discussions, guest speakers, intensive literature searches/evaluation.

SAPh 8100. Seminar. (1 cr [max 8 cr]; SP–Grad SAPh major or #)
Contemporary issues and research problems in sociobehavioral pharmacy, pharmacoeconomics and policy, and clinical research.

SAPh 8173. Principles and Methods of Implementing Research. (3 cr; QP–Two grad stat courses; SP–Two grad stat courses)
Integrates scientific, statistical, and practical aspects of research. Interrelationships among design, sample selections, subject access, human subjects requirements, instrument selection and evaluation, data management, analyses plans, grant writing, and research career issues. Field experiences.

SAPh 8200. Research Problems. (1-8 cr [max 16 cr]; SP–Grad SAPh major or #)
Individually designed research experience directed at contemporary problems related to drug use process.

SAPh 8235. Pharmaceutical Economics and Policy. (3 cr; SP–Grad SAPh major or #; A-F only)
Economic analysis of pharmaceutical sector of health care systems. Problems of pricing production and distribution of pharmaceuticals. Domestic or international policy issues relevant to price and access of pharmaceuticals.

SAPh 8255. Pharmaceutical Marketing. (3 cr; SP–Grad SACP major or #; A-F only)
Historical development of distributive systems, marketing channels, institutions, policies, and practices as they relate to pharmaceutical industry. Contemporary issues/theory related to pharmaceutical marketing. Pharmaceutical proportion, especially directed to consumer advertising.

SAPh 8270. Clinical Conferences. (2 cr; SP–Grad SAPh major or #)

SAPh 8420. Social and Behavioral Aspects of Pharmacy Practice. (3 cr; SP–Grad SAPh major or #; A-F only)
Historical development of the profession, its growth and development, emphasizing forces of education, professionalization, attitude modification, and changes occurring as a product of legal and organizational forces in society.

SAPh 8500. Pharmacy and Its Environment. (3 cr; SP–Grad SAPh major or #; A-F only)
Cultural foundations of pharmacy. Development of present state of pharmacy practice. Role of pharmacist as health practitioner in relation to other health practitioners. Identification of factors (health policy, regulation, economics, research and development, promotion) that affect individual responses to drug therapy.

SAPh 8700. Hospital Pharmacy Administration. (3 cr; SP–Grad SAPh major or #; A-F only)
History, classification, organization, and functions of hospital departments in relation to the pharmacy service.

SAPh 8702. Hospital Pharmacy Survey. (1 cr [max 3 cr]; SP–Grad SAPh major or #)
Readings for self-directed students to explore contemporary issues in hospital pharmacy practices.

SAPh 8810. Social Psychology of Health Care. (2 cr; SP–Grad SAPh major or #)
Behavioral and social aspects of recovery responses to drugs and other therapies, patients' compliance with prescribed therapies, relationships between healthcare professional and patient.

SAPh 8840. Social Measurement. (3 cr; QP–Intro stat course, understanding of simple correlations; SP–Intro stat course, understanding of simple correlations or #; A-F only)
How social factors such as innovativeness, compliance, religiosity, and stress are measured and tested for reliability and validity. Relationships between theory, concepts, variables, data.

Social Work (SW)

School of Social Work

College of Human Ecology

SW 5051. Human Behavior and the Social Environment. (2-3 cr; QP–Grad student or 12 cr in social sciences or #; SP–Grad student or 8 cr social sciences or #)
Social, psychological, biological, and cultural factors of individual and group development as applied to social work practice. Behavior and life-cycle development focusing on diversity and each stage of life. Discuss development in terms of the individual, and in terms of overlapping social systems such as the multigenerational family, culture, community, and society.

SW 5052. Ecologies of Child Development Within Communities of Color. (3 cr; QP–Grad or #; SP–Grad or #)
Examine social, affective, and cognitive development of children of color via a life course, ecological systems framework. Family, school, peers, and community are studied as ecological contexts which influence developmental trajectories for these children and youth. Attention is given to poverty, racism, and oppression.

SW 5101. Historical Origins and Contemporary Policies and Programs in Social Welfare. (3-4 cr; QP–Grad or 12 cr of social sciences; SP–Grad or 8 sem cr of social sciences)
Contemporary policies and programs in social welfare are examined in light of their historical origins and evolution. A framework is then developed for analysis of concepts and principles in contemporary social policy for social welfare programs and services. The emergence of the profession of social work also examined.

SW 5105. Women and Public Policy. (3 cr)
Study of feminist organizations; issues and conflicts within organizations and movements; methods and sources for studying feminism.

SW 5107. Child Development and Social Policy. (3 cr; QP–Grad or #; SP–Grad or #)
Examine the intersection of conceptual orientations of developmental psychology with policies that affect children and families. Demographic, historic, and social trends underlying the assumptions that drive policies directed at women and children; projections of future policies.

SW 5309. Case Management with Special Populations. (3 cr; QP–Grad or adult special or #; SP–Grad or adult special or #)
Examine concepts and principles of case management practice with special populations such as older adults, persons with developmental disabilities, and persons with serious and persistent mental illness. The core functions of case management practice in a range of settings are addressed in relationship to issues of diversity, vulnerability, and empowerment.

SW 5313. Social Work with Older Adults. (2 cr; QP–Grad or adult special or #; SP–Grad or adult special or #)
The practice components of social work with older adults including assessment, intervention, and case management. Taught from the perspective of bio-psycho-social strengths and challenges and within the context of current social policy and delivery systems.

SW 5314. Social Work in the Schools. (2 cr; QP–Grad or adult special or #; SP–Grad or adult special or #)
Application of social work methods in a school setting. Emphasizes assessment, diagnosis, consultation, advocacy, interdisciplinary team building, and crisis intervention.

SW 5315. Social Work Practice in Hospitals and Health Care Settings. (2 cr; QP–Grad or adult special or #; SP–Grad or adult special or #)
Prepares students for social work practice in a hospital or health care setting. Focus on integration of conceptual and practice subject matter that covers differential assessment, clinical intervention models, impact of acute and chronic illness, special populations, managed care, legal and ethical issues, interdisciplinary team work, and transition planning in healthcare.

SW 5316. Brief Treatment and the Task-Centered Approach. (2 cr; QP–Grad or adult special or #; SP–§8303; grad or adult special or #)
The advent and current prominence of brief treatment models in work with individuals, families, and groups including their theoretical and empirical bases. Practice with diverse populations in a context of managed care. Emphasis on the task-centered approach including skill training and supervised practice.

SW 5317. Social Work With Involuntary Clients. (2 cr; QP–Grad or adult special or #; SP–Grad or adult special or #)
Includes theory, ethics, effectiveness, and intervention methods for work with client systems that experience involuntary contact with a social worker. Interventions at micro, mezzo, and macro levels are included. Practice in varied settings such as child welfare, mental health, corrections, and public schools as well as practice related to organizational responses to change.

SW 5318. Family Centered Home Based Services. (2 cr; QP–Grad or adult special or #; SP–§8314; grad or adult special or #)
Ecological, multisystems approach focusing on the family system. Triadic theory, meta-neutrality, strengths-focus, case management and team treatment. Family-based services evaluated for high-risk, multi-problem families and as an alternative to foster placement.

SW 5319. Adolescents: Norms, Culture, and Health. (2 cr)
Relationships among familial, social, societal, political, economic, environmental, psychosocial, and cultural determinants of adolescent behavior that affect health; major public health issues and problems of adolescents.

SW 5481. Child Abuse Prevention I: Research and Theory. (3 cr; QP–Admission to child abuse prevention specialization; SP–Bachelor's degree or #)
Foundation of research/theory for level I child abuse prevention studies certificate.

SW 5482. Child Abuse Prevention II: Program Development, Evaluation, and Advocacy. (3 cr; QP–Admission to child abuse prevention specialization, #; SP–5481)
Design and evaluation of policies and programs of interventions to prevent child abuse. This is the second course in the Level I Child Abuse Certificate program.

SW 5483. Child Abuse Prevention III: Skill Building I—Cultural and Legal Issues. (3 cr; SP–Bachelor's degree or #)
Risk factors, protective factors, resilience in cultural settings. Identifying/designing strategies appropriate to cultural characteristics. First course for level II child abuse prevention certification.

SW 5484. Child Abuse Prevention IV: Skill Building II—Risk Assessment and Interviewing. (3 cr; SP–Bachelor's degree or #)
Designing instruments for child abuse risk assessment. Culturally/ethnically competent interviewing. Ethnographic interviewing. Strengths-based ecosystemic assessment. Strategies for evaluating interventions. Second course for level II child abuse prevention certification.

SW 5519. Mediation and Conflict Resolution. (3 cr; SP–§8519)
Develop mediator skills for making informed decisions regarding the appropriateness of mediation for conflicts that frequently confront social worker practitioners such as divorce, neighborhood disputes, conflicts between parents and adolescents, conflicts between spouses, and conflicts between crime victims and offenders.

SW 5525. Global Perspectives on Social Welfare, Peace, and Justice. (3 cr; QP–1001 or #; SP–2001 or #)
Role of international social welfare in meeting basic human needs and promoting human rights, social justice, and peace. Theories, models, and social policies in different economic and political systems with emphasis on Third World nations.

SW 5705. Violence in Families. (3 cr; SP–§5706, §5707; grad student or adult special or #)
Prevention/intervention with perpetrators, survivors, and social institutions. Perpetration, effects on victims, social responses to family violence. Child abuse/neglect. Abuse of women/vulnerable adults. Roles of gender, race, culture, age, physical ability, and sexual orientation.

SW 5706. Issues and Interventions in Child Sexual Abuse. (2 cr; QP–Grad or adult special or #; SP–§5705; grad or adult special or #)
Major issues and interventions involved in child sexual abuse. Develop knowledge and skills in working with sexually abused children and their families. Perceptions of victims, non-offending parents, perpetrators, and other family members; interviewing; justice system; child protection.

SW 5707. Interventions with Battered Women and Their Families. (2 cr; QP–Grad or adult special or #; SP–§5705; grad or adult special or #)
Current theories, research, and evaluation of interventions with battered women and their families. Focus on practice, e.g., direct work with social institutions, victim-survivors, and assailants and their families.

SW 5708. Substance Abuse and Social Work. (3 cr; QP–Grad or adult special or #; SP–Grad or adult special or #)
Assessment and intervention in situations involving substance abuse with special emphasis on cross cultural practice. Relationships of substance abuse to areas such as child welfare, mental illness, and violence within families are examined.

SW 5810. Seminar: Special Topics. (1-4 cr)
Topics specified in *Class Schedule*.

SW 5811. Social Work Ethics. (2 cr; QP–Grad student or adult special or #; SP–§8801, grad student or adult special or #)
Acquire knowledge base and develop skills required to identify ethical issues, resolve ethical dilemmas, and make ethical decisions within the context of the professional practice of social work. Values base and ethical standards of the profession and ethical decision-making models examined in-depth.

SW 5812. Legal Aspects of Social Work. (2 cr; QP–Grad or adult special or #; SP–§5813, §8801; grad or adult special or #)
Legal regulation of social work; licensing standards; professional liability; ethical issues and sanctions. Social worker involvement in legal processes of preparing for court; testimony and cross examination. Substantive law affecting social work practice in selected areas such as child protection, mental health, family law, and domestic violence.

SW 5813. Child Welfare and the Law. (2 cr; QP–Grad student or adult special or #; SP–§5812, §8801; second yr M.S.W. or advanced standing or #)
Social work practice in juvenile court; child abuse and neglect reporting laws, risk assessment, reasonable efforts, case plan, custody proceedings, permanency planning, termination of parental rights, child testimony, social worker testimony, adoption laws.

SW 5991. Independent Study in Social Work. (1-4 cr [max 4 cr])
Independent study in areas of special interest to students and faculty.

SW 8010. Field Practicum I. (1-4 cr [max 8 cr]; QP–8400; SP–8201; S-N only)
Field practice and social work process under direct supervision. Professional tasks in various types of practice, development of professional identity, and understanding of social justice as integral to the profession. Field practice seminar completed concurrently with placement.

SW 8020. Field Practicum II. (1-6 cr [max 6 cr]; QP–8010; SP–8010; S-N only)
Builds upon the skills developed in 8010. Students develop competence in identified concentration and integrate policy formulations into coherent professional position. Field practice seminar completed concurrently with placement.

SW 8030. Advanced Standing Social Work Practicum. (1-4 cr [max 8 cr]; SP–Advanced standing; S-N only)
Field practice under direct supervision. Advanced social work practice related to student's concentration, and policy formulation integrated into coherent professional position; social justice as integral to the profession. Field practice seminar completed concurrent with placement.

SW 8051. Psychopathology and Social Work Practice. (3 cr; QP–8401; SP–8202 or advanced standing or #)
Psychopathology from ecosystemic perspective. Biopsychosocial influences on incidence, course, treatment of common mental disorders diagnosed from infancy through adulthood. Differential effects on populations at risk. Diagnostic skills, alternative intervention strategies, social work roles.

SW 8101. Social Policy and Delivery Systems for Child Welfare and Family Services. (3 cr; QP–5111; SP–5101 or advanced standing or #)
Federal, state, and local policies related to contemporary child welfare system and system of social services to families. Current debates about policies, financing, and structure and organization of service delivery; process of influencing policy changes in children and family services.

SW 8103. Health and Mental Health Policy. (3 cr; QP–5111; SP–5101 or advanced standing or #)
Factors affecting health and mental health status of variety of populations. Policies on organizational, local, state, and federal levels affecting health status, financing, and delivery of health and mental health services. Ethical issues embedded in policies and issues in need of policy development.

SW 8150. Special Topics in Social Policy. (1-9 cr [max 9 cr]; SP–#)

SW 8201. Social Work Methods: Practice With Individuals and Systems. (3 cr; SP–MSW)
Introduction to theories, knowledge, values, skills in initial phases of social work practice. Practice phases: assessment, goal setting, contracting, intervention, treatment. Developing relationships, interviewing skills in practice with diverse populations. Ecological problem-solving framework from empowerment orientation.

SW 8202. Social Work Methods: Practice With Families and Groups. (3 cr; QP–8400; SP–8201 or #)
Intervention theories, roles, methods, evaluation in practice with families/groups. Continues ecological problem-solving framework from 8201.

SW 8211. Macro Social Work Practice and Policy Advocacy. (3 cr; QP–5111, 5349; SP–5101 or #)
Policy analysis, development, implementation, community development, social action, social planning. Ecological, problem-solving, empowerment perspectives, policy/methods. Theories of organizational/community development/change.

SW 8301. Advanced Child Welfare Practice. (3 cr; QP–5111, 8401; SP–[8202, 8211] or adv standing or #)
Survey of child welfare policies. Use of multisystemic interventions. Impact of poverty, race, ethnicity, and gender on policy/practice. Developments in family preservation, relative placement, foster care, adoptions, and Indian child welfare. Role of social work in child protection services.

SW 8303. Advanced Mental Health Practice with Adults. (3 cr; QP–8401; SP–[8202, 8211] or adv standing or #)
Theory/practice of cognitive, cognitive-behavioral, and psychodynamic social work treatment in community/clinical settings. Criteria for differential applications, including brief treatment and crisis-oriented approaches. Cultural/social aspects of mental health, issues important to populations at risk.

SW 8304. Advanced Practice With Children and Adolescents. (3 cr; QP–8401; SP–[8202, 8211] or adv standing or #)
Practice with children, adolescents, and their families. Ecosystemic model that undergirds assessment/intervention. Mastery of developmental tasks and enhanced social functioning as protective mechanisms. Biopsychosocial focus. Integrates familial/community contributions, especially in face of loss or disruption.

SW 8313. Social Work Practice in Interdisciplinary Teams. (3 cr; QP–Foundation courses; SP–Advanced standing or foundation courses)
Interdisciplinary and interorganizational collaboration primarily in healthcare and school settings. Socialization processes and status differences. Role expectations, ambiguity, strain. Value disparities and other barriers to collegiality. Collaborative practice: relational communication, advocacy, consultation, mediation, conflict resolution skills.

SW 8314. Social Work Interventions With Families. (3 cr; QP–8402, [8121 or 8122 or 8150]; SP–§5318; adv standing or 8202 or #)
Interventions based on systems perspective of family as center of focus, in environmental context. Policy/practice principles of working with families in their home, community environment.

SW 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

SW 8411. Life-Cycle Therapy. (2 cr; QP–8401; SP–Advanced standing or 8202 or #)
Strength-based approach to client treatment grounded in Erik H. Erikson's theory of the life cycle. Model explicitly considers differences in environmental supports and in "healthy" outcomes, based on culture, race, gender, sexual orientation, spiritual belief, and age. Focus on maximizing health and remediating disorders.

SW 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

SW 8460. Special Topics: Practice With Individuals, Families, and Groups. (1-3 cr [max 9 cr]; QP–8401; SP–8201 or #)
Advanced practice courses.

SW 8501. Planning, Marketing, and Program Development. (3 cr; QP–5111, 8402; SP–[5101, 8202] or advanced standing or #)
Principles, applied practice of management concepts in human service settings. Management theories, organizational planning, program development, marketing/communications. Management practice that is client/community-focused, results-oriented, and that seeks to achieve positive social change.

SW 8502. Resource Development and Management. (3 cr; QP–8301; SP–[8202, 8211] or adv standing or #)
Procuring/managing financial resources in social work settings. Principles of philanthropy. Fund raising, grant writing, preparing/monitoring budgets, interpreting basic financial reports. Management information systems, accountability requirements.

SW 8503. Personnel Leadership and Management. (3 cr; QP–8301; SP–8501 or #)
Skills and principles in effective leadership. Legal and strategic considerations in personnel management, including workplace diversity, selection, hiring and development of paid/unpaid staff, evaluation, compensation and benefits, promotions and staff termination, management of work groups and collaboratives.

SW 8505. Advanced Community Organization and Advocacy. (3 cr; QP–8301; SP–8501 or #)
Methods for stimulating and supporting joint action for constructive change to fulfill community needs. Principles of working with local organizations and social action to accomplish specific changes.

SW 8519. Mediation and Conflict Resolution for Social Workers. (3 cr; SP–§5519; M.S.W. student or grad conflict mgmt minor or #)
Advanced mediator skills for social workers; appropriateness of mediation for conflicts that frequently confront social work practitioners, such as divorce, neighborhood disputes, and conflicts between parents and adolescents, between spouses, and between crime victims and offenders.

SW 8525. Global Perspectives on Social Welfare, Peace, and Justice. (3 cr; QP–5111 or 5349; SP–5101 or #)
Role of international social welfare in meeting basic human needs and promoting human rights, social justice, and peace. Theories, models, and strategies of social welfare in different economic and political systems, emphasizing Third World nations. Skills for social workers and other professionals in the helping professions.

SW 8601. Social Work Research Methods. (3 cr; SP–M.S.W. student or #)
Introduction to quantitative and qualitative social work research skills fundamental to development and critical use of information relevant to social work practice decision-making and evaluation at case, program, policy levels. Social research ethics, development of research questions, sampling, measurement, research design, data collection and analysis.

SW 8602. Direct Practice Evaluation. (2 cr; QP–8901 or equiv; SP–8601 or equiv or #)
Students design evaluations that incorporate current evaluation methods and principles derived from research, theory, practice wisdom, their own experience. Evaluation methods include single-system designs, client- focused evaluations, practitioner-focused evaluations, and use of event analyses, standardized instruments, self-constructed instruments.

SW 8603. Program Evaluation. (2 cr; QP–8901 or equiv; SP–8601 or equiv or #)
Conceptual, methodological, political, psychological, and administrative factors related to conduct and consequences of social work program evaluation. Social programs as cause and effect; models, types, and strategies of evaluation; appraisal of selected research literature.

SW 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer, doctoral student who has not passed prelim oral)

SW 8693. Directed Study. (1-6 cr [max 6 cr]; SP–#)
Independent study under tutorial guidance.

SW 8694. Directed Research. (1-6 cr [max 6 cr]; SP–#)
Individual or small group research inquiry translating introductory course content into research design and study. Projects may be conducted in conjunction with field learning experiences or other coursework.

SW 8702. Advanced Social Work Practice With Diverse Populations. (2 cr; QP–Foundation courses; SP–Advanced standing or foundation courses or #)
Models of ethnic-sensitive social work practice applied in human service management or direct practice settings. Critical examination of human needs and organizational responses to racially and culturally competent practice with populations at risk.

SW 8801. Social Work Ethics and Legal Issues. (3 cr; QP–Foundation courses; SP–§5811, §5812, §5813; foundation courses or adv standing or #)
Develops knowledge base and skills required to identify and understand legal and ethical issues, resolve ethical dilemmas, and make ethical decisions within social work. Values base, ethical standards, ethical decision-making models, and laws and legal procedures related to social work. Legal aspects of child welfare practice.

SW 8803. Social Work Supervision, Consultation, and Leadership. (3 cr; QP–Foundation courses; SP–Foundation courses or advanced standing or #)
Principles, practices, and models of supervision in human service systems: administrative, educational, and supportive functions. Organizational leadership and mediation skills. Contextual factors that influence supervisory role and function. Principles and methods of teamwork, staff development, and consultation.

SW 8851. History of Social Work and Historical Research Methods. (3 cr; QP–Required research courses for soc work Ph.D. student; equiv research methods courses for other grad students; SP–Required research courses for soc work Ph.D. student; equiv research methods courses for other grad students)
Methods of historical research in, and survey of, history and evolution of social welfare and social work, using primary and secondary source materials.

SW 8855. Social Policy Formulation and Analysis. (3 cr; SP–Soc work Ph.D. student or #)
Application of theoretical perspectives, conceptual frameworks, and research methodologies to analysis of social issues and analysis and formulation of social welfare policy.

SW 8861. Theory and Model Development in Social Work. (3 cr; SP–Soc work Ph.D. student or #)
Intervention research methods and contemporary social work practice models. Practice models studied include direct intervention in variety of systems from individual to community. Theoretical, value, empirical foundations of contemporary practice models examined through lens of intervention research.

SW 8863. Social Work Teaching Methods and Educational Issues. (3 cr; SP–Soc work Ph.D. student or 2nd-yr M.S.W. student or #)
Teaching methods, skills, strategies, and issues related to teaching, scholarship, and service roles in context of social work education. Familiarizes students with current issues, including curriculum development. Includes concurrent teaching experience in a social work class.

SW 8871. Social Work Research Seminar I. (3 cr; SP–Soc work Ph.D. student or #)
First of two required Ph.D. seminars. Students review and expand their knowledge of basic concepts and methods of social research; current issues and controversies in social science and social work research and knowledge development. Development of research questions, sampling, measurement, data collection strategies in qualitative and quantitative research.

SW 8872. Social Work Research Seminar II. (3 cr; QP–8991; SP–8871 or #)
Additional topics: methodologies and design of quasi-experiments, surveys, descriptive research, grounded theory, and analysis of quantitative and qualitative data.

SW 8875. Research Practicum. (2 cr [max 6 cr]; SP–Soc work Ph.D. student or #; S-N only)
Experience in conduct of research, following completion of 8871 and 8872. Students work under faculty direction.

SW 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer, 24 cr required)

Sociology (Soc)

Department of Sociology

College of Liberal Arts

Soc 5090. Topics in Sociology. (1-3 cr; QP–#; SP–1001 or #)
Topics specified in *Class Schedule*.

Soc 5091. Independent Study. (1-4 cr; QP–#; SP–#)
Independent study of an established 5xxx course.

Soc 5301W. Social Movements. (3 cr; SP–# for undergrads; 3301 or #)
Origins, dynamics, and consequences of social movements. Dilemmas and challenges facing movement organizations. Relationship among movements, parties, and states and role of movements in bringing about change. Case studies of civil rights, labor, environmental, women's, gay rights, and student movements.

Soc 5455. Sociology of Education. (3 cr; QP–1001 or equiv or #; SP–1001 or equiv or #)
Structures and processes within educational institutions. Links between educational organizations and their social contexts, particularly as these relate to educational change.

Soc 5811. Intermediate Social Statistics. (4 cr; SP–3811 or equiv)
Measurement, theory of probability, and bivariate statistics. Focus on multiple regression analyses of sociological data. Primarily for first-year sociology graduate students who need preparation for advanced social statistics. Undergraduates preparing for graduate programs may register upon availability.

Soc 8001. Sociology as a Profession. (1 cr; SP–Grad soc major; S-N only)
Sample topics: role of sociology in society, professional organizations, employment opportunities, professional ethics, and writing for publication or grant proposals.

Soc 8011. Sociology of Higher Education: Theory and Practice. (3 cr; SP–Grad soc major or #)
Social/political context of teaching. Ethical issues, multiculturalism, academic freedom. Teaching skills (e.g., lecturing, leading discussions). Active learning. Evaluating effectiveness of teaching. Opportunity to develop a syllabus or teaching plan.

Soc 8090. Topics in Sociology. (1-4 cr; SP–#)
Topics specified in *Class Schedule*.

Soc 8091. Independent Study. (1-5 cr; SP–#)
Independent study of an established 8xxx course.

Soc 8093. Directed Study. (1-4 cr; SP–#)

Soc 8094. Directed Research. (1-4 cr; SP–#)
May be used to fulfill sociology graduate requirement for advanced methodological training.

Soc 8101. Sociology of Law. (3 cr; QP–3101, 3102; 5705 recommended)
Sociological analysis of law and society. In-depth review of research on why people obey the law, of social forces involved in creation of law (both civil and criminal), procedures of enforcement, and impact of law on social change.

Soc 8111. Criminology. (3 cr)
Overview of theoretical developments and empirical research. Underlying assumptions, empirical generalizations, and current controversies in criminological research.

Soc 8148. Law, Society, and the Mental Health System. (3 cr; QP–[Grad student, 5148] or #; SP–[Grad student, 4148] or #; A-F only)
Intensive survey of psychopathology. Reference to criminal behavior, criminal justice system.

Soc 8190. Topics in Law, Crime, and Deviance. (3 cr [max 12 cr]; QP–Grad student in sociology or #; SP–Grad student in sociology or #)
Advanced topics in law, crime, and deviance. Social underpinnings of legal/illegal behavior and of legal systems.

Soc 8201. Social Stratification and Mobility. (3 cr; QP–3xxx soc course or 5401 or #; some stat recommended; SP–3811 or equiv or #)
Form and content of hierarchical arrangements. Relationship of hierarchy to social order and individual behavior. Structures of social stratification. Status attainment. Mobility. Inequality and economic development, social development, and technological change. Economic status in relation to social status, including race, gender.

Soc 8211. Race Relations Theory. (3 cr)
Major theoretical debates. Classic and contemporary theoretical approaches to studying U.S. race relations; contemporary and historical experiences of specific racial and ethnic groups.

Soc 8221. Sociology of Gender. (3 cr; QP–3401)
Organization, culture, and dynamics of gender relations and gendered social structures. Sample topics: gender, race, and class inequalities in the workplace; women's movement; social welfare and politics of gender inequality; theoretical and methodological debates in gender studies; sexuality; science; sociology of emotions.

Soc 8290. Topics in Social Stratification. (3 cr)
Comparative perspectives on racial inequality; race, class, and gender; quantitative research on gender stratification; stratification in post-communist societies; institutional change and stratification systems; industrialization and stratification. Topics specified in *Class Schedule*.

Soc 8311. Political Sociology. (3 cr; QP–3401 or 5401 or equiv)
Social dimensions of political behavior and social origins of different forms of the state. How various theoretical traditions—Marxist, Weberian, and feminist—address key issues in political sociology, including citizenship, revolution, state formation, origins of democracy, welfare state, and fascism.

Soc 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Soc 8390. Topics in Political Sociology. (3 cr)
Topics with common focus on social underpinnings of political behavior and political change. Sample topics: democracy and development, international legal and political systems, power and protest in advanced capitalist states, xenophobia and international migration, and civil society and democracy. Topics specified in *Class Schedule*.

Soc 8411. Research on Formal Organizations. (3 cr; QP–3401 or 5401 or equiv or 8 cr soc or anth)
Theories of the structure of and behavior in corporations and bureaucracies. Corporate structure from standpoint of role expectations, transaction costs, and structural responses to organizational failures. Power, conflict, and bargaining in organizational decision making. Course content varies.

Soc 8421. Work and Occupations. (3 cr; QP–3201 or 3401 or 3405 or 5201 or 5401 or equiv or #)
Sociological analysis of work, occupations, and labor markets, including contemporary theory and research. Course emphasis varies with instructor.

Soc 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

Soc 8490. Advanced Topics in Social Organization. (3 cr; SP–#)
Content varies with instructor. Sample topics: gender and organizations, interorganizational relations, comparative study of organizations, nonprofit organizations, consumer behavior, industry and technology, social networks, conflict, coercion, and social exchange. Topics specified in *Class Schedule*.

Soc 8501. Sociology of the Family. (3 cr)
Theoretical and empirical works from contemporary family sociology. Content varies with instructor. Sample topics: definitions of the family, family roles, family interactions, marriage and divorce, childbearing, parenthood, and cultural variations in families.

Soc 8540. Topics in Family Sociology. (3 cr)
Families and mental health; families, work, and the labor market; historical/comparative research on the family. Topics specified in *Class Schedule*.

Soc 8551. Social Structure and the Life Course. (3 cr)
Central concepts and premises of life course analysis as applied to intersocietal (comparative), intrasocietal (socioeconomic status, race, and gender), and historical variability; institutional patterning of life course (family, education, work, the polity); deviance and criminal careers; changes in the self; and methodological strategies.

Soc 8590. Topics in Life Course Sociology. (3 cr)
Sociology of aging, sociology of youth, and mental health and adjustment in early life course. Topics specified in *Class Schedule*.

Soc 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Soc 8701. Sociological Theory. (4 cr; QP–8711, 8725; SP–Grad soc major or #; A-F only)
Traditions of social theory basic to sociological knowledge, their reflection and expansion in contemporary theory, their applications in selected areas of empirical research. Sample topics: social inequality, social organization and politics, family organization and social reproduction, social order and change, sociology of knowledge and religion.

Soc 8711. Theories of Social Organization. (3 cr)
Key frameworks and theories, structure and process, micro and macro levels of analysis. Empirical literature on major substantive issues related to work, gender, and race; politics and social movements; and post-industrialization and technological change. World systems theory.

Soc 8721. Theories of Social Psychology. (3 cr)
Prominent contemporary theories of sociological social psychology, including structural (social structure and personality) perspectives, social relationships and small group processes (exchange, equity, expectation states theories), and symbolic interactionism. Classical writings, theoretical statements, and empirical studies.

Soc 8725. Sociological Theory Construction. (3 cr; QP–Grad student or #; SP–Δ)
Structure of social scientific theories, basic tools for developing/critiquing them. Types of theoretical statements, concept formation, operationalization, testability. Contrasts goals/methods of different theoretical perspectives.

Soc 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Soc 8790. Advanced Topics in Sociological Theory. (3 cr)
Sample topics: theories of conflict, theories of purposive action, Marxist theory, and structure-agency debate.

Soc 8801. Sociological Research Methods. (4 cr; SP–Grad soc major or #; A-F only)
Multiple objectives of social research and how they inform research design. Conceptualization and measurement of complex concepts. Broad issues in research design and quantitative and qualitative approaches to data collection and management.

Soc 8811. Advanced Social Statistics. (4 cr; SP–5811 or equiv, grad soc major or #; A-F only)
Statistical methods for analyzing social data. Sample topics: advanced multiple regression, logistic regression, limited dependent variable analysis, analysis of variance and covariance, log-linear models, structural equations, and event history analysis. Applications to datasets using computers.

Soc 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Soc 8890. Advanced Topics in Research Methods. (3-4 cr; SP–Grad soc major, 8801, 8811 or #)
Advanced quantitative methods (e.g., multilevel models) and historical/comparative, field, and survey research. Topics specified in *Class Schedule*.

Software Engineering (SEng)

Department of Computer Science

Institute of Technology

SEng 5115. Graphical User Interface Design, Evaluation, and Implementation. (3 cr; SP–Grad SEng major; A-F only)
Design and evaluation of interactive application interfaces, user- and task-centered approaches to design, guidelines for graphical design, interface evaluation techniques, current interface trends, including web interfaces and information visualization. Group projects that include designing, prototyping, and implementing an application interface.

SEng 5116. Graphical User Interface Toolkits. (2-3 cr; QP–Grad SEng major; SP–Grad SEng major; A-F only)
Toolkit-centered introduction to GUI implementation technology. Students learn to use a GUI toolkit to implement a graphical application. Introduction to advanced techniques, including constraint-based data management, 3D visualization tools, and toolkit structure and design.

SEng 5131. Network Programming. (2-3 cr; QP–Grad SEng major; SP–Grad SEng major; A-F only)
Java programming, concurrent programming, workflow, distributed database, security, collaborative computing, object-oriented architecture and design, network publishing, messaging architecture, distributed object computing and intranet.

SEng 5199. Topics in Software Engineering. (2-3 cr [max 6 cr]; QP–SE grad student; SP–SE grad student; A-F only)
Topics specified in *Class Schedule*.

SEng 5511. Artificial Intelligence. (3 cr; QP–Grad SEng major; SP–Grad SEng major; A-F only)
Introduces ideas and theories of AI. Problem solving, search, inference techniques. Logic and theorem proving. Knowledge representation, rules, frames, semantic networks. Planning and scheduling. Introduces Lisp programming language.

SEng 5551. Introduction to Intelligent Robotic Systems. (3 cr; QP–Grad SEng major; SP–Grad SEng major; A-F only)
Transformations, kinematics and inverse kinematics, dynamics, and control. Sensing (robot vision, force control, tactile sensing), applications of sensor-based robot control, robot programming, mobile robotics, and micro-robotics.

SEng 5707. The Principles of Database Systems. (3 cr; QP–Grad SEng major; SP–Grad SEng major; A-F only)
Fundamental concepts; conceptual data organization; data models; data manipulation languages; database design; security and integrity; performance evaluation; query optimization; distributed database systems.

SEng 5708. Object-Oriented Databases. (2-3 cr; QP–Grad SEng major; SP–Grad SEng major; A-F only)
Applications and motivation; extended relational, object-relational, and object-oriented data models; object identifier, types and constructors; versions and schema evolution; query language (recursion, path expressions, etc.); object indices, buffer management and other implementation issues; triggers, rules, complex objects, and case studies.

SEng 5801. Software Engineering I: Software Life Cycle, Requirements Specification, and Design. (3 cr; QP–Grad SEng major; SP–Grad SEng major; A-F only)
Developing cost-effective software. Software engineering lifecycles, problem specification/analysis, system design techniques, documentation. Lectures, project.

SEng 5802. Software Engineering II: Advanced Software Engineering. (3 cr; QP–Grad SEng major; SP–Grad SEng major; A-F only)
Topics in software engineering and in object-oriented software development. Software design/implementation using UML, object-oriented techniques, object-oriented languages such as Java. Lectures, project.

SEng 5811. Software Testing and Verification. (2 cr; QP–5801, grad SEng major; SP–5801, grad SEng major; A-F only)
Theoretical/practical aspects of testing software. Analyzing a requirements document for test conditions. Writing a test plan. Designing, creating, and executing test cases. Recording defects. Writing a testreport.

SEng 5831. Software Development for Real-Time Systems. (2-3 cr; QP–Grad SEng major; SP–Grad SEng major; A-F only)
Analysis, design, verification, and validation of real-time systems. Periodic, aperiodic, and sporadic processes, scheduling theory. Pragmatic issues.

SEng 5841. Formal Modeling and Analysis in Software Engineering. (2 cr; QP–Grad SEng major; SP–Grad SEng major; A-F only)
Formal specification of software artifacts; applicability of formal specifications; introduction to methods such as Z, SCR, and Satecharts. Formal analysis techniques; basic theorem proving; reachability analysis techniques; model checking; introduction to tools such as PVS, Statemate, SPIN, and SMV.

SEng 5851. Software Project Management. (3 cr; SP–Grad SEng major; A-F only)
Concepts used to manage software projects. Project management cycle: initiation, planning/control, status reporting, review, post-project analysis. Leadership and motivation strategies. Lecture, discussion, individual/team presentations/projects.

SEng 5852. Quality Assurance and Process Improvement. (3 cr; QP–Grad SEng major; SP–Grad SEng major; A-F only)
Theory and application of capability maturity model: process assessment, modeling, and improvement techniques. Life cycle issues related to development and maintenance; quality, safety, and security assurance; project management; and automated support environments. Group projects and case studies.

SEng 5899. Software Engineering Seminar. (1-3 cr; QP–Grad SEng major; SP–Grad SEng major, #; A-F only)
Software engineering trends. Talks by invited speakers, selected readings.

SEng 5900. Directed Study. (1-3 cr; A-F only)
Directed study/research in software engineering. Topics/scope decided in collaboration with instructor.

SEng 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

SEng 8494. Capstone Project (Plan B Project). (3 cr; SP–SEng major; A-F only)
Students work in teams on software project using tools, techniques, and skills acquired during previous coursework. Each team works with a client to establish requirements, agree upon design, and achieve a successful acceptance test of resulting software system.

Soil Science (Soil)

Department of Soil, Water, and Climate

College of Agricultural, Food, and Environmental Sciences

Soil 5111. Practicum Internship in Precision Agriculture. (2-5 cr; QP–#; SP–#; S-N only)
Practical experience in precision agriculture in agri-industry/business. Content and extent of work at the internship site is jointly decided by the instructor, host business representative, and student's principal adviser.

Soil 5125. Soil Science for Teachers. (3 cr)
Basic physical, chemical, and biological properties of soil. Soil genesis classification and principles of soil fertility. WWW used for lab. Soil survey information used to make a land-use plan. Similar to 2125 with less emphasis on chemistry.

Soil 5211. Environmental Biophysics and Ecology. (2 cr; QP–[[Biol 1009 or equiv], Math 1251, Phys 1101, [upper div or grad student]] or #; SP–[[Biol 1009 or equiv], Math 1271, Phys 1101, [upper div or grad student]] or #; A-F only)
Basic concepts of environmental variables such as temperature, humidity, wind, and radiation. Mechanics of heat/mass transfer between a living organism and its surrounding environment. Set of practical examples to integrate concepts and transport processes.

Soil 5212. Environmental Biophysics and Ecology Laboratory. (1 cr; QP–Biol 1009, Math 1271, Math 1282, Phys 1101; SP–Biol 1009, Math 1271, Math 1282, Phys 1101; A-F only)
Introduces experimental techniques in environmental biophysics and ecological studies. Measuring biophysical parameters of plants, animals, and their surrounding environments. Defining/describing physical status of a living organism, determining the rate of mass/energy exchange.

Soil 5232. Vadose Zone Hydrology. (3 cr; QP–[[Math 1251 or equiv], [Phys 1041 or equiv]] or #; SP–[Math 1271 or equiv], [Phys 1042 or equiv])
Basic soil physical properties/processes governing transport of mass/energy in soils. Emphasizes water/solute transport through unsaturated root/vadose zones, their impact on subsurface hydrology and on water quality. Lectures, hands-on laboratory exercises, discussion of real world problems, problem solving.

Soil 5311. Soil Chemistry and Mineralogy. (3 cr; QP–[[Chem 1052 or equiv], Phys 1042, grad] or #; SP–[[Chem 1022 or equiv], Phys 1102, grad] or #)
Structural chemistry, origin/identification of crystalline soil clay minerals. Structure of soil organic matter. Chemical processes in soil: solubility, adsorption/desorption, ion exchange, oxidation/reduction, acidity, alkalinity. Solution of problems related to environmental degradation, plant nutrition, and soil genesis.

Soil 5312. Soil Chemistry and Mineralogy Laboratory. (2 cr; QP–5360; SP–¶5311 recommended)
Companion laboratory 5311. Clay mineral preparation for x-ray diffraction, selective mineral dissolution, cation exchange properties, absorption and solubility reactions and their modeling, carbonate equilibria, and organic matter extraction and identification.

Soil 5402. The Atmospheric Boundary Layer. (3 cr; QP–Math 1251, Phys 1251, Stat 3011; SP–Math 1271, Phys 1201, Stat 3011)
Calculus-based introduction to the atmospheric boundary layer (ABL), the interface between the earth's surface and the atmosphere. Topics include ABL development and turbulence, surface energy balance, ABL clouds, air quality, microclimate, and observational and modeling methods.

Soil 5421. Introduction to Atmospheric Science. (3 cr [max 3 cr]; QP–Math 1251, Phys 1251, Stat 3011; SP–Math 1271, Phys 1201, Stat 3011)
Calculus-based, introductory description of the atmosphere including atmospheric dynamics, radiation, thermodynamics, chemical composition, and cloud processes. Discuss applications to climate, meteorology, the hydrologic cycle, air quality, and biogeochemical cycles.

Soil 5515. Soil Genesis and Landscape Relations. (3 cr; QP–3125 or #; SP–2125 or #)
Basic soil morphology and soil profile descriptions; pedogenic processes and models of soil development; soil geomorphology, hydrology, and hillslope processes; digital spatial analysis; soil classification; soil surveys and land use; soil geography.

Soil 5555. Wetland Soils. (2-3 cr; QP–1020 or 3125 or equiv or #; ¶4511 recommended; SP–1125 or 2125 or equiv or #; ¶4511 recommended; A-F only)
Morphology, chemistry, hydrology, formation of mineral/organic soils in wet environments. Soil morphological indicators of wet conditions, field techniques of identifying hydric soils for wetland delineations. Peatlands. Wetland benefits, preservation, regulation, mitigation. Field trips, lab, field hydric soil delineation project.

Soil 5601. Principles of Waste Management. (3 cr; QP–1020 or 3125, Biol 1009/1221-22 or Chem 1051, Stat 3011, ApEc 1101 or #; SP–1125 or 2125, Biol 1002/1009 or Chem 1021, Stat 3011, ApEc 1101 or #; A-F only)
Waste and waste management principles. Issues, problems, and solutions in remedying waste stream. MSW and yard waste composting, WTE incineration operation, ash disposal, recycling, land fill requirements, direct land disposal, regulatory trends, and case studies.

Soil 5611. Soil Biology and Fertility. (3 cr; QP–3125, Biol 1009 or equiv, Chem 1051 or equiv, sr or grad, BioC 3xxx and MicB 3xxx recommended; SP–2125, Biol 1009 or equiv, Chem 1021 or equiv, sr or grad, BioC 3xxx, MicB 3xxx recommended)
Soil microbial populations and biodiversity. Soil microorganisms. Biogeochemical cycles. Macro and micronutrient fertilization, and element function in plants and microbes. Composts, sludge and manures in fertilization. Plant microbe associations: nitrogen fixation, mycorrhizal fungi, and biological control of root pathogens. Pollution and bioremediation.

Soil 5711. Forest Soils. (2 cr; QP–1020 or 3125; SP–1125 or 2125)
Factors affecting tree growth; estimation, modification, and management effects on site productivity; regeneration.

Soil 8005. Supervised Classroom or Extension Teaching Experience. (2 cr; SP–#)
Teaching experience in one of five departments: Biosystems and Agricultural Engineering; Agronomy and Plant Genetics; Horticultural Science; Soil, Water, and Climate; or Plant Pathology. Participation in discussions about effective teaching to strengthen skills and develop a personal teaching philosophy.

Soil 8110. Colloquium in Soil Science. (1-3 cr [max 6 cr]; S-N only)
Research or intellectual areas in soil science or climatology not covered in regular courses. Topics vary; contact department for current offerings.

Soil 8128. Seminar in Soils. (1 cr [max 2 cr]; S-N only)
Students present an open seminar on an advanced topic and attend seminars presented by other graduate students.

Soil 8195. Research Problems in Soils. (1-5 cr [max 10 cr]; SP–[Grad major in soil sci or related field], #)
Directed research on special topics of interest in soil science or climatology supervised by individual or small groups of faculty.

Soil 8252. Advanced Soil Physics. (2 cr; SP–[5232, differential equations] or #; A-F only)
Advances in measurements/modeling of soil physical properties/processes as they relate to water, solute, heat movement in soils. Measuring/estimating hydraulic/thermal properties. Scaling, media concepts. Applying fractals. Analytical/numerical solutions of non-steady state heat/water flow equations. Analytical solutions of diffusion-dispersive equation for solute movement. Spatial variability in soil physical properties/processes.

Soil 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Soil 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

Soil 8510. Advanced Topics in Pedology. (2-4 cr [max 12 cr]; SP–5515; A-F only)
Sample topics: soil-landscape relations, soil genesis, landscape evolution, land use and management, precision agriculture, digital terrain modeling, forest soils.

Soil 8541. Aquatic and Soil Chemistry. (3 cr; QP–5310; SP–5311 or CE 4541; A-F only)
Physical chemical principles, geochemical processes controlling chemical composition of natural waters, soil-/sediment-water interactions. Emphasizes behavior of inorganic contaminants in natural waters, engineered systems, dissolved natural organic matter.

Soil 8550. Teaching Experience. (1 cr [max 6 cr]; SP–Grad major in soil sci or related field, #; S-N only)
Provides students with practical experiences in instructional techniques in a university setting.

Soil 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Soil 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Soil 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

South Asian Languages and Cultures (SALC)

Department of Asian Languages and Literatures
College of Liberal Arts

SALC 5011. Indo-Aryan Linguistics. (3 cr)
Phonological, morphological, and syntactic developments; Indo-European, Old Indo-Aryan, Middle Indo-Aryan, Hindi, and other major modern Indo-Aryan languages.

SALC 5090. Instruction in South Asian Languages. (3-5 cr)
Individualized instruction in one of the South Asian languages.

SALC 5201. Ancient Indian Literature in Translation. (3 cr)
Literary achievements of Indian civilization from the ancient period.

SALC 5202. Modern Indian Literature in Translation. (3 cr)
Literary achievements of Indian civilization from the modern period.

SALC 5204. Folklore of India. (3 cr)
A study of the main genres of Indian folklore—folk tales, folk songs, folk epics, folk dramas, proverbs, and riddles—their relationship to Indian society and inter-relationship with literary traditions, both great and small.

SALC 5411. Introduction to Indian Philosophy. (3 cr)
Major concepts; principal schools of Indian philosophy; traditional and contemporary views.

SALC 5412. Hinduism. (3 cr)
Development of Hinduism focusing on sectarian trends, modern religious practices, myths and rituals, pilgrimage patterns and religious festivals, and the interrelationship between Indian social structure and Hinduism.

SALC 5413. Buddhism. (3 cr)
Historical account of Buddhist religion in terms of its rise, development, various schools, and common philosophical concept. Indian Buddhism compared with Hinduism; Buddhism's demise and revival on the Indian subcontinent.

SALC 5414. Comparative Religions of South Asia. (3 cr)
Compares and contrasts basic philosophical concepts, literatures, ideologies, and ritualistic practices of Hinduism, Buddhism, and Jainism with those of Islam and Sikhism.

SALC 5456. The Cinema of India. (3 cr)
Survey of cinema of South Asia; aesthetic, social, economic, and political perspectives.

SALC 5500. Problems in Indian Philosophy. (3 cr; SP–3411 or 3412 or 3413 or 5411 or 5412 or 5413)
An introduction to Indian philosophy emphasizing analyses of mind and knowledge.

SALC 5521. Gandhi and Non-Violent Revolution. (3 cr)
Character of Gandhi, his influence over contemporaries, and his hold on the world today.

SALC 5556. Women in India: Role and Repression. (3 cr)
Representation of Indian women studied through literature of contemporary Indian women and against background of traditional Indian values and roles.

SALC 5710. Seminar in South Asian Languages. (4-5 cr)
Selected topics on South Asian languages; no knowledge of South Asian languages required.

SALC 5720. Seminar in South Asian Literature. (4-5 cr)
Selected topics on South Asian literature.

SALC 5730. Seminar in South Asian Culture. (4-5 cr)
Selected topics on South Asian cultures.

SALC 5833. India's Gods and Goddesses. (3 cr)
Indian history examined by following development of the deities Krishna, Shiva, and Kali.

SALC 5993. Directed Studies. (1-5 cr; SP–#, Δ, ❑)
Guided individual reading and study of topics not covered in regular courses. Open to qualified students for one or more semesters.

SALC 5994. Directed Research. (1-5 cr; SP–#, Δ, ❑)
Directed research on topics of language, literature, or civilization selected by qualified students with consent of instructor and studied on tutorial basis.

SALC 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

SALC 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

SALC 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

SALC 8710. Seminar: South Asian Languages, Literatures, and Cultures. (1-5 cr; SP–#)
Topic specified in *Class Schedule*.

SALC 8720. Seminar: Interdisciplinary Study of South Asian Topics. (1-5 cr; SP–#)
Selected Indian topics: language problems, social structure, social and cultural change, law, and religion, as seen from a variety of social science and humanities disciplinary perspectives.

SALC 8730. Teaching South Asian Languages, Literatures, and Cultures. (1-5 cr; SP–#)
Fundamentals of language instruction as applied to South Asian languages and literatures. Materials preparation and teaching of specific languages to a controlled group.

SALC 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

SALC 8790. Research. (1-5 cr; SP–#)

SALC 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Spanish (Span)

Department of Spanish and Portuguese
College of Liberal Arts

Span 5012. Advanced Problems in the Spanish Language. (0.2 cr; A-F only)
Development of oral proficiency in Spanish. Participants choose section of course based on their current ACTFL level of Spanish language proficiency. Problematic aspects of Spanish pronunciation, grammar, idiomatic expressions reviewed according to needs of class participants.

Span 5106. The Literature of the Reconquest and Feudal Spain. (3 cr; SP–Three 3xxx or 5xxx literature courses in Spanish)
The major literary genres developed in Spain from the Reconquest to 1502, with reference to the crucial transformations of the Middle Ages, including primitive lyric, epic, clerical narrative, storytelling, debates, collections, chronicles, "exempla," and the Celestina (1499-1502).

Span 5107. The Literature of the Spanish Empire and Its Decline. (3 cr; SP–Three 3xxx or 5xxx literature courses in Spanish or Portuguese)
Major Renaissance and Baroque works of the Spanish Golden Age (16th- and 17th-century poetry, nonfiction prose, novel, drama) examined against the historical background of internal economic decline, national crisis, and ideological apparatus developed by the modern state.

Span 5108. *Don Quixote.* (3 cr; SP–Three 3xxx or 5xxx literature courses in Spanish or Portuguese)
Analysis of Cervantes' *Don Quixote* in its sociohistorical context; focus on the novel's reception from the romantic period to postmodern times.

Span 5109. The Crisis of the Old Regime: Spanish Literature of the Enlightenment and Romanticism. (3 cr; SP–Three 3xxx or 5xxx literature courses in Spanish or #)
Major literary works and intellectual movements and conflicts represented in written culture, of the 18th and early 19th centuries (1680-1845), examined as expressions of the long crisis of Spain's Old Regime and the rise of bourgeois liberalism.

Span 5110. Discursive Formations at the Threshold of 20th-Century Spain. (3 cr; SP–Three 3xxx or 5xxx literature courses in Spanish or #)
Theory and representative examples of the realist/naturalist novel (Galdós, Pardo Bazán) in the context of its antecedents ("costumbrismo"), opposites (the idealist/sentimental novel), and turn-of-the-century innovations of modernism and the "generation of 1898."

Span 5111. Contemporary Spanish Literature Since 1915. (3 cr; SP–Three 3xxx or 5xxx literature courses in Spanish or #)
Major literary works and movements in Spain from 1915 to 2000. Neomodernism; surrealism; social realism; literatures of dictatorship and exile; postmodernism. Poetry, novel, drama, essays, film, video/TV; problems of literary history.

Span 5221. Spanish Drama in Performance: 17th-Century Comedia. (3 cr; SP–Three 3xxx or 5xxx literature courses in Spanish or Portuguese)
Major dramatists of the Spanish comedia (e.g., Cervantes, Lope, Tirso, Calderón). Traditional genres such as tragedy, farce, interludes or auto sacramentales and problems of honor, blood purity, free will, city vs. country, and poetic justice examined against the background of cultural and social history.

Span 5234. Feminism and Literature in Spain. (3 cr; SP–Three 3xxx or 5xxx literature courses in Spanish or Portuguese or #)
Spanish feminist thought and practice; literature, cultural discourse, literary and critical theory.

Span 5272. Hispanic Modernism. (3 cr; SP–Three 3xxx or 5xxx literature courses in Spanish or Portuguese)
Critique of artistic and literary production in Hispanic cultures from mid-19th century to present. Modernity and modernization in Hispanic world. "Generation of 1898." Castilian, Catalán, and Latin American practices along interdisciplinary and comparative lines.

Span 5316. Spanish Picaresque Narratives. (3 cr; SP–Three 3xxx or 5xxx literature courses in Spanish or Portuguese)
Major picaresque narratives—*Lazarillo, Guzmán, Buscón*, Cervantes' *Picaros, Estebanillo González*—in relation to Spanish ambience, Western tradition, European novel, realism. Literary autobiography, episodic structure, themes of roguery, delinquency, sin, marginality, social criticism, moral preoccupations. Comparison to European counterparts.

Span 5525. Caribbean Literature: An Integral Approach. (3 cr; SP–Three [3xxx or 5xxx] literature courses in Spanish or #)
Literature of Spanish-speaking Caribbean. Emphasizes historical legacy of slavery, African culture, and independence struggles.

Span 5526. Creole Consciousness and Mercantilist Culture. (3 cr; SP–Three 3xxx or 5xxx literature courses in Spanish)
Discourse production in Spanish America between 1492 and 1700. Conquest and colonial writing and counterwriting; historical origin and evolution and the impact of cultural, political, and socioeconomic factors.

Span 5527. National Literary Consciousness and Free Trade. (3 cr; SP–Three 3xxx or 5xxx literature courses in Spanish)
Literary movements as part of the process of forming nation-states in Spanish America.

Span 5528. Popular Literary Consciousness: 1900-1950. (3 cr; SP–Three 3xxx or 5xxx lit courses in Spanish or Portuguese or Δ)
Spanish-American literature between the eve and aftermath of the two world wars. Impact of modernization, industrialization, and nationalistic and populist thought on emergence of distinctive writing, thematic trends, and literary genre conventions.

Span 5529. National Affirmation and Transnationalization. (3 cr; SP–Three 3xxx or 5xxx literature courses in Spanish or #)
Literary trends of the contemporary period (1950 to present) as a reaction to internal social demands for development of independent national cultures and in response to international cultural pressures.

Span 5531. Hispanic Literature of the United States. (3 cr; SP–Three 3xxx or 5xxx Spanish or Portuguese literature courses or #)
Interdisciplinary approach providing a framework for deconstructing issues of national identity, marginalization, and gender. U.S. Hispanic theatre/literature and its ethnic diversity, regional variations, cultural links, and scope of its genres.

Span 5532. Literature and National Disintegration. (3 cr)
Literary reaction to contemporary structural changes in world economic system (1970 to present). Effects on literature as institution. Texts related to revolutionary trends and social movements (feminism, theology of liberation, defense of human rights).

Span 5536. Feminism and Literature in Latin America. (3 cr; SP–Three 3xxx or 5xxx lit courses in Spanish or Portuguese or Δ)
Latin American feminism in thought and practice; literature, cultural discourse, literary theory.

Span 5701. History of Ibero-Romance. (3 cr; SP–3703, two other 3xxx or 5xxx Spanish linguistics courses or #)
Origins and developments of Ibero-Romance languages; evolution of Spanish, Portuguese, and Catalan.

Span 5711. The Structure of Modern Spanish: Phonology. (3 cr; SP–3701, two 3xxx or 5xxx linguistics courses in Spanish or #)
Formulating and evaluating a phonological description of Spanish. Approaches to problems in Spanish phonology within metrical, autosegmental, and lexical phonological theories.

Span 5712. The Structure of Modern Spanish: Morphology. (3 cr; SP–#)
Evaluating morphological theories and descriptions of Spanish. Examining of phonological and syntactic effects on morphology.

Span 5713. The Structure of Modern Spanish: Syntax. (3 cr; SP–3702, two 3xxx or 5xxx Spanish linguistics courses or #)
Study and analysis of the principal constructions found in the syntax of Spanish.

Span 5714. Theoretical Foundations of Spanish Syntax. (3 cr; SP–5713 or #)
Linguistic types/processes that appear across languages. Grammatical relations, word order, transitivity, subordination, information structure, grammaticalization. How these are present in syntax of Spanish.

Span 5715. The Structure of Modern Spanish: Semantics. (3 cr; SP–#)
Applying semantic theory to Spanish: conceptual organization and the structuring of experience; meaning and cultural values; semantic fields; categorization and prototypes; cognitive model theory; metaphor, metonymy, and mental imagery as source and change of meaning.

Span 5716. The Structure of Modern Spanish: Pragmatics. (3 cr; SP–#)
Concepts used in current literature in Spanish pragmatics, such as deixis, presupposition, conversational implicature, speech act theory, and conversational structure.

Span 5731. Spanish Dialectology: Regional and Social Dialects of Modern Spain. (3 cr; SP–Three 3xxx or 5xxx linguistics courses in Spanish or #)
Major dialect areas of Spain, with distinguishing phonological, morphological, lexical, and syntactic variations of each. Impact of recent cultural, political, and socioeconomic transformations on language.

Span 5732. Spanish Dialectology: Regional and Social Dialects of Modern Spanish America. (3 cr; SP–Three 3xxx or 5xxx linguistics courses in Spanish or #)
Major dialect areas of Spanish America, with distinguishing phonological, morphological, lexical, and syntactic variations of each. Their historical origin and evolution and the impact of cultural, political, and socioeconomic transformations on the language.

Span 5800. Spain's Image and the Hispanic Culture (Towards the XXI Century). (0.1 cr; A-F only)
Contemporary Spanish society from perspectives of humanities, social sciences. Major sociocultural changes in Spain during 20th century. Emphasizes current situation, developments leading into 21st century. Literature, history, politics, geographical/regional diversity, art, music, cinema.

Span 5910. Topics in Spanish Peninsular Literature. (3 cr [max 9 cr]; SP–Three 3xxx or 5xxx literature courses in Spanish or Portuguese)
Problems in Spanish cultural history and their applicability to studies of artistic movements, ideological trends, formal methods, or literary genres. Topics specified in *Class Schedule*.

Span 5920. Topics in Spanish-American Literature. (3 cr [max 9 cr]; SP–3104 or Δ)
Spanish-American literature analyzed according to important groups, movements, trends, methods, and genres. Specific approaches depend on topic and instructor. Topics specified in *Class Schedule*.

Span 5930. Topics in Ibero-Romance Linguistics. (3 cr [max 9 cr]; SP–#)
Problems in Hispanic linguistics; a variety of approaches and methods.

Span 5970. Directed Readings. (1-4 cr [max 9 cr]; SP–M.A. or Ph.D. candidate, #, Δ, ❑)
Students must submit reading plans for particular topics, figures, periods, or issues. Readings in Spanish and/or Spanish-American subjects.

Span 5985. Sociolinguistic Perspectives on Spanish in the United States. (3 cr; SP–Three 3xxx or 5xxx linguistics courses in Spanish or #)
Sociolinguistic analysis of issues such as language maintenance/shift in U.S. Latino communities, code switching, attitudes of Spanish speakers toward varieties of Spanish and English, language change in bilingual communities, and language policy issues.

Span 5990. Directed Research. (1-4 cr [max 9 cr]; SP–#, Δ, ❑)

Span 5991. The Acquisition of Spanish as a First and Second Language. (3 cr; SP–Three 3xxx or 5xxx linguistics courses in Spanish or #)
Analysis of issues such as the acquisition of Spanish and English by bilingual children; Spanish in immersion settings; developmental sequences in Spanish; classroom language learners' attitudes, beliefs, and motivation; development of pragmatic competence.

Span 8100. Research in Sociohistorical Approaches to Spanish Literature. (3 cr [max 9 cr]; SP–5xxx courses in Span literature and culture)
Sociohistorical functions of Spanish literary works and major theories concerning literary production of texts. Testing modern theories in terms of representative fictional discourses from specific historical periods.

Span 8200. Spanish Literary Texts: Theories of Formal Structures. (3 cr [max 9 cr]; SP–5xxx courses in Span literature and culture)
Advanced research in methods of literary analysis of discourse. Emphasizes theoretical and practical frameworks within which representative texts are analyzed and interpreted from differing perspectives.

Span 8212. Spanish Theater of the 16th Century: Drama up to Lope. (3 cr; SP–5xxx courses in Span literature and culture)
Medieval origins of drama to *La Celestina* (1499-1502), pastoral dialogues, crossover plays of Spanish and Portuguese dramatists, popular theater up to emerging public and private theaters under Italian influence. Rojas, Encina, Vicente, Naharro, Cervantes, and new tragedians.

Span 8223. The Poetry of the Spanish Golden Age. (3 cr; SP–5xxx courses in Span literature and culture)
New Spanish poetic forms, from Garcilaso de León, mystics, and San Juan to Baroque trends by Góngora, Lope, and Quevedo. Classic traditions and modern adaptations. Ideological foundations of lyric genres—eclogue, lira, mystics, satire, conceptismo/culteranismo, and sonnet.

Span 8252. Spanish Literature: 19th Century. (3 cr)
Critical review of 19th-century Spanish literary movements, their relationships, and recent research. Romanticism, realism/naturalism; development of the novel, poetry, theater.

Span 8271. Spanish Theater: 20th Century. (3 cr; SP–5109, 5111 or 5xxx course in Portuguese)
Development and evolution of dramatic genres (experimental, absurd, or vanguard) from 1898 crisis to World War I, Civil War, World War II, and Franco era to the present: Galdós, Valle-Inclán, Unamuno, Grau, Lorca, Vallejo, Arrabal, and "Subterraneans." Emphasizes "drama in performance" and diverging ideologies.

Span 8300. The Construction of Spanish Literary History. (3 cr [max 9 cr]; SP–Two 5xxx courses in Span literature and culture)
Origins and development of Hispanic literary canon: sociocultural theories of Spanish literary histories as academic and historiographic disciplines. Critiques of modern literary theories through analysis of literary works by major writers.

Span 8312. Two Spanish Masterpieces: *Libro de Buen Amor* and *La Celestina*. (3 cr; SP–5106, 5107 or 5xxx course in Portuguese)
Cultural reappraisal of the late Middle Ages by reference to two Spanish masterpieces: the Archpriest's *Book of True Love* and Rojas' *La Celestina* (1499-1502). Emphasizes historical function of varied genres, motifs, and sources adapted by the authors.

Span 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Span 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

Span 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Span 8710. Seminar in Spanish and Portuguese Phonology. (3 cr [max 9 cr]; SP–5711, Ling 5302 or #)
Critical examination of readings and research on specific topic.

Span 8730. Seminar in Spanish and Portuguese Syntax. (3 cr [max 9 cr]; SP–5714 or #)
Critical examination of readings and research on specific topic.

Span 8750. Seminar in Spanish and Portuguese Pragmatics. (3 cr [max 9 cr]; SP–5716 or #)
Critical examination of readings and research in specific topic.

Span 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Span 8780. Seminar in Hispanic Sociolinguistics. (3 cr [max 9 cr]; SP–5731 or 5732 or 5985 or #)
Current issues.

Span 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Span 8900. Spanish Seminar. (3 cr [max 9 cr]; SP–Span 5xxx series required for M.A. or #)
Projects relying heavily on advanced research in Spanish problems. Investigation of assigned fields, analysis of problems, appraisal of principles. Limited to small group of students. For list of sample seminars, consult department and director of graduate studies.

Span 8940. Advanced Research in Spanish-American Literary Historiography. (3 cr [max 9 cr])
Sources and procedures that have given rise to institutionalizations of Spanish-American literary history. Evaluation and review of epistemological principles and assumptions in theory of literary criticism and histories of literature.

Span 8960. Workshop: Research in Hispanic Cultural Issues. (3 cr [max 9 cr]; SP–Reading knowledge of Spanish and Portuguese; A-F only)
Individualized support and advice in framing, theorizing, problematizing, and interpreting areas of cultural research. Taught in Spanish, Portuguese, and English.

Span 8990. Advanced Comparative Research of Caribbean Genres. (3 cr [max 9 cr]; SP–5525 or #)
Major literary works and genres of Caribbean literature studied against the background of sociohistorical vicissitudes of the process leading to the formation and consolidation of the national states.

Spanish-Portuguese (SpPt)

Department of Spanish and Portuguese
College of Liberal Arts

SpPt 5930. Selected Topics in Hispanic Cultural Discourse. (3 cr [max 9 cr]; SP–Reading knowledge of Span and Port; A-F only)
Cultural discourses in Spanish- and Portuguese-speaking areas. Historical intersections and divergences. Taught in Spanish and/or Portuguese; English when cross-listed. Topics specified in the *Class Schedule*.

SpPt 5999. The Teaching of College-Level Spanish: Theory and Practice. (3 cr; SP–Grad or #)
Theoretical grounding in the general principles of second language acquisition and guidance with their practical applications to the teaching of first-and second-year Spanish at the college-level.

SpPt 8400. Topics in Modern Hispanic and Lusophone Culture. (3 cr [max 9 cr]; SP–Three 5xxx Span or Port courses)
Advanced research in methods of analysis of culture. Emphasizes theoretical and practical frameworks within which representative cultural products and events are analyzed and interpreted from differing perspectives.

SpPt 8920. Cross-Cultural Issues in Hispanic and Luso-Brazilian Cultural Discourses. (3 cr [max 9 cr])
Comparative study of literary and cultural production in historical periods when economic, social, political, and ideological bonds among Hispanic and Lusophone countries were intensified. Topics specified in *Class Schedule*.

Speech-Communication (Spch)

Department of Speech–Communication
College of Liberal Arts

Spch 5110. Special Topics in Communication Theory. (3 cr [max 6 cr])
Advanced theoretical problems. See department office for current offering.

Spch 5210. Contemporary Problems in U.S. Electronic Media. (3 cr [max 3 cr]; SP–3211)
Problems affecting U.S. commercial and educational electronic media. Audiences; race/gender issues; regulation.

Spch 5220. Television Genres. (3 cr [max 3 cr])
Nature, historical development, and influence on society of specific genres of television programming: drama, situation comedy, mystery, soap opera. Program genre change over time and how society, government regulation, and economics of production influence that historical process.

Spch 5233W. Electronic Media and National Development. (3 cr)
Use of electronic media to change social, political, economic, and cultural life. Use by developing nations to improve agricultural practices, hygienic standards, literacy, and awareness of civic responsibility.

Spch 5261. Political Economy of Media Culture. (3 cr; SP–3211 or #)
Organizational practices of media communicators. Media content as link between communicators and audiences. How viewers use/process media content.

Spch 5401. Advanced Theories of Communication. (3 cr; SP–3401 or grad)
Survey of major theoretical approaches to communication including, positivism, constructivism, and systems.

Spch 5402. Advanced Interpersonal Communication. (3 cr; SP–1102, 3402 or 3411 or 3431 or 3441 or 3451)
Social scientific approaches to interpersonal communication; theory and research findings.

Spch 5404. Language, Culture, and Identity. (3 cr; SP–3401 or #)
How language/communication transmit cultural knowledge, attitudes, and beliefs. Connections among language, thought, and culture. Social/ethnic perspectives on study of language/communication.

Spch 5406. Communication and Gender. (3 cr; SP–One women's studies course or #)
How gender affects verbal communication. Development of analytical skills through readings, exercises, research that raise awareness of the power of language and the influence of gender prescriptions. Comparisons across languages where possible.

Spch 5408. Social Cognition. (3 cr)
Role of cognitive processing in communication studies. Models include perception, attention, memory and their use in communication. Evaluation of social cognition theory and research.

Spch 5411. Small Group Communication Research. (3 cr; SP–3411 or #; A-F only)
Survey of small group communication research; theory and practice. Group decision-making and leadership.

Spch 5421. Quantitative Methods in Communication Research. (3 cr; SP–3401 or #; A-F only)
Social scientific methods used in studying human communication. Optional data processing laboratory for additional credit.

Spch 5431. The Process of Persuasion. (3 cr; SP–3431)
Communication campaigns (e.g., advertising, political) illustrating persuasive processes and theories. Research paper required.

Spch 5441. Communication in Human Organizations. (3 cr; SP–9 cr social science, 3441 or #)
Communication in organizational settings. Organizational structure and dynamics and their effect upon the communication process. Individual projects.

Spch 5451W. Intercultural Communication Processes. (3 cr)
Theory and research on cultural differences in values, norms, behaviors, and perceptions that affect communication across cultures internationally and domestically.

Spch 5461. Conversation Analysis. (3 cr; SP–Ling 3001 or 5001)
Discourse processes in dyadic and multiparty conversation. Application of concepts through analysis of conversations.

Spch 5462. Field Research in Spoken Language. (3 cr; SP–5461, Ling 3001 or 5001)
Transcribing and analyzing verbal communication and movement related to it. Applying concepts to recorded conversations.

Spch 5611. Survey of Rhetorical Theory. (3 cr; SP–1101)
Survey of rhetorical theory from ancient to contemporary period; application of theory to public discourse.

Spch 5615W. Introduction to Rhetorical Criticism. (3 cr; SP–1101, 3601 recommended)
Analysis of public discourse using various theoretical perspectives.

Spch 5617. History and Criticism of U.S. Public Discourse: 1630-1865. (3 cr; SP–Jr)
How discourse has been used to establish or maintain power. Speeches and public debates used to examine American public address from 17th century (e.g., Puritan sermons) to the Civil War.

Spch 5618. History and Criticism of U.S. Public Discourse: 1865-1950. (3 cr; SP–Jr)
How discourse has been used to establish or maintain power. Speeches and public debates used to examine U.S. public address from the mid 19th century to 1950.

Spch 5970. Directed Study. (1-3 cr [max 6 cr]; SP–Nine 3xxx-5xxx Spch cr, #, Δ, ❑; S-N only)
Guided individual reading or study.

Spch 8110. Seminar: Advanced Speech Problems. (3 cr; SP–undergrad degree in spch-comm or equiv)
Evaluation of research methods in speech-communication.

Spch 8210. Seminar: Selected Topics in U.S. Electronic Media. (3 cr [max 6 cr]; SP–5210 or #; offered when feasible)
Literature survey; evaluating research on topics; conducting independent research project on a particular topic.

Spch 8211. Critical Communication Studies: History, Theory, Method. (3 cr)
Qualitative research methods for studying media institutions, texts, audiences, and contexts.

Spch 8231. Seminar: National and International Electronic Media Systems. (3 cr; SP–4231 or #)
Historical and contemporary aspects of national and international electronic media systems. Roles of national and international regulatory bodies. Approaches to programming and evidence of effectiveness.

Spch 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Spch 8402. Seminar: Interpersonal Communication. (3 cr; SP–5402 or #)
Evaluate and develop new perspectives for analyzing, diagnosing, and managing interpersonal communication problems.

Spch 8403. Seminar: Emotion and Communication. (3 cr)
Major theories of emotion and the role of emotion in communication.

Spch 8406. Seminar: Language and Gender Research. (3 cr; SP–5406)
Readings and research on current issues. Data collected to test hypotheses and apply theory.

Spch 8411. Seminar: Small Group Communication Theory. (3 cr)
Research problems and methods.

Spch 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

Spch 8451. Seminar: Intercultural and Diversity Research. (3 cr; SP–#)
Development of ideas and methods for research project, M.A. Plan B project, or Ph.D. dissertation.

Spch 8452. Seminar: Methods of Intercultural/ Diversity Facilitation. (3 cr; SP–4451 or 5452 recommended)
Theories of and techniques for managing effective intercultural communication and diversity. Intercultural training.

Spch 8502. Seminar: Communication Theory Construction. (3 cr; SP–5421 or #)
Logic of communication theory development and modification from a social scientific perspective. Types of communication theories.

Spch 8503. Historical and Descriptive Research in Speech-Communication. (3 cr)
Elements involved in conducting and analyzing historical and descriptive research; approaches to historical research, assessing primary and secondary sources; completing a major research project.

Spch 8504. Seminar: Rhetorical Criticism. (3 cr; SP–5615 or #)
Rhetorical criticism theories and methods. Rhetoric as applied to literary studies and the growth of hermeneutics as vantage points for reassessing rhetorical methods.

Spch 8606. Seminar: Rhetorical Analysis of Campaigns and Movements. (3 cr; SP–5431, 5617 or 5618, 10 cr soc sci or #)
Literature and methodology in historical and contemporary rhetorical campaigns and movements.

Spch 8611. Seminar: Rhetoric. (3 cr [max 6 cr]; SP–5611 or #)
History and criticism of rhetorical theory. Research in rhetoric.

Spch 8625. Seminar: Communication Ethics. (3 cr; SP–Ethics course or #; A-F only)
Independent research on communication ethics in interpersonal, group, organizational, intercultural, and media settings. Theories of ethics and methods of analysis.

Spch 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Spch 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Spch 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Statistics (Stat)

School of Statistics
College of Liberal Arts

Stat 5021. Statistical Analysis. (4 cr; QP–College algebra or #; SP–§3011; College algebra or #; Stat course recommended)
Intensive introduction to statistical methods for graduate students needing statistics as a research technique.

Stat 5031. Statistical Methods for Quality Improvement. (4 cr; QP–[3012 or 3091 or 5021 or 5122 or 5132 or 5152], Math 1252; SP–[3021 or 3022 or 4102 or 5021 or 5102 or 8102], Math 1272)
Random variability/sampling. Controlling statistical process. Shewhart/accumulative charting. Analyzing plant data, trend surface, and variance/design of experiments.

Stat 5041. Bayesian Decision Making. (3 cr; QP–5122 or 5132 or 5152 or #; SP–4101 or 5021 or 5101 or #)
Axioms for subjective probability/utility. Optimal statistical decision making. Sequential decisions/ decision trees. Backward induction. Bayesian data analysis.

Stat 5101. Theory of Statistics I. (4 cr; QP–§5121, §5122; Math 3252; SP–§4101, §5651; Math 2263)
Logical development of probability, basic issues in statistics. Probability spaces. Random variables, their distributions and expected values. Law of large numbers, central limit theorem, generating functions, multivariate normal distribution.

Stat 5102. Theory of Statistics II. (4 cr; SP–§4102; 5101 or Math 5651)
Sampling, sufficiency, estimation, test of hypotheses, size/power. Categorical data. Contingency tables. Linear models. Decision theory.

Stat 5201. Sampling Methodology in Finite Populations. (3 cr; QP–3091 or 5021 or 5121 or #; SP–3011 or 3021 or 5021 or #)
Simple random, systematic, stratified, unequal probability sampling. Ratio, model based estimation. Single stage, multistage, adaptive cluster sampling. Spatial sampling.

Stat 5302. Applied Regression Analysis. (4 cr; QP–§5161; 3012 or 5021 or 5133 or 5153; SP–3022 or 4102 or 5021 or 5102 or #)
Simple, multiple, and polynomial regression. Estimation, testing, prediction. Use of graphics in regression. Stepwise and other numerical methods. Weighted least squares, nonlinear models, response surfaces. Experimental research/applications.

Stat 5303. Designing Experiments. (4 cr; QP–§5163; 3012 or 5021 or 5133 or 5153 or #; SP–3022 or 4102 or 5021 or 5102 or #)
Analysis of variance. Multiple comparisons. Variance-stabilizing transformations. Contrasts. Construction/ analysis of complete/incomplete block designs. Fractional factorial designs. Confounding split plots. Response surface design.

Stat 5401. Applied Multivariate Methods. (3 cr; QP–5302 or 5133 or 5153; SP–5302 or 8102 or #)
Bivariate and multivariate distributions. Multivariate normal distributions. Analysis of multivariate linear models. Repeated measures, growth curve and profile analysis. Canonical correlation analysis. Principle components and factor analysis. Discrimination, classification, and clustering.

Stat 5421. Analysis of Categorical Data. (3 cr; QP–§5162; 3012 or 5021 or 5133 or 5153 or #; SP–5302 or 8102 or #)
Varieties of categorical data, cross-classifications, contingency tables. Tests for independence. Combining 2x2 tables. Multidimensional tables/ loglinear models. Maximum-likelihood estimation. Tests for goodness of fit. Logistic regression. Generalized linear/multinomial-response models.

Stat 5601. Nonparametric Methods. (3 cr; QP–5021 or 5122 or 5132 or 5152 or #; SP–3022 or 4102 or 5021 or 5102 or #)
Order statistics. Classical rank-based procedures (e.g., Wilcoxon, Kruskal-Wallis). Goodness of fit. Topics may include smoothing, bootstrap, and generalized linear models.

Stat 5931. Topics in Statistics. (3 cr)
Topics vary according to student needs and available staff.

Stat 5932. Topics in Statistics. (3 cr)
Topics vary according to students' needs and available staff.

Stat 5993. Tutorial. (1-6 cr [max 12 cr]; SP–#)
Directed study in areas not covered by regular offerings.

Stat 8061. Applied Statistical Methods I. (4 cr; QP–§5201, §5301, §5302, §5421, ¶5131 or ¶5151; SP–Grad stat major or #; A-F only)
The regression problem; linear regression with one or more predictors; using graphics in regression; model building; model assessment and diagnostics; outliers; generalized linear models; logistic, Poisson, and nonlinear regression.

Stat 8062. Applied Statistical Methods II. (4 cr; QP–5162; SP–8061, grad stat major or #; A-F only)
Categorical data analysis: loglinear models, logit models, multinomial response models, exact and asymptotic inference, conditional independence; models of association. Experimental design: randomization, ANOVA, contrasts and multiple testing, factorials, blocking, covariates, split plots, random effects, fractional factorials, response surfaces.

Stat 8101. Theory of Statistics I. (3 cr; SP–Grad stat major or #)
Probability, transformations, expectation, univariate and multivariate distributions, central limit theorem, sampling and sampling distributions, sufficiency, likelihood.

Stat 8102. Theory of Statistics II. (3 cr; QP–5152; SP–8101, grad stat major or #)
Point and interval estimation, maximum likelihood, delta method, hypothesis testing, decision theory, analysis of variance, regression.

Stat 8111. Mathematical Statistics I. (3 cr; QP–[5133 or 5153], real analysis, matrix algebra; SP–[5102 or 8102 or #], [[Math 5615, Math 5616] or real analysis], matrix algebra)
Probability theory, basic inequalities, characteristic functions, and exchangeability. Multivariate normal distribution. Exponential family. Decision theory, admissibility, and Bayes rules.

Stat 8112. Mathematical Statistics II. (3 cr; QP–8152; SP–8111)
Statistical inference, estimation, and hypothesis testing. Convergence and relationship between convergence modes. Asymptotics of maximum likelihood estimators, distribution functions, quantiles. Delta method.

Stat 8121. Theory of Inference. (3 cr; QP–8153, Math 8658; SP–8112, Math 8657 or #)
Topics may vary according to instructor and student interests. Sample topics: conditional distributions and sufficiency, estimation theory, comparison of statistical inference theories; Neyman-Pearson hypothesis-testing theory and its extensions, confidence regions, invariance, and nonparametric, sequential, likelihood, and Bayesian inference.

Stat 8131. Predictive Inference. (3 cr; QP–8152 or equiv; SP–8112 or equiv)
Traditional frequentist and nontraditional predictive approaches. Bayesian predictive methods and the purpose for which data are used. Theoretical apparatus discussed using a variety of common statistical paradigms. Model selection, comparisons and allocation, perturbation analysis and control.

Stat 8141. Probability Assessment. (3 cr; QP–5133 or equiv; SP–5102)
Probability as a language of uncertainty for quantifying and communicating expert opinion and for use as Bayesian prior distributions. Methods for elicitation and construction of subjective probabilities. De Finetti coherence, predictive elicitation, fitting subjective-probability models, computer-aided elicitation, and use of experts.

Stat 8151. Statistical Decision Theory. (3 cr; QP–8153, Math 8658; SP–8112, Math 8656)
Comparison of inferential methods in statistics (including risk comparison, minimaxity, and admissibility) using Wald's formulation of decision. Formal and proper Bayes rules compared with frequentist inferences. Topics may vary depending on instructor.

Stat 8171. Sequential Analysis. (3 cr; QP–8153; SP–8112)
Walds's sequential probability ratio test and modifications. Sequential decision theory. Martingales. Sequential estimation, design, and hypothesis testing. Recent developments.

Stat 8201. Topics in Sampling. (3 cr; QP–5153; SP–8102 or #; S-N only)
Sampling theory; stratified sampling, ratio estimators, cluster sampling, double sampling, superpopulation theory, Bayesian methods, multiple imputation, nonresponse.

Stat 8311. Linear Models. (4 cr; QP–Linear algebra, 5122 or 5133 or 5153; SP–Linear algebra, 5102 or 8102 or #)
General linear model theory from a coordinate-free geometric approach. Distribution theory, ANOVA tables, testing, confidence statements, mixed models, covariance structures, variance components estimation.

Stat 8312. Linear and Nonlinear Regression. (3 cr; QP–8312; SP–8311)
Nonlinear regression: asymptotic theory, Bates-Watts curvatures, super leverage, parameter plots, projected residuals, transform-both-sides methodology, Wald versus likelihood inference. Topics in linear and generalized linear models as they relate to nonlinearity issues, including diagnostics, semi-parametric models, and model assessment.

Stat 8313. Topics in Experimental Design. (3 cr; QP–8312; SP–8311)
Optimal, Bayes, and nonlinear designs; algorithms for computing designs; sample size; recent developments.

Stat 8321. Regression Graphics. (3 cr; QP–8312; SP–8311)
Foundations: dimension-reduction subspaces, Li-Duan Lemma, structural dimension. Inferring about central dimension-reduction subspaces by using 3D plots, graphical regression, inverse regression graphics, net-effect plots, principal Hessian directions, sliced inverse regression and predictor transformations. Graphics for model assessment.

Stat 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Stat 8401. Topics in Multivariate Methods. (3 cr; QP–8312; SP–8311)
Bivariate and multivariate distributions. Multivariate normal distributions. Hotellings's T-squared, MANOVA, MANCOVA, and regression with multivariate dependent variable. Repeated measures, growth curve, and profile analysis. Canonical correlation analysis. Principle components and factor analysis. Discrimination, classification, clustering.

Stat 8411. Multivariate Analysis. (3 cr; QP–8153; SP–8152)
Multivariate normal distribution. Inference on the mean, covariance, and correlation and regression coefficients; related sampling distributions such as Hotelling's T-squared and Wishart distributions. Multivariate analysis of variance. Principal components and canonical correlation. Discriminant analysis.

Stat 8421. Theory of Categorical Data Analysis. (3 cr; QP–5162; SP–8062 or #)
Categorical data, multidimensional cross-classified arrays, mixed categorical and continuous data. Loglinear, logit, and multinomial response models. Ordinal responses. Current research topics.

Stat 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

Stat 8501. Introduction to Stochastic Processes With Applications. (3 cr; QP–5131 or 5151; SP–5101 or 8101)
Markov chains in discrete and continuous time, renewal processes, Poisson process, Brownian motion, and other stochastic models encountered in applications.

Stat 8511. Time Series Analysis. (3 cr; QP–5133 or 5153; SP–5102 or 8111 or #)
Discrete and continuous parameter time series. Stationarity. Second-order descriptions of times series. Frequency domain representation and univariate and multivariate time series analysis. Smoothed modified periodograms, multi-taper estimation. Time-domain representation and time series analysis. ARIMA models, structural models.

Stat 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Stat 8701. Computational Statistical Methods. (3 cr; QP–8312, programming exper; SP–8311, programming exper)
Random variate generation, variance reduction techniques. Robust location estimation and regression, smoothing additive models, regression trees. Programming projects; basic programming ability and familiarity with standard high-level language (preferably FORTRAN or C) are essential.

Stat 8711. Statistical Computing. (3 cr; QP–8162; SP–8701 or #)
Basic numerical analysis for statisticians. Numerical methods for linear algebra, eigen-analysis, integration, and optimization and their statistical applications.

Stat 8721. Programming Paradigms and Dynamic Graphics in Statistics. (3 cr; QP–5153, 5163; SP–8062, 8102)
Alternative programming paradigms to traditional procedural programming, including object-oriented programming and functional programming. Applications to development of dynamic statistical graphs and representation and use of functional data, such as mean function in nonlinear regression log likelihoods and prior densities in Bayesian analysis.

Stat 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Stat 8801. Statistical Consulting. (2 cr; SP–Grad stat major or #; S-N only)
Almost all statistics graduates will provide some level of consulting to statistics users in other subject areas. Principles of effective consulting and problem-solving, meeting skills, and reporting. Aspects of professional practice and behavior, ethics, and continuing education.

Stat 8811. Statistical Consulting Practicum. (3 cr [max 3 cr]; SP–Statistics grad student, Δ; S-N only)
Providing (under faculty supervision) statistical support to clients, primarily University researchers. Exercise in problem solving, ethics, listening/communication skills.

Stat 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Stat 8900. Student Seminar. (1 cr [max 2 cr]; SP–Statistics grad student; S-N only)
Preparation or presentation of seminar on statistical topics.

Stat 8931. Advanced Topics in Statistics. (3 cr)
Topics vary according to student needs and available staff.

Stat 8932. Advanced Topics in Statistics. (3 cr)
Topics vary according to student needs and available staff.

Stat 8992. Directed Readings and Research. (1-6 cr [max 12 cr]; SP–#; S-N only)
Directed study in areas not covered by regular offerings.

Studies of Science and Technology (SST)

Institute of Technology

SST 8000. Colloquium. (1.5 cr [max 3 cr]; SP–Grad SST minor; S-N only)
Series of weekly lectures by nationally and internationally known scholars with diverse disciplinary and methodological backgrounds speaking on a variety of issues.

SST 8100. Seminar: Models, Theories, and Reality. (3 cr; SP–HSci 8111 or [Phil 8601 or 8602 or 8605] or #)
Students participate in ongoing research on the role of models and theories in science, and prepare and present research papers.

SST 8200. Seminar: The Physical Sciences. (3 cr; SP–HSci 8111 or [Phil 8601 or 8602 or 8605] or #)
Students participate in ongoing research in history, philosophy, and social study of physical sciences and prepare and present research papers.

SST 8300. Seminar: The Biological and Biomedical Sciences. (3 cr; SP–HSci 8111 or [Phil 8601 or 8602 or 8605] or #)
Students participate in ongoing research in history, philosophy, and social study of biological and biomedical sciences, and prepare and present research papers.

SST 8400. Seminar: Science, Technology, and Society. (3 cr; SP–HSci 8111 or [Phil 8601 or 8602 or 8605] or #)
Students participate in ongoing research on interactions involving science, technology, and society from perspectives of history, philosophy, and social study of science, and prepare and present research papers.

SST 8420. Social and Cultural Studies of Science. (3 cr; SP–#)
Recent work; theoretical and methodological differences among practitioners; selected responses from historians and philosophers of science.

Sumerian (Sum)

Department of Classical and Near Eastern Studies
College of Liberal Arts

Sum 5011. Elementary Sumerian I. (3 cr; SP–Adv undergrads with 2 yrs of another foreign lang, grads)
Sumerian writing and grammar. Readings from classical Sumerian literary and historical texts.

Sum 5012. Elementary Sumerian II. (3 cr; SP–5011)
Reading from classical literary and historical texts.

Surgery (Surg)

Department of Surgery
Medical School

Surg 8200. Clinical Surgical Problems in Management. (3 cr; SP–Grad surg major; A-F only)
Diagnostic and management instruction in all phases of clinical surgery, inpatient and outpatient.

Surg 8201. Surgery Roentgenological Pathology Conference. (1 cr; SP–Grad surg major; A-F only)
Weekly review of surgical patients presenting interesting roentgen and pathological findings. Staff from the Departments of Surgery, Radiology, and Laboratory Medicine and Pathology. Basic science and management principles of the surgical patient.

Surg 8202. Surgical Research. (3 cr; SP–Grad surg major; A-F only)
Graduate students undertake original investigation of problems in either experimental or clinical surgery.

Surg 8203. Surgery Complications and Research Conference. (1 cr; SP–Grad surg major; A-F only)
Evaluation of surgical patients, including postoperative course. Discussion and critical evaluation of current research problems.

Surg 8207. Transplantation Conference. (1 cr; SP–Grad surg major; A-F only)
Interdepartmental discussion and evaluation of current clinical and research problems.

Surg 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Surg 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

Surg 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Surg 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Surg 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Sustainable Agricultural Systems (SAgr)

Department of Agronomy and Plant Genetics
College of Agricultural, Food, and Environmental Sciences

SAgr 8010. Colloquium in Sustainable Agriculture. (2 cr; QP–Coursework in biological or social sciences that provides intro to ag practices or issues; SP–Coursework in biological or social sciences that provides intro to ag practices or issues; A-F only)
Forum for University faculty and students, and representatives of the farming community, including farmers, grassroots organizations, agricultural businesses, and representatives of state agencies, to engage in discussions on topics related to sustainability of food production.

SAgr 8020. Field Experience in Sustainable Agriculture. (1-4 cr; QP–Coursework in biological or social sciences that provides intro to ag practices or issues; SP–Coursework in biological or social sciences that provides intro to ag practices or issues; S-N only)
3- to 14-week internship with growers or organizations working with sustainable agriculture issues. Students analyze issues in final written project, oral seminar.

Teaching English as a Second Language (TESL)

Institute of Linguistics, ESL, and Slavic Languages and Literatures
College of Liberal Arts

TESL 5401. Language Analysis for Teachers of English as a Second Language. (4 cr; SP–Ling 5001)
Overview of the structure of the English language geared to the needs of teachers of English to speakers of other languages. Study the structures of English from the point of view of second-language speakers as well as native speakers. Phonetics, phonology, morphology, and some aspects of the syntax of the English language. Part of a two-course sequence.

TESL 5402. Language Analysis for Teachers of English as a Second Language. (4 cr; SP–5401, Ling 5001)
Overview of the structure of the English language geared to the needs of teachers of English to speakers of other languages. Study the structures of English from the point of view of second-language speakers as well as native speakers. More complex structures of English syntax, as well as English semantics, pragmatics, and discourse structures. Second in a two-course sequence.

TESL 5721. Methods in Teaching English as a Second Language. (3 cr; SP–Ling 3001 or 5001 or #)
Introduction to methods for teaching English as a second language to adults.

TESL 5722. Practicum in Teaching English as a Second Language. (4 cr [max 8 cr]; SP–ESL major or minor, 5721 or #; S-N only)
Observation of, and practice in, teaching English as a second language to adults at the college or university level.

TESL 5723. Materials for Teaching English as a Second Language. (3 cr; SP–5721, 5722 or #)
Evaluation and preparation of teaching materials for English as a second language.

TESL 5724. Introduction to Language Assessment. (3 cr; QP–Ling 5001 or #; SP–Ling 5001 or #; A-F only)
Prepares students to engage in meaningful, appropriate, and fair second-language assessment practices. Students develop ability to interpret test results and to construct new forms of assessment.

TESL 5910. Seminar in Teaching English as a Second Language. (3 cr [max 9 cr]; SP–#)
Topics related to English as a second language and applied linguistics. Topics specified in *Class Schedule*.

TESL 5993. Directed Studies. (1-4 cr [max 9 cr]; SP–#, Δ, ❑)
Directed study for teaching English as a second language.

TESL 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

TESL 8751. English for Specific Purposes. (3 cr; SP–5721, 5401, 5402 or #)
Critical review of literature: registers of English used in fields such as engineering, nursing, and business. Students gather data and write reports.

TESL 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Theatre Arts (Th)

Department of Theatre Arts and Dance
College of Liberal Arts

Th 5100. Theatre Practicum. (1-4 cr [max 20 cr]; QP–#, Δ; SP–#, Δ [4 cr of 3100 for undergrads])
Individual creative projects in production of approved plays as an actor, director, dramaturg, or playwright. (See 5500 for design practicums.)

Th 5171. History of the Theatre I. (3 cr)
Theatre as a mirror of society. Aesthetics, philosophy, and practices of theatre arts. Ancient to mid-18th century.

Th 5172. History of the Theatre II. (3 cr)
Theatre as a mirror of society. Aesthetics, philosophy, and practices of theatre arts. Mid-18th century to the present.

Th 5181. Blacks in American Theatre. (3 cr)
Historical survey of significant events in the development of American Black theatrical tradition; essays, plays, playwrights, and theatres from early colonial references to Black Arts Movement.

Th 5182. Contemporary Black Theatre: 1960-Present. (3 cr)
Essays, plays, playwrights, and theatres that have contributed to contemporary Black theatre. From the beginning of the Black Arts Movement to the present.

Th 5321. Career Preparation for the Actor. (3 cr; QP–3323 or M.F.A. actor or #; SP–3322)
Information/techniques necessary for professional acting career.

Th 5331. Physical Approaches to Acting: Use of Self. (2 cr; QP–3323, # by audition or M.F.A. actor; SP–M.F.A. or # by audition)
Movement for advanced actors: awareness, flexibility, observation, release, improvisation in both verbal and nonverbal physical modes.

Th 5332. Physical Approaches to Acting: Stage Combat. (2 cr; QP–3323, # by audition or M.F.A. actor; SP–M.F.A. or # by audition)
Movement for advanced actors: awareness, flexibility, observation, release, improvisation in both verbal and nonverbal physical modes; focus on stage combat.

Th 5333. Physical Approaches to Acting: Period Styles. (2 cr; QP–3323, # by audition or M.F.A. actor; SP–M.F.A. or # by audition)
Movement for advanced actors: awareness, flexibility, observation, release, improvisation in both verbal and nonverbal physical modes; focus on period styles of movement.

Th 5334. Physical Approaches to Acting: Mask. (2 cr; QP–3323, # by audition or M.F.A. actor; SP–M.F.A. or # by audition)
Movement for advanced actors: awareness, flexibility, observation, release, improvisation in both verbal and nonverbal physical modes; focus on mask work.

Th 5341. Speech for Actors. (2 cr; QP–M.F.A. or #; SP–M.F.A. or #; A-F only)
Theories of professional voice production, anatomy and physiology of the vocal mechanism and respiratory system, phonetics, tonal placement, vowel standardization, and articulation are applied to dramatic texts.

Th 5342. Classical Text for Actors. (3 cr; QP–M.F.A. or #; SP–M.F.A. or #; A-F only)
Metrical and rhetorical techniques used in the dramatic texts of Shakespeare and Shaw, as well as textual performance styles from Elizabethan to contemporary. Discussion, presentation, oral reports, and performances.

Th 5500. Theatre Design Practicum. (1-3 cr [max 20 cr]; QP–#, Δ; SP–3515, Δ, #)
Individual projects in production of approved plays as a designer of scenery/properties, costumes, lighting, or sound. (See 5100 for other creative practicums.)

Th 5510. Drawing, Rendering, and Painting for the Theatre Designer I. (3 cr; QP–[3513 or 3515 or grad], #; SP–3515 or grad or #)
Development of skills necessary for presentation of theatre scene/costume designs. Materials, layout, and techniques in scene painting. Basic drawing/graphic skills.

Th 5515. Design Composition and Collaboration. (3 cr; QP–Grad or 3513, 3711; #;; SP–Grad or 3515, 3711; #;)
Classical composition of art and its application to stage design and directing through the collaborative process.

Th 5520. Scene Design. (3 cr [max 9 cr]; QP–3513 or grad or #; SP–3515 or grad or #)
Conceiving/communicating design ideas in both two-dimensional sketches and three-dimensional models for theatre and allied venues. Drafting.

Th 5530. Costume Design. (3 cr [max 9 cr]; QP–3515 or grad or #; SP–3515 or grad or #)
Theory and process of costume design for theatrical productions (e.g., dance, opera, film) through hypothetical productions.

Th 5540. Lighting Design for the Theatre. (3 cr [max 9 cr]; QP–3515 or grad or #; SP–3515 or grad or #)
Design aesthetics and exploration of design for various stage forms and venues. Development of the lighting plot and paperwork; use of the computer in lighting design.

Th 5545. Stage Lighting Technology. (3 cr; QP–3515 or grad or #; SP–3515 or grad or #)
The lighting technician's skills and crafts: equipment, techniques, control operation, wiring, and maintenance.

Th 5550. Sound Design for Performance. (3 cr [max 9 cr]; QP–5564 or #; SP–5555 or #)
Audio technology and psychology and their impact on an audience in a performance situation. Communication, design process, psychoacoustics, and scriptanalysis.

Th 5555. Audio Technology. (3 cr; QP–5564 or #; SP–Th major or #)
Sound as science. Technology to create/manipulate sound. Recording techniques. Effects/signal processing. Microphone/mixing techniques.

Th 5557. Digital Audio and MIDI for Performance. (3 cr; SP–#)
Hands-on computer/CPU-generated audio technology. Use of MIDI language protocol for performance in all aspects of the arts.

Th 5560. Drawing, Rendering, and Painting for the Theatre Designer II. (3 cr; QP–5510; SP–5510)
Development of skills necessary for presentation of theatre scene/costume designs. Materials, layout, and techniques in scene painting. Rendering and scene painting skills.

Th 5570. Properties/Scenery Technology. (1-3 cr [max 15 cr]; QP–3513 or grad or #; SP–3515 or grad or #)
Management, structures, upholstery, mask-making, furniture construction, stage mechanics, soft properties, faux finishes. Topics specified in *Class Schedule*.

Th 5580. Costume Technology. (1-3 cr [max 15 cr]; QP–3515 or grad or #; SP–3515 or grad or #)
Fabric enhancement techniques, masks, wig-making, millinery, makeup prosthetics, pattern drafting, and draping. Topics specified in *Class Schedule*.

Th 5590. Theatre Technology Practicum. (1-3 cr [max 15 cr]; QP–#, Δ; SP–3515, #, Δ; 4 cr max for undergrads)
Individual creative project in technology/craft area of theatre. Practical work in costume, lighting, makeup, props, scenery, sound, or theatre management.

Th 5711. Advanced Stage Direction. (3 cr; QP–3711 or grad or #; SP–[3711, #] or grad)
Realistic/nonrealistic dramatic forms. Theory/technique of rehearsal. Production problems. Includes directing of three one-act plays.

Th 5715. Actor-Director Collaboration. (3 cr; QP–3323, 3711 or #; SP–Grad or 3322, 3711)
Applying advanced acting and directing technique to an artistic, collaborative process that promotes flexibility and creativity. Actors and directors are exposed to a challenging range of roles, styles, and scenes.

Th 5716. Stage Management for the Theatre. (4 cr; QP–[1101, 1504, 1321] or #; SP–[1101, 1321, soph] or grad)
Theories, practicalities, and techniques for rehearsal/performance. Organizing/managing various types of performance venues.

Th 5718. Principles of Theatre Management. (3 cr)
Nonprofit theatre structure: concept; mission; organization; financial, marketing, fund-raising, and grant-writing strategies. Discussion/guest professionals from Twin Cities' arts/funding communities.

Th 5753. Text Analysis for Drama. (3 cr; QP–5711 or grad; SP–5711 or grad)
Tools for intensive textual analysis for advanced directors/designers. Traditional, Aristotelian analysis and contemporary approaches covered through theories/writings of Bertolt Brecht and Howard Barker.

Th 5760. Advanced Stage Management. (2-3 cr; QP–5716, #; SP–5716 or ¶5716, # [4 cr max for undergrads])
Practical experience in stage management for specific productions of the University Theatre with emphasis on rehearsal and performance.

Th 5780. Advanced Topics in Theatre Management. (2-4 cr [max 8 cr]; QP–5718; SP–5718)
Study and apply theatre management theories and techniques learned in 5718. Marketing/audience development, fundraising and grant writing strategies, and financial management of a nonprofit theatre organization.

Th 5950. Topics in Theatre. (1-4 cr [max 20 cr]; QP–Varies by topic; SP–Varies by topic)
Topics specified in *Class Schedule*.

Th 5993. Directed Study. (1-5 cr [max 20 cr]; QP–6 Th cr, #, Δ, ❑; SP–6 Th cr, #, Δ, ❑)
Guided individual reading or study.

Th 8100. Theatre Practicum. (1-4 cr [max 20 cr]; SP–#, Δ)
Individual creative projects in production of approved plays as an actor, director, dramaturg, or playwright (see 8500 for design practicums).

Th 8102. Theatre Historiography. (3 cr)
Current trends in historiography; research strategies and methods.

Th 8103. The Theatre Dramaturg. (3 cr)
The dramaturg's role in theatrical performance: history, theory, and practice.

Th 8111. History and Theory of Western Theatre: Ancient World and Early Medieval. (3 cr)
History, theories, arts, and crafts of western theatre from the ancient world to the present.

Th 8112. History and Theory of Western Theatre: Medieval Through Renaissance. (3 cr)
History, theories, arts, and crafts of western theatre from the ancient world to the present.

Th 8113. History and Theory of Western Theatre: National Theatres to the French Revolution. (3 cr)
History, theories, arts, and crafts of western theatre from the ancient world to the present.

Th 8114. History and Theory of Western Theatre: Enlightenment Through Naturalism. (3 cr)
History, theories, arts, and crafts of western theatre from the ancient world to the present.

Th 8115. History and Theory of Western Theatre: 20th Century Through World War II. (3 cr)
History, theories, arts, and crafts of western theatre from the ancient world to the present.

Th 8116. History and Theory of Western Theatre: 20th Century From 1945 to the Present. (3 cr)
History, theories, arts, and crafts of western theatre from the ancient world to the present.

Th 8120. Seminar. (3 cr [max 12 cr])
Selected research topics from various theatre fields and periods. Sample topics: Border Crossings—Theatre History and Representation; The Theatre and Drama of the Third Reich, 1927-1944.

Th 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Th 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

Th 8500. Theatre Design Practicum. (1-3 cr [max 20 cr]; SP–#, Δ)
Individual creative projects in production of approved plays as a designer for scenery/properties, costumes, lighting, or sound (see 8100 for other creative practicums).

Th 8590. Theatre Technology Practicum. (1-3 cr [max 20 cr]; SP–#, Δ)
Individual creative projects in the technology or craft of costume, lighting, makeup, props, scenery, sound, or theatre management.

Th 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Th 8711. Theory and Practice of the Modern Stage Director. (3 cr)
Survey of principal stage directors (e.g., Saxe-Meiningen, Meyerhold, Brecht, Strehler, Mnouchkine, Brook) and their theories and practices from 1871 to today using books, journals, firsthand accounts, and videos.

Th 8750. MFA Directing Practicum. (2-3 cr [max 10 cr]; SP–MFA directing specialization; A-F only)
Rehearsed and performed production of published or original one-act (2 cr) or full-length play (3 cr) with budgeted design and technical support.

Th 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Th 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Th 8980. Internship. (1-5 cr [max 10 cr]; SP–#, Δ)

Th 8990. MFA Creative Thesis. (3-4 cr; SP–#, Δ)

Th 8994. Directed Research. (1-5 cr; SP–#, Δ)

Therapeutic Radiology (TRad)

Department of Therapeutic Radiology

Medical School

TRad 8204. Tumor Clinic Conference. (3 cr)

TRad 8240. Radiation Therapy Conference. (3 cr)

TRad 8300. Radiation Therapy. (1-15 cr)

TRad 8310. Fundamentals of Radiation Therapy. (1 cr)

TRad 8315. Radiation Therapy Pathology. (1 cr)

TRad 8320. Radiation Therapy Treatment Planning Problems. (1 cr)

TRad 8325. Radiation Therapy Pediatrics Oncology. (1 cr)

TRad 8350. Research: Radiation Therapy. (1-15 cr)

TRad 8450. Research: Radiation Biology. (1-15 cr)

TRad 8550. Research: Radiological Physics. (1-15 cr)

Toxicology (Txcl)

Graduate School

Txcl 5011. Principles of Toxicology. (2 cr; SP–Grad txcl major or #; A-F only)
Introduction to fundamentals of poisoning in individuals and the environment, assessment of potential health hazards, and application of toxicology in various professional careers.

Txcl 5195. Veterinary Toxicology. (3 cr; SP–Grad student or #; A-F only)
Toxicology of minerals, pesticides, venoms, and various toxins. Identification of poisonous plants. Recognition, diagnosis, and treatment of animal poisons.

Txcl 5545. Introduction to Regulatory Medicine. (2-4 cr; SP–Grad student or #; A-F only)
Explanation of products requiring pre-market approval and those that may be marketed without approval. Post-market surveillance. Adverse reactions, removal of product from market.

Txcl 8012. Advanced Toxicology I. (3 cr; QP–5214 or PubH 5261; SP–[Duluth: 5011, Chem 4341 or #]; [TC: 5011 or BioC 4331, PubH 5104 or #]; A-F only)
Absorption, distribution, metabolism, and excretion of xenobiotics; toxicokinetics; mechanisms of toxicity or specific classes of chemical agents.

Txcl 8013. Advanced Toxicology II. (3 cr; QP–5214 or PubH 5261; SP–[Duluth: 8012, Chem 4342, PhsI 5601 or #]; [TC: 8012, BioC 4332, PhsI 5062 or PhsI 6101 or #]; A-F only)
Kinetic and dynamic determinants of target organ toxicity; pathological alterations in structure/function relationships for major target organ systems; mechanisms of mutagenesis, carcinogenesis, and teratogenesis.

Txcl 8100. Investigative Toxicology. (1 cr [max 2 cr]; QP–5214; SP–8013 or #; A-F only)
Evaluating toxicology research issues and literature.

Txcl 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

Txcl 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

Txcl 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Txcl 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Txcl 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Translation and Interpreting (TrIn)

Institute of Linguistics, ESL, and Slavic Languages and Literatures

College of Liberal Arts

TrIn 5900. Topics in Translation and Interpreting. (1-4 cr; QP–#; SP–#)
Topics specified in *Class Schedule*.

TrIn 5993. Directed Study. (1-3 cr; QP–#, Δ, ❑; SP–#, Δ, ❑)
Directed study in translation and interpretation.

Urban Studies (UrbS)

Department of Geography

College of Liberal Arts

UrbS 5101. The City and the Metropolis: An Exploration. (3-4 cr; SP–Grad or advanced UrbS undergrad with #)
Advanced interdisciplinary examination of complex metropolitan environments using a grounded experiential approach. Examine the topic from historical, spatial, social, economic, political, policy and design perspectives. Day-long or weekend-long field trips are expected.

Veterinary Medicine, Graduate (VMed)

College of Veterinary Medicine

VMed 5080. Problems in Veterinary Epidemiology and Public Health. (1-3 cr; SP–#; A-F only)
Individual study on problem of interest to epidemiology or public health student.

VMed 5165. Monitoring and Surveillance of Disease and Production. (2 cr; SP–#; A-F only)
Seminars and discussion on techniques used to monitor animal disease and production.

VMed 5596. Swine Diseases and Diagnostics. (2-3 cr)
Review of recent advances in swine diseases; farm visits for on-farm disease diagnostics and control programs.

VMed 8090. Epidemiology of Zoonoses and Diseases Common to Animals and Humans. (1-4 cr; SP–Epidemiology and infectious disease course or #; A-F only)
Major human zoonotic diseases, methods of transmission, diagnosis, control, and prevention.

VMed 8195. Pre-Harvest Food Safety and Public Health Aspects of Food Animal Production. (1-3 cr; SP–#)
Includes presentations and discussions on on-farm HACCP principles and prudent use of antibiotics.

VMed 8201. Advanced Small Animal Veterinary Medicine. (1-5 cr; A-F only)
Discussions of diseases of organs or systems in animals, including degenerative, psychological, anomolous, metabolic, nutritional, neoplastic, immune, inflammatory, toxic, and traumatic disorders.

VMed 8202. Internal Medicine in Small Companion Animals. (1-3 cr; A-F only)
Lectures, assigned readings, and discussions on internal medical problems of dogs and cats.

VMed 8203. Advanced Diagnosis and Therapeutics of Animal Disease. (1-2 cr; A-F only)
Detailed examination, treatment, and discussions of naturally occurring disease in patients admitted to Veterinary Teaching Hospital.

VMed 8210. Seminar: Veterinary Medicine. (1 cr)
Participation and presentations of regularly scheduled seminars about internal medicine.

VMed 8220. Advanced Nephrology/Urology Clinics. (1-3 cr)
Clinical investigation of naturally occuring urinary diseases in patients admitted to Veterinary Teaching Hospital.

VMed 8230. Medical Conference. (1-3 cr)
Participation in weekly conference about internal medical disorders.

VMed 8250. Problems in Acid-base, Electrolyte, and Fluid Metabolism. (2-4 cr; A-F only)
Clinical problems and physiology of acid-base, electrolyte, and fluid disorders of dogs and cats.

VMed 8293. Advanced Studies in Nephrology and Urology. (1-3 cr; A-F only)
Studies of urinary tract disease with goal of generating new knowledge.

VMed 8294. Research Studies in Nephrology and Urology. (1-3 cr)
Individual research on selected problems

VMed 8296. Advanced Large Animal Veterinary Medicine. (1-3 cr [max 6 cr]; SP–DVM, grad vet med major, CAPS 7801, #; A-F only)
Discussions of diseases of organs or systems in animals in a clinical setting.

VMed 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

VMed 8360. Evidence-based Medicine. (2 cr; A-F only)
Use of medicine literature in clinical problem solving.

VMed 8393. Medical Conference. (1-3 cr [max 6 cr]; SP–#; A-F only)
Medical, surgical, or obstetrical cases supported by anatomic, bacteriologic, pathologic, physiologic, pharmacologic, and radiologic evaluations whenever applicable.

VMed 8394. Research in Veterinary Medicine. (1-3 cr)
Research problems relating to any aspect of internal medicine or to the various systems in animals.

VMed 8396. Diagnostic and Therapeutic Techniques of Animal Diseases. (1-3 cr [max 6 cr]; SP–CAPS 7801, DVM, grad vet med major, #)
Detailed examination, discussions, and treatments of cases of animal diseases in a clinical setting.

VMed 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

VMed 8492. Seminar: Infectious Diseases and Swine Medicine. (1-2 cr)
Students, faculty, and guest speakers present seminars on current research in diagnosis, control, and treatment of infectious diseases.

VMed 8494. Research in Infectious Diseases. (1-3 cr)
Directed research.

VMed 8495. Problems in Infectious Diseases. (1-3 cr)
In-depth discussion on specific problems for various infectious diseases of farm animals.

VMed 8520. Advanced Immunology. (2 cr)
Lectures and case presentations.

VMed 8530. Advanced Swine Diseases. (2 cr)
Lectures and discussion on advances.

VMed 8592. Infectious Disease Journals: Critical Thinking. (1 cr)
Reading and critical discussion of journal articles.

VMed 8593. Advanced Veterinary Virology and Serology. (1-3 cr)
Discussion and laboratory practice.

VMed 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

VMed 8679. Problems in Veterinary Critical Care/ Emergency Medicine. (2 cr; SP–DVM or equiv degree; A-F only)

VMed 8680. Advanced Veterinary Critical Care/ Emergency Medicine. (2-4 cr; SP–DVM or equiv degree)
Discussions of current topics, focusing on literature and research results in periodicals, proceedings, texts.

VMed 8681. Advanced Small Animal Surgery. (1-3 cr)
Advanced techniques and procedures.

VMed 8682. Advanced Large Animal Surgery. (1-3 cr [max 6 cr]; SP–DVM or equiv degree, #; A-F only)
Surgery of various systems in large animals, with preoperative and postoperative evaluation and management.

VMed 8683. Surgery of the Gastrointestinal System. (2-4 cr; A-F only)
Advanced techniques and problems.

VMed 8684. Surgical Physiology. (1-3 cr)
Discussions on pathophysiology of surgical diseases in dogs and cats.

VMed 8685. Neurosurgery. (2-3 cr; A-F only)
Advanced neurosurgical diseases of small animals amenable to surgical treatment.

VMed 8686. Thoracic and Cardiovascular Surgery. (2-4 cr; A-F only)
Advanced thoracic and cardiovascular diseases of small animals amenable to surgical treatment.

VMed 8687. Plastic and Reconstructive Surgery. (2-3 cr; A-F only)
Advanced techniques in conditions of small animals.

VMed 8688. New Techniques in Large Animal Surgery. (1-6 cr [max 6 cr]; SP–DVM or equiv degree, #; A-F only)

VMed 8689. Urogenital Surgery. (2-3 cr)
Advanced techniques in treatment of small animals.

VMed 8691. Research in Large Animal Surgery. (1-6 cr; SP–DVM or equiv degree, #; A-F only)
Independent research projects.

VMed 8692. Seminar: Small Animal Surgery. (1 cr; A-F only)
Discussions of problems and case analysis.

VMed 8693. Seminar: Large Animal Surgery. (1 cr [max 6 cr]; SP–DVM or equiv degree, #; A-F only)
Discussion of current literature and surgery board preparation.

VMed 8694. Research in Small Animal Surgery. (1-3 cr; S-N only)

VMed 8695. Problems in Large Animal Surgery. (1-3 cr [max 6 cr]; SP–DVM or equiv degree, #; A-F only)
New techniques and procedures in large animal orthopedic surgery.

VMed 8696. Research in Critical Care/Emergency Medicine. (1-3 cr; SP–DVM or equiv degree)
Special problems course. Controlled study; prospective and retrospective models of evaluation are defined, critiqued, and used for experimental design and data collection to validate research methods.

VMed 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

VMed 8780. Advanced Avian Critical Care: Principles and Procedures. (2 cr; SP–Course each in vet pathology, physiology, pharmacology, anatomy, small animal anesthesiology and critical care; A-F only)
Procedures and protocols for managing avian medical emergencies such as starvation, toxicities, respiratory failure, and massive trauma.

VMed 8781. Seminar: Advanced Veterinary Anesthesiology. (1-3 cr; SP–[[CVM 6321, CVM 6322] or equiv], grad student; A-F only)
Active interaction around topics of advanced anesthesiology in veterinary species.

VMed 8782. Advanced Veterinary Abdominal Imaging. (1-3 cr)
Applications and discussion of basic principles through emerging techniques.

VMed 8783. Advanced Veterinary Thoracic Imaging. (1-3 cr)
Application and discussion of basic principles through emerging techniques.

VMed 8784. Veterinary Therapeutic Radiology. (2-3 cr [max 6 cr])
In-depth discussion of principles, practice, techniques, and complications.

VMed 8785. Veterinary Nuclear Medicine. (1-3 cr [max 6 cr])
In-depth discussion of principles, practice, techniques, and complications.

VMed 8788. Seminar: Veterinary Critical Care/ Emergency Medicine. (1 cr; SP–DVM or equiv degree; A-F only)
Current topics.

VMed 8789. Research in Avian Clinical Problems and Procedures. (1-3 cr; SP–5330, 8780, 8796, DVM; A-F only)
Students conduct medical and surgical procedures involved in management of avian trauma and critical care patients.

VMed 8791. Research in Veterinary Anesthesia. (1-3 cr; SP–8781 or equiv, SACS 5380 or equiv; A-F only)
Research methodology; controlled prospective and retrospective research studies. Collection and analysis of scientific data.

VMed 8792. Seminar: Veterinary Radiology. (1 cr [max 6 cr])
Current topics in veterinary imaging, veterinary radiation therapy, or specific applications.

VMed 8793. Seminar: Veterinary Anesthesiology. (1-2 cr; SP–CVM 6321, CVM 6322 or equiv, DVM degree; A-F only)
Discussion and presentations; for veterinary anesthesiology and surgery residents and graduate students.

VMed 8794. Research in Veterinary Radiology. (1-3 cr)
Research into an application, development of an application, or prospective/retrospective study of any aspect of veterinary imaging or veterinary radiotherapy.

VMed 8795. Problems: Veterinary Radiology. (1-3 cr [max 6 cr])
Discussion of problems associated with veterinary imaging or radiation therapy.

VMed 8796. Avian Anesthesia and Orthopedic Surgery. (1-3 cr; SP–Courses in vet anesthesia, vet small animal orthopedics; A-F only)
Current methods for anesthetizing raptors, psittacine birds, and waterfowl. Lecture and lab on current methods for avian fracture bone fixation.

VMed 8882. Theriogenology Journals: Critical Evaluation. (1 cr [max 1 cr])
Reading and presentation of selected current research journal articles; critical evaluation of experimental design, methods, and results.

VMed 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

VMed 8891. Seminar: Theriogenology. (1 cr)

VMed 8893. Advanced Diagnostic Methods in Theriogenology. (1-3 cr; SP–CAPS 5570)
Directed research in methods for studying fertility factors affecting female and male animal reproduction.

VMed 8894. Special Problems in Theriogenology. (1-3 cr; SP–CAPS 5570, #)
Specialized and directed scientific readings and discussion; allows for individualizing students' graduate programs.

Veterinary Pathobiology (VPB)

Department of Veterinary Pathobiology
College of Veterinary Medicine

VPB 5601. Veterinary Parasitology. (4 cr)

VPB 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

VPB 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

VPB 8501. Advanced Veterinary Basic Pathology. (2-3 cr; SP–#)
Basic mechanisms and concepts relating to reaction of tissue to injury. Gross and microscopic interpretation of retrogressive cellular changes, cellular infiltrations, inflammation, and neoplasia. Students complete a special project selected in conjunction with instructor.

VPB 8502. Advanced Systemic Pathology. (3-4 cr; QP–5501 or 8501, #; SP–5501 or 8501, #)
Reaction of specific systems to injury emphasizing basic response capabilities of tissue or organ, with materials illustrating gross and microscopic changes. Students complete a special project selected in conjunction with instructor.

VPB 8504. Advanced Veterinary Histopathology. (1 cr; QP–5502, 5503, #; SP–5502, 5503, #)
Discussion and study of selected case materials from veterinary anatomic, diagnostic, and surgical pathology programs.

VPB 8531. Hospital Pathology. (1-2 cr; QP–5501, 5502, 5503, #; SP–5501, 5502, 5503, #)
Necropsy and surgical pathology techniques, examination of tissue for diagnosis, and preparation of reports and records.

VPB 8540. Problems: Veterinary Pathology. (2-6 cr [max 12 cr]; SP–#)
Independent study.

VPB 8550. Problems: Veterinary Clinical Pathology. (2-6 cr [max 12 cr]; SP–#)
Independent study.

VPB 8640. Problems: Parasitology. (2-6 cr [max 12 cr]; SP–#)
Independent research.

VPB 8666. Doctoral Pre-Thesis Credits. (1-18 cr; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

VPB 8700. Seminar: Veterinary Pathobiology. (1 cr [max 5 cr]; SP–#)

VPB 8724. Advanced Veterinary Diagnostic Microbiology. (3 cr; SP–#)
Lectures and laboratory in techniques of diagnostic mycology, bacteriology, virology, and serology.

VPB 8740. Problems: Veterinary Microbiology. (2-6 cr [max 12 cr]; SP–#)
Independent study.

VPB 8777. Thesis Credits: Master's. (1-18 cr; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

VPB 8888. Thesis Credits: Doctoral. (1-24 cr; SP–Max 18 cr per semester or summer; 24 cr required)

Water Resources Science (WRS)

Graduate School

WRS 5001. Introduction to Field Research in Water Resources. (2 cr; SP–Grad WRS major or #)
Introduction to field research techniques and opportunities during two-week summer excursion to regional sites. Data acquisition in large/small lakes, streams, and wetlands for biota and chemical/physical water quality; surface and groundwater hydrologic measurements and sampling.

WRS 5101. Water Resources: Individuals and Institutions. (3 cr; SP–Grad student or #)
Control of water resources by natural system functions, user actions, and influence of social and political institutions. How these controls vary in space and time; complexities of each control and feedbacks among them.

WRS 8050. Special Topics in Water Resources Science. (1-3 cr [max 6 cr]; SP–#; A-F only)

WRS 8060. Directed Studies in Water Resources Science. (1-3 cr [max 6 cr]; SP–#; A-F only)

WRS 8095. Plan B Project. (3 cr; SP–#; S-N only)
Satisfies Plan B project requirement. May appear on master's program, but does not count toward credit minimum in major. Project topic arranged between student and adviser. Written report required.

WRS 8100. Interdisciplinary Seminar in Water Resources. (1-3 cr [max 3 cr])

WRS 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

WRS 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

WRS 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

WRS 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]; SP–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

WRS 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

Women's Studies (WoSt)

Department of Women's Studies
College of Liberal Arts

WoSt 5101. Feminist Approaches to Ethnography. (3 cr)
Preparation for feminist ethnographic research in the social sciences. Using recent works by feminist ethnographers, focus is on the methods, politics, and ethics, as well as gender, race, class, and cross-cultural issues pertaining to fieldwork.

WoSt 5102. Feminist Approaches to History. (3 cr; SP–8 cr WoSt or grad or #)
Analysis and practice of feminist history. Theories, methods, and sources that address the interrelationship of gender, race, class, and sexuality.

WoSt 5103. Feminist Pedagogies. (3 cr; SP–grad or #)
Theory and practice of feminist pedagogies by comparing and evaluating various multicultural feminist theories of education/teaching and the application of specific theories, techniques, and teaching strategies.

WoSt 5105W. Gendered Rhetoric of Science and Technology. (3 cr; SP–8 cr WoSt or grad or #)
How cultural gender roles are affected by science and technology as well as influence scientific and technological thinking and communication strategies.

WoSt 5106. The Cultural Construction of Sex, Gender, and Sexuality. (3 cr; SP–Feminist studies grad or 12 cr WoSt or #)
Investigation of Euro-American concepts of sex, gender, sexuality in representative texts and images from the 17th century to the present. Critical and source materials from literary and cultural studies, history, biology, anthropology, psychology, and sociology.

WoSt 5107. Gender, Culture, and Science. (3 cr)
Critical study of some of the major papers concerning the relations of gender and scientific inquiry produced in the past 20 years.

WoSt 5190. Topics: Methods of Inquiry. (3 cr)
Topics specified in *Class Schedule*.

WoSt 5201. Global Processes and the Politics of Sexuality. (3 cr; SP–12 cr WoSt or feminist studies grad student or #)
Comparative examination of the social construction of sexuality. Formal/informal norms/regulations, categories of deviance, representation of sex in the media/arts, role of sexuality in relation to agency/subjectivity.

WoSt 5202. Feminist Therapies. (3 cr)
Feminist and multicultural perspectives regarding therapy and other helping forms for women, including philosophy of feminist theory; feminist ethics in therapy; gender, sexual identity, race and class in therapy, and related topics.

WoSt 5203. Women and Madness in History and Literature. (3 cr; SP–§3206; jr, 4 cr WoSt or #)
The representation of madness and how it intersects with gender as well as class, race, sexual orientation, and nationality.

WoSt 5290. Topics: Biology, Psychology, and Social Perspectives. (3 cr)
Topics specified in *Class Schedule*.

WoSt 5300. Communication and Gender. (3 cr; SP–One women's studies course or #; A-F only)
How gender affects verbal communication. Development of analytical skills through readings, exercises, research that raise awareness of the power of language and the influence of gender prescriptions.

WoSt 5390. Topics: Literature, Film, and Other Arts. (3 cr)
Topics specified in *Class Schedule*.

WoSt 5403. Chicana/Latina Feminisms. (3 cr; SP–8 cr WoSt and/or Chic or grad or #)
The historical and social development of Chicana and Latina feminisms in general and their various specific types.

WoSt 5404. Working Class Women's Cultures. (3 cr; SP–12 cr WoSt or #)
Myths and realities surrounding working class women and their cultures. Use sociological and literary material in an effort to learn about working class women and to hear their own voices.

WoSt 5405. Chicanas: Women and Work. (3 cr; SP–#)
Chicanas, their various relationships to family/community. Local, national, and global work forces. Questions/issues related to growing integration of world's systems of production.

WoSt 5490. Topics: Comparative and Global Studies. (3 cr [max 12 cr])
Topics specified in *Class Schedule*.

WoSt 5501. Women and the Law. (3 cr; SP–9 cr [WoSt or pre-law grad] or #)
Legal system as it relates to women: historical legal approach to issues related to constitutional rights of women.

WoSt 5505. Women and Indigenous Land Struggles. (3 cr; SP–8 cr WoSt and/or Chic and/or AmIn or #)
Representative land struggles by indigenous women from a critical race and gender perspective.

WoSt 5590. Topics: Civic and Community Studies. (3 cr [max 12 cr])
Topics specified in *Class Schedule*.

WoSt 5993. Directed Study. (1-12 cr [max 12 cr]; SP–#)

WoSt 5994. Directed Instruction. (1-12 cr [max 36 cr])

WoSt 5995. Directed Research. (1-8 cr [max 36 cr])

WoSt 8101. Intellectual History of Feminism. (3 cr)
Major trends in feminist intellectual history from 14th century to the present, especially in the United States and Europe.

WoSt 8102. Advanced Studies in Sexuality. (3 cr)
Contemporary theoretical scholarship and research on selected issues related to sexuality, gender, and the body.

WoSt 8103. Feminist Theories of Knowledge. (3 cr)
Interdisciplinary seminar; feminist approaches to knowledge and to criticism of paradigms of knowledge operative in the disciplines. Feminists' use of concepts of subjectivity, objectivity, and intersubjectivity; feminist empiricism, standpoint theory, and contextualism, and postmodern and postcolonial theorizing.

WoSt 8108. Feminist Theories and Methods I. (3 cr; SP–Feminist studies Ph.D. or grad minor student)
Two-semester interdisciplinary seminar. First term: current debates in gender theory; intersections of gender theory with critical race theory, post-colonial theory, sexuality theory, and social class analysis. Second term: inter- and multi-disciplinary feminist research frameworks and methodologies from humanities and social sciences.

WoSt 8109. Feminist Theories and Methods II. (3 cr; SP–8108, feminist studies Ph.D. or grad minor student)
Two-semester interdisciplinary seminar. First term: current debates in gender theory; intersections of gender theory with critical race theory, post-colonial theory, sexuality theory, and social class analysis. Second term: inter- and multi-disciplinary feminist research frameworks and methodologies from humanities and social sciences.

WoSt 8190. Topics: Feminist Theory. (1-3 cr [max 12 cr])

WoSt 8201. Feminist Theory and Methods in the Social Sciences. (3 cr)
Seminar on recent theories, including feminist versions of positivist, interpretivist, critical theoretical, and postmodernist models of social science knowledge. Methodologies congenial to feminist practices of inquiry, including use of narrative in theory, feminist ethnography, discourse analysis, and comparative methods in history.

WoSt 8202. Sociology of Gender. (3 cr)
Organization, culture, dynamics of gender relations and gendered social structures. Gender, race, and class inequalities in the workplace; the women's movement; social welfare and politics of gender inequality; gender and science; theoretical debates in gender theory and methods; sexuality; cultural studies of gender; sociology of emotions.

WoSt 8290. Topics: Social Sciences and Public Policy. (1-3 cr)

WoSt 8301. Feminist Literary Criticism. (3 cr)
Recent developments and major issues in feminist studies of literature. Introduction to array of scholars and scholarship in field of feminist literary theory and criticism, emphasizing broad range of feminist textual analysis taking place in various University departments.

WoSt 8333. FTE: Master's. (1 cr; SP–Master's student, adviser and DGS consent)

WoSt 8390. Topics: Literary Studies. (1-3 cr)

WoSt 8401. Gender, Space, and Resistance. (3 cr)
Identity politics, social movements, and development politics; complex interrelationships among gender, space, and resistance. Social nature of place and space; sociopolitical and economic processes by which gendered, raced, and classed differences are constituted, reinforced, and resisted in and through space, place, and social networks.

WoSt 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

WoSt 8490. Topics: Comparative and Global Studies. (1-3 cr)

WoSt 8590. Topics: Historical Studies. (1-3 cr)

WoSt 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

WoSt 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

WoSt 8993. Directed Study. (1-6 cr [max 9 cr])

WoSt 8994. Directed Instruction. (1-8 cr [max 36 cr])

WoSt 8995. Directed Research. (1-8 cr [max 36 cr])

WoSt 8996. Women's Studies/CAFS Colloquium. (1-8 cr [max 36 cr]; S-N only)
Feminist studies Ph.D. students must register for 1 credit per semester. Credit available also to other graduate students.

WoSt 8997. Feminist Research and Writing. (3 cr; SP–8109, passed written prelims in degree granting program)
Develops interdisciplinary feminist components of Ph.D. thesis or other major piece of writing. Facilitates research/writing.

Wood and Paper Science (WPS)

Department of Wood and Paper Science
College of Natural Resources

WPS 5402. Business Markets in the Forest Products Industry. (3 cr [max 3 cr]; A-F only)
How forest products companies sell to other businesses, how this differs from traditional consumer process. Emphasizes business marketing communications, sales force management, organizational buying, partnering, e-commerce, globalization of business markets. Case studies, discussion, daily readings from course text, academic/industry publications.

WPS 8300. Research Problems. (1-10 cr [max 10 cr]; SP–#)
Independent research under faculty guidance.

WPS 8303. Advanced Topics in Panel Products Technology. (2 cr; QP–5307; SP–4307)
Particle/fiber processing, additives, press cycle, design of panels for specific end uses.

WPS 8304. Advanced Topics in Wood Drying. (2 cr; QP–5304; SP–4304)
Rheological behavior of first-dried solid wood. Significance of creep to stress-strain pattern, shrinkage, and degrade development in lumber drying. Interpretation/evaluation of schedules, processes, and primary/auxiliary equipment used in commercial drying processes. Energy consideration in drying processes.

WPS 8306. Graduate Seminar. (1 cr [max 3 cr])
Communication of scientific knowledge related to wood and paper science through the media of poster sessions, oral presentations, and the Internet.

WPS 8307. Advances and Methods in Forest Products Pathology and Preservation. (2 cr; QP–5303; SP–4303)
Principles of wood protection, methods of evaluating preservatives. Emphasizes international developments.

WPS 8311. Mechanics of Wood and Wood Composites. (2 cr; SP–#)
Advanced topics on behavior of wood composites.

Work, Community, and Family Education (WCFE)

Department of Work, Community, and Family Education
College of Education and Human Development

WCFE 5002. Thinking, Learning, and Teaching in Work, Community, and Family. (3 cr; A-F only)
Nature of thinking/learning in everyday life contexts of family, work, community. Theory/practice relevant to stimulating/supporting thinking/learning in/for these contexts.

WCFE 5011W. Technology and Public Ethics. (3 cr; A-F only)
Nature of technology. Values, ethical issues related to technology. Technology and transformation of workplace, family, community life. Critique of technology.

WCFE 5021. Learning Through Service. (3 cr)
Service as both a philosophy and method of learning. Content covers both the theory and the practice of service in school-based and community-based organizations.

WCFE 5031. Information Resources in Education. (3 cr; S-N only)
Sources of knowledge and search strategies for accessing library, electronic, institutional, and informal resources of interest to educators.

WCFE 5101. Introduction to Leadership and Administration of WCFE. (3 cr)
Basic concepts of finance, public relations, communications, legal aspects, leadership, personnel policies and management, program planning and development, evaluation, and interinstitutional collaboration of work, community, and family education programs in school-based settings.

WCFE 5102. Leadership in WCFE. (2 cr)
An introduction to the concepts of leadership, leadership roles and responsibilities, and application to work, community, and family education settings.

WCFE 5121. Principles of Supervisory Management. (3 cr)
Introduction to the principles of supervision in education, business, industry, government, and service organizations.

WCFE 5125. Critical Pedagogy. (3 cr; S-N only)
Examination of critical pedagogy; critique of power relations regarding race, culture, class, gender, and age in various educational settings; consideration of improved practice in education for children, youth, and adults.

WCFE 5131. Planning WCFE. (3 cr)
Examination of educational planning and evaluation of work, community, and family education in formal and nonformal settings.

WCFE 5141. Evaluation of WCFE. (3 cr)
Designing and conducting project, program, and systems evaluations in work, community, and family education contexts and settings.

WCFE 5201. Family and Work Relationships. (3 cr; A-F only)
Examination of the interactions of work and family to prepare professionals to improve work and family relationships.

WCFE 5301. Philosophy and Practice of Vocational Education. (2 cr; A-F only)
Purposes, recipients, practices, legislation and funding, socioeconomic contexts of work, community, and family education.

WCFE 5331. Coordination Techniques for Work and Community Education. (3 cr)
Purposes of cooperative work and community education; responsibilities of instructor coordinator; guidance, selection, placement, supervision and evaluation of students; articulation of related instruction; training sponsor identification, orientation, development, and evaluation; management of the program.

WCFE 5341. Global Program Delivery Techniques and Technology. (2 cr; A-F only)
Special educational activities and teaching and communications methods and techniques for youth and adults, ranging from outreach to extension services, with an emphasis on youth and adult education programs in different global settings.

WCFE 5351. Methods for Change in Developing Countries. (3 cr; A-F only)
Sociological and cultural parameters as they pertain to promoting the adoption of improved practices in rural, community, and agricultural development, including formal and informal education institutions. Project planning, implementation, and evaluation related to actual change and development situations in developing countries.

WCFE 5400. Special Topics in Youth Development Leadership. (1-4 cr [max 4 cr])
An examination of important social and political topics of current interest to youth development practitioners with an emphasis on leadership implications for practice in youth agencies, congregations, schools, and other community settings. Content varies by offering.

WCFE 5411. The Everyday Lives of Youth. (3 cr; A-F only)
Lived realities of body, time, space, other, and self from an existential and phenomenological perspective.

WCFE 5412. Experiential Learning: Theory and Practice. (3 cr; A-F only)
Examines the theory and practices of learning by doing. Emphasis on the educator's personal engagement in the actual process to understand the technical, motivational, and evaluative aspects of experiential learning.

WCFE 5413. Organizational Approaches to Youth Development. (3 cr; A-F only)
Language, historical influences, and educational philosophies fundamental to youth development work in organizations serving youth.

WCFE 5414. Issues in Youth Development Leadership. (3 cr; A-F only)
An examination of issues that drive the professional practice of community-based youth work. Participants engage experts from the family, community, schools, and workplace to develop a deeper understanding of how public issues and policy affect the everyday lives of youth.

WCFE 5451. Seminar: Youth Development Leadership. (1-4 cr [max 4 cr]; SP–Youth Development Leadership student or #; S-N only)
Applies principles of healthy youth development, nonformal learning venues, and experiential education to practice/policies of community-based youth work. Individual/group projects focus on applied research, community-based teaching/learning, and foundations of ethical practice. Four-course sequence.

WCFE 5496. Leadership Field Experience: Youth Development. (4 cr; S-N only)
Leadership in support of healthy youth development. Work in agency dedicated to community-based youth programming, education, public policy; advocacy for children, youth, families.

WCFE 5511. Education for Work. (3 cr)
Examination of contextual bases underlying education for work; implications for practice.

WCFE 5521. School-to-Work Policies. (3 cr)
Examination of the aims and purposes, federal and state policies, educational reform, and issues and concepts relating to school-to-work education.

WCFE 5522. School-to-Work Practices. (3 cr)
Examination of learning in context; curricular integration; educational system articulation; educational partnerships; best practices in school-based, work-based, service-based learning, and connecting activities; building community support; and leadership relating to school-to-work education.

WCFE 5696. Teaching Internship: Introduction. (1 cr; SP–Admission to an init lic program; S-N only)
Initial experiences in the teaching profession provided through observations of school organization and administration, seminars, relationship building with cooperating teachers, and a reflection on personal involvement as a beginning student teacher.

WCFE 5697. Teaching Internship: School and Classroom Settings. (2 cr; SP–5696 for init lic program)
Part-time supervised teaching experience in a school. Seminars on managing student's learning in the context of work, community, and family education programs in contemporary schools and on becoming a reflective educator.

WCFE 5698. Teaching Internship. (3 8 cr [max 8 cr]; SP–Admission to an init lic program)
Teaching experience in a school system that provides programs for grades 5-12.

WCFE 5699. Teaching Internship: Extended Practice. (1 cr; SP–5698)
Extended student teaching experience in a school system that provides programs for grades 5-12.

WCFE 5771. Teaching Entrepreneurship: Small Business Management. (3 cr)
Methods, organization, curriculum development and modification, and implementation of educational programs for entrepreneurs.

WCFE 5801. Educating Special Populations in Work, Community, and Family Settings. (3 cr)
Identifying and accommodating educational traits of students with disabilities and disadvantaging conditions in work, community, and family settings.

WCFE 5802. Interagency Collaboration for Special Populations in Work, Community, and Family Settings. (2 cr)
Interagency planning issues and practices relating to special populations for educational, business, and human service organization personnel, as well as family members and advocates.

WCFE 5821. Diversity Issues and Practices in Work, Community, and Family Settings. (3 cr)
Examination of the nature of diverse populations and their unique learning and training needs, exemplary programs, and collaborative efforts among persons representing work, community, and family settings.

WCFE 5822. Diversity and Organizational Transformation in Work, Community, and Family Education. (2 cr)
Developing models for understanding the impact of diversity on individual, organizational, and community outcomes; discussing organizational change in relation to diversity.

WCFE 5823. Program Planning and Improvement for Special Populations in Work, Community, and Family Education. (2 cr)
Concepts, issues, and practices related to the design, implementation, and evaluation of efforts focused on developing new programs or modifying existing programs for individuals with special learning needs in work, community, and family settings.

WCFE 5901. Using Research in Work, Community, and Family Education. (3 cr)
Introduction to the role of work, community, and family education research in professional practice, significant problems of practice for research, alternative modes of research, and synthesis and application of the results of research.

WCFE 5990. Special Topics in Work, Community, and Family Education. (1-4 cr [max 4 cr])
Topics vary.

WCFE 5993. Directed Study in WCFE. (1-4 cr [max 4 cr]; SP–Δ)
Self-directed study, with faculty advice, in areas not covered by regular courses.

WCFE 8100. Work, Community, and Family Education Colloquium. (1-3 cr [max 3 cr])
Selected topics of significance to work, community, and family education professionals. Topics based on interest and demand.

WCFE 8141. History and Philosophy of Work, Community, and Family Education. (3 cr)
Historical influences and philosophical views regarding ideas, research, practice, and continuing issues in work, community, and family education.

WCFE 8142. Work, Community, and Family Education Comparative Systems. (3 cr; SP–8141)
Comparison of work, community, and family education systems within the United States and between the United States and other countries.

WCFE 8444. FTE: Doctoral. (1 cr; SP–Doctoral student, adviser and DGS consent)

WCFE 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; SP–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

WCFE 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]; SP–Max 18 cr per semester or summer; 24 cr required)

WCFE 8896. Internship. (1-10 cr [max 10 cr]; SP–Δ; S-N only)
Student applies for position in professional practice; individual arrangements describe specific responsibilities during internship. Ed.D. program requirement.

WCFE 8911. Foundations of Inquiry. (2 cr; A-F only)
Practice of inquiry in work, community, and family education. Historical/philosophical origins/influences. Scientific/political nature of inquiry. Alternative inquiry perspectives. Central concepts. Positivistic, interpretive, and critical science research perspectives.

WCFE 8912. Positivistic Research. (3 cr; SP–8911)
Assumptions and procedures related to planning and conducting positivistic research. Problems of positivism, including limitations of the scientific method in social science research. Identifying problems, validating instruments, writing the positivistic research proposal, analyzing positivistic data.

WCFE 8913. Interpretive Research. (3 cr; SP–8911; A-F only)
Hermeneutic, ethnomethodological, and phenomenological research methodologies. Consideration of ethics, evaluation, and usefulness of interpretive research. Practice in conducting interpretive research in work, community, and family education.

WCFE 8914. Critical Science Research. (3 cr; SP–8911; A-F only)
Origins, influences, characteristics, and central concepts; distinction between critical science and other action research; requisite skills and knowledge for conducting critical science research and using that knowledge in a project.

WCFE 8915. Ethics and Responsible Research. (1 cr; A-F only)
Introduction to ethical and legal issues involved in practicing responsible educational research. Key issues, formal and informal codes of conduct, and ethical reasoning skills.

WCFE 8990. Research Seminar. (1 cr [max 6 cr]; SP–8911, [8912 or 8913 or 8914] or Δ; S-N only)
Developing, reporting, and evaluating research. Participants make and react to presentations. (Two credits counted in doctoral program.)

Youth Development and Research (YoSt)

School of Social Work

College of Human Ecology

YoSt 5031. Youth in the World. (3 cr; QP–Upper div AdPy course; SP–Upper div AdPy course)
Encourages critical thinking about how youth as ideal and as lived reality are understood in scholarship, public discourse, and professional practice. Larger framework includes building a basis for understanding youth and working with or on behalf of youth.

YoSt 5032. Child and Adolescent Psychology for Practitioners. (3 cr; QP–Courses in ed psych or child or adolescent psych; SP–Courses in ed psych or child or adolescent psych)
Application of theory and research about children and adolescents including how findings can be used and how theories facilitate understanding of behavior.

YoSt 5101. Youth Work Practice I: Internship. (3 cr; QP–3100, 5330, #; SP–3101, 5032 or equiv, ¶5111, #)
First course of a sequential internship that includes 15 hours per week working with youth in a community youth-serving organization. Develop and enhance competence and identity as a youth worker, and reflect on and integrate knowledge about youth with on-going experience in youth work.

YoSt 5102. Youth Work Practice II: Internship. (3 cr; QP–5201, 5330, #; SP–5101, ¶5112, #)
Second course of a sequential internship that includes 15 hours per week of work with youth in a community youth-serving organization. Develop and enhance competence and identity as a youth worker, and reflect on and integrate knowledge about youth with ongoing experience in youth work.

YoSt 5111. Youth Work Methods I: Seminar. (1 cr; QP–5201, 5202, #; SP–3101, 5032 or equiv, ¶5101, #)
Weekly discussion seminar taken concurrently with 5101 to integrate theory and praxis with youth work experience. Written and experiential assignments to increase knowledge, competency, and skills related to working with youth.

YoSt 5112. Youth Work Methods II: Seminar. (1 cr; QP–5201, 5202, #; SP–5111, ¶5102, #)
Weekly discussion seminar taken concurrently with 5102 to integrate theory and praxis with youth work experience. Written and experiential assignments to increase knowledge, competency, and skills related to working with youth.

YoSt 5234. Youth Agencies, Organizations, and Youth Service System. (2 cr; QP–Two soc/anth courses, work exper in a youth agency or org; SP–Two soc/anth courses, work exper in a youth agency or org)
Overview of major forms of youth agencies and organizations, sources of agency legitimacy, ideologies and values, and goals. Relations between and among agencies and organizations. Roles of adults and youth; professionals and nonprofessionals; paid staff and volunteers; youth participation; legal and ethical issues. Examples of existing and ideal agencies.

YoSt 5235. Community Building for Healthy Youth Development. (2 cr; QP–Two social sci courses, exper working with youth or #; SP–Two social sci courses, exper working with youth or #)
Community is a major context of adolescence and youth life, and community-building is a major strategy for healthy development. Explore recent foundation and government reports that address issues and practical problems of community-building.

YoSt 5240. Special Topics in Youth Studies. (2-8 cr [max 10 cr]; QP–Two social sci courses, exper working with youth or #; SP–Two social sci courses, exper working with youth or #)
In-depth investigation of one area of youth studies. Teaching procedure and approach determined by specific topic and student needs. Topic announced in advance.

YoSt 5241. Experiential Learning. (2 cr; QP–Two social sci courses, exper working with youth or #; SP–Two social sci courses, exper working with youth or #)
Cover rationale for and purposes of experiential learning in schools and youth-serving agencies, development and implementation of experiential programs for adolescents, and evaluation of experiential-learning programs. Each student will develop a plan for an experiential program for teenagers.

YoSt 5291. Independent Study in Youth Studies. (1-8 cr [max 8 cr]; QP–#; SP–#)
Independent reading and/or research under faculty supervision.

YoSt 5301. Communicating with Adolescents About Sexuality. (2 cr; QP–Upper div AdPy course, exper working with youth or #; SP–Upper div AdPy course, exper working with youth or #)
Sexual development and experiences emphasizing how adults can be comfortable in communicating more effectively with young people. Sexual patterns, variations, roles, power, exploration, and sex education.

YoSt 5313. Direct Work with Adolescents. (2 cr; QP–Two social sci courses, exper working with youth or #; SP–Two social sci courses, exper working with youth or #)
Designed to give an understanding of direct work with troubled and at-risk adolescents in a wide range of settings where youth workers or social workers are typically involved. Emphasis on young people in groups in the "life space" in everyday life, rather than in one-to-one office-based interactions.

YoSt 5321. Work with Youth—Individual. (2 cr; QP–5330 or equiv or #; SP–5032 or equiv or #)
Examination of basic assumptions underlying individual work with youth. Attention to special issues and concerns of adolescents and of persons who work with them, especially those who work with youth in one-to-one interactions.

YoSt 5322. Work with Youth—Families. (2 cr; QP–5230 or equiv or #; SP–5321 or upper div AdPy course, family theory course or #)
Theories and techniques of working with youth and their families. Emphasis on practical methods of structural change, developing effective communication, decision-making and problem-solving systems, winning the family's cooperation; the role of the professional to influence healthy family development.

YoSt 5323. Work with Youth—Groups. (2 cr; QP–5230 or 5330 or #; SP–5321 or upper div AdPy course or #)
Increase knowledge and understanding of adolescent group needs and associations; increase knowledge of group process; and enhance skill in working with groups of adolescents in the community, in group living situations, and in group therapy.

YoSt 5402. Youth Policy: Enhancing Healthy Development in Everyday Life. (3 cr; QP–Two social sci courses, exper working with youth or #; SP–Two social sci courses, exper working with youth or #)
Youth policy is typically grounded to problems and risks and is specific to human services domains such as education, health, juvenile justice, employment, and the like. Create youth policy directed at enhancing healthy development through community building, program development, and other strategies.

Related Fields

Graduate degree programs do not exist in the following fields. However, students may earn graduate credit in courses related to their program and use faculty members on their examining committees from these fields. For graduate courses, see the Courses section in this catalog.

Anesthesiology

Lecturer
Lisa C. Anderson, E

Chicano Studies

Professor
Dennis Valdes, E

Associate Professor
Guillermo Rojas, E

Dermatology

Professor
Mark V. Dahl (emeritus), E

Assistant Professor
James C. Vance, E

Family Practice and Community Health

Professor
Carole J. Bland, E
Charles E. Boult, E
Edmond J. Coleman, E
Dwenda Gjerdingen, E
Joseph M. Keenan, E
Roger S. Mazze, E
Brian R. Rosser, E
Vernon E. Weckwerth, E

Associate Professor
Sharon S. Allen, E
Byron Crouse, Family Medicine, Duluth, E
Kenneth Hepburn, Nursing, E
James Pacala, E
Beatrice E. Robinson, E

Assistant Professor
Walter Bockting, E
Michael H. Miner, E
Angela M. Vargas, E
Mark W. Yeazel, E

Humanities

Assistant Professor
George Kliger, E

Middle Eastern Languages

Professor
Iraj Bashiri, Linguistics, and Asian and Slavic Languages, E

Associate Professor

Daniel D. Reisman, Classical and Near Eastern Studies, E

Neurosurgery

Professor
Timothy J. Ebner, Neuroscience, E
Donald L. Erickson, E
Walter A. Hall, E
Walter C. Low, E
Robert E. Maxwell, E
Gaylan L. Rockswold, E

Other
Stephen J. Haines, E
Setti S. Rengachary, E

Pediatrics

Regents Professor
Alfred F. Michael, E
James G. White, E

Professor
Bruce R. Blazar, E
David M. Brown, E
Carlyle C. Clawson, E
Patricia Ferrieri, E
Alfred J. Fish, E
G. Scott Giebink, E
Edward L. Kaplan, Epidemiology, E
Sheldon M. Mauer, E
James H. Moller, E
Harvey Sharp, E
Kenneth F. Swaiman, E
Homer D. Venters, E
Warren J. Warwick, E

Associate Professor
Amos S. Deinard, E
Rolf R. Engel, E
John P. Perentesis, E

Assistant Professor
Pinian Chang, E

Psychiatry (AdPy and CAPy)

Professor
Gerald J. August, E
Paula J. Clayton, E
Elke D. Eckert, E
William H. Frey, Pharmacy, E
Judith G. Garrard, Health Services Research, Policy and Administration, E
James A. Halikas, E
Dorothy Hatsukami, Epidemiology, E
Jerome L. Kroll, E
David T. Lykken (emeritus), Psychology, E
Thomas B. Mackenzie, E
Michael K. Popkin, E
Marilyn C. Santi, E

Associate Professor
Michael L. Bloomquist, E
Carrie M. Borchardt, E
Scott J. Crow, E
George Realmuto, E

Assistant Professor
Daniel R. Hanson, E

Other
Harry M. Hoberman, E
Susan L. Warren, E

Radiology

Professor
Donovan B. Reinke, E

Associate Professor
Marvin E. Goldberg, E

Other
Kent B. Remley, E

Therapeutic Radiology

Professor
John J. Kersey, Pediatrics, E
Faiz M. Khan, E
Seymour H. Levitt, E
Chang W. Song, E

Duluth Degree Programs

Duluth Degree Programs

General Information

At the University of Minnesota Duluth, the Graduate School offers programs for the *master of arts* in communication sciences and disorders, counseling psychology (emphases in college counseling, community counseling, and school counseling), and English (emphases in literary studies for concentrated study of literature, English studies, and publishing and print culture). Programs for the *master of science* are offered in applied and computational mathematics, biology, chemistry, computer science, engineering management, geology, and physics. In addition, the *master of business administration*, *master of fine arts* in art (emphasis in graphic design), *master of liberal studies*, *master of music*, and *master of social work* are offered.

All-University M.S./Ph.D. programs in toxicology and water resources science are offered jointly with the Twin Cities campus. In addition, several graduate programs operate at the University of Minnesota Duluth under the aegis of graduate programs on the Twin Cities campus. Cooperative programs offered at both the master's and doctoral levels include biochemistry; microbiology, immunology and cancer biology; pharmacology, and cellular and integrative physiology. Students interested in these programs should see Degree Programs in this catalog.

All programs are under the jurisdiction of the Graduate School dean and have admission, candidacy, and degree requirements comparable to their counterpart programs on the Twin Cities campus. General Graduate School regulations, including those for minimum degree requirements, apply to programs offered on the Duluth campus (see General Information at the beginning of this catalog).

Financial Aid and Other Assistance

Assistantships are normally granted through individual departments subject to stipulations described in General Information at the beginning of this catalog. Information about these assistantships can be obtained by writing to the department director of graduate studies. With an assistantship appointment of 25 percent or more, hospitalization and medical insurance coverage is provided at no additional cost.

Some residence counseling positions may be available. For information, write to the Housing Office, 149 Lake Superior Hall, University of Minnesota Duluth, MN 55812.

Inquiries regarding loan funds, living accommodations, employment, and placement should be addressed to the Vice Chancellor for Academic Support and Student Life, 297 Darland Administration Building, University of Minnesota Duluth, MN 55812.

Key to Abbreviations

Faculty

Graduate faculty are listed at the beginning of each degree program. After the faculty name, the home department will be listed (unless the department is the same as the program name), followed by the graduate faculty status in the program. Professors emeriti are identified by "(emeritus)."

Membership Categories

Full Membership (FM)—Authorization to advise students at all levels, including the doctorate; serve as a thesis reviewer and an examiner on student examining committees, including service as chair of doctoral committees; and teach courses for graduate credit. In fields that also offer a professional doctorate, some full-member appointments may be restricted to the supervision of students seeking the professional degree.

Associate Membership (AM)— Authorization to advise students at the master's and specialist certificate levels; serve as a thesis reviewer and an examinter on student examining committees at all levels, but not as chair of doctoral committees; co-advise doctoral students with a full member of the graduate faculty in the same field; and teach courses for graduate credit.

Examining Membership (E)— Authorization to serve as a thesis reviewer and an examiner on student examining committees at all levels, but not as chair; and teach courses for graduate credit.

Tests

The following test abbreviations appear throughout graduate program listings.

GMAT—Graduate Management Admission Test

GRE—Graduate Record Examination

MELAB—Michigan English Language Assessment Battery

TOEFL—Test of English as a Foreign Language

For more information about these individual tests, see page 9 in the General Information section.

Program Descriptions

Brief descriptions of the various degree programs are listed below. Course offerings are listed in the *University of Minnesota Duluth Catalog.* General information concerning graduate work on the Duluth campus may be obtained from the Graduate School Office—Duluth, 431 Darland Administration Building, University of Minnesota Duluth, MN 55812. Information is also available at <www.d.umn.edu/grad>.

Applied and Computational Mathematics

Contact Information—Department of Mathematics and Statistics, University of Minnesota Duluth, 140 Campus Center, 10 University Drive, Duluth, MN 55812 (218-726-8747; fax 218-726-8399; e-mail math@d.umn.edu; <www.d.umn.edu/math>).

Professor

Sabra S. Anderson, AM
Joseph A. Gallian, AM
Richard F. Green, AM
Barry R. James, AM
Kang Ling James, AM
Zhuangyi Liu, AM
Ronald R. Regal, AM
Harlan W. Stech, AM
Jiann Shiou Yang, Electrical and Computer Engineering, AM

Associate Professor

Richard A. Davis, Chemical Engineering, AM
Linda L. Deneen, Computer Science, AM
Douglas J. Dunham, Computer Science, AM
John R. Greene, AM
Robert L. McFarland, AM
Bruce B.L. Peckham, AM
Kathryn E. Lenz, AM
James W. Rowell, AM
Gary M. Shute, Computer Science, AM
Steven A. Trogdon, AM

Assistant Professor

Guihua Fei, AM
Carmen M. Latterell, AM

Curriculum—This program is for those wishing to pursue careers that use applied mathematics and statistics in science, industry, business, and teaching, and for those wishing to go on for Ph.D. degrees in mathematics or statistics. It emphasizes the use of modern modeling techniques and computational methods, with areas of concentration available in continuous modeling, probability/statistics, and discrete mathematics. The faculty is drawn largely from the Department of Mathematics and Statistics, but includes members from the Departments of Computer Science, Electrical and Computer Engineering, and Chemical Engineering.

Admission Requirements—Applicants should have completed an undergraduate degree in mathematics or statistics. However, a student with a degree in another major, and with a substantial background in mathematics or statistics (e.g., computer science or engineering), may also qualify; students lacking certain prerequisites may make up deficiencies concurrently with graduate work.

GRE General Test scores are required. Students whose native language is not English must submit their TOEFL scores.

M.S. Degree Requirements

The M.S. is offered under both Plan A (with thesis) and Plan B (without thesis). All students must complete at least 33 credits, of which at least 17 must be from approved mathematics or statistics courses or seminars (including a graduate seminar and two of the three core courses) and 6 must be from a minor or related field (statistics is a related field). Plan A also requires 10 thesis credits; Plan B requires a 2-credit project and an additional 8 credits from approved graduate-level mathematics, statistics, or related-field courses. 4xxx courses (maximum of 8 credits) may be applied to the degree.

Language Requirements—None.

Final Exam—The final exams are written and oral.

Minor Requirements for Students Majoring in Other Fields—A master's minor requires 6 credits in approved Math or Stat courses.

Art—Graphic Design

Contact Information—Department of Art, University of Minnesota Duluth, 317 Humanities Building, 10 University Drive, Duluth, MN 55812 (218-726-7800; fax 218-726-6532; e-mail art@d.umn.edu; <www.d.umn.edu/art/design/mfa/>).

Professor
Gloria Brush, AM
Leif G. Brush, AM
James C. Klueg, AM
Thomas G. Kovacs, AM
Dean Lettenstrom, AM

Associate Professor
Alyce B. Coker, AM
Janice D. Kmetz, AM
Robert A. Repinski, AM
Robyn S. Roslak, AM

Assistant Professor
Alison J. Aunehinkel, AM
Sarah Bauer, AM
Kenneth R. Fitzgerald, AM
Stephen J. Hilyard, AM
Catherine Jo Ishino, AM
Suzanne Szucs, AM

Lecturer
Martin D. Dewitt, AM

Curriculum—Graphic design is the manipulation of type and image for communication. Traditionally, this has meant design for the print medium, but the same skill and understanding go into design for video, computer-based presentations, and an ever-widening range of applications. The Department of Art strongly believes that, even though many graphic design M.F.A. graduates choose to practice rather than teach, the M.F.A. is a primary prerequisite for teaching at the university level, and M.F.A. programs therefore have a responsibility to prepare students for academic as well as aesthetic rigor. Consequently, although the M.F.A. is largely a studio degree, the program includes a strong analytical and intellectual component.

The department also believes that such rigor is ultimately the best approach for training graphic design practitioners as well. The field is rapidly changing, and only by being versed in the traditional capacities of the area, the skills and knowledge of related fields, and the skills of critical thought can future designers hope to lead rather than merely react to changes.

Admission Requirements—Applicants should have an interest in art making, the cultural and historical importance of art, and have a B.A., B.S., or B.F.A. in art. Individuals with undergraduate degrees in other disciplines who have completed a substantial number of art courses also may be considered for admission.

Applicants must have a minimum undergraduate GPA of 3.00. Those whose native language is not English must have a TOEFL score (computer based) of at least 213 or a MELAB score of 80. The GRE is not required.

A portfolio of at least 20 slides of design work (or work submitted on CD, videotape, or disk), a letter of intent, a sample of the applicant's writing (written in or translated into English), and three letters of recommendation are required as part of the application.

M.F.A. Plan B Degree Requirements

The M.F.A. program requires at least two years in residence and 60 credits. The program may be completed on a part-time basis by first taking all requirements other than the Art 8901—Graduate Seminar/Art 8980—Graduate Studio series and Art 8990—M.F.A. Creative Thesis. The 8901/8980 series must be taken within a two-year period. A final project and minimum 15-page supporting paper are required. Although a gallery exhibition is typical, the project may take forms such as a book, video, Web site, or interactive project. Inclusion of 4xxx courses on degree program forms is subject to program approval.

Language Requirements—None.

Final Exam—An oral exam based on the project and supporting paper is required.

Biology

Contact Information—Department of Biology, University of Minnesota Duluth, 221 Life Science Building, 10 University Drive, Duluth, MN 55812 (218-726-6262; fax 218-726-8142; e-mail biol@d.umn.edu; <www.d.umn.edu/biology/gradprograms/gradprog.htm>).

Professor
Matthew Andrews, AM
Lester R. Drewes, Biochemistry and Molecular Biology, AM
Conrad E. Firling, AM
Stephen C. Hedman, AM
Muhammad R. Ul Karim, AM
Andrew R. Klemer, AM
Gerald J. Niemi, AM
John Pastor, AM
Arlen R. Severson, Anatomy and Cell Biology, AM
George J. Trachte, Pharmacology, AM

Associate Professor
Alice Adams, Medical Microbiology and Immunology, AM
Benjamin L. Clarke, Medical Microbiology and Immunology, AM
Stephen W. Downing, Anatomy and Cell Biology, AM
Donna J. Forbes, Anatomy and Cell Biology, AM
Cecilia Giulivi, Chemistry, AM
Randall E. Hicks, AM
Linda L. Holmstrand, AM
Jon M. Holy, Anatomy and Cell Biology, AM
Robert L. Lloyd, Psychology, AM
Merry Jo Oursler, AM
Lilllian A. Repesh, Anatomy and Cell Biology, AM
David J. Schimpf, AM

Assistant Professor
Richard P. Axler, Natural Resources Research Institute, AM
Donn K. Branstrator, AM
Arun Goyal, AM
Carol A. Johnston, Natural Resources Research Institute, AM
Allen Mensinger, AM

Lecturer
Lyle J. Shannon, E

Teaching Specialist
JoAnn M. Hanowski, Natural Resources Research Institute, E

Post-Doctoral Associate
Malcolm T. Jones, Natural Resources Research Institute, E

Reseach Associate
George E. Host, Natural Resources Research Institute, AM
Lucinda B. Johnson, Natural Resources Research Institute, AM
Richard L. Leino, Anatomy and Cell Biology, AM
John C. Kingston, Natural Resources Research Institute, AM

Program Director
Thomas Malterer, Natural Resources Research Institute, AM
Carl R. Richards, Sea Grant, AM
Neil D. Nelson, Natural Resources Research Institute, E

Curriculum—The program offers study toward the M.S. under either Plan A or Plan B. Plan A students must select an area of concentration from among botany, cellular and physiological biology, environmental biology, or zoology.

Admission Requirements—A bachelor's degree or equivalent from an accredited department in the life sciences or a related degree field, *or* one year of general biology and a one year course sequence in the physical/mathematical sciences. Students with deficiencies may be admitted with the provision that equivalent coursework or approved substitutions be completed during the first year of graduate study.

As part of the their application materials, applicants must also submit recent GRE General Test scores.

Prior coursework and/or GRE scores are used to assess proficiency in the areas of general biology, genetics, cell biology, and ecology. Such proficiency is considered in the admission decision.

M.S. Degree Requirements

Plan A students must complete at least 14 course credits in the major, including at least 10 credits in courses approved for the selected area of concentration; at least 6 credits of approved coursework in one or more related fields or a minor; and at least 10 thesis credits. Plan B students must complete at least 14 course credits in the major, at least 6 credits of approved coursework in one or more related fields or a minor, and at least 10 credits of other approved coursework. Plan A requires a thesis; Plan B requires one to three Plan B projects. Inclusion of 4xxx courses on degree program forms is subject to program approval.

Language Requirements—None.

Final Exam—Students must present a department seminar and pass a final oral exam.

Minor Requirements for Students Majoring in Other Fields—Any course that may be used as credit for the major may be used as credit toward the minor.

Business Administration

Contact Information—M.B.A. Department, School of Business and Economics, University of Minnesota Duluth, 21 School of Business and Economics Building, 10 University Drive, Duluth, MN 55812 (218-726-8986; fax 218-726-6936; e-mail sbe@d.umn.edu; <www.d.umn.edu/depts/Listing/mba.html>).

Professor

Stephen B. Castleberry, Management Studies, AM
Thomas B. Duff, Finance and Management Information Sciences, AM
Ehsan H. Feroz, Accounting, AM
Richard W. Lichty, Economics, AM
Patricia A. Merrier, Finance and Management Information Sciences, AM
John W. Newstrom, Management Studies, AM
Jerrold M. Peterson, Economics, AM
Jon L. Pierce, Management Studies, AM
Raymond L. Raab, Economics, AM
Stephen A. Rubenfeld, Management Studies, AM
Donald N. Steinnes, Economics, AM
Shee Q. Wong, Finance and Management Information Sciences, AM

Associate Professor

Manjeet Dhaatt, Finance and Management Information Sciences, AM
Kjell R. Knudsen, Management Studies, AM
June F. Li, Accounting, AM
A. Maureen O'Brien, Economics, AM
Linda Rochford, Management Studies, AM
Alan C. Roline, Accounting, E
Rajiv Vaidyanathan, Management Studies, AM

Assistant Professor

Praveen Aggarwal, Management Studies, AM
Sanjay Goel, Management Studies, AM
Jerry Lin, Accounting, AM

Curriculum—The M.B.A. program meets the needs of residents of northeastern Minnesota and northwestern Wisconsin who are currently employed full time, pursuing professional managerial careers, or seeking general management education at the graduate level part-time. The M.B.A. core courses and electives are offered in the evening, with most courses meeting one evening per week. Full-time enrollment is possible, however, and a relatively small number of domestic and international students enroll full time.

Admission Requirements—Applicants must have a bachelor's degree from an accredited college or university; completed prerequisite or foundation courses in accounting, economics, finance, production/operations, marketing, organizational management, and human resource management *or* be able to demonstrate knowledge and proficiency in each of these areas; and have an acceptable score on the GMAT or GRE, passed the Certified Professional Accountant (CPA) examination, or completed a graduate degree from an accredited college or university. In addition, international students must have an acceptable score on the TOEFL.

The bachelor's degree may be in any field. However, students who have had little or no undergraduate or other education in business administration must complete prerequisite or foundation courses in the areas identified above before admission to the M.B.A. program. No graduate credit or credit toward M.B.A. program requirements is granted for prerequisite courses.

M.B.A. Plan B and Coursework Only Degree Requirements

The M.B.A. requires 32 credits. All students must complete six core and three support area courses, which provide exposure to financial reporting, analysis, and markets; the domestic and global environments of business and organizations; the creation and distribution of goods and services; and human behavior in organizations. Also required are a capstone strategic management course and a minimum of 2 credits of cross-functional experience selected from special topics, workshops, projects, or field study. Students then choose one of two options for completing an additional 6 credits of elective coursework: coursework only or field research (Plan B). M.B.A. students may include 4xxx courses for electives in their degree programs subject to M.B.A. director approval.

Language Requirements—None.

Final Exam—For Plan B, students meet with their faculty committee for a final review of their completed project. For coursework only, no final exam is required.

Chemistry

Contact Information—Department of Chemistry, 246 Chemistry Building, 10 University Drive, Duluth, MN 55812 (218-726-7212; fax 218-726-7394; e-mail chem@d.umn.edu; <www.d.umn.edu/chem/graduate/index.html>).

Professor

Paul M. Anderson, Biochemistry and Molecular Biology, FM
Ronald Caple, FM
Robert M. Carlson, FM
Lester R. Drewes, Biochemistry and Molecular Biology, AM
John F. Evans, AM
Donald K. Harriss, FM
Vincent R. Magnuson, AM
Donald P. Poe, AM
Joseph R. Prokaska, AM
James P. Riehl, AM
Larry C. Thompson, FM
Bilin P. Tsai, AM
Kendall B. Wallace, AM
Viktor Zhdankin AM

Associate Professor

Benjamin L. Clarke, Medical Microbiology and Immunology, AM
Cecilia Giulivi, AM
Thomas E. Huntley, Biochemistry and Molecular Biology, AM
Paul Kiprof, AM
Keith B. Lodge, Chemical Engineering, AM
Paul D. Siders, AM

Assistant Professor

Annette L. Boman, Biochemistry and Molecular Biology, AM
Peter E. Kebbekus, AM
James McManus, AM

Curriculum—The M.S. program offers a broad-based education in chemistry that is well suited to students going on to Ph.D. programs, careers in industry, or professional schools. Both Plan A (with thesis) and Plan B (without thesis) are available. For Plan A, emphases include analytical, biological, inorganic, organic, and physical chemistry. The faculty includes members from the Departments of Chemistry and Chemical Engineering in the College of Science and Engineering and from the Departments of Biochemistry and Molecular Biology, and Microbiology and Immunology in the School of Medicine.

Admission Requirements—Applicants must have completed an undergraduate chemistry major, including an upper division course in inorganic chemistry, one year of physical chemistry, mathematics through calculus, and one year of college physics, preferably taught using calculus. Students lacking some of these prerequisites may make up deficiencies concurrently with graduate work.

M.S. Plan A and Plan B Degree Requirements

All students must complete 30 credits, including a minimum of 14 credits in the major (including four core courses) and 6 credits in a related field or minor. Plan A students must also register for 10 thesis credits; Plan B students must complete an additional 10 course credits and prepare three papers. Attendance and presentation at the chemistry seminar are required. Individual programs are designed to best serve the interests of the student.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master's minor requires a minimum of 6 credits in chemistry courses. Individual programs must be approved by the director of graduate studies in chemistry.

Communication Sciences and Disorders

Contact Information—Department of Communication Sciences and Disorders, University of Minnesota Duluth, 221 Bohannon Hall, 10 University Drive, Duluth, MN 55812 (218-726-7974; fax 218-726-8693; e-mail cd@d.umn.edu; <www.d.umn.edu/csd/general/csdgrad.html>).

Professor
Paul N. Deputy, AM
Mark I. Mizuko, AM

Associate Professor
Faith C. Loven, AM
Cynthia S. Spillers, AM

Assistant Professor
Kent R. Brorson, AM
Amy Meredith, AM

Curriculum—The graduate program in communication sciences and disorders effectively combines academic and clinical endeavors to prepare students to become speech-language pathologists. The program places a major emphasis on the development of clinical skills, although students have the opportunity to engage in a wide variety of academic and research activities as well. The curriculum, which is based on five semesters of study, is accredited by the Council of Academic Accreditation (CAA) in speech-language pathology and also by the American Speech-Language Hearing Association (ASHA).

Admission Requirements—Applicants must have a bachelor's degree in communication sciences and disorders. Three letters of recommendation evaluating the applicant's scholarship and clinical potential are required. At least two letters should be from academic faculty familiar with the applicant. A personal statement of the applicant's short- and long-term goals is also required.

M.A. Plan B Degree Requirements

The M.A. is offered under Plan B only. At least 43 credits are required, including 31 credits of required CSD courses, 2 credits of Plan B project (CSD 8099), 4 credits of internship, and at least 6 credits of approved courses (4xxx and higher) from related fields. All Plan B projects must be pre-approved by the student's examining committee, which also must give final approval.

Language Requirements—None.

Final Exam—The final exam is oral.

Computer Science

Contact Information—Department of Computer Science, University of Minnesota Duluth, 320 Heller Hall, 10 University Drive, Duluth, MN 55812 (218-726-7678; fax 218-726-8240; e-mail cs@d.umn.edu; <www.d.umn.edu/cs/grad>).

Professor
Donald B. Crouch, AM
Marian Stachowicz, Electrical and Computer Engineering, AM
Harlan Stech, Mathematics and Statistics, AM

Associate Professor
Timothy R. Colburn, AM
Carolyn C. Crouch, AM
Linda L. Deneen, AM
Douglas, J. Dunham, AM
Richard F. Maclin, AM
Gary M. Shute, Am

Assistant Professor
Theordore D. Pedersen, AM
Christopher G. Price, AM
Maria Sosonkina, AM
C. Hudson Turner, AM

Curriculum—Computer science is a discipline that involves understanding the design of computers and computational processes. The discipline ranges from the theoretical study of algorithms to the design and implementation of software at the systems and applications levels.

The M.S. is a two-year program that provides the necessary foundational studies for graduates planning to pursue either a Ph.D. in computer science or a career as a computer scientist in business or industry.

Admission Requirements—The program is for students with undergraduate degrees in computer science or computer engineering. These students should be able to enroll immediately in 8xxx computer science courses. Students with other backgrounds may be considered if they have completed the following courses or their equivalents: CS 1511-1521—Computer Science I-II; CS 2511—Software Development; CS 2521—Computer Organization; CS 4511—Automata, Computability, and Formal Languages; CS 4521—Advanced Data Structures and Algorithms; CS 5621—Computer Architecture; and CS 5631—Operating Systems. The appropriate math prerequisites, namely Math 1296-1297—Calculus I-II and Stat 3611—Introduction to Probability and Statistics are also required. Students who fail to meet these requirements may be admitted provisionally and must complete specified courses before proceeding with their graduate work. The GRE General Test is required; the TOEFL is also required of international students.

M.S. Degree Requirements

The M.S. is offered under Plan A (thesis) and Plan B (non-thesis). At least 33 credits are required, including 16 credits from 8xxx courses in computer science, 1 credit of CS 8993—Seminar, and at least 6 credits from a minor or related field outside computer science. Plan A also requires 10 thesis credits and Plan B requires a minimum of 10 credits in additional computer science courses (5xxx or above). All courses are chosen in consultation with the student's adviser, subject to approval by the director of graduate studies. 4xxx computer science courses may not be included in degree programs for the M.S. in computer science.

Language Requirements—None.

Final Exam—Students present a department colloquium, followed by an oral exam.

Minor Requirements for Students Majoring in Other Fields—A minimum of 6 credits in computer science is required for a master's minor.

Counseling Psychology

Contact Information—Department of Psychology, University of Minnesota Duluth, 320 Bohannon Hall, 10 University Drive, Duluth, MN 55812 (218-726-7117; fax 218-726-7186; e-mail psy@d.umn.edu; <www.d.umn.edu/grad/educational.html>).

Professor
Ajit K. Das, AM
Aydin Y. Durgunoglu, AM
Randall A. Gordon, AM
Bud A. McClure, AM
Kristelle E. Miller, AM
Uwe H. Stuecher, AM

Associate Professor
Helen M. Doane, AM
Eugene E. Grossman, AM
Jane C. Hovland, AM
Robert L. Lloyd, AM
Sandy Woolum, AM

Assistant Professor
Mark W. Olson, AM
Paula J. Pedersen-Randall, AM
Donald E. Streufert, AM

Curriculum—The M.A. in counseling psychology is based on a developmental philosophy that encourages academic learning and personal growth. The overall emphasis is on the promotion of healthy psychological functioning and the prevention of psychological disturbances. A core curriculum provides theoretical frameworks and practice in counseling skills from which students can develop their unique strategies and pursue specialty training.

Three emphases for specialty training are offered: community counseling, college counseling, and school counseling. The community and school counseling emphases are accredited by the Council for Accreditation of Counseling and Related Educational Programs (CACREP). Students select an emphasis during their second semester.

Community counseling students may elect coursework that provides a foundation for pursuing licensure as a psychological practitioner in Minnesota or as a licensed professional counselor in many other states. The college counseling emphasis offers preparation for student support and development in colleges and universities. The school counseling emphasis allows for specialization in grades K-12.

Admission Requirements—A minimum undergraduate GPA of 3.00 on a 4.00 point scale and a minimum of 6 credits in psychology or education, including an undergraduate inferential statistics course are required. Applicants must submit scores from the GRE General Test with minimum scores of 350 in the verbal and quantitative sections; scores of 500 in both sections are preferred. A written statement providing evidence of social service or teaching experience and three recommendation forms are required. Applications should be submitted by March 15 for consideration for admission in the following fall semester. Applications submitted after March 15 will be considered only if space is available.

M.A. Plan B Degree Requirements

The M.A. requires 50 credits, including 31 counseling core credits, 13 professional emphasis credits, and 6 credits in a minor or related field. Counseling core credits include a 4-credit Plan B research paper (Psy 5061, 5062—Research Problems I, II) with an oral exam; professional emphasis credits include a semester practicum (2 credits) and a nine-month internship (23 hours per week, 6 credits). Core credits must include Psy 5051, 5052, 5061, 5062, 5121, 5501, 5502, 5601, 5603, 5611, and 5651. Professional emphasis credits are as follows: community counseling—Psy 5125, 8001, 8101, 8197, 8297; college counseling—Psy 8003, 8101, 8397, 8497, 3-credit elective; school counseling—Psy 5201, 8005, 8101, 8597 or 8797, 8697 or 8897.

Students pursuing licensure in Minnesota as psychological practitioners or professional school counselors must complete specified courses, which can be completed as major or related field requirements. Students should consult with the program for current specified courses, as requirements are determined by state agencies and may change.

Students may also complete a national counselor exam, such as the National Counselor Examination for Licensure and Certification (NCE), before graduation.

Language Requirements—None.

Final Exam—A final oral exam on the Plan B paper is required. Students must also take a comprehensive exam.

Minor Requirements for Students Majoring in Other Fields—A master's minor requires 8 credits of psychology and is structured to include a research component, counseling orientation, and an elective. Interested students should contact the director of graduate studies in counseling psychology.

Engineering Management

Contact Information—Department of Industrial Engineering, University of Minnesota Duluth, 229 Voss-Kovach Hall, 10 University Drive, Duluth, MN 55812 (218-726-8117; fax 218-726-8581; e-mail msem@d.umn.edu; <http://ie.d.umn.edu/MSEM/>).

Professor

L. Alden Kendall, AM

Associate Professor

Ryan G. Rosandich, AM
David A. Wyrick, AM

Curriculum—The master of science in engineering management program develops the concepts of managing technology, people, and information for persons with a background in engineering. People in engineering positions often manage technical projects of varying size and complexity, and a graduate program in engineering management provides excellent preparation.

Admission Requirements—All applicants must meet the general admission requirements to the Graduate School of the University of Minnesota. Applicants should have completed an undergraduate degree in an engineering discipline. However, an applicant with a degree in another technical major and with a substantial background in engineering may qualify. Such students may be admitted on a case-by-case basis and will be asked to submit documentation that substantiates their engineering and technology experience and responsibilities.

M.S.E.M. Plan B Degree Requirements

Students must complete 30 credits, including a minimum of 15 credits in the major, a 3-credit capstone project course, and 6 credits in a related field or minor (business administration). Students must complete an additional 6 credits in engineering management or other electives, whichever best fits the needs of the student. The capstone project course requires a formal report and oral presentation. Individual programs are designed to best serve the interest of the student. The director of graduate studies must approve the use of 4xxx courses in degree programs.

Language Requirements—None.

Final Exam—The final exam is a formal report and oral presentation in EMgt 8310.

Minor Requirements for Students Majoring in Other Fields—A master's minor requires 6 credits in engineering management courses. Individual programs must be approved by the director of graduate studies in engineering management.

English

Contact Information—Department of English, University of Minnesota Duluth, 410 Humanities Building, 10 University Drive, Duluth, MN 55812 (218-726-8228; fax 218-726-6882; e-mail englma@d.umn.edu; <www.d.umn.edu/engl/englishgrad/index.htm>).

Professor

Stephen Adams, AM
Thomas D. Bacig, Sociology-Anthropology, AM
Klaus P. Jankofsky, AM
Michael D. Linn, Composition, AM
Joseph C. Maiolo, AM
Linda Miller-Cleary, AM
Kathryn L. Riley, Composition, AM

Associate Professor

Katherine L. Basham, AM
Carol A. Bock, AM
Martin F. Bock, AM
Thomas J. Farrell, Composition, AM
Eleanor M. Hoffman, Composition, AM
Roger C. Lips, AM
Kenneth C. Risdon, Composition, AM

Assistant Professor

Paul Cannan, AM
Jill D. Jenson, Composition, AM
Kathleen Maurer, Composition, AM
Krista Sue-Lo Twu, AM

Curriculum—The M.A program offers courses in English, Irish, and American literature; creative writing; linguistics; composition and rhetorical theory; book history; publishing; and English education. The program has three master's emphases: a literary studies emphasis for concentrated study of literature, an interdisciplinary emphasis in English studies, and an emphasis in publishing print culture.

Admission Requirements—Students applying to this program must submit GRE General Test scores, two writing samples such as course papers, and three letters of recommendation. International applicants must submit TOEFL scores of at least 600 (written test). Entering students should have completed at least 30 credits in English (these may include credits in literature, language, and advanced composition), including 20 credits of upper division English courses that offer broad coverage of English and American literature and at least one course in English language or English linguistics. Any deficiencies will be determined by the director of graduate studies in consultation with the graduate committee. Certain course prerequisites may be taken concurrently with graduate work and may be applied toward degree requirements.

M.A. Plan B Degree Requirements

Literary Studies Emphasis (Plan B): a minimum of 30 credits, including at least 24 credits in the major, 6-8 credits in a related field, and two Plan B projects.

English Studies Emphasis (Plan B):a minimum of 31 credits, including at least 25 credits in the major, distributed in literature, linguistics, and composition/rhetoric; 6-8 credits in a related field; and two Plan B projects.

Publishing and Print Culture (Plan B): a minimum of 31 credits, including at least 25 credits in the major, distributed in literature, publishing, and print culture; 6-8 credits in a related field; and two Plan B projects.

4xxx courses in English, composition, and linguistics may not be included on degree program forms in English. 4xxx courses are permitted in the related field.

Language Requirements—The emphases in literary studies and publishing and print culture require a reading knowledge of Latin, Greek, French, Italian, Spanish, Russian, or another approved language.

The English studies emphasis requires certification of a reading knowledge of a foreign language appropriate to the candidate's area of study and approved by the English graduate committee or completion of at least 6 course credits beyond the 31 required credits. Candidates, whose professional objectives are best served by completing the additional 6 credits, select courses from literature and literary analysis, linguistics, composition/rhetoric, print culture, publishing, or courses closely related to the field of concentration.

Final Exam—The final exams are written and oral. Students must submit two Plan B projects totaling 120 hours of effort before taking the exam. The projects normally are completed in connection with courses in English or in a related field. A completed project must be approved by a graduate faculty member.

Minor Requirements for Students Majoring in Other Fields—At least 8 credits in English, composition, and/or linguistics are required for a master's minor.

Geology

Contact Information—Department of Geological Sciences, University of Minnesota Duluth, 229 Heller Hall, 10 University Drive, Duluth, MN 55812 (218-726-7238; fax 218-726-8275; e-mail geol@d.umn.edu; <www.d.umn.edu/geology/main/gprogram.html>).

Regents Professor

George R. Rapp, AM

Professor

James Grant, AM
Timothy B. Holst, AM
Thomas C. Johnson, AM
Charles L. Matsch, AM
James D. Miller, Jr., AM
Ronald L. Morton, AM
Richard W. Ojakangas, AM

Associate Professor

Erik T. Brown, AM
Howard D. Mooers, AM
Penelope Morton, AM
Nigel J. Wattrus, AM

Assistant Professor

Keith A. Brugger, AM
Christian D. Gallup, AM
Richard D. Ricketts, AM
Steven P. Sternberg, Chemical Engineering, AM
John B. Swenson, AM

Adjunct Assistant Professor

Glenn L. Evavold, AM

Senior Research Associate

Carol A. Johnston, Natural Resources Research Institute, AM

Research Associate

John C. Kingston Natural Resources Research Institute, AM

Curriculum—The M.S. program in geology encompasses areas of interest in hard-rock geology (igneous, metamorphic, and sedimentary petrology; economic geology; and Precambrian geology), Quaternary geology, hydrogeology, geoarchaeology, and physical and chemical limnology. Several of these areas are strengthened by collaboration with the Large Lakes Observatory, the Natural Resources Research Institute, and the Geoarchaeology Laboratory.

Admission Requirements—Applicants must have completed an undergraduate major in geology, geophysics, or related earth science with one year each of college mathematics (including calculus), chemistry, and physics. A full-time geological field course of at least five weeks is also required, as are GRE General Test scores.

M.S. Degree Requirements

The M.S. is offered under Plan A (thesis) and Plan B (non-thesis). Courses are selected with approval of the student's adviser and the director of graduate studies; also, no more than 25 percent of the courses may be 4xxx except by their approval. For both plans, a written candidacy exam during the second semester of residency is required.

Plan A requires 30 credits, including 14 course credits in the major, 6 course credits in a minor or related field (which may be taken within geology if they are in an area different from the student's principal area), and 10 thesis credits. All courses must be 4xxx or 5xxx. Plan B requires 30 credits in approved courses, including three Plan B papers. Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master's minor requires a minimum of 6 credits and is decided in consultation with the student's adviser and the director of graduate studies in geology.

Liberal Studies

Contact Information—College of Liberal Arts, M.L.S. Program, University of Minnesota Duluth, 494 Humanities Building, 10 University Drive, Duluth, MN 55812 (218-726-8149; fax 218-726-6386; e-mail caker@d.umn.edu; <http://www.d.umn.edu/ce/program_guide/mls/mls.html>).

Professor

Stephen Adams, English, AM
Thomas D. Bacig, Sociology-Anthropology, AM
Elizabeth Bartlett, Women's Studies, AM
James H. Fetzer, Philosophy, AM
William Fleischman, Sociology-Anthropology, AM
Thomas F. Hedin, Art, AM
Tom K. Isbell, Theatre, AM
Thomas F. Jordan, Physics, AM
Andrew R. Klemer, Biology, AM
Lawrence Knopp, Geography, AM
Charles L. Matsch, Geological Sciences, AM
Jerrold M. Peterson, Economics, AM
Kathryn Riley, Composition, AM
Fred E. Schroeder (emeritus), Humanities, AM
Richard A. Seybolt, Foreign Languages and Literatures, AM
David M. Smith, Sociology-Anthropology, AM
Neil T. Storch, History, AM
Judith Ann Trolander, History, AM

Associate Professor

Stephen P. Chilton, Political Science, AM
Eve Browning Cole, Philosophy, AM
Jonathan B. Conant, Foreign Languages and Literatures, AM
Robert H. Evans, Philosophy, AM
Scott Freundschuh, Geography, AM
Tineke A. Ritmeester, Women's Studies, AM
Robyn S. Roslak, Art, AM

Assistant Professor

John Bower, Sociology-Anthropology AM

Curriculum—The interdisciplinary M.L.S. is a community outreach program that provides citizens with the opportunity to return to higher education to broaden their intellectual horizons without having to focus on specific professional goals. Two emphases include the traditional M.L.S. or an ecology, economics, and ethics emphasis. In both emphases, students write one to three papers exploring in depth an interdisciplinary topic.

Admission Requirements—Applicants must have a bachelor's degree from a recognized college or university with a 3.00 GPA. The application should include three letters of recommendation and a thoughtfully composed letter stating, in narrative form, reasons for wishing to pursue the M.L.S. and describing education and career experiences. This letter should be addressed to the director of graduate studies in the UMD Graduate School Office.

M.L.S. Plan B Degree Requirements

The M.L.S. is offered under Plan B only. Students in either emphasis must complete 32 credits, including at least 4 credits of IS 8001—Introduction to Liberal Studies. Those students electing the traditional emphasis must also take 4 credits of IS 8501—Seminar: Ethics and the Human Condition and 24 elective credits. Students selecting the ecology, economics, and ethics emphasis must also take 4 credits of IS 8250—

Ecological Economics, 4 credits of IS 8502—Ecology, Economics, and Ethics, and an additional 20 credits of electives. One to three Plan B papers are required in both emphases.

Language Requirements—None.

Final Exam—The final exam is oral.

Linguistics

Contact Information—Program in Linguistics, University of Minnesota Duluth, 457 Humanities Building, 10 University Drive, Duluth, MN 55812 (218-726-7951; fax 218-726-8109; e-mail jconant@d.umn.edu; <www.d.umn.edu/ling>).

Professor
Michael D. Linn, Composition, E
Kathryn L. Riley, Composition, E

Associate Professor
Jonanthan B. Conant, Foreign Languages and Literatures, E

Curriculum—Linguistics, offered interdepartmentally and through the Department of Interdisciplinary Programs, may be elected by graduate students as a related field, or with approval of the director of graduate studies of the major, as a designated minor.

Freestanding Minor Requirements

The minor in linguistics requires a minimum of 12 credits selected from Engl 5811—Introduction to Modern English (4 cr), Engl 5821—History of the English Language (4 cr), Ling 5802—Applied Linguistics (4 cr), Ling 5852—Practicum in Teaching Linguistics (3 cr), and Ling 8500—Graduate Seminar (3 cr).

Music

Contact Information—Department of Music, University of Minnesota Duluth, 231 Humanities Building, 10 University Drive, Duluth, MN 55812 (218-726-8207; fax 218-726-8210; e-mail mu@d.umn.edu; <www.d.umn.edu/music/degrees/degrees.html>).

Professor
Ann C. Anderson, E
Judith Ann Kritzmire, AM
Thomas J. Wegren, E
Robert E. Williams (emeritus), AM
Stanley R. Wold, AM

Associate Professor
George Lynn Hitt (emeritus), E
David J. Schmalenberger, E
Mark E. Whitlock, AM

Assistant Professor
Daniel G. Lipori, AM
Justin H. Rubin, AM
Theodore A. Schoen, AM
Tina L. Thielen-Gaffey, E
Ramon F. Vasquez, E

Other
Christopher Oberholtzer, E
Michael A. Pagan, E

Curriculum—The M.M. program offers students an opportunity to acquire advanced understanding and skill in music education theory and practice and musical performance. A course of study is designed to meet the interests and objectives of the student.

Admission Requirements—Applicants must have an undergraduate degree in music and have applied to the University of Minnesota Graduate School. In addition, the following must be submitted for review by the music graduate committee: 1) Department of Music Graduate Study Application; 2) sample of professional writing (a three- to five- page paper addressing current issues in music education); 3) two letters of reference from professional colleagues and/or supervisors describing the candidate's potential for success in the graduate music program; and 4) an entrance performance audition on the major instrument or a videotape of classroom teaching or conducting.

M.M. Plan B Degree Requirements

The M.M. in music education and performance emphases each requires 30 credits. The music education emphasis requires 14 credits in music education/education, 8 credits in the related field of music, 6 credits for the Plan B paper, and 2 elective credits. The performance emphasis requires 14 credits in performance/pedagogy, 8 credits in music theory and literature, 6 credits in research/foundations courses, 2 elective credits and a solo recital.

Language Requirements—None.

Final Exam—A comprehensive written and oral final are required.

Physics

Contact Information—Department of Physics, University of Minnesota Duluth, 371 Marshall W. Alworth Hall, 10 University Drive, Duluth, MN 55812 (218-726-7594; fax 218-726-6942; e-mail phys@d.umn.edu; <www.d.umn.edu/~jmaps/gradpgm.html>).

Professor
John R. Hiller, AM
Thomas F. Jordan, AM
Michael Sydor, AM

Associate Professor
Bo R. Casserberg, AM
John L. Kroening, AM

Assistant Professor
Alec T. Habig, AM
Jonathan Maps, AM
Brian D. May, AM
Elise A. Ralph, AM
Meng Zhou, AM

Curriculum—The M.S. program provides grounding in the fundamentals of physics, combined with significant research involvement. The primary areas of research include computational physics, experimental work in condensed-matter physics, high-energy neutrino physics, and observational and theoretical work in physical limnology.

Admission Requirements—An undergraduate degree in physics or the equivalent is required.

M.S. Degree Requirements

The M.S. is offered under both Plan A and Plan B. All students take 14 credits in a common core of courses (Phys 5501, 5511, 5521, 5522, and 2 credits in 5090) and 6 credits in a minor or related fields. Plan A also requires 10 thesis credits; Plan B requires one or more projects requiring a minimum of 120 hours work total, preparation of a written report for each project, and 10 additional course credits in physics. 4xxx courses may be included if appropriate and if approved for graduate credit; for distinctly interdisciplinary programs, the courses may be outside physics. In all cases, the overall plan of study and selection of elective courses must form a coherent program and be approved by the director of graduate studies.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master's minor requires 6 credits, of which no more than 1 credit can be from Phys 5090.

Social Work

Contact Information—Department of Social Work, University of Minnesota Duluth, 220 Bohannon Hall, 10 University Drive, Duluth, MN 55812 (218-726-7245; fax 218-726-7185; e-mail sw@d.umn.edu; <www.d.umn.edu/sw/msw.html>).

Professor
Dennis R. Falk, AM
Joyce M. Kramer, AM
Melanie F. Shepard, AM

Associate Professor
Priscilla A. Day, AM
Kathleen E. Nuccio, AM
R. Michael Raschick, AM

Assistant Professor
Donald Carpenter, AM

Instructor
Lila George, AM

Curriculum—The M.S.W. program offers a concentration in advanced generalist practice. The curriculum prepares students to practice at the direct service, program, and community levels of intervention. Graduates undertake a variety of professional social work functions, including counselor, community organizer, case manager, educator, and administrator. The curriculum has a special focus on services to American Indians and their communities. The M.S.W. program is accredited by the Council on Social Work Education.

Admission Requirements—1) A bachelor's degree from a regionally accredited college or university is required. The bachelor's degree should include a solid background in the liberal arts, as evidenced on the transcript

by courses in the arts, humanities, and behavioral and social sciences. Applicants should be knowledgeable about diverse cultures, social problems, social conditions, and the social, psychological, and biological determinants of human behavior. Applicants with undergraduate majors in social work or a related field or discipline are given preference over applicants with other majors.

2) Completion of at least 18 credits in two or more social science disciplines (e.g., sociology, psychology, economics, anthropology, political science).

3) Strong academic preparation as demonstrated by undergraduate GPA.

4) Demonstrated interest in becoming a social worker. Preference is given to applicants with professional experience in human service settings, particularly when this experience involves working with underrepresented and protected classes.

Enrollment Prerequisites—Admitted applicants must complete a college-level biology course with content on human anatomical and physiological development and a college-level statistics course. The biology course must be completed before registering for the first semester in the M.S.W. program, and the statistics course must be completed before registering for the first research course. Interested persons can apply and be admitted before completing the enrollment prerequisites.

Advanced Standing—Applicants with a bachelor of social work degree from a program accredited by the Council on Social Work Education may apply for admission to the advanced standing program. All other applicants are ineligible for this program.

M.S.W. Plan B Degree Requirements

The M.S.W., which is offered under Plan B only, requires 51 credits (34 credits for students admitted with advanced standing), including a minimum of 41 credits in social work courses (28 for students with advanced standing), at least 2 credits in a related field, and a master's research (Plan B) project. The program requires two field placements in human service agencies (one field placement for students with advanced standing). A minimum GPA of 3.00 for courses included in the degree program is required. A level of personal and professional competence, as indicated by course and field placement evaluations, is required.

Language Requirements—None.

Final Exam—The final exam is oral, except for students who are over 250 miles from Duluth. They may complete an oral or written exam using distance technology.

Related Fields

Graduate degree programs do not exist in the following fields. However, students may earn graduate credit in courses related to their program and use faculty members on their examining committees from these fields. For graduate courses, see the Courses section of this catalog.

American Indian Studies

Professor
John G. Red Horse, E

Assistant Professor
Mark J. Gonzalez, E

American Studies

Professor
Thomas E. Bacig, Sociology-Anthropology, E

Anthropology

Professor
Linda S. Belote, E
Michael D. Linn, Composition, E
Timothy G. Roufs, E
David M. Smith, E

Associate Professor
Sharon R. Kemp, E

Art History

Professor
Thomas F. Hedin, E

Associate Professor
Robyn S. Roslak, E

Behavioral Sciences

Professor
Barbara A. Elliott, E
Frederic W. Hafferty, E

Associate Professor
James G. Boulger, E
Gary L. Davis, E
Richard Hoffman, E

Assistant Professor
Mustafa al'Absi, E

Chemical Engineering

Associate Professor
Richard A. Davis, E
Keith B. Lodge, E

Assistant Professor
Gerardine G. Botte, E

Communication

Professor
Mike Sunnafrank, E

Associate Professor
Virginia T. Katz, E
Linda T. Krug, E
Elizabeth J. Nelson, E
Gerald L. Pepper, E
Deborah Petersen-Perlman, E

Assistant Professor
Gregory S. Larson, E
Artemio Ramirez, E

Education

Professor
Thomas D. Bacig, Sociology-Anthropology, E
Thomas G. Boman, E
Helen L. Carlson, E
Ajit K. Das, Psychology, E
Dennis R. Falk, Social Work, E
Joan M. Karp, E
David A. McCarthy, E
Linda Miller-Cleary, English, E

Associate Professor
Francis Guldbrandsen, E
Donald Haynes, Health, Physical Education, and Recreation, E
Nedra A. Hazareesingh, E
John R. Keener, Health, Physical Education, and Recreation, E
Georgia L. Keeney, Health, Physical Education, and Recreation, E
June E. Kreutzkampf, E
Edmond F. Lundstrom, Health, Physical Education, and Recreation, E
Bruce H. Munson, E
Thomas D. Peacock, E
Elizabeth P. Quintero, E
Helen Rallis, E
Mary Kay Rummel, E

Assistant Professor
Kenneth Gilbertson, Health, Physical Education, and Recreation, E
Noell W. Reinhiller, E

Electrical and Computer Engineering

Professor
Stanley G. Burns, E
Nazmi M. Shehadeh, E
Marian Stachowicz, E
Jiann Shiou Yang, E

Associate Professor
Christopher R. Carroll, E
Taek Mu Kwon, E

Assistant Professor
Rocio Alba-Flores, E
Mohammed A. Hasan, E
Fernando Rio-Gutierrez, E
Bassam Shaer, E
George Lee Zimmerman, E

Family Life

Associate Professor
Terrie M. Shannon, Education, E
Janine A. Watts, Psychology, E

French

Associate Professor
Yolande J. Jenny, Foreign Languages and Literatures, E

Geography

Professor
Lawrence M. Knopp, E

Associate Professor
Scott M. Freundschuh, E

Assistant Professor
Patrice Farrell, E
Gordon L. Levine, E
Maureen Kim L. Sioh, E
Tongxin Zhu, E

German

Associate Professor
Jonathan B. Conant, Foreign Languages and Literatures, E

Health Education

Professor
Eugene S. Ley, Health, Physical Education, and Recreation, E

Associate Professor
Donald K. Haynes, Health, Physical Education, and Recreation, E
Georgia L. Keeney, Health, Physical Education, and Recreation, E
Edmond F. Lundstrom, Health, Physical Education, and Recreation, E

History

Professor
Ronald T. Marchese, E
Neil T. Storch, E
Judith A. Trolander, E

Associate Professor
Alexis E. Pogorelskin, E
Nkasa T. Yelengi, E

Other
Dennis L. Anderson, E

Humanities

Professor
Thomas D. Bacig, Sociology-Anthropology, E
Ronald T. Marchese, History, E

Associate Professor
Thomas J. Farrell, Composition, E

Industrial Engineering

Professor
Bernard DeRubeis, E
Mark A. Fugelso, E
Thys B. Johnson (emeritus), E
L. Alden Kendall, E
Richard R. Lindeke, E

Associate Professor
Hamid F. Fard, E
Ryan G. Rosandich, E
David A. Wyrick, E

Assistant Professor
John C. Voss, E

Philosophy

Professor
James H. Fetzer, E
David J. Mayo, E

Associate Professor
David J. Cole, E
Eve Browning Cole, E
Robert H. Evans, E
Richard H. Hudelson, E

Physical Education

Professor
Joann M. Johnson, E
Eugene S. Ley, E

Associate Professor
John R. Keener, E
Mark Nierengarten, E

Political Science

Professor
Elizabeth Bartlett, Women's Studies, E
Geoffrey Paul Sharp, E

Associate Professor
Stephen P. Chilton, E
Craig H. Grau, E

Assistant Professor
Martin A. Nie, E
Bradley A. Thayer, E

Recreation

Associate Professor
Edmond F. Lundstrom, Health, Physical Education, and Recreation, E

Sociology

Professor
John A. Arthur, E
William Fleischman, E
J. Clark Laundergan, E

Associate Professor
Sheryl J. Grana, E
John E. Hamlin, E
Sharon F. Kemp, E
Janelle L. Wilson, E

Assistant Professor
Mitra C. Emad, E

Spanish

Professor
Richard A. Seybolt, Foreign Languages and Literatures, E
Eileen M. Zeitz, Foreign Languages and Literatures, E

Special Education

Professor
Joan M. Karp, Education, E
Uwe H. Stuecher, Psychology, E

Associate Professor
Clayton E. Keller, E

Theatre

Associate Professor
Ann A. Bergeron, E
Jon M. Berry, E
Patricia Dennis, E
Mark A. Harvey, E
Thomas K. Isbell, E
Cathryn F. Ufema, E
Arden W. Weaver, E

Women's Studies

Professor
Elizabeth A. Bartlett E

Associate Professor
Helen M. Doane, Psychology, E
Margaret N. Kamau, E
Tineke A. Ritmeester, E

Course Designators

Below is an alphabetical list of course designators and their referents under which courses are organized within the Courses section of this catalog. The list is provided to help students find the full description of prerequisite courses and identify the programs to which the courses apply.

Directly following each designator and its referent is a "see" note in cases where the program name or names differ from the referent. For example, courses in physiology (Phsl) pertain to the cellular and integrative physiology program.

Courses in fields that do not offer graduate programs, but which may be taken for graduate credit if related to a student's program, also appear in the course section; their designators and referents below are followed by "related courses."

Acct	Accounting—see Business Administration; Business Taxation
AdEd	Adult Education—see Education—Work, Community, and Family Education; Work, Community, and Family Education
AdPy	Adult Psychiatry—related courses
AEM	Aerospace Engineering and Mechanics—see Aerospace Engineering; Mechanics
Afro	Afro-American Studies—see Studies in Africa and the African Diaspora
AFEE	Agricultural, Food, and Environmental Education—see Education—Work, Community, and Family Education; Work, Community, and Family Education
AgET	Agricultural Engineering Technology—see Biosystems and Agricultural Engineering
Agro	Agronomy and Plant Genetics—see Applied Plant Sciences
Akka	Akkadian—see Ancient and Medieval Art and Archaeology; Classical and Near Eastern Studies; Classics
AmIn	American Indian Studies—related courses
AmSt	American Studies
ANE	Ancient Near Eastern—see Ancient and Medieval Art and Archaeology; Classical and Near Eastern Studies; Classics
Anes	Anesthesiology—related courses
AnSc	Animal Sciences
Anth	Anthropology
ApEc	Applied Economics—see Agricultural and Applied Economics
APSc	Applied Plant Sciences
Arab	Arabic
Arch	Architecture
Arm	Aramaic—see Ancient and Medieval Art and Archaeology; Classical and Near Eastern Studies; Classics
ArtH	Art History
ArtS	Art
ASL	American Sign Language—related courses
Ast	Astronomy—see Astrophysics
BA	Business Administration
BAE	Biosystems and Agricultural Engineering
BGS	Business, Government, and Society—see Business Administration; Business Taxation
BIE	Business and Industry Education—see Education—Work, Community, and Family Education; Work, Community, and Family Education
BioC	Biochemistry—see Biochemistry, Molecular Biology, and Biophysics
Biol	Biology—related courses
BLaw	Business Law—see Business Administration; Business Taxation
BMEn	Biomedical Engineering
BMSc	Biomedical Science
BPhy	Biophysical Sciences—see Biophysical Sciences and Medical Physics
CAPy	Child and Adolescent Psychiatry—related courses
CAS	Central Asian Studies—see Russian Area Studies
CBio	Conservation Biology
CBN	Cell Biology and Neuroanatomy—see Anatomy; Molecular, Cellular, Developmental Biology and Genetics
CDis	Communication Disorders
CE	Civil Engineering
CgSc	Cognitive Science
Chem	Chemistry
ChEn	Chemical Engineering—see also Materials Science and Engineering
Chic	Chicano Studies—related courses
Chn	Chinese
ChPh	Chemical Physics
CI	Curriculum and Instruction—see Art Education; Education—Curriculum and Instruction; Elementary Education
Clas	Classics—see also Ancient and Medieval Art and Archaeology; Classical and Near Eastern Studies
CLit	Comparative Literature
CLS	Clinical Laboratory Science
CmpE	Computer Engineering
Copt	Coptic—see Classical and Near Eastern Studies
CPsy	Child Psychology
CSci	Computer Science—see Computer and Information Sciences; Computer Engineering
CSCL	Cultural Studies and Comparative Literature—related courses
CSDS	Comparative Studies in Discourse and Society
CSDy	Control Science and Dynamical Systems
CSpH	Center for Spirituality and Healing—See Complementary Therapies and Healing Practices
Dent	Dentistry
DHA	Design, Housing, and Apparel
Dnce	Dance—see Theatre Arts
DSSC	Development Studies and Social Change
Dtch	Dutch—see Germanic Studies
EAS	East Asian Studies
Econ	Economics
ECP	Experimental and Clinical Pharmacology
EdHD	Education and Human Development
EdPA	Educational Policy and Administration
Educ	Education—see Art Education; Education—Curriculum and Instruction; Education—Recreation, Park, and Leisure Studies; Education—Work, Community, and Family Education; Elementary Education; Mathematics Education
EE	Electrical Engineering—see also Computer Engineering
EEB	Ecology, Evolution, and Behavior
EngC	English: Writing, Rhetoric, and Language—see Creative Writing; English
EngL	English: Literature—see Creative Writing; English
EngW	English: Creative and Professional Writing—see Creative Writing; English
Ent	Entomology
EPsy	Educational Psychology
ESL	English as a Second Language
FE	Family Education—see Education—Work, Community, and Family Education; Work, Community, and Family Education
Fina	Finance—see Business Administration; Business Taxation
Fors	Forestry
FPCH	Family Practice and Community Health—related courses
FR	Forest Resources—see Forestry
Fren	French
FrIt	French and Italian—see French; Italian
FScN	Food Science and Nutrition—see Food Science; Nutrition
FSoS	Family Social Science
FW	Fisheries and Wildlife—see Fisheries; Wildlife Conservation
GCB	Genetics and Cell Biology—see Molecular, Cellular, Developmental Biology and Genetics
GCD	Genetics, Cellular, and Developmental Biology—see Molecular, Cellular, Developmental Biology and Genetics
Geo	Geology and Geophysics—see Geology; Geophysics
GeoE	Geological Engineering
Geog	Geography
Ger	German—see Germanic Studies
Gero	Gerontology
GIS	Geographic Information Science
GloS	Global Studies—see East Asian Studies; Russian Area Studies
Grad	Graduate School
Grk	Greek—see Ancient and Medieval Art and Archaeology; Classical and Near Eastern Studies; Classics
GSD	German, Scandinavian, and Dutch—see Germanic Studies
Hebr	Hebrew—see Ancient and Medieval Art and Archaeology; Classical and Near Eastern Studies; Classics
HInf	Health Informatics
Hist	History
HMed	History of Medicine—see History of Medicine and Biological Sciences
Hndi	Hindi—see South Asian Languages
Hort	Horticultural Science—see Applied Plant Sciences
HRD	Human Resources Development—see Education—Work, Community, and Family Education; Work, Community, and Family Education

HRIR	Human Resources and Industrial Relations
HSci	History of Science and Technology
HumF	Human Factors—see Human Factors/Ergonomics
IDSc	Information and Decision Sciences—see Business Administration; Business Taxation
IE	Industrial Engineering—see also Mechanical Engineering
InAr	Interdisciplinary Archaeological Studies
Ins	Insurance—see Business Administration; Business Taxation
IntR	International Relations—related courses
IRel	Interpersonal Relationships Research
ISE	Infratructure Systems Engineering
Ital	Italian
Jour	Journalism and Mass Communication—see Mass Communication
Jpn	Japanese
JwSt	Jewish Studies—related courses
Kin	Kinesiology
LA	Landscape Architecture
LASk	Learning and Academic Skills—related courses
Lat	Latin—see Ancient and Medieval Art and Archaeology; Classical and Near Eastern Studies; Classics
LgTT	Language, Teaching, and Technology—related courses
Ling	Linguistics
LM	Logistics Management—see Business Administration; Business Taxation
LS	Liberal Studies
Mar	Marathi—see South Asian Languages
Math	Mathematics
MatS	Materials Science—see Chemical Engineering; Materials Science and Engineering
MBT	Master of Business Taxation—see Business Taxation
MCDG	Molecular, Cellular, Developmental Biology and Genetics
ME	Mechanical Engineering—see also Industrial Engineering
MedC	Medicinal Chemistry
MELC	Middle Eastern Languages and Cultures—see South Asian Languages
MeSt	Medieval Studies
Mgmt	Management—see Business Administration; Business Taxation
MHA	Master of Healthcare Administration—related courses
MICa	Microbiology, Immunology, and Cancer Biology
MicE	Microbial Engineering
Mktg	Marketing—see Business Administration; Business Taxation
MOT	Management of Technology
MS	Manufacturing Systems
MSt	Museum Studies
MthE	Mathematics Education
MuEd	Music Education—see also Music
Mus	Music—see also Music Education
MusA	Music Applied—see Music; Music Education
MVB	Molecular Veterinary Biosciences
NRES	Natural Resource and Environmental Studies—see Forestry
NSc	Neuroscience
Nurs	Nursing
Nutr	Nutrition
OBio	Oral Biology
OMS	Operations and Management Science—see Business Administration; Business Taxation
OT	Occupational Therapy
Otol	Otolaryngology
PA	Public Affairs—see also Public Policy; Science, Technology, and Environmental Policy; Urban and Regional Planning
PBio	Plant Biology—see Plant Biological Sciences
Phcl	Pharmacology
Phil	Philosophy
Phm	Pharmaceutics
Phsl	Physiology—see Cellular and Integrative Physiology
Phys	Physics
PlPa	Plant Pathology
Plsh	Polish—see Russian Area Studies
PMed	Physical Medicine and Rehabilitation—see Occupational Therapy; Physical Therapy; Rehabilitation Science
Pol	Political Science
Port	Portuguese—see Hispanic and Luso-Brazilian Literatures and Linguistics; Hispanic Linguistics; Hispanic Literature; Luso-Brazilian Literature
Psy	Psychology
PT	Physical Therapy
PubH	Public Health—see also Biostatistics; Environmental Health; Epidemiology; Health Services Research, Policy and Administration
Rad	Radiology—related courses
RAS	Russian Area Studies
Rec	Recreation, Park, and Leisure Studies—see also Education—Recreation, Park, and Leisure Studies
RelA	Religions in Antiquity—see Ancient and Medieval Art and Archaeology; Classical and Near Eastern Studies; Classics
RelS	Religious Studies
Rhet	Rhetoric—see Rhetoric and Scientific and Technical Communication; Scientific and Technical Communication
RSc	Rehabilitation Science
Russ	Russian—see Russian Area Studies
SACP	Social, Administrative, and Clinical Pharmacy
SAgr	Sustainable Agricultural Systems
SALC	South Asian Languages and Cultures—see South Asian Languages
SAPh	Social and Administrative Pharmacy—see Social, Administrative, and Clinical Pharmacy
Scan	Scandinavian—see Germanic Studies
SciC	Scientific Computation
SEng	Software Engineering
Skt	Sanskrit—see South Asian Languages
Slav	Slavic—see Russian Area Studies
Soc	Sociology
Soil	Soil Science
Span	Spanish—see Hispanic and Luso-Brazilian Literatures and Linguistics; Hispanic Linguistics; Hispanic Literature; Luso-Brazilian Literature
Spch	Speech-Communication
SpPt	Spanish-Portuguese—see Hispanic and Luso-Brazilian Literatures and Linguistics; Hispanic Linguistics; Hispanic Literature; Luso-Brazilian Literature
SST	Studies of Science and Technology
Stat	Statistics
Sum	Sumerian—see Ancient and Medieval Art and Archaeology; Classical and Near Eastern Studies; Classics
Surg	Surgery—see also Experimental Surgery
SW	Social Work
TESL	Teaching English as a Second Language—see English as a Second Language
Th	Theatre Arts
TRad	Therapeutic Radiology—related courses
TrIn	Translation and Interpreting—see English as a Second Language
Txcl	Toxicology
UrbS	Urban Studies—related courses
VMed	Veterinary Medicine
VPB	Veterinary Pathobiology—see Veterinary Medicine
WCFE	Work, Community, and Family Education—see also Education—Work, Community, and Family Education
WoSt	Women's Studies—see Feminist Studies
WPS	Wood and Paper Science—see Forestry
WRS	Water Resources Science
YoSt	Youth Development and Research—see Social Work

Course Numbers and Symbols

The courses in this catalog are not offered every semester. For a listing of courses offered in a particular semester, consult the *Class Schedule.*

Course Numbers—Courses numbered from 5000 to 5999 (listed as 5xxx if individual course number is unspecified) are primarily for graduate students, but are also open to third or fourth year undergraduate students. (5xxx courses in the School of Dentistry and in some clinical departments of the Medical School may not be applied to graduate programs.) Courses numbered 8000 or above (8xxx) are open to graduate students only. Courses at the 6000 (6xxx) and 7000 (7xxx) levels are for postbaccalureate students in professional degree programs not offered through the Graduate School. Courses numbered at the 4000 (4xxx) level are primarily for undergraduate students in their fourth year of study. 4xxx, 6xxx, and 7xxx courses may be applied toward a Graduate School degree with approval by the student's major field and if the course is taught by a member of the graduate faculty or an individual authorized by the program to teach at the graduate level. Courses at the 1000 (1xxx), 2000 (2xxx), and 3000 (3xxx) levels are for undergraduates and may not be applied to graduate programs. Courses numbered 0000 to 0999 do not carry credit.

Department Designators—In conjunction with course numbers, departments and programs are identified by a 2-, 3-, or 4- letter prefix known as a designator (e.g., CE for Civil Engineering, Pol for Political Science, WoSt for Women's Studies). When no department designator precedes the number of a course listed as a prerequisite, that prerequisite course is in the same department as the course being described.

Course Symbols—The following abbreviations and symbols are used throughout the course descriptions of most University catalogs to denote common and recurring items of information.

QP ..... Quarter prerequisite. Courses following the QP are quarter courses.

SP ..... Semester prerequisite. Courses following the SP are semester courses.

! ..... Work for this course will extend past the end of the term. A grade of K will be assigned to indicate that the course is still in progress.

† ..... All courses preceding this symbol must be completed before credit will be granted for any semester of the sequence.

§ ..... Credit will not be granted if credit has been received for the course listed after this symbol.

¶ ..... Concurrent registration is required (or allowed) in the course listed after this symbol.

..... Approval of the instructor is required for registration.

Δ ..... Approval of the department offering the course is required for registration.

❑ ..... Approval of the college offering the course is required for registration.

, ... In prerequisite listings, comma means "and."

DGS ..... Director of graduate studies.

W ..... Following a course number, the W indicates the course is writing intensive.