



This is the Introduction and General Information sections of the  
2005-2007 Graduate School Catalog for the University of Minnesota.

# ***Graduate School Catalog***

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*Note: The information in this catalog is subject to change without notice. Many departments make changes in their degree requirements and course descriptions between prints of the catalog. For the most current information, check with the department offices.*



# 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. At the beginning of the Courses section, the Course Numbers and Symbols page explains the numbering system, punctuation, department designators, and symbols used throughout the course descriptions. The short section that follows describes Duluth Degree Programs.

At the back is a complete set of Campus Maps and Course Designators. Maps are also online at <http://onestop.umn.edu/Maps/campusmaps.html>.

The catalog, produced by University Relations, is available in the Graduate School (outside 309 Johnston Hall) and online at [www.catalogs.umn.edu/grad/index.html](http://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 online at [www.grad.umn.edu](http://www.grad.umn.edu).

**Other Publications**—The *Class Schedule* lists courses, class hours, locations, instructors, and basic costs and regulations. It is available online at <http://onestop.umn.edu/onestop>. Separate catalogs are printed for the College of Continuing Education, the Duluth campus, and the professional colleges.

## 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; [admissions@umn.edu](mailto: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.

Inquiries regarding compliance may be directed to the 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 and building accessibility information is printed in the Student-Staff Directory. For more information, contact Disability Services, University of Minnesota, 180 McNamara Alumni Center, 200 Oak Street S.E., Minneapolis, MN 55455 (612-626-1333 voice or TTY). For online access go to <http://ds.umn.edu>.

**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 and to challenge the contents of those records. The Regents policy is available for review online at [http://onestop.umn.edu/onestop/Grades\\_Transcripts/RecordsPolicy.html](http://onestop.umn.edu/onestop/Grades_Transcripts/RecordsPolicy.html), at 200 Fraser Hall, Minneapolis, and at records offices on other campuses of the University. Questions may be directed to the One Stop Services Center, 200 Fraser Hall (612-624-1111).

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

**Additional information about the Graduate School is available online at [www.grad.umn.edu](http://www.grad.umn.edu).**

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.

**E-Mail**—E-mail is the University's official means of communication with students. Students are responsible for all information sent via their University e-mail account. Students who forward their University e-mail account are still responsible for all information, including attachments, sent to the account.

## 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, Mondale Hall (formerly the Law Center), the Ted Mann Concert Hall, the Carlson School of Management, and the Arts Quarter.

Three miles away and connected by a free express transit way, 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. 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.uccs.umn.edu](http://www.uccs.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 Walter Library); 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](http://www.lib.umn.edu).

Research support is provided by the Offices 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

The University has numerous research centers and institutes. A partial list can be found at [www.mbbnet.umn.edu/res.html](http://www.mbbnet.umn.edu/res.html).

## Administration

### University Regents

David R. Metzen, Congressional District 4, Chair  
 Anthony R. Baraga, Congressional District 8, Vice Chair  
 Clyde Allen, Jr., Congressional District 7  
 Peter Bell, Congressional District 5  
 Frank R. Berman, At Large  
 Dallas Bohnsack, Congressional District 2  
 John Frobenius, Congressional District 6  
 Steven D. Hunter, At Large  
 David M. Larson, Congressional District 3  
 Richard McNamara, At Large  
 Lakeesha K. Ransom, At Large  
 Patricia Simmons, Congressional District 1

### University Administrators

Robert H. Bruininks, President  
 E. Thomas Sullivan, Senior Vice President for Academic Affairs and Provost  
 Frank B. Cerra, Senior Vice President for Health Sciences  
 Robert J. Jones, Senior Vice President for System Administration  
 Kathryn F. Brown, Vice President and Chief of Staff  
 Carol Carrier, Vice President for Human Resources  
 R. Timothy Mulcahy, Vice President for Research  
 Charles Muscoplat, Vice President for Agricultural Policy  
 Kathleen O'Brien, Vice President for University Services  
 Richard Pfutzenreuter, Vice President and Chief Financial Officer  
 Linda Thrane, Vice President for University Relations  
 Mark B. Rotenberg, General Counsel

### Graduate School Administrators

Gail L. Dubrow, Ph.D., 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

## McKnight Land-Grant Professorship Program

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 \$30,000 research grant in each of two years, summer support, and a research leave in the second year.

## Distinguished McKnight Professorship Program

The purpose of this program is to honor and reward the University's highest achieving faculty who recently have attained full professor status, and whose research has brought great renown and prestige to Minnesota. Each year, the Graduate School selects five recipients who hold the title Distinguished McKnight University Professor for as long as they remain at the University. The award comes with a research grant of \$100,000. For more information, visit [www.grad.umn.edu/faculty-staff/mcknight](http://www.grad.umn.edu/faculty-staff/mcknight).

# ***General Information***

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# General Information

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; engineering, physical and mathematical 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, the Biomedical 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* online at [www.onestop.umn.edu/onestop/Tuition\\_Billing/Tuition\\_Rates.html](http://www.onestop.umn.edu/onestop/Tuition_Billing/Tuition_Rates.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. For more information on eligibility requirements for resident status, 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. For information on the benefit for underrepresented and educationally disadvantaged students, see Graduate School Diversity Office.

## 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 prefer a higher GPA. Applicants should consult the program to which they are applying for more specific information about admission standards.

**Graduate School Commitment to Diversity**—The Graduate School embraces the University of Minnesota's position that promoting and supporting diversity among the student body is central to the academic mission of the University. The Graduate School defines diversity to encompass many

characteristics including economic disadvantage, special talents, evidence of leadership qualities, race or ethnicity, a strong work record, and disability. A diverse student body enriches graduate education by providing a multiplicity of views and perspectives that enhance research, teaching, and the development of new knowledge. A diverse mix of students promotes respect for, and opportunities to learn from, others with the broad range of backgrounds and experiences that constitute modern society. Higher education trains the next generation of leaders of academia and society in general, and such opportunities for leadership should be accessible to all members of society. The Graduate School and its constituent graduate programs are therefore committed to providing equal access to educational opportunities through recruitment, admission, and support programs that promote diversity, foster successful academic experiences, and cultivate the leaders of the next generation.

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

Applicants are required to apply online at [www.grad.umn.edu/prospective\\_students/apply\\_online.html](http://www.grad.umn.edu/prospective_students/apply_online.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.

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), International English Language Testing System (IELTS), and Michigan English Language Assessment Battery (MELAB)**—The operational standard for admission to the Graduate School is a TOEFL score of 213 on the computer-based test, an IELTS score of 6.5, 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 (612-625-3014).

## 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

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](http://www.ets.org).

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 at [www1.umn.edu/ohr/gao](http://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 and the University fee. 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 four 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; [gaoinfo@umn.edu](mailto: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 42.5 to 95 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; [gradins@bhs.umn.edu](mailto:gradins@bhs.umn.edu); [www.bhs.umn.edu](http://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, 314 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.

Contact the Graduate School Fellowship Office for additional information at 612-625-7579 or [gsfellow@umn.edu](mailto:gsfellow@umn.edu).

**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). For details and updates on this policy, contact the Graduate School Fellowship Office, 314 Johnston Hall, 612-625-7579.

## For New Graduate Students

**Graduate School Fellowships**—Intended for recruiting outstanding new students to the University's graduate programs, these fellowships provide approximately \$17,500 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 late January 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 Graduate School Diversity Office, 333 Johnston Hall (612-625-6858; 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 \$17,500 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 12 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 Graduate School Diversity Office, 333 Johnston Hall, for information. In addition, underrepresented and educationally disadvantaged students should check all regular sources of support described in this catalog.

## 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 below).

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 One Stop Student Services Center 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 612-624-1111 or, July-September, 1-800-400-UofM (8636); the fax number is 612-624-9584 and the e-mail address is helpingu@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 Student and Scholar 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 at [www.iss.umn.edu](http://www.iss.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).

## Graduate School Diversity Office

The Graduate School Diversity Office (333 Johnston Hall, 612-625-6858, [gsoeo@umn.edu](mailto:gsoeo@umn.edu)) works closely with other University of Minnesota offices that are concerned with diversity and multiculturalism. The office

- provides service to prospective and currently enrolled graduate students, faculty, funding representatives, and university colleagues;
- provides information about the University of Minnesota and its commitment to enrolling a diverse student population;
- supports a diverse student body in recruiting, funding, retention, and graduation with strategies for clarifying goals; selecting an appropriate graduate program; preparing the best possible graduate school application; and funding graduate work through assistantships and fellowships;
- serves as the administrative unit for funding programs that support a diverse graduate student body;
- promotes professional development and scholarship across disciplines and works toward creating the institutional environment necessary for facilitating the academic achievements of graduate and professional students, and
- encourages undergraduate students to consider graduate study by participating in research and other academic projects outside of their regular coursework.

## Student Grievance Procedures

**Academic Grievances**—The Graduate School follows the University's policy on student academic grievance issues. Information about the Student Academic Grievance policy is available online at [www1.umn.edu/regents/policies/academic/StudentGrievances.html](http://www1.umn.edu/regents/policies/academic/StudentGrievances.html).

**Sexual Harassment**—Policies pertaining to sexual harassment are contained in the Regents 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.”

All-University policies and procedures pertaining to sexual harassment are available online at [www1.umn.edu/regents/policies/humanresources/SexHarassment.html](http://www1.umn.edu/regents/policies/humanresources/SexHarassment.html).

**Crime Statistics**—Crime statistics can be found on the University of Minnesota Police Web site at [www1.umn.edu/umpolice/crime.htm](http://www1.umn.edu/umpolice/crime.htm).

**Student Conduct Code**—Matters concerning student conduct are addressed by the University's Student Conduct Code rather than by Graduate School policies. The code applies both to academic and non-academic misconduct. Alleged violations involving graduate students in either instance are governed by the procedures outlined in the code itself. Allegations of non-academic misconduct by graduate students are dealt with directly by the University's conduct code coordinator. See section 5 of the Student Conduct Code ([www.sja.umn.edu/conduct.html](http://www.sja.umn.edu/conduct.html)). Because the Graduate School does not use a scholastic-standing committee or a disciplinary committee, responsibility for a full hearing concerning alleged academic misconduct by a graduate student most often lies with the department or program in which the student is majoring. When the alleged misconduct occurs in a course originating from a department or program outside of the student's major, and the matter cannot be satisfactorily be resolved by the instructor, the allegation is forwarded to the conduct code coordinator for possible referral to a University disciplinary agency. For more information, contact the Student Judicial Affairs office at 612-624-6073, or visit their Web site at [www.sja.umn.edu](http://www.sja.umn.edu).

## Housing

At the current time, the University guarantees thirty-seven places in University Village and Centennial Hall for new and current graduate students that apply before May 1 for fall term. More graduate and professional students can be housed in residence halls/apartments 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; [housing@umn.edu](mailto: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](http://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 Orientation and First-Year Programs at 612-624-1979 or 800-234-1979 or visit their Web site at [www.ofyp.umn.edu](http://www.ofyp.umn.edu).

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 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 405 Johnston Hall, 101 Pleasant Street S.E., Minneapolis, MN 55455 (612-626-1612; [cogs@umn.edu](mailto:cogs@umn.edu); [www.cogs.umn.edu](http://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 more information, contact PFF at 612-625-3811 or [pff@umn.edu](mailto:pff@umn.edu), drop by CTLS in 315 Science Classroom Building, or visit [www.umn.edu/ohr/pff](http://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 [www.onestop.umn.edu/onestop/calendar.html](http://www.onestop.umn.edu/onestop/calendar.html).

For information about the summer term, including registration deadlines, refer to the *Summer Session Catalog* or the 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**—To maintain their active status, graduate students must register every fall and spring term. Those who do not register in the Graduate School every fall and spring are considered to have withdrawn and 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 requirements, refer to [www.grad.umn.edu/current\\_students/registration](http://www.grad.umn.edu/current_students/registration).

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

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

**Grad 999**—Grad 999 is a zero-credit, zero-tuition, non-graded registration option for Graduate School students who must register solely to meet the Graduate School’s registration requirement. *Grad 999 does not meet any other internal/external departmental or agency requirements.* Other than requiring Graduate School students to hold active student status, the Graduate School does not impose any eligibility requirements on Grad 999 registrations. However, individual graduate programs may establish their own eligibility criteria. Students considering registering for Grad 999 should first check with their graduate program. For more information on Grad 999, visit [www.grad.umn.edu/current\\_students](http://www.grad.umn.edu/current_students).

**For information about new student orientation plus writing and library research workshops, contact the Graduate Student Orientation program coordinator at 612-624-1979 or 800-234-1979, or visit the Web site at [www.ofyp.umn.edu](http://www.ofyp.umn.edu).**

## 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 are still 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 status with one credit registration" courses are available only to advanced master's (8333) and doctoral (8444) students who have met eligibility criteria. 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 visit [www.grad.umn.edu/current\\_students](http://www.grad.umn.edu/current_students).

## 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 outside 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 register every fall and spring term*. Previously registered students who do not register in the Graduate School of the University of Minnesota every fall and spring term 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/current\\_students/registration](http://www.grad.umn.edu/current_students/registration).

**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; changes in grading option are not allowed after the second week of the term. 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 at [www.grad.umn.edu](http://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, appropriate tuition and fees will be assessed. 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

Graduate programs are required to provide their students with an annual review of their degree progress. 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 every fall and spring term are considered to have withdrawn; their Graduate School records are deactivated (see Registration Requirements).

## 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 12 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 Graduate School requirements for postbaccalaureate certificates, refer to the Graduate School Web site at [www.grad.umn.edu/current\\_students](http://www.grad.umn.edu/current_students), 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-level 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. Registration for graduate credit by non-admitted students—students may be able to register for graduate credit when not admitted to the Graduate School. Non-admitted students interested in taking graduate-level courses must work with the respective departments (generally the director of graduate studies or his/her designee) to gain admission to non-degree status. The registration procedure outlined in the current *Class Schedule*, "Registering for Graduate Credit," must be followed for courses to be considered for transfer by the Graduate School.
3. Registrations through other University of Minnesota units (e.g., College of Education and Human Development, Law School) in pursuit of graduate-level degrees;
4. Adult special, summer session, and College of Continuing Education registrations at the University of Minnesota taken *before spring semester 2001*. Any registrations in these categories taken spring semester 2001 or later will not be accepted towards any Graduate School degree requirement.

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.* 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; *however, readmission under these circumstances is not assured.* 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.

For more information about the master's degree time limit and petitioning procedure, visit [www.grad.umn.edu/current\\_students/forms/masters.html](http://www.grad.umn.edu/current_students/forms/masters.html).

**Official Program for the Degree**—Students are expected to file an official program for the degree by the time they have completed 10 credits. The specific semester depends on individual major field requirements, but students must submit their degree program forms to the Graduate School for approval at least one semester before the term in which they plan to take their final examination and/or graduate. The degree program form is available from the Graduate School, 316 Johnston Hall or online at [www.grad.umn.edu/current\\_students/forms/masters.html](http://www.grad.umn.edu/current_students/forms/masters.html). 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 petition form is available from the Graduate School, 316 Johnston Hall, or online at [www.grad.umn.edu/current\\_students/forms/masters.html](http://www.grad.umn.edu/current_students/forms/masters.html).

**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/current\\_students/forms/masters.html](http://www.grad.umn.edu/current_students/forms/masters.html).

**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/current\\_students](http://www.grad.umn.edu/current_students) or contact the Graduate School by e-mail ([gsmast@umn.edu](mailto:gsmast@umn.edu)). **Note:** Some commonly used forms are available on the Graduate School Web site at [www.grad.umn.edu/forms](http://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. Courses included on the official degree program form cannot be used to meet both major and outside credit requirements. 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. Minors generally are declared when the degree program form is filed, but must be declared prior to the final examination.

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). 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.

*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/current\\_students/forms](http://www.grad.umn.edu/current_students/forms). 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). 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/current\\_students/forms](http://www.grad.umn.edu/current_students/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. Courses included on the official degree program form cannot be used to meet both major and outside credit requirements. 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

**Graduate students  
must file an  
official degree  
program. Forms are  
available from the  
Graduate School,  
316 Johnston Hall,  
or online at  
[www.grad.umn.edu](http://www.grad.umn.edu)  
/current\_students  
/forms.**

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 examination 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 field 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/current\\_students/forms](http://www.grad.umn.edu/current_students/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). *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/current\\_students](http://www.grad.umn.edu/current_students) or contact the Graduate School by e-mail at [gsmast@umn.edu](mailto:gsmast@umn.edu). **Note:** Some commonly used forms are available on the Graduate School Web site at [www.grad.umn.edu/forms](http://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 option 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 (8777) credits. Students who wish to complete a designated minor must complete 6 or more credits in a single field. Courses included on the official degree program form cannot be used to meet both major and outside credit requirements. 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 option 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. Courses included on the official degree program form cannot be used to meet both major and outside credit requirements. 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](mailto: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. University of Minnesota coursework meeting specific registration criteria (see “Registering for Graduate Credit” at [www.onestop.umn.edu/onestop/Registration/Additional\\_Registration\\_Information/Registering\\_for\\_Courses/Graduate\\_Credit.html](http://www.onestop.umn.edu/onestop/Registration/Additional_Registration_Information/Registering_for_Courses/Graduate_Credit.html) for registration instructions);
3. Registration through other University of Minnesota units (e.g., College of Education, Law School) in pursuit of graduate-level degrees;
4. Adult special, summer session, and College of Continuing Education registrations at the University of Minnesota taken *before spring semester 2001*.

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.

*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 or see [www.grad.umn.edu/current\\_students](http://www.grad.umn.edu/current_students) 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 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 is comprised of three members from the student's major field.

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/current\\_students/forms](http://www.grad.umn.edu/current_students/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). *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.

**More Information**—Students who have questions about the specialist certificate after reading this entire section may review online information at [www.grad.umn.edu/current\\_students](http://www.grad.umn.edu/current_students) or e-mail [gsmast@umn.edu](mailto:gsmast@umn.edu). **Note:** some commonly used forms are available on the Graduate School Web site at [www.grad.umn.edu/forms](http://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. The number of credits accepted for transfer is determined by the graduate program faculty.

*From other University of Minnesota graduate-level degrees*—Graduate credits earned while admitted to pursue University of Minnesota graduate-level degrees (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.

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 other registration categories*—A maximum of 12 semester credits of completed graduate-level coursework, in any combination of the specific registration categories listed below, may be considered for transfer.

*Registration for graduate credit by non-admitted students*—Students may be able to register for graduate credit when not admitted to the Graduate School. Non-admitted students interested in taking graduate-level courses must work with the respective departments (generally the director of graduate studies or his/her designee) to gain admission to non-degree status. *The registration procedure outlined in the current Class Schedule, "Registering for Graduate Credit," must be followed for courses to be considered for transfer by the Graduate School. See [www.onestop.umn.edu/onestop/Registration/Additional\\_Registration\\_Information/Registering\\_for\\_Courses/Graduate\\_Credit.html](http://www.onestop.umn.edu/onestop/Registration/Additional_Registration_Information/Registering_for_Courses/Graduate_Credit.html).*

*Adult special, summer session, and College of Continuing Education (CCE) registrations taken prior to spring semester 2001*—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).

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.* 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.

For more information about the doctoral degree time limit and petitioning procedure, visit [www.grad.umn.edu/current\\_students/forms](http://www.grad.umn.edu/current_students/forms).

**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 one semester 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/current\\_students/forms](http://www.grad.umn.edu/current_students/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). 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/current\\_students/forms](http://www.grad.umn.edu/current_students/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. Courses included on the official degree program form cannot be used to meet both major and outside credit requirements.

**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 outside the major, 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.

*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/current\\_students/forms](http://www.grad.umn.edu/current_students/forms).

**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/current\\_students](http://www.grad.umn.edu/current_students) or contact the Graduate School by e-mail at [gsdoc@umn.edu](mailto:gsdoc@umn.edu). **Note:** Some commonly used forms are available on the Graduate School Web site at [www.grad.umn.edu/forms](http://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. The Preliminary Written Examination form is available online at [www.grad.umn.edu/current\\_students/forms/doct.html](http://www.grad.umn.edu/current_students/forms/doct.html). 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 health science fields, however, the faculty requires 30 days' notice of the date of the preliminary oral. The Preliminary Oral Examination Scheduling form is available online at [www.grad.umn.edu/current\\_students/forms/doct.html](http://www.grad.umn.edu/current_students/forms/doct.html).

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

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).

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 a preliminary 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 doctoral final oral examination, the preliminary oral examination 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**—Students must file the thesis proposal form with the Graduate School, 316 Johnston Hall, no later than the first semester after passing the preliminary oral examination. 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.*

**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 to the Graduate School 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/current\\_students/forms](http://www.grad.umn.edu/current_students/forms). This form will be released only if the student has a Graduate School-approved thesis proposal form on file and has maintained active status (see **Registration Requirements** under Registration).

**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).

## 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).* In certain of the health science fields, however, the faculty requires 30 days' notice of the date of the final oral. The Final Oral Examination Scheduling Form is available online at [www.grad.umn.edu/current\\_students/forms/doctoral.html](http://www.grad.umn.edu/current_students/forms/doctoral.html).

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, if possible) 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 senior member or affiliate senior 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. 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.

**Reporting the Results of the Final Oral Examination—**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/current\\_students/forms](http://www.grad.umn.edu/current_students/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, or contact the Graduate School by e-mail at [gsdoc@umn.edu](mailto:gsdoc@umn.edu). Note: Some commonly used forms are available on the Graduate School Web site at [www.grad.umn.edu/current\\_students/forms](http://www.grad.umn.edu/current_students/forms).

## 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, or contact the Graduate School by at [gsdoc@umn.edu](mailto:gsdoc@umn.edu). **Note:** Some commonly used forms are available on the Graduate School Web site at [www.grad.umn.edu/forms](http://www.grad.umn.edu/forms).

## Joint Degrees

The University offers the opportunity for study toward degrees in the following areas: M.D./Ph.D. program; M.D. and master of health informatics (M.H.I.); 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 science; M.S. in nursing and M.P.H.; doctor of veterinary medicine (D.V.M.) and M.S./Ph.D. in veterinary medicine; M.S.W. and master of urban and regional planning (M.U.R.P.); M.U.R.P. and master of landscape architecture (M.L.A.); M.U.R.P. and M.S. in civil engineering; 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. Commencement information, including deadlines and forms, can be found online at [www.grad.umn.edu/current\\_students](http://www.grad.umn.edu/current_students). 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. Degree completion procedures can be found online at [www.grad.umn.edu/current\\_students/degree\\_completion/index.html](http://www.grad.umn.edu/current_students/degree_completion/index.html).

# Majors and Degrees

## Twin Cities Campus

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

#### Majors

|   |                    |
|---|--------------------|
| Aerospace Engineering                                   | M.S.Aero.E., Ph.D. |
| Agricultural and Applied Economics                      | M.S., Ph.D.        |
| American Studies  | 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.        |
| Asian Literature, Cultures, and Media                   | M.A., Ph.D.        |
| Astrophysics  | M.S., Ph.D.        |
| Biochemistry, Molecular Biology, and Biophysics         | M.S., Ph.D.        |
| Biomedical Engineering                                  | M.S., 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.        |
| Civil Engineering                                       | M.S., Ph.D.        |
| Classical and Near Eastern Studies                      | M.A., Ph.D.        |
| Communication Studies                                   | M.A., Ph.D.        |
| Comparative and Molecular Biosciences                   | M.S., Ph.D.        |
| Comparative Literature                                  | M.A., Ph.D.        |
| Comparative Studies in Discourse and Society            | M.A., Ph.D.        |
| Computer Science  | 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.        |
| Education, Curriculum, and Instruction                  | M.A., Ph.D.        |
| Educational Policy and Administration                   | M.A., Ph.D.        |
| Educational Psychology <sup>1</sup>                     | 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.        |
| Food Science  | 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                                      | M.S., 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                | M.A., Ph.D.        |
| Industrial Engineering                                  | M.S.I.E., Ph.D.    |

#### Degrees Offered

|   |                             |
|---|-----------------------------|
| 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 | M.S., Ph.D.                 |
| Music   | M.A., Ph.D.                 |
| Natural Resources Science and Management                | M.S., 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.                 |
| Speech-Language-Hearing Sciences                        | 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)

|                                       |                        |
|---------------------------------------|------------------------|
| <b>Majors</b>                         | <b>Degrees Offered</b> |
| Arabic                                | M.A.                   |
| Architecture                          | M.S.                   |
| Clinical Laboratory Science           | M.S.                   |
| Clinical Research                     | M.S.                   |
| Dentistry                             | M.S.                   |
| East Asian Studies                    | 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.                   |
| Microbial Engineering                 | M.S.                   |
| Music Education                       | M.A.                   |
| Recreation, Park, and Leisure Studies | M.A.                   |
| Speech-Language Pathology             | M.A.                   |

<sup>1</sup> See also Certificate of Specialist in Education offerings near the end of this list.

## Professional Degrees

### Majors

Aerospace Engineering  
 Architecture  
 Art  
 Audiology  
 Biological Science  
 Biosystems and Agricultural Engineering  
 Business Taxation  
 Chemical Engineering  
 Civil Engineering  
 Computer Science  
 Creative Writing  
 Dentistry  
 Design, Housing, and Apparel  
 Educational Policy and Administration  
 Electrical Engineering  
 Experimental Surgery  
 Forestry  
 Geographic Information Science  
 Geological Engineering  
 Geology  
 Health Informatics  
 Health Journalism  
 Human Resources and Industrial Relations  
 Infrastructure Systems Engineering  
 Landscape Architecture  
 Liberal Studies  
 Management of Technology  
 Manufacturing Systems Engineering  
 Materials Science and Engineering  
 Molecular, Cellular, Developmental Biology and Genetics  
 Music  
 Occupational Therapy  
 Physical Therapy  
 Political Science  
 Public Affairs  
 Public Policy  
 Science, Technology, and Environmental Policy  
 Scientific and Technical Communication  
 Social Work  
 Software Engineering  
 Speech-Language Pathology  
 Strategic Communication  
 Theatre Arts  
 Urban and Regional Planning  
 Work, Community, and Family Education

### Degrees Offered

M.Aero.E.  
 M.Arch.  
 M.F.A.  
 Au.D.  
 M.B.S.  
 M.B.A.E.  
  
 M.B.T.  
 M.Ch.E.  
 M.C.E.  
 M.C.S.  
 M.F.A.  
 M.S.  
 M.F.A.  
 Ed.D.  
 M.E.E.  
 M.S.Exp.Surg.  
 M.F.  
 M.G.I.S.  
 M.Geo.E.  
 M.S.  
 M.H.I.  
 M.A.  
 M.A.  
  
 M.S.I.S.E.  
 M.L.A.  
 M.L.S.  
 M.S.MOT.  
 M.S.M.S.E.  
 M.Mat.S.E.  
 M.S.  
  
 M.M., D.M.A.  
 M.S.  
 D.P.T.  
 M.A.  
 M.P.A.  
 M.P.P.  
 M.S.  
  
 M.S.  
 M.S.W.  
 M.S.S.E.  
 M.A.  
 M.A.  
 M.F.A.  
 M.U.R.P.  
 Ed.D.

## Certificate of Specialist in Education

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

## Minor Only

Bioethics  
 Bioinformatics  
 Cognitive Science  
 Complementary Therapies and Healing Practices  
 Conflict Management  
 Development Studies and Social Change  
 Family Policy  
 Gerontology  
 Human Factors/Ergonomics  
 Human Genetics  
 Human Rights  
 International Education  
 Interpersonal Relationships Research  
 Law  
 Literacy and Rhetorical Studies  
 Medieval Studies  
 Microbial Ecology  
 Museum Studies  
 Nanoparticle Science and Engineering  
 Political Psychology  
 Population Studies  
 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

Addictions Studies  
 Applied Developmental Psychology  
 Complementary Therapies and Healing Practices  
 Early Childhood Policy  
 French Studies  
 Housing Studies  
 Nonprofit Management  
 Nursing  
 Policy Issues on Work and Pay  
 Transportation Studies

## Duluth Campus

### Research Degrees (Master's Only)

#### Majors

Applied and Computational Mathematics  
 Biology  
 Chemistry  
 Computer Science  
 Criminology  
 Electrical and Computer Engineering  
 Engineering Management  
 English  
 Geological Sciences  
 Physics

#### Degrees Offered

M.S.  
 M.S.  
 M.S.  
 M.S.  
 M.A.  
 M.S.E.C.E.  
 M.S.E.M.  
 M.A.  
 M.S.  
 M.S.

## Professional Degrees

### Majors

Art  
 Business Administration  
 Communication Sciences and Disorders  
 Engineering Management  
 Liberal Studies  
 Music  
 Social Work

### Degrees Offered

M.F.A.  
 M.B.A.  
 M.A.  
 M.S.E.M.  
 M.L.S.  
 M.M.  
 M.S.W.

## Minor Only

Linguistics



**This is the Degree Program and Faculty section (Addictions Studies-Educational Policy and Administration) of the 2005-2007 Graduate School Catalog for the University of Minnesota.**

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# Degree Programs and Faculty

## 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

**Senior Member (SM)**—Authorization to advise students at all levels, including the doctorate; to serve as a thesis reviewer and as an examiner on student examining committees, including service as chair of doctoral committees; to teach courses for graduate credit; and to participate in governance. In fields that also offer a professional doctorate, some senior member appointments may be restricted to the supervision of students seeking the professional degree.

**Affiliate Senior Member (ASM)**—Authorization to assume the same responsibilities as senior member, but not to participate in governance. In fields that also offer a professional doctorate, some affiliate senior member appointments may be restricted to the supervision of students seeking the professional degree.

**Member/Advising (M2)**—Authorization to advise students at the master's level; to serve as a thesis reviewer at the master's level and as an examiner on student examining committees at the master's and postbaccalaureate certificate levels; to teach courses for graduate credit; and to participate in governance. At the discretion of the appointing program, may also include authorization to co-advise doctoral students with a senior member or affiliate senior member of the graduate faculty, and to serve as a thesis reviewer and examining committee member for doctoral students, but not as chair.

**Affiliate Member/Advising (AM2)**—Authorization to assume the same responsibilities as member/advising, but not to participate in governance.

**Member (M)**—Authorization to serve as a thesis reviewer at the master's level and as an examiner on student examining committees at the master's and postbaccalaureate certificate levels; to teach courses for graduate credit; and to participate in governance. At the discretion of the appointing program, may also include authorization to serve as a thesis reviewer and examining committee member for doctoral students, but not as chair.

**Affiliate Member (AM)**—Authorization to assume the same responsibilities as member, but not to participate in governance.

**Examining Status (E)**—Authorization to serve as a thesis reviewer and as an examiner on student examining committees at all levels, but not as chair, and to teach courses for graduate credit. Examining status does not include membership on the graduate faculty and does not confer governance privileges.

### Tests

The following test abbreviations appear throughout graduate program listings.

**ECFMG**—Educational Commission Foreign Medical Graduates

**GMAT**—Graduate Management Admission Test

**GRE**—Graduate Record Examination

**IELTS**—International English Language Testing System

**MELAB**—Michigan English Language Assessment Battery

**SPEAK**—Speaking Proficiency English Assessment Kit

**TOEFL**—Test of English as a Foreign Language

**TSE**—Test of Spoken English

**USMLE**—United States Medical Licensing Examination

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

## Addictions Studies

### Postbaccalaureate Certificate

**Contact Information**—Addictions Studies Certificate, College of Continuing Education, Student Support Services, 150 Wesbrook Hall, 77 Pleasant Street S.E., Minneapolis, MN 55455 (612-624-4000; adv@cce.umn.edu; www.cce.umn.edu/certificates).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

#### Professor

David C. Hollister, Social Work, AM  
Ken C. Winters, Psychiatry, M

#### Associate Professor

Traci Louise Toomey, Epidemiology, M

#### Assistant Professor

Jodi Dworkin, Family Social Sciences, M

#### Teaching Specialist

Peter Dimock, Social Work, M

**Curriculum**—The postbaccalaureate addictions studies certificate gives students expertise in the prevention and treatment of addictive disorders relevant to a wide variety of human service, health care, and public health

settings. Two tracks are available: public health and service provider. The public health track focuses on specialization in the epidemiology of addictive disorders and promising prevention approaches. The service provider track allows students to study advanced counseling and therapy skills, models, and intervention techniques related to the treatment of addictive disorders. Students can use the curriculum in this track to qualify for the Alcohol and Drug Counselor license from the Minnesota Department of Health.

**Admission Requirements**—Applicants for either track must have a bachelor's degree from an accredited postsecondary U.S. institution or its foreign equivalent. A GPA of 3.00 is required. There are additional admissions requirements for the service provider track. Admissions information is available at [www.cce.umn.edu/certificates](http://www.cce.umn.edu/certificates).

**Certificate Requirements**—The public health track consists of 17 core credits and 2 elective credits. To earn a service provider track certificate, students must take 9 core credits and 10 elective credits. However, to sit for the licensure exam, students must also complete additional coursework (15 credits).

## 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; dept@aem.umn.edu; [www.aem.umn.edu](http://www.aem.umn.edu)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

#### Regents Professor

Daniel D. Joseph, SM

#### Professor

Roger E. A. Arndt, Civil Engineering, SM  
Gary J. Balas, SM  
Gordon S. Beavers, SM  
Graham V. Candler, SM  
Roger Fosdick, SM  
William L. Garrard, SM  
Richard D. James, SM  
Perry H. Leo, SM  
Ellen K. Longmire, SM  
John S. Lowengrub, Mechanics, SM  
Mitchell B. Luskin, Mechanics, SM

Thomas W. Shield, SM  
Yiyuan Zhao, SM

**Associate Professor**

Yohannes Ketema, AM  
Krishnan Mahesh, SM  
Ivan Marusic, SM

**Adjunct Associate Professor**

Dale F. Enns, SM

**Assistant Professor**

Ryan Elliott, SM  
Demoz Gebre-Egziabher, SM  
Ashley James, SM

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.

**Note:** The department is working towards the merger of the aerospace engineering degrees and the mechanics degrees, into one degree program. This means that the M.S. and Ph.D. degrees would be in aerospace engineering and mechanics. The master of aerospace engineering (M.Aero.E.) will be unaffected. Upon final approval of the merger, it is anticipated that the change would take effect by fall 2005. For further updates, please visit the department Web site at [www.aem.umn.edu](http://www.aem.umn.edu). The information below is current as of the printing of this catalog.

**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.

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

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

**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 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 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 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 (612-625-3777; dgs@apec.umn.edu; www.apec.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### **Regents Professor**

Vernon W. Ruttan (emeritus), ASM  
G. Edward Schuh, SM

### **Professor**

Jeffrey D. Apland, SM  
Brian L. Buhr, SM  
K. William Easter, SM  
Vernon R. Eidman, SM  
William C. Gartner, SM  
Robert P. King, SM  
Jean D. Kinsey, SM  
William F. Lazarus, SM  
George W. Morse, SM  
Kent D. Olson, SM  
Philip G. Pardey, SM  
Claudia A. Parliament, SM  
Glenn D. Pederson, SM  
Stephen Polasky, SM  
Terry L. Roe, SM  
C. Ford Runge, SM  
Benjamin H. Senauer, SM

### **Associate Professor**

Jay S. Coggins, SM  
Elizabeth E. Davis, SM  
Jeremiah E. Fruin, SM  
Paul W. Glewwe, SM  
Frances R. Homans, SM  
Terrance M. Hurley, SM  
Donald J. Liu, SM  
Gerard McCullough, SM  
Pamela J. Smith, SM  
Rodney B. Smith, SM  
Thomas F. Stinson, SM  
Steven J. Taff, SM

### **Assistant Professor**

Laura T. J. Klambokidis, SM  
Margaretha V. Rudstrom, SM

### **Research Associate**

Naomi Zeitouni, M2

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 consumer behavior and household economics; development, trade, and policy; natural

resource and environmental economics; production and marketing economics; and community development.

**Prerequisites for Admission**—A GPA of 3.00 in an undergraduate program and in graduate level work is the preferred standard for admission. Applicants with out a master'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, domestic and foreign. A TOEFL score of 550 (paper) or 213 (computer) is also required for all international applicants whose native language is not English. The TOEFL requirement will be waived for applicants who have completed a degree within the last three years from an institution at which English is the primary language of instruction. 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.

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

**Use of 4xxx Courses**—Use of 4xxx courses toward degree requirements is not permitted, with the exception of Stat 4101-02 for the M.S. degree only.

### **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 preferred minimum GPA of 3.00 in program courses is preferred 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 higher.

### **Ph.D. Degree Requirements**

The Ph.D. degree program 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. is a 1-credit seminar, 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 program of study 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. A typical program involves at least ten semester courses totaling at least 35 credits. Courses in economics may be counted in the major field or as part of the supporting field. A preferred 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 higher.

## **Agricultural Engineering**

See Biosystems and Agricultural Engineering.

## **American Studies**

**Contact Information**—Department of American Studies, University of Minnesota, 104 Scott Hall, 72 Pleasant Street S.E., Minneapolis, MN 55455 (612-624-4190; amstudy@umn.edu; www.cla.umn.edu/american).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### **Regents Professor**

Sara M. Evans, History, SM



**Professor**

Patricia C. Albers, American Indian Studies, SM  
 Ronald R. Aminzade, Sociology, SM  
 W. John Archer, Cultural Studies and Comparative Literature, SM  
 David O. Born, Preventive Sciences, SM  
 Timothy Andres Brennan, Cultural Studies and Comparative Literature, SM  
 Hazel Dicken-Garcia, Journalism and Mass Communication, SM  
 Mary G. Dietz, Political Science, SM  
 Lisa J. Disch, Political Science, SM  
 James Farr, Political Science, SM  
 Philip J. Gersmehl, Geography, SM  
 Edward M. Griffin, English, SM  
 Karen N. Hoyle, Library Collection, and Preservation (Children's Literature Research Collections), AM  
 Mary Jo Kane, Kinesiology, SM  
 Sally J. Kenney, Public Affairs, SM  
 Sally G. Kohlstedt, Geology and Geophysics (Science/Technology, History of) SM  
 Richard D. Leppert, Cultural Studies and Comparative Literature, SM  
 Alex J. Lubet, Music, SM  
 Karal Ann R. Marling, Art History, SM  
 Judith A. Martin, Geography-Urban and Regional Planning, SM  
 Elaine Tyler May, SM  
 Lary L. May, SM  
 Russell R. Menard, History, SM  
 Ellen Messer-Davidow, English, SM  
 John D. Nichols, American Indian Studies, SM  
 David W. Noble, SM  
 Riv-Ellen Prell, SM  
 Paula Rabinowitz, English, SM  
 Nancy L. Roberts, Journalism and Mass Communication, SM  
 Steven Ruggles, History, SM  
 Harvey B. Sarles, Cultural Studies and Comparative Literature, SM  
 Eric Sheppard, Geography, SM  
 Rudolph J. Vecoli, History, SM  
 David E. Wilkins, American Indian Studies, SM  
 Jack D. Zipes, German, Scandinavian, and Dutch, SM

**Associate Professor**

Lisa Albrecht, Social Work, School of, SM  
 Thomas Augst, English, SM  
 Bruce P. Braun, Geography, SM  
 Rose M. Brewer, African American and African Studies, SM  
 Robert "Robin" Brown, Cultural Studies and Comparative Literature, SM  
 Brenda J. Child, SM  
 Catherine C. Choy, SM  
 Patricia Crain, AM  
 Jeffrey R. Crump, Design, Housing, and Apparel, SM  
 Maria Damon, English, Language and Literature, SM  
 John M. Dolan, Philosophy, SM  
 Penny A. Edgell, Sociology, SM  
 Roderick Ferguson, SM  
 Kirsten Fischer, History, SM  
 George D. Green, History, SM  
 Douglas Hartmann, Sociology, SM  
 Erika Lee, History, SM  
 Josephine D. Lee, English, SM  
 Louis G. Mendoza, Chicano Studies, SM

Carol A. Miller, SM  
 Roger P. Miller, Geography, SM  
 Lisa A. Norling, History, SM  
 Jean M. O'Brien-Kehoe, History, SM  
 Joanna O'Connell, Spanish and Portuguese Studies, SM  
 Daniel J. Philippon, Rhetoric, SM  
 Jennifer L. Pierce, SM  
 Guillermo Rojas, Chicano Studies, SM  
 Jani Scandura, English, M2  
 Thomas M. Scanlan, Rhetoric, SM  
 Robert B. Silberman, Art History, SM  
 Katherine M. Solomonson, Architecture, SM  
 Eden Torres, Women's Studies, SM  
 Barbara Welke, History, SM  
 John S. Wright, English, African American and African Studies, SM  
 Jacquelyn N. Zita, Women's Studies, SM

**Assistant Professor**

David Chang, History, M2  
 Tracey Ann Deutsch, History, M2  
 Vinay Gidwani, Geography, M2  
 Karen Zouwen Ho, M2  
 David Martinez, American Indian Studies, M2  
 Keith A. Mayes, African American and African Studies, M2  
 Patrick McNamara, History, M2  
 Kevin P. Murphy, History, M2  
 Brian G. Sonthwell, Journalism and Mass Communications, M2  
 Dara Z. Strolovitch, Political Science, M2  
 David Treuer, English, M2  
 David Valentine, Anthropology, M2  
 Haidee S. Wasson, Cultural Studies and Comparative Literature, M2

**Senior Fellow**

Harry C. Boyte, Public Affairs, AM

**Other**

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 department office: a special application cover sheet available through the department office or on the Web site, a personal statement, three letters of recommendation, an academic writing sample, scores from the General (Aptitude) Test of the GRE that are less than five years

old, and transcripts of all college work. Applications must be submitted by December 15. Entry is only in fall semester.

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

**Use of 4xxx Courses**—One 4xxx course in American studies, English, history, American Indian studies, or another appropriate program, may be included as one of the seminars to meet the one-semester specialty requirement in American studies.

**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 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); a comparative cultures course covering international or non-U.S. subjects (3 credits) and two adviser-approved courses in the field of concentration including one focused on cultural pluralism within the United States (6 credits).

Plan A requires 10 thesis credits for a total of 31 credits and a written thesis.

Plan B requires three additional adviser-approved courses in the field of concentration, (9 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 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.

**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, one of which must be original research (9 credits); one comparative culture course covering international or non-U.S. topics (3 credits); and seven adviser-approved field of concentration courses, including cultural pluralism courses (21 credits). Twenty-four thesis credits are also required. Ph.D. students may register for 0999 no more than two semesters total without approval from their adviser and the director of graduate studies.

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

**Minor Requirements for Students Majoring in Other Fields**—For a doctoral minor, students must complete at least 12 credits of courses consistent with or complementary to their major, including four 5xxx or 8xxx courses in American studies, one of which must be AmSt 8201 or AmSt 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; renox001@umn.edu; www.ansci.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### **Professor**

Mitchell S. Abrahamsen, Veterinary Pathobiology, SM

David R. Brown, Veterinary Pathobiology, SM

Brian A. Crooker, SM

William R. Dayton, SM

John Deen, Clinical and Population Sciences, SM

Mohamed E. El-Halawani, SM

Douglas N. Foster, SM

Leslie B. Hansen, SM

Marcia R. Hathaway, SM

Dennis G. Johnson, M

Lee J. Johnston, SM

Mathur S. Kannan, Veterinary Pathobiology, SM

James G. Linn, SM

Sally L. Noll, SM

Scott M. O'Grady, SM

F. Abel Ponce de Leon, SM

Jeffrey K. Reneau, SM

Anthony James Seykora, SM

Gerald C. Shurson, SM

Marshall D. Stern, SM

Roger D. Walker, M

Jonathan E. Wheaton, SM

Michael E. White, SM

### **Adjunct Professor**

Hans-Joachim G. Jung, Agronomy and Plant Genetics, SM

### **Associate Professor**

Sam K. Baidoo, SM

Yang Da, SM

Hugh Chester-Jones, M2

Alfredo DiCostanzo, SM

Scott C. Fahrenkrug, SM

Graham C. Lamb, SM

### **Assistant Professor**

Marcia Endres, SM

Jacqueline P. Jacob, SM

Laura J. Mauro, SM

Deborah L. Roeber, M2

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 preferred 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.

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

**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.

### **M.S. Degree Requirements**

Plan A requires a minimum of 14 semester credits in the major and 6 credits in a designated minor, or related field 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.

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 Avenue S., Minneapolis, MN 55455 (612-625-3400; fax 612-625-3095; anth@umn.edu; <http://cla.umn.edu/anthropology>).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### **Professor**

Patricia Albers, American Indian Studies, ASM

Guy E. Gibbon, SM

Stephen F. Gudeman, SM

John M. Ingham, SM

Riv-Ellen Prell, American Studies, ASM

Gloria G. Raheja, SM

Peter S. Wells, SM

Joseph J. Westermeyer, Psychiatry, AM2

### **Associate Professor**

Daphne Berdahl, SM

Timothy Dunnigan, SM

David M. Lipset, SM

Jean Langford, SM

Martha Tappen, SM

Mischa Penn, SM

Thomas Wolfe, History, ASM

### **Assistant Professor**

Karen Ho, SM

Gregory Laden, SM

Stuart McLean, SM

Hoon Song, SM

Karen S. Taussig, Medicine, SM

Gilbert B. Tostevin, SM

David Valentine, SM

**Fellow**

Sonia E. Patten, Family Medicine and Community 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**—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**—A B.A. degree or equivalent is required for admission.

**Special Application Requirements**—Three letters of recommendation on a form furnished by the department and scores from the General Test of the GRE should be sent to the director of graduate studies. Admission is for fall semester; the deadline for all materials is January 5.

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

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

**M.A. Degree Requirements**

For Plan A and Plan B, 20 semester credits; 14 in anthropology and 6 in minor or related field. Students should consult the department Web site at [www.cla.umn.edu/anthropology](http://www.cla.umn.edu/anthropology) for special requirements for sociocultural anthropology and for archaeology and biological anthropology.

**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**

Requirements include 36 credits of coursework; 24 in anthropology and 12 in a minor or supporting program. Students should consult the department Web site at [www.cla.umn.edu/anthropology](http://www.cla.umn.edu/anthropology) for special requirements for sociocultural anthropology and for archaeology and biological anthropology.

**Language Requirements**—Requirements depend upon student's special area of research.

**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****Postbaccalaureate Certificate**

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

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

**Professor**

Herbert L. Pick, Jr., M

Richard Weinberg, M

The certificate in applied developmental psychology allows graduate students who major or minor in child psychology to study and experience applications of developmental science issues, policies, and problems concerning children and child development at the local, state, and national level. Through the combination of theory and field experience, students learn how to help solve pressing real-life problems and to improve the lives of children. The 21-credit program explores such topics as ethical issues in applied developmental psychology, media and children's programming, nutrition and hunger, accidents and safety issues, children in the judicial system, the design and role of children's museums, and the development of children's toys, games, and recreational activities. Professionals in this field need to develop an in-depth understanding of how public policy affects children's lives, how to make pure research comprehensible and practical without losing its complexity, and how to work in interdisciplinary teams.

**Admission**—Admission is open to graduate students enrolled in a doctoral program at the University. Students in child psychology must consult with the training director(s) and complete a department application form before officially registering for the first seminar. Students not in child psychology must have successfully completed a four-year undergraduate degree with a preferred 3.00 GPA and equivalent of 12 quarter or 9 semester course credits in psychology, and one statistics course. Admission is based primarily on the applicant's academic record, GRE scores, and research experience.

**Curriculum**—CPsy 8360 (2 cr, section 7) gives an overview of applied developmental science problems and provides a framework for the second two components of the program. CPsy 8301 (4 cr) and 8302 (4 cr) are the core courses in developmental psychology covering biological, cognitive, and social aspects of development. They are fundamental to understanding the developmental perspective. CPsy 8996 (5 cr) integrates and applies information learned in coursework. The course is individually designed based on each student's prior experience and interests. Students focus on practical and/or public policy applications of developmental research in settings such as the Search Institute, the Minnesota Children's Museum, the guardian ad litem program in the local courts, the Center for

4-H Youth Development, and the National Institute on Media and the Family. The field experience may be taken in one to three semesters or a summer session, but must be at least 5 credits and total 188 hours. A major paper describing the field experience and integrating relevant basic research literature with practical availability taking place in the field setting is expected. Electives (6 cr) may include 5xxx or 8xxx courses approved by the training directors and chosen to complement the student's area of interest.

**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; [apsc@umn.edu](mailto:apsc@umn.edu)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

**Regents Professor**

Ronald L. Phillips, SM

**Professor**

Roger L. Becker, SM

Rex N. Bernardo, SM

Deborah L. Brown, M2

Vernon B. Cardwell, SM

Iris Charvat, SM

Jerry D. Cohen, SM

Gregory J. Cuomo, SM

Beverly R. Durgan, SM

Nancy J. Ehlke, SM

Vincent A. Fritz, SM  
Gary M. Gardner, SM  
Burle G. Gengenbach, SM  
John W. Gronwald, SM  
Jeffrey L. Gunsolus, SM  
Leland L. Hardman, SM  
Dale R. Hicks, SM  
Emily E. Hoover, SM  
Robert J. Jones, SM  
Nicholas R. Jordan, SM  
Hans-Joachim G. Jung, SM  
Pen Hsiang Li, SM  
James J. Luby, SM  
Albert H. Markhart III, SM  
Thomas E. Michaels, SM  
Peter J. Olin, M2  
James H. Orf, SM  
David G. Pitt, Landscape Architecture, M2  
Carl J. Rosen, Soil, Water, and Climate, SM  
Ruth G. Shaw, SM  
Craig C. Sheaffer, SM  
Steve R. Simmons, SM  
David A. Somers, SM  
Joseph R. Sowokinos, SM  
Deon D. Stuthman, SM  
Donald B. White, SM  
David K. Wildung, SM  
Donald L. Wyse, SM  
Nevin D. Young, Plant Pathology, SM  
Howard W. Rines, SM  
Carroll P. Vance, SM

### **Associate Professor**

James A. Anderson, SM  
Neil O. Anderson, SM  
John E. Erwin, SM  
Frank Forcella, SM  
Susan M. Galatowitsch, SM  
Jeffrey H. Gillman, SM  
Gregg A. Johnson, SM  
JoAnn F. Lamb, SM  
Mary H. Meyer, SM  
Gary J. Muehlbauer, SM  
Bradley W. Pedersen, M2  
Paul M. Porter, SM  
Lori K. Scott, SM  
Alan G. Smith, SM  
Kevin P. Smith, SM  
Christian A. Thill, SM  
Cindy B. Tong, SM  
John V. Wiersma, M2

### **Assistant Professor**

David Francis Garvin, SM  
Stan C. Hokanson, SM  
Brian P. Horgan, SM  
Helene Murray, SM  
Seth L. Naeve, SM  
Paul Peterson, SM  
Eric Watkins, SM  
Jochum J. Wiersma, SM

### **Other**

Karen E. Hokanson, AM  
Raymie A. Porter, M2

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**

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**—Students conduct research related to fruits, vegetables, potatoes, flowers, ornamental trees and shrubs or turf; and on the physiology, production, environmental impact of cropping systems, and use of horticultural crops. Research areas include the effect of horticultural commodities on human health, hormonal, and stress physiology; flower development and flowering physiology; integrated pest management; postharvest physiology; and cropping system strategies. Students get a broad range of experiences in the field, greenhouse, and/or laboratory using genetic, molecular, biochemical, and ecological tools to answer research questions.

### **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, genetic engineering, and genomic research 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**

Applicants must submit scores from the General (Aptitude) 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 December 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.

**Courses**—Please refer to Agronomy and Plant Genetics (Agro), Applied Plant Sciences (APSc), Horticultural Science (Hort) and Sustainable Agricultural Systems (SAGr) in the course section of this catalog for courses pertaining to the program.

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

### **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 one graduate seminar; 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 currently being accepted to this program. Contact the Graduate School for information on the status of the program.*

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

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

### Professor

Caesar E. Farah, M2

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 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 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 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, 145 Rapson Hall, 89 Church Street S.E., Minneapolis, MN 55455 (612-624-7866; fax 612-624-5743; [calainfo@umn.edu](mailto:calainfo@umn.edu)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

Thomas Fisher, M2

Ann Forsyth, M2

Lance A. LaVine, M2

Julia Robinson, M2

Leon G. Satkowski, M2

### Adjunct Professor

Robert Mack, FAIA, AM2

Dale M. Mulfinger, AM2

Duane Thorbeck, FAIA, AM2

### Associate Professor

Lee B. Anderson, M2

Arthur H. Chen, M2

Renée Cheng, M2

William F. Conway, AIA, M2

Gunter Dittmar, M2

Bruno Franck, M2

Mary M. Guzowski, M2

Cynthia Jara, M2

Andrzej Piotrowski, M2

Katherine M. Solomonson, M2

J. Stephen Weeks, AIA, M2

### Adjunct Associate Professor

Thomas A. Meyer, FAIA, AM2

Ralph K. Nelson, AIA, AM

Todd J. Rhoades, AIA, AM2

Lee E. Tollefson, FAIA, AM2

### Assistant Professor

Ritu Bhatt, M2

Mark Swackhamer, M2

### Adjunct Assistant Professor

Steven K. Beutow, AIA, AM

William Anthony Blanski, AM

Richard A. Carter, AIA, AM

Dave Dimond, AIA, AM

Walid H. El-Hindi, AIA, AM

Timothy Fuller, AIA, AM

Jay Isenberg, AIA, AM

Tracey S. Jacques, AIA, AM

Mic Johnson, AIA, AM

Charles L. Lazor, AIA, AM

Douglas Lew, AM

Martha McQuade, AIA, AM

Ralph Nelson, AM

Mark Partridge, AIA, AM

Tim Quigley, AIA, AM

Ernesto Garcia Ruiz, AM

Marcy Schulte, AIA, AM

Mary Springer, AM

Mark Tambornino, AM

Josh Weinstein, AIA, AM

Thomas Westbrook, AM

Mark Wentzell, AIA, AM

Jennifer A. Yoos, AIA, AM

### Senior Lecturer

Sharon Roe, AM2

### Lecturer

Martha Abbott, AM

Jim Dozier, AM

Robert Ferguson, AM2

Nancy Miller, AM2

### Adjunct Teaching Instructor

Lucas Alm, AM

Mike Christenson, AM

Mary deLaittre, AM

Malini Srivistava, AM

Suzi Strothman, AM

Mark Tambornino, AM

Marcelo Valdes, AM

### Research Associate

Louise Goldberg, AM

Kathleen Harder, AM

### Research Fellow

Dan Marckel, AM

Virajita Singh, M

William Weber, M

### Other

Janet Abrams, M

Jonee K. Brigham, M

John C. Carmody, AM2

Richard Milgrom, M

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 environments 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 department offers an accredited professional degree, the M.Arch., and an academic degree, the M.S. in architecture with a sustainable design track.

The master's of architecture degree is a three-year professional program that prepares students for the practice and discipline of architecture as a speculative, analytic, and investigative endeavor. Through rigorous methods of inquiry developed in the design studio, lectures and seminars, students acquire the breadth of knowledge required of the professional architect: the techniques and processes of representation, communication and analysis; the history and theory of making architecture and urban form for human use; and the technology, systems, processes, and economics of construction and practice. The 90-credit M. Arch. professional degree program is fully accredited by the National Architectural Accrediting Board (NAAB). A portfolio is required.

The master's of science in architecture is a non-professional degree offering advanced studies and research methods in a sustainable design track commencing in 2005 and four concentrations in metropolitan design, digital design, heritage preservation and history-

theory of criticism available in 2006. The M.S. seeks students from architecture, landscape architecture, environmental design or related disciplines to pursue multidisciplinary graduate study and research in sustainable practices and careers in sustainable design. The M.S. offers students a wide range of topics and research methods within sustainable and green building practices, including energy and indoor air quality; site, water, and climate design; waste and environmental factors; innovative materials technology; and high performance building design applications.

**Prerequisites for Admission**—All applicants to the M.Arch or M.S. programs are expected to have basic computer skills before beginning the program, including familiarity either with Macintosh or Windows operating systems, word processing, basic drawing or painting programs, and use of e-mail.

Students entering the three-year M.Arch. program have varied educational backgrounds that add to a diverse student body. There are several different paths into and through the M.Arch. program. Students who have a B.A. or B.S. degree in architecture or environmental design, enter the three-year M.Arch. program.

Students who have earned a bachelor degree in a field other than architecture and little or no background in architecture apply for the 3+ Option, enrolling in a summer semester to establish the foundation needed to succeed in the professional program. A limited number of students with an extensive background in architecture studies may be granted advanced standing (see below) in the master's program, usually completing two years of studies. And those with a professional degree bachelor degree in architecture, who are seeking additional education, apply for a one-and-half year post-professional course of studies. Information about each of these paths and the requirements for admission appears below.

**The 3+ Option**—This option is designed for students with a broad range of academic backgrounds in undergraduate fields other than architecture. Students who are admitted to the 3+ program receive graduate level preparation through an rigorous summer semester of studies in drawing, architectural history-theory and design studio. The ensuing fall semester, 3+ students join other M.Arch. 3-year program candidates for the remaining complement of design studios and courses. Physics and pre-calculus are required; drawing and architectural/art history are preferred.

**Advanced standing**—Though the core program is three years in length, students who have completed a pre-professional degree in architecture may apply for advanced standing, which enables them to enter directly into the second year of the 3-year program. Admission with advanced standing is infrequent, and is evaluated on a case-by-case basis. In addition to the prerequisites indicated for the 3-year

program, advanced standing applicants must have completed at least one course in structures and building systems, and advanced design studios

**Post-professional**—A small group of students who already hold a professional degree (B.Arch. or M.Arch) participate in the master of architecture program as a special category of advanced standing student. The director of graduate studies tailors the program to post-professional students' specific needs, insuring that they have met all NAAB requirements prior to graduation. The reduced course requirements allows completion of advanced electives or cross-disciplinary courses in studio, technology, representation, digital design, history, theory or metropolitan design, or undertake coursework towards a master of science degree or a certificate in metropolitan design. They must be in residence a minimum of 3 semesters and complete 21 semester credits plus a thesis (an additional 12 credits).

Master of science in architecture sustainable design track applicants must have a bachelor degree in architecture or a related field. Application requirements include a written statement, transcripts of all coursework, three faculty recommendations and the department financial aid form. The 2- 3 page statement should outline a probable research agenda, topics or themes that the applicant wishes to pursue, including information about the applicant's preparation for the field and career goals by January 15 directly to the Department. A portfolio and GRE results are recommended but optional.

**Special Application Requirements**— Admission to the M.Arch. program is highly competitive. In addition to meeting Graduate School application requirements, all M.Arch. 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, GRE scores and the optional department financial aid form. The portfolio should be no larger than 8.5" x 11". International students must submit scores from the TOEFL or the MELAB. For all applicants, the department may waive requirements for required courses when they are equivalent to those offered by the department.

**Accreditation and Licensing**—In the United States, most state registration boards require a degree from an accredited professional degree program as a prerequisite for licensure. The National Architectural Accrediting Board (NAAB), which is the sole agency authorized to accredit U.S. professional degree programs in architecture, recognizes two types of degrees: the bachelor of architecture and the master of architecture. A program may be granted a six-year, three-year, or two-year term of accreditation, depending on its degree of conformance with established educational standards.

Master's degree programs may consist of a pre-professional undergraduate degree and a professional graduate degree, which, when earned sequentially, comprise an accredited professional education. However, the pre-professional degree is not, by itself, recognized as an accredited degree.

The master of architecture degree program at the University of Minnesota College of Architecture and Landscape Architecture is fully accredited by the NAAB.

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

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

### M.Arch. Degree Requirements

The professional M. Arch. curriculum requires completion of 78 course credits and a 12 credit design studio Plan A Thesis. M.Arch. students can expect to complete the program in six semesters (three years), including the pre-thesis research phase and the thesis studio thesis. The first three semesters include an integrated core curriculum in studio, building and environmental technologies, history-theory and digital methods. The core curriculum is followed by three semesters of "options" studios and elective courses in urbanism, practice, representation and the integrated studio.

**Language Requirements**—None.

**Final Exam**—An oral presentation, a visual presentation of the thesis and the submission of the written thesis document are required for the M.Arch.

### M.S. Degree Requirements

Students are admitted to the M.S. Sustainable Design Track under either Plan A or Plan B. Both programs are 34-credits, including 18 course credits in sustainable design core and elective courses, 6 course credits outside the department in disciplinary studies and either a ten credit Plan A thesis or Plan B masters projects. Architecture graduate students may complete the M.Arch. and the M.S. in sustainable design with concurrent enrollment over an additional year.

**Language Requirements**—None.

**Final Exam**—An oral presentation, a visual presentation of the thesis and the submission of the written thesis document are required for the MS Plan A. The Plan B MS requires an oral examination.

## Art

**Contact Information**—Department of Art, University of Minnesota, E201 Regis Center for Art, 405 21st Avenue S., Minneapolis, MN 55455 (612-625-8096; fax 612-625-7881; artdept@umn.edu; http://artdept.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

Karl E. Bethke, (emeritus), AM2  
Curtis C. Hoard, M2  
M. Diane Katsiaficas, M2  
Clarence E. Morgan, M2  
Mark Pharis, M2  
Wayne E. Potratz, M2  
Thomas A. Rose, M2

### Associate Professor

Guy A. Baldwin, M2  
Thomas R. Cowette, M2  
David Feinberg, M2  
Lynn A. Gray, M2  
Gary L. Hallman, M2  
James V. Henkel, M2  
Jerald A. Krepps, M2  
Alexis Kuhr, M2  
Thomas J. Lane, M2  
Lynn T. Lukkas, M2  
Joyce Lyon, M2

### Assistant Professor

Christine A. Baeumler, M2  
Jan Estep, M2  
Andrea Stanislav, M2  
Diane Willow, M2  
Tetsuya Yamada, M2

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**—An undergraduate degree is required.

**Special Application Requirements**—Admission to the M.F.A. program is highly competitive. In addition to meeting Graduate School application requirements, students applying to the program must demonstrate a high degree of capability and commitment in a visual portfolio and must submit all of the

following to the director of graduate studies: a one page statement of artistic and academic intent, the Department of Art Supplementary Application form, transcripts of all coursework, and three letters of recommendation.

Admission is in fall semester only. Ceramics, painting, and sculpture applicants must submit from 10 to 20 color slides of work in a slide carousel 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. 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. Incomplete files will not be reviewed.

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

**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.

### 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 consecutive years for the pursuit of appropriate visual research. The program requires that coursework be completed prior to the final year of creative thesis registration. Candidates must plan programs with their advisers to include the graduate seminars ArtS 8400 (taken in the first term) and ArtS 8410 (taken in the second year) and up to 18 credits of creative thesis 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 course from another academic department pertinent to the student's program). Candidates must be reviewed annually for progress through the program. At the end of the thesis year, candidates demonstrate their visual research accomplishments through a solo, creative 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.

## Art History

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

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

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

### Associate Professor

W. John Archer, ASM  
Catherine B. Asher, SM  
Jane M. Blocker, SM  
Lyndel I. King, AM  
Robert B. Silberman, SM  
Katherine M. Solomonson, ASM  
John W. Steyeart, SM

### Assistant Professor

Ritu Bhatt, AM  
Michael Gaudio, SM  
Branislav Jakovljevic, AM  
Elizabeth Kutz, AM  
Diane Mullin, 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: American art, architecture, and popular culture; early modern 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 and theory, including film and photography studies as well as nineteenth through twenty-first century art; and 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 are 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, an 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 are 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 applying.

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.

**Art History Visual Resources Center**—The Art History Visual Resources Center (VRC) is located at 460 Heller Hall. The center has holdings of approximately 250,000 slides, ten percent of which are in digital format and accessible online, and 100,000 photo archives, with content ranging from the prehistoric to the contemporary, in architecture, sculpture, painting, and other media, from all areas of the world. In addition, there is a collection of over 300 films.

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

**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.

### 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, early

modern, East Asian, Islamic, medieval, modern and contemporary, South Asian. Of these, three 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 Literatures, Cultures, and Media

**Contact Information**—Department of Asian Languages and Literatures, University of Minnesota, 453 Folwell Hall, 9 Pleasant Street S.E., Minneapolis, MN 55455 (612-625-6534; fax 612-624-5513; [alcmdgs@umn.edu](mailto:alcmdgs@umn.edu); [www.all.umn.edu](http://www.all.umn.edu)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

Joseph R. Allen, SM  
Arlene A. Teraoka, German, Scandinavian, and Dutch, ASM  
Ann B. Waltner, History, SM

### Associate Professor

Catherine Asher, Art History, ASM  
Daniel Brewer, French and Italian, ASM  
Jeffrey Broadbent, Sociology, ASM  
Keya Ganguly, Cultural Studies and Comparative Literature, ASM  
Michael Molasky, SM  
Richa Nagar, Women's Studies, ASM  
Paul Rouzer, SM  
Ajay Skaria, History, ASM

### Assistant Professor

Mark Anderson, SM  
Jigna Desai, Women's Studies, ASM  
Jason McGrath, SM  
Hiromi Mizuno, History, ASM  
Maki Isaka Morinaga, SM  
Simona Sawhney, SM

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 Asian Literatures, Cultures, and Media (ALCM) program is organized around three intersecting categories of knowledge: 1) language of concentration, 2) focus of study, 3) theory or problematic. Students must designate a language of concentration on their ALCM Program Application Form. Currently, students may select Chinese, Japanese, or Hindi/Urdu for their language of concentration. However, it is possible to select another South Asian language with permission of the director of graduate studies. For details, see the graduate program Web site at [www.all.umn.edu](http://www.all.umn.edu).

**Prerequisites for Admission**—Only applications from students seeking the Ph.D. degree are considered, although applicants are not required to have taken graduate coursework before entering the program. The M.A. is offered as an exit degree or interim credential. A bachelor's degree from an accredited U.S. institution (or its foreign equivalent) is required for admission. Students entering with an M.A. in a related field will have the appropriate number of credits and courses applied to their program of study (as determined by the director of graduate studies). Applicants are expected to have a strong academic record from a relevant humanities or social science discipline and at least three years of college-level study in the proposed language of concentration, or a demonstration of comparable linguistic proficiency.

**Special Application Requirements**—The following are required by the department: completed ALCM application form, official transcripts, three letters of recommendation, an intellectual profile, a writing sample, GRE scores, and for international applicants, IELTS or TOEFL scores. Applications (including all supporting materials) must reach the ALCM Graduate Studies Committee and the Graduate School by January 15.

**Courses**—Please refer to [www.all.umn.edu](http://www.all.umn.edu) for courses pertaining to the program.



**Use of 4xxx Courses**—4xxx courses may not normally be included on degree program forms for the ALCM graduate major or minor.

### M.A. Degree Requirements

The M.A. is offered under Plan B only, which requires 30 credits (including at least 12 from other departments). A Ph.D. qualifying exam, normally given at the end of the student's second year in the program, also serves as the M.A. exam. Students entering the program with an M.A. in a related field can take this qualifying exam after one year of study, with approval of the director of graduate studies.

**Language Requirements**—Advanced knowledge in the chosen language of concentration.

**Final Exam**—consists of the following: (1) Written language exam(s): typically an in-room reading/translation exam on materials directly related to study and research interests; (2) Oral presentation and interview (conducted in the language of concentration), discussing the materials that were part of the written exam; (3) Submission of two Plan B research papers for evaluation (normally papers from two different classes, revised for submission); (4) Oral exam (in English) by the above committee, based on the submitted papers.

### Ph.D. Degree Requirements

The Ph.D. requires 53 credits plus 24 thesis credits (toward the Ph.D. dissertation). See program Web site at [www.all.umn.edu/graduate/index.htm](http://www.all.umn.edu/graduate/index.htm) for details.

**Language Requirements**—Advanced reading ability and spoken competence in the language of concentration, as assessed by the Ph.D. qualifying exam. Some students may require additional foreign language study, depending on the dissertation topic.

**Minor Requirements for Students Majoring in Other Fields**—For the doctoral minor, students are expected to take a minimum of 15 credits in graduate courses offered in the Department of Asian Languages and Literatures, 8 of which must be at the 8xxx level; the student must also pass the reading language exam that is part of the Ph.D. qualifying exam for ALCM (see above). The director of graduate studies acts as the student's adviser and approves a course of study.

## 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; [grad-req@astro.umn.edu](mailto:grad-req@astro.umn.edu); [www.astro.umn.edu](http://www.astro.umn.edu)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

### Professor

Cynthia A. Cattell, Physics, ASM  
Kris D. Davidson, SM  
John M. Dickey, SM  
Robert D. Gehrz, SM  
Robert M. Humphreys, SM  
Terry J. Jones, SM  
Thomas W. Jones, SM  
Robert L. Lysak, Physics, ASM  
Keith A. Olive, Physics, ASM  
Robert O. Pepin, Physics, ASM  
Lawrence Rudnick, SM  
Evan D. Skillman, SM  
Charles E. Woodward, SM  
Paul R. Woodward, SM

### Associate Professor

Shaul Hanany, Physics, ASM  
Yong-zhong Qian, Physics, ASM  
Liliya L. R. Williams, SM  
John R. Wygant, Physics, ASM

### Assistant Professor

Michael DuVernois, Physics, ASM  
Kim A. Venn, ASM

### Senior Research Associate

David H. Porter, SM

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 activities that cover X-ray, ultraviolet, optical, infrared, and radio wavelengths. 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 into fall semester only.

**Facilities**—The Department of Astronomy has purchased 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 2005. This purchase will also 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—as well as other smaller telescopes in Arizona, 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. Excellent shop facilities support our instrument development for the telescopes at O'Brien and Mt. Lemmon and for major national observatories such as the NASA Infrared Telescope Facility (IRTF) in Hawaii and for the LBT.

The Automated Plate Scanner has been used to digitize the entire Palomar Sky Survey resulting in a massive catalog of over 89 million objects, including star and galaxy positions, magnitudes, and colors. The catalog of the first epoch survey is available on the Web, with data from the second epoch survey available in the department.

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 Digital Technology Center 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; and the NASA space based facilities such as the Hubble Space Telescope, the Far Ultraviolet Space Explorer, the Spitzer Infrared Telescope Facility, the Chandra X-ray Space Telescope, and the IRTF in Hawaii.

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

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

### **M.S. Degree Requirements**

The master's degree requires a minimum of 30 credits, including one semester of classical physics (Phys 5011). Additional requirements depend on whether the student chooses the thesis (Plan A) or non-thesis (Plan B) option. Plan A requires 20 credits of coursework and 10 thesis credits. Plan B requires 30 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.

### **Ph.D. Degree Requirements**

The Ph.D. degree requires a minimum of 40 course credits, including a year of classical physics (Phys 5011-5012) 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.

## **Biochemistry, Molecular Biology, and Biophysics**

**Contact Information**—Director of Graduate Studies, Department of Biochemistry, Molecular Biology, and Biophysics, University of Minnesota, 6-155 Jackson Hall, 321 Church Street S.E., Minneapolis, MN 55455 (612-625-5179; fax 612-625-2163), [bmbbgp@umn.edu](mailto:bmbbgp@umn.edu); <http://cbs.umn.edu/gpbmbbb>).

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, 1035 University Drive, Duluth, MN 55812 (218-726-7922).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

#### **Professor**

Matthew T. Andrews, Biology, Duluth, SM  
Ian M. Armitage, SM  
Leonard J. Banaszak, SM  
George Barany, Chemistry, SM  
David A. Bernlohr, SM  
Victor A. Bloomfield, SM

Robert J. Brooker, Genetics, Cell Biology, and Development, SM  
Bianca M. Conti-Fine, SM  
Anath Das, SM  
Lester R. Drewes, Biochemistry and Molecular Biology, Duluth, SM  
Michael C. Flickinger, SM  
James A. Fuchs, SM  
Thomas S. Hays, Genetics, Cell Biology, and Development, SM  
Alan B. Hooper, SM  
David C. LaPorte, SM  
John D. Lipscomb, SM  
Dennis M. Livingston, SM  
Kevin H. Mayo, SM  
Matthew F. Mescher, Laboratory Medicine and Pathology, SM  
Karin Musier-Forsyth, Chemistry, SM  
Gary L. Nelsestuen, SM  
Michael B. O'Connor, Genetics, Cell Biology, and Development, SM  
Douglas H. Ohlendorf, SM  
Harry T. Orr, Laboratory Medicine and Pathology, SM  
Joseph R. Prohaska, Biochemistry and Molecular Biology, Duluth, SM  
Lawrence Que, Chemistry, SM  
Michael J. Sadowsky, Soil, Water, and Climate, SM  
Michel M. Sanders, SM  
Claudia Schmidt-Dannert, SM  
Janet L. Schottel, SM  
David D. Thomas, SM  
Howard C. Towle, SM  
Brian G. Van Ness, SM  
Lawrence P. Wackett, SM  
Kendall B. Wallace, Biochemistry and Molecular Biology, Duluth, SM

#### **Associate Professor**

Kenneth W. Adolph, SM  
Vivian J. Bardwell, Genetics, Cell Biology, and Development, SM  
Benjamin L. Clarke, Medical Microbiology and Immunology, Duluth, SM  
Antony Michael Dean, BioTechnology Institute, SM  
Stephen C. Ekker, Genetics, Cell Biology, and Development, SM  
Eric A. Hendrickson, SM  
Romas J. Kazlauskas, SM  
Alex J. Lange, SM  
Sharon E. Murphy, SM  
Merry Jo Oursler, Biology, Duluth, SM  
Lincoln R. Potter, SM  
Robert J. Roon, SM  
Ann E. Rougvie, Genetics, Cell Biology and Development, SM  
Claudia Schmidt-Dannert, SM  
Paul G. Siliciano, SM  
Jeffrey A. Simon, Genetics, Cell Biology, and Development, SM  
Jennifer J. Westendorf, Cancer Center, SM  
David A. Zarkower, Genetics, Cell Biology, and Development, SM

#### **Assistant Professor**

Anja K. Bielinsky, SM  
Robert Cormier, Biochemistry, Duluth, SM  
Deborah A. Ferrington, Ophthalmology, SM  
Arun Goyal, Biology, Duluth, SM

Timothy J. Griffin, SM  
Reuben S. Harris, SM  
Julio E. Herrera, SM  
Arkady B. Khodursky, SM  
Do-Hyung Kim, SM  
Hiroshi Matsuo, SM  
Laura J. Mauro, Animal Science, SM  
Edward Perkins, Biochemistry, Duluth, SM  
Robert J. Sheaff, SM  
Gianluigi Veglia, Chemistry, SM  
Kylie J. Walters, SM  
Carrie M. Wilmot, SM

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. Students are admitted only to the Ph.D. program.

**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 chemistry is strongly recommended, but not required. The

recommended date for receipt of completed applications is January 2. Completed files are reviewed between January and February. Graduate studies typically begin fall semester. Information about an early start program involving participation in laboratory research beginning on July 1 may be obtained from the director of graduate studies.

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

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

### 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**—A master's minor requires 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**—A doctoral minor requires BioC 8002 (4 credits) plus additional courses (8 credits), approved by the director of graduate studies, to meet the minimum requirement of 12 total credits. In extenuating cases, students may petition the director of graduate studies for substitution of a required course.

## Bioethics

### Minor Only

**Contact Information**—Graduate Minor in Bioethics, Center for Bioethics, University of Minnesota, N504 Boynton, 410 Church St. SE, Minneapolis MN 55455 (612-624-9440; fax 612-624-9108; bioethx@umn.edu; www.bioethics.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

#### Professor

Muriel Bebeau, Preventive Sciences, M  
Dan Burk, Law, M  
Ronald Cranford, Neurology, M  
Norman Dahl, Philosophy, M  
Raymond DeVries, AM  
Carl Elliott, Pediatrics, M  
John Eyler, History of Medicine, M  
Jasper Hopkins, Philosophy, M  
Jeffrey Kahn, Medicine, M  
Rosalie Kane, Public Health, M  
David Mayo, Philosophy, Duluth, M  
Steven Miles, Medicine, M  
Naomi Scheman, Philosophy, M  
Susan M. Wolf, Law School, M

#### Associate Professor

John Dolan, Philosophy, M  
Joan Liaschenko, Nursing, M  
Gregory Plotnikoff, Medicine, M  
Michael Root, Philosophy, M

#### Assistant Professor

Debra DeBruin, Medicine, M  
Edward Ratner, Medicine, M  
John Song, Medicine, M  
Karen-Sue Taussig, Medicine, M  
Maryam Valapour, Medicine, M  
Beth Virnig, Health Services Research and Policy, M

#### Other

Dianne Bartels, Center for Bioethics, M

**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. The form is also available in a PDF of the Graduate Minor in Bioethics Brochure at [www.bioethics.umn.edu/education/grad\\_minor.pdf](http://www.bioethics.umn.edu/education/grad_minor.pdf). Enrollment is contingent upon approval by the director of graduate studies for bioethics.

**Courses**—Please contact the minor program office or the Center for Bioethics Web site at [www.bioethics.umn.edu/education](http://www.bioethics.umn.edu/education) for information on relevant coursework.

**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 or the Center for Bioethics Web site at [www.bioethics.umn.edu/education](http://www.bioethics.umn.edu/education).

### Minor Only Requirements

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

## Bioinformatics

### Minor Only

**Contact Information**—Graduate Minor Program in Bioinformatics, Department of Laboratory Medicine and Pathology, University of Minnesota, MMC 511, 420 Delaware Street S.E., Minneapolis, MN 55455 (612-625-8440; fax 612-625-7166; [www.binf.umn.edu](http://www.binf.umn.edu))

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

#### Professor

Daniel Boley, Computer Science, M  
John Carlis, Computer Science, M  
Lynda B. M. Ellis, Laboratory Medicine and Pathology, M  
Alexander Grosberg, Physics, M  
Vivek Kapur, Microbiology, M  
Claudia Neuhauser, Ecology, Evolution, and Behavior, M  
Hans Othmer, Mathematics, M

Lawrence P. Wackett, Biochemistry, Molecular Biology, and Biophysics, M  
Nevin Dale Young, Plant Pathology, M

**Associate Professor**

Colin Campbell, Pharmacology, M  
Yang Da, Animal Science, M  
Scott Fahrenkrug, Animal Science, M  
George Karypis, Computer Science, M  
Georgiana May, Ecology, Evolution, and Behavior, M  
Wei Pan, Biostatistics, M

**Assistant Professor**

Yiannis Kaznessis, Chemical Engineering and Materials Science, M  
Arkady Khodursky, Biochemistry, Molecular Biology, and Biophysics, M  
Cavan Reilly, Biostatistics, M

**Curriculum**—The bioinformatics minor is available to master's (M.A. and M.S.) and doctoral students. The minor includes core coursework in computer and biological sciences and opportunities to interact with others interested in bioinformatics. The curriculum encourages interdisciplinary interaction, communication, and synthesis. The minor is intended to provide graduate-level biological or computer science students with basic training in bioinformatics as a complement to their major science background and broaden their professional abilities. The program of study is tailored by advance consultation between the student and the director of graduate studies for the bio-informatics minor. All courses taken to fulfill minor requirements must be graded A-F.

**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 bioinformatics is required. Potential programs must be discussed with the director of graduate studies.

**Courses**—Courses are taken from a designated course list available online at [www.binf.umn.edu/courses.html](http://www.binf.umn.edu/courses.html).

**Use of 4xxx Courses**—Biol 4003—Genetics and CSci 4707—Practice of Database Systems are the only 4xxx course that may be included on degree program forms.

**Minor Only Requirements**

The master's and doctoral minors are developed in consultation with, and must be approved in advance by, the director of graduate studies for bioinformatics. The master's minor requires at least 9 credits, including CSci 5481—Computational Techniques for Genomics, one of several genomics or sequence analysis courses, and a third designated course. Other courses may be substituted upon the recommendation of the director of graduate studies.

The doctoral minor requires at least 15 credits, including the master's courses, one of several courses in statistical genomics, and an elective. Other courses may be substituted upon the recommendation of the director of graduate studies.

## 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; [biolink@cbs.umn.edu](mailto:biolink@cbs.umn.edu); [www.cbs.umn.edu](http://www.cbs.umn.edu) /[biolink/mbs/](http://biolink/mbs/)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

**Professor**

John S. Anderson, Biochemistry, Molecular Biology, and Biophysics, M2  
Henry H. Balfour, Jr., Laboratory Medicine and Pathology, AM2  
Jay Bell, Soil, Water, and Climate, AM2  
Judith G. Berman, Molecular, Cellular, Developmental Biology and Genetics, M2  
David A. Bernlohr, Biochemistry, Molecular Biology, and Biophysics, M2  
Linda J. Brady, Food Science and Nutrition, AM2  
Robert M. Brambl, Plant Biology, M2  
Paul P. Cleary, Microbiology, AM2  
Gary M. Dunny, Microbiology, AM2  
Leonard C. Ferrington, Entomology, AM2  
James A. Fuchs, Biochemistry, Molecular Biology, and Biophysics, M2  
Daniel D. Gallaher, Food Science and Nutrition, AM  
Ralph W. Holzenthal, Entomology, AM2  
Paul A. Iaizzo, Surgery, AM2  
Ronald R. Jemmerson, Microbiology, AM2  
Ross G. Johnson, Molecular, Cellular, Developmental Biology and Genetics, AM2  
John H. Kersey, Laboratory Medicine and Pathology, AM2  
Youngki Kim, Pediatrics, AM2  
Richard King, Pediatrics, AM2  
Mindy S. Kurzer, Food Science and Nutrition, AM2  
Paul T. Magee, Microbiology, M2  
Michael Mauer, Pediatrics, M2  
Gary L. Nelsestuen, Biochemistry, Molecular Biology, and Biophysics, AM2  
Harry T. Orr, Laboratory Medicine and Pathology, M2  
Laura P. W. Ranum, Genetics, Cell Biology, and Development, M2  
Gary A. Reineccius, Food Science and Nutrition, AM2  
Michael J. Sadowsky, Soil, Water, and Climate, AM2  
Leslie A. Schiff, Microbiology, AM2  
Patrick M. Schlievert, Microbiology, AM2  
Michael J. Simmons, Molecular, Cellular, Developmental Biology and Genetics, M2  
Donald B. Siniff, Ecology, Evolution, Behavior, ASM  
Joanne L. Slavin, Food Science and Nutrition, AM2  
D. Peter Snustad, Plant Biology, M2  
George R. Spangler, Fisheries, Wildlife, and Conservation Biology, AM2  
Clifford J. Steer, Medicine, SM  
Howard Towle, Biochemistry, Molecular Biology, and Biophysics, M2  
Daniel A. Vallera, Therapeutic Radiology, AM2  
Brian G. Van Ness, Laboratory Medicine and Pathology, M2  
Lawrence P. Wackett, BioTechnology Institute, M2

Clifford M. Wetmore, Plant Biology, M2  
Chester B. Whitley, Pediatrics, AM2

**Adjunct Professor**

Bruce Vondracek, Fisheries, Wildlife, and Conservation Biology, AM2

**Associate Professor**

Vivian J. Bardwell, Genetics, Cell Biology, and Development, M2  
Gregory Jose Beilman, Surgery, AM2  
Wei Chen, Pediatrics, AM2  
Kathleen F. Conklin, M2  
Joellen Feirtag, Food Science and Nutrition, AM2  
Susan M. Galatowitsch, Horticultural Science, AM2  
Craig A. Hassel, Food Science and Nutrition, AM2  
Marc A. Hillmyer, Chemistry, AM2  
Stephen Jameson, Laboratory Medicine and Pathology, AM2  
David A. Largaespada, Genetics, Cell Biology and Development, AM2  
Christopher A. Pennell, Laboratory Medicine and Pathology, AM2  
Lisa A. Peterson, Environmental Health Sciences, AM2

**Assistant Professor**

Vincent A. Barnett, Physiology, AM2  
Richard W. Bianco, Surgery, AM2  
Frank H. Burton, Pharmacology, ASM  
David C. Fulton, Fisheries, Wildlife, and Conservation Biology, AM2  
Cheryl A. Gale, Pediatrics, AM2  
Nicole Kirchhof, Surgery, AM2  
Susan E. Marino, Pharmacy, AM2  
Karen S. Oberhauser, Fisheries, Wildlife, and Conservation Biology, AM2  
Anna Petryk, Pediatrics, AM2  
Robert J. Sheaff, Cancer Center, AM2  
Robert C. Venette, Entomology, AM2

**Research Associate**

Kevin A. Silverstein, Plant Biology, M2  
Laura J. Suggs, Biomedical Engineering, AM2  
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 multicollge, 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.

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

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

### 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 is 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). An overall GPA of 3.00 is preferred 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 BSBE, 312 Church Street S.E., Minneapolis, MN 55455 (612-624-8396; fax 612-626-6583; bmenp@umn.edu; www1.umn.edu/bme).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/stepl](http://www.grad.umn.edu/faculty_rosters/stepl).

### Regents Professor

Robert P. Hebbel, Medicine, SM

### Professor

James Ashe, Neural Engineering, SM

Robert J. Bache, Medicine, SM

David G. Benditt, Medicine, SM

John C. Bischof, Mechanical Engineering, SM

Frank B. Cerra, Surgery, SM

Wei Chen, Radiology, SM

Jay N. Cohn, Medicine, SM

Max Donath, Mechanical Engineering, SM

William K. Durfee, Mechanical Engineering, SM

Timothy J. Ebner, Neuroscience, SM

Arthur G. Erdman, Mechanical Engineering, SM

Stanley M. Finkelstein, Laboratory Medicine and Pathology, SM

Martha Flanders, Neuroscience, SM

John E. Foker, Surgery, SM

Lorraine F. Francis, Chemical Engineering and Materials Science, SM

Leo T. Furcht, Laboratory Medicine and Pathology, SM

James R. Gage, Orthopaedic Surgery, M2

Michael G. Garwood, Radiology, M2

Bin He, Biomedical Engineering, SM

Wei-Shou Hu, Chemical Engineering and Materials Science, SM

Paul A. Iaizzo, Anesthesiology, SM

Kenneth H. Keller, Public Affairs, SM

Tarald O. Kvalseth, Mechanical Engineering, SM

Paul C. Letourneau, Cell Biology and Neuroanatomy, SM

David G. Levitt, Physiology, SM

Jack L. Lewis, Orthopaedic Surgery, SM

Keith G. Lurie, Medicine, M2

James B. McCarthy, Laboratory Medicine and Pathology, SM

Jeffrey McCullough, Laboratory Medicine and Pathology, M2

Robert P. Patterson, Physical Medicine and Rehabilitation, SM

Dennis L. Polla, SM

Richard E. Poppele, Neuroscience, SM

Gundu H. R. Rao, Laboratory Medicine and Pathology, SM

William P. Robbins, Electrical and Computer Engineering, M2

Ronald A. Siegel, Pharmaceutics, SM

Ephraim M. Sparrow, Mechanical Engineering, SM

Doris Taylor, Physiology, SM

Ahmed H. Tewfik, Electrical Engineering, SM

Gerald Timm, Urological Surgery, ASM

Robert T. Tranquillo, Biomedical Engineering, SM

Charles L. Truwit, Neurology, M2

J. Thomas Vaughan, Radiology, SM

Neal F. Viemeister, Psychology, SM

Timothy S. Wiedmann, Pharmaceutics, SM

Robert F. Wilson, Medicine, M2

Jay Zhang, Medicine, SM

### Associate Professor

Jerome H. Abrams, Surgery, SM

Edgar A. Arriaga, Chemistry, SM

Alan J. Bank, Medicine, M2

Victor H. Barocas, Biomedical Engineering, SM

J. David Brown, Ophthalmology, M

Gladwin S. Das, Medicine, SM

Emad S. Ebbini, Electrical and Computer Engineering, SM

William B. Gleason, Laboratory Medicine and Pathology, SM

Bruce E. Hammer, Radiology, SM

Ramesh Harjani, Electrical and Computer Engineering, M2

James E. Holte, Electrical and Computer Engineering, SM

Allison Hubel, Laboratory Medicine and Pathology, SM

Robert LaPrade, Orthopaedic Surgery, M

Ronald C. McGlennen, Laboratory Medicine and Pathology, M2

Tom Novacheck, Orthopaedic Surgery, AM

David J. Odde, SM

Kenneth P. Roberts, Urologic Surgery, SM

Clark M. Smith II, Pediatrics, SM

Babak Ziaie, Electrical and Computer Engineering, M2

### Assistant Professor

Joan E. Bechtold, Orthopaedic Surgery, M2

Michael Bowser, Chemistry, SM

Linda K. Hansen, Laboratory Medicine and Pathology, SM

Goran Hellekant, Physiology and Pharmacology, SM

Efrosini Kokkoli, Chemical Engineering and Materials Science, M

Haiying Liu, Radiology, M2

Jennifer Maynard, Chemical Engineering and Materials Science, SM

A. David Redish, Neuroscience, M2

Osha Roopnarine, Biochemistry, Molecular Biology and Biophysics, SM

Michael H. Schwartz, Orthopaedic Surgery, SM

Carl S. Smith, Urologic Surgery, M2

Chun Wang, Biomedical Engineering, SM

### Instructor

Michel Cramer Bornemann, MD, Neurology, AM2

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 areas of science and engineering that are relevant for the degree objectives.

**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 (including linear algebra and differential equations) 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 preferred performance minimum for the TOEFL is 575 (paper) or 230 (computer).

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

**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.

### **M.S. Degree Requirements**

The M.S. is offered under two plans: Plan A (with thesis) and Plan B (with project). Each program requires courses in mathematics, biology, biomedical engineering, and relevant areas of science and engineering, 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 at least 6 course credits, including one BMEn core course (5001, 5101, 5201, 5311, 5351 or Biomedical Imaging—5920 currently) and one other BMEn course at 5xxx or higher.

### **Ph.D. Degree Requirements**

The Ph.D. program requires coursework in mathematics, biology, biomedical engineering, and relevant areas of science and engineering (typically 40 credits, including those satisfying a minor field or supporting program), 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 at least 12 credits, including two BMEn core courses (5001, 5101, 5201, 5311, 5351 or Biomedical Imaging—5920 currently), one course with a biological sciences emphasis (may be BMEn 5501), and one course with an engineering emphasis. All courses must be at 5xxx or higher.

## **Biophysical Sciences and Medical Physics**

**Contact Information**—Biophysical Sciences and Medical Physics Program, Department of Radiology, University of Minnesota, MMC 292, Room B272 Mayo Building, 420 Delaware Street S.E., Minneapolis, MN 55455 (612-626-6638; hanse032@umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

### **Professor**

Dwight L. Anderson, Oral Sciences, SM  
Victor A. Bloomfield, Biochemistry, SM  
Bianca M. Conti-Fine, Biochemistry, SM  
Ralph DeLong, Oral Sciences, M2  
William H. Douglas, Oral Sciences, SM  
Stanley M. Finkelstein, Laboratory Medicine and Pathology, SM  
John E. Foker, Surgery, SM  
Michael G. Garwood, Radiology, SM  
Rolf Gruetter, Radiology, SM  
Russell K. Hobbie (emeritus), Physics and Astronomy, ASM  
Xiaoping Hu, Radiology, ASM

Faiz M. Khan (emeritus), Therapeutic Radiology, ASM  
Merle K. Loken (emeritus), Radiology, ASM  
Robert H. Margolis, Otolaryngology, SM  
Scott M. O'Grady, Animal Science, SM  
Robert P. Patterson, Physical Medicine and Rehabilitation, SM  
Richard E. Poppele, Physiology, SM  
E. Russell Ritenour, Radiology, SM  
Chang W. Song, Therapeutic Radiology, SM  
David D. Thomas, Biochemistry, SM  
Kamil Ugurbil, Radiology, SM  
Warren J. Warwick, Pediatrics, SM

### **Associate Professor**

Alan J. Bank, Medicine, M2  
Richard A. Geise, Radiology, ASM  
Bruce J. Gerbi, Therapeutic Radiology, SM  
Bruce E. Hammer, Radiology, SM  
Patrick Higgins, Therapeutic Radiology, M2  
James E. Holte, Electrical Engineering, SM  
Michael Jerosch-Herold, Radiology, M2

### **Assistant Professor**

Vincent A. Barnett, Physiology, M2  
Mark J. Conroy, Radiology, M2  
Bruce E. Hasselquist, Radiology, AM2  
Haiying Liu, Radiology, M2  
Kelly Rehm, Radiology, AM2

### **Senior Research Associate**

Ching-Change Ko, Oral Science, M2  
David H. Live, Biochemistry, Molecular Biology, and Biophysics, M2

### **Other**

Kevin G. Waddick, M2

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.

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

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

### **M.S. Degree Requirements**

The M.S. is offered under two plans: Plan A, (with thesis), and Plan B, (with 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, MMC 819, 420 Delaware Street S.E., Minneapolis, MN 55455 (612-626-3500 or 1-800-774-8636; fax 612-626-6931; sph-ssc@umn.edu; [www.sph.umn.edu](http://www.sph.umn.edu) or [www.biostat.umn.edu](http://www.biostat.umn.edu)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

#### Professor

Bradley P. Carlin, SM  
John E. Connert, SM  
Chap T. Le, SM  
James D. Neaton, SM

#### Associate Professor

Lynn E. Eberly, SM  
Patricia M. Grambsch, SM  
Birgit Grund, ASM  
Wei Pan, SM  
William Thomas, M2  
Melanie M. Wall, SM

#### Assistant Professor

Sudipto Banerjee, M2  
Susan Duval, AM2  
Na Li, M2  
Cavan S. Reilly, M2  
Baolin Wu, M2

#### Senior Research Associate

James S. Hodges, SM

#### Research Associate

Judith Bechuk, M2  
Tracy L. Bergemann, AM  
Katherine Huppler Hullsiek, M2  
Robert E. Leduc, M2

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.

For an online application, see the School of Public Health Web site at [www.sph.umn.edu/students/application/home.html](http://www.sph.umn.edu/students/application/home.html).

**Note:** If you are or ever were a student in the University of Minnesota Graduate School and you are applying to any graduate or professional program in the University of Minnesota, you must complete a change of status application. See the Graduate School Web site for the appropriate form and fee at [www.grad.umn.edu/current\\_students/forms/cos.pdf](http://www.grad.umn.edu/current_students/forms/cos.pdf).

**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 participating 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, Fortran, or other high-level programming language are required. For the Ph.D., a bachelors or masters degree in mathematics, statistics, or biostatistics.

Three letters of recommendation and the GRE are required. Applicants should have an overall GPA of 3.10. 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. Applicants to either program who are not native speakers of English should have a TOEFL score of 600 (paper version) or 250 (computer version) or a score of 7.0 on IELTS.

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

**Courses**—Please refer to Public Health (PubH), where most biostatistics courses are numbered 64xx, 74xx or 84xx, or online at <http://onestop2.umn.edu/courses/index.html>.

**Use of 4xxx Courses**—No 4xxx courses may be used to satisfy any graduate degree program requirements in biostatistics.

#### M.S. Degree Requirements

For the M.S. Plan B degree, students must complete 11 courses with a GPA of 3.00, pass a written exam, complete the Plan B project, and pass 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) seven required courses in statistical theory and biostatistics methods; 2) one elective course in health science; 3) three elective courses in biostatistics. Details of the program are in the *Student Handbook* at [www.biostat.umn.edu](http://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), pass a written exam, complete the Plan A thesis, and a final oral exam.

**Language Requirements**—None.

**Final Exam**—The final exam is oral.

**Minor Requirements for Students Majoring in Other Fields**—The master's minor in biostatistics requires two courses from the following list: PubH 7420, 7430, 7435, 7440, 7445, 7450. Details for minor requirements at [www.biostat.umn.edu](http://www.biostat.umn.edu).

#### Ph.D. Degree Requirements

The Ph.D. program requires five core courses (including mathematical statistics, linear models, probability models, and Bayesian methodology) and four elective courses in biostatistical theory and methods, a preliminary written examination on the material from some of the required courses, a preliminary oral examination, a written dissertation, and dissertation defense in a final oral examination. This usually requires three years of full-time study after the M.S. degree.

**Language Requirements**—None.

**Minor Requirements for Students Majoring in Other Fields**—A doctoral minor for students majoring in statistics consists of two required courses: PubH 7420, 7450, and a choice of two courses from the following: PubH 7455, 8442, 8452, 8462, 8472, 8482.

A doctoral minor for students in programs other than statistics consists of two required courses: PubH 7405, 7406, and two courses from the following: PubH 7407, 7420, 7430, 7435, 7440, 7445, 7450. Details for minor requirements at [www.biostat.umn.edu](http://www.biostat.umn.edu).

## 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; [bae@umn.edu](mailto:bae@umn.edu); [www.bae.umn.edu](http://www.bae.umn.edu)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

#### Professor

Mrinal Bhattacharya, SM  
Charles J. Clanton, SM  
Forrest T. Izuno, SM  
Larry D. Jacobson, SM  
Kevin A. Janni, SM  
Theodore P. Labuza, Food Science and Nutrition, SM  
R. Vance Morey, SM  
John L. Nieber, SM  
Rongsheng R. Ruan, SM  
John M. Shutske, SM  
William F. Wilcke, SM  
Bruce N. Wilson, SM

#### Associate Professor

James J. Boedicker, M2  
Jonathan Chaplin, SM  
Philip R. Goodrich, SM  
Gary R. Sands, SM  
Jun Zhu, SM

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 focusing on bioprocessing and food topics such as, renewable energy, biofuels, bioproducts, bioprocessing, biorefining, food engineering, packaged food shelf life extension, and grain quality; environment topics such as water quality, surface and subsurface flow, contaminant transport, animal environment and air quality, waste and manure management, and resource utilization; and machinery systems design topics such as precision agriculture, biosensors, urban land care, BSE (bovine spongiform encephalopathy, or “mad cow disease”) and slaughter equipment, and safety engineering. Programs usually

include study in at least one other engineering discipline as well as study or research in a biological or agricultural discipline. Students have flexibility in planning individualized programs to support their research interests, and courses from other disciplines may be included for credit in the major area.

The program offers the following degrees: M.B.A.E., M.S.B.A.E. Plan A or Plan B, and Ph.D.

The master of biosystems and agricultural engineering (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 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. Students can select a Plan A, or thesis program, or Plan B without a thesis.

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**—Students having lower grade point averages or having non-engineering degrees may be admitted subject to conditions agreed upon by the adviser and the Biosystems and Agricultural Engineering Graduate Program Committee.

**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 United States, or have a low GPA. Students are admitted each semester.

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

**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.

### 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. As an alternative, 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.

**Final Exam**—Students must pass preliminary written and oral exams, write a dissertation, 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 12 credits of BAE courses numbered 4xxx or higher.

## Business Administration

**Contact Information**—Ph.D. Program in Business Administration, Carlson School of Management, Suite 4-201, 321 19th Avenue S., University of Minnesota, Minneapolis, MN 55455 (612-624-0875 or 612-624-5065; fax 612-624-8221; ebronson@csom.umn.edu; www.carlsonschool.umn.edu/Page798.aspx).

**Master of Business Administration**—Graduate School students who wish to take MBA 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).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

### Professor

Carl R. Adams, Information and Decision Sciences, SM  
Dennis A. Ahlburg, Human Resources and Industrial Relations, AM2  
Gordon J. Alexander, Finance, SM  
John C. Anderson, Operations and Management Science, SM  
Richard D. Arvey, Human Resources and Industrial Relations, ASM  
Frederick J. Beier, Marketing and Logistics Management, SM  
Lawrence M. Benveniste, Finance, SM  
Mark E. Bergen, Marketing and Logistics Management, SM  
Norman E. Bowie, Strategic Management and Organization, SM  
John H. Boyd, Finance, SM  
Philip Bromiley, Strategic Management and Organization, SM  
John M. Bryson, Public Affairs, Strategic Management and Organization, AM2  
Chun Chang, Finance, SM  
Norman L. Chervany, Information and Decision Sciences, SM  
Shawn P. Curley, Information and Decision Sciences, SM  
Gordon B. Davis, Information and Decision Sciences, (emeritus), ASM



John W. Dickhaut, Accounting, SM  
 W. Bruce Erickson, Strategic Management and Organization, SM  
 Alok Gupta, Information and Decision Sciences, SM  
 Arthur V. Hill, Operations and Management Science, SM  
 Thomas R. Hoffman (emeritus), Information and Decision Sciences, SM  
 Michael J. Houston, Marketing and Logistics Management, SM  
 Deborah R. John, Marketing and Logistics Management, SM  
 George John, Marketing and Logistics Management, SM  
 Paul E. Johnson, Information and Decision Sciences, SM  
 Edward J. Joyce, Accounting, SM  
 Chandra S. Kanodia, Accounting, SM  
 John H. Kareken (emeritus), Finance, ASM  
 Robert J. Kauffman, Information and Decision Sciences, SM  
 Stefanie A. Lenway, Strategic Management and Organization, SM  
 Ross Levine, Finance, SM  
 Barbara J. Loken, Marketing and Logistics Management, SM  
 Ian H. Maitland, Strategic Management and Organization, SM  
 Alfred A. Marcus, Strategic Management and Organization, SM  
 Joan Meyers-Levy, Marketing and Logistics Management, SM  
 Christopher J. Nachtshiem, Operations and Management Science, SM  
 Timothy J. Nantell, Finance, SM  
 Mary L. Nichols, Strategic Management and Organization, SM  
 Akshay R. Rao, Marketing and Logistics Management, SM  
 Judy Rayburn, Accounting, SM  
 Kenneth J. Roering, Marketing and Logistics Management, SM  
 Robert W. Ruekert, Marketing and Logistics Management, SM  
 Harry J. Sapienza, Strategic Management and Organization, SM  
 Roger G. Schroeder, Operations and Management Science, SM  
 Myles Shaver, Strategic Management and Organization, SM  
 Kingshuk K. Sinha, Operations and Management Science, SM  
 Andrew H. Van de Ven, Strategic Management and Organization, SM  
 Jan Werner, Economics, Finance, ASM  
 Andrew F. Whitman, Human Resources and Industrial Relations, ASM  
 Andrew Winton, Finance, SM  
 Akbar Zaheer, Strategic Management and Organization, SM  
 Srilata Zaheer, Strategic Management and Organization, SM  
 Mahmood A. Zaidi, Human Resources and Industrial Relations, ASM

**Associate Professor**  
 Rohini Ahluwalia, Marketing and Logistics Management, SM  
 Stuart Albert, Strategic Management and Organization, SM

Rajesh Chandy, Marketing and Logistics Management, SM  
 Karen L. Donohue, Operations and Management Science, SM  
 Gordon L. Duke, Accounting, SM  
 Gordon C. Everest, Information and Decision Sciences, SM  
 Frank Barry Gigler, Accounting, SM  
 Robert Goldstein, Finance, SM  
 Susan Meyer Goldstein, Operations and Management Science, SM  
 Robert A. Hansen, Marketing and Logistics Management, SM  
 William Li, Operations and Management Science, SM  
 Kevin Linderman, Operations and Management Science, M2  
 Erzo Luttmmer, Economics, Finance, ASM  
 John J. Mauriel, Strategic Management and Organization, SM  
 Thomas P. Murtha, Strategic Management and Organization, SM  
 J. David Naumann, Information and Decision Sciences, SM  
 Paul J. Seguin, Finance, SM  
 Priti P. Shah, Strategic Management and Organization, SM  
 Pervin Shroff, Accounting, SM  
 Rajdeep Singh, Finance, SM  
 Mani R. Subramani, Information and Decision Sciences, SM

**Assistant Professor**  
 Gediminas Adomavicius, Information and Decision Sciences, M2  
 Regina M. Anctil, Accounting, M2  
 Luca Benzoni, Finance, M2  
 Alvaro Cuervo-Cazurra, Strategic Management and Organization, M2  
 Michael DeV Vaughn, Strategic Management and Organization, M2  
 Yan Dong, Marketing and Logistics Management, M2  
 Jane E. Ebert, Marketing and Logistics Management, M2  
 Daniel Forbes, Strategic Management and Organization, M2  
 Ioulia Ioffe, Finance, M2  
 Loraine Lau-Gesk, Marketing and Logistics Management, M2  
 Debasish Mallick, Operations and Management Science, M2  
 Prokriti Mukherji, Marketing and Logistics Management, M2  
 Om Narasimhan, Marketing and Logistics Management, M2  
 Valery Polkovnichenko, Finance, M2  
 Paul Povel, Finance, M2  
 Frederick J. Riggins, Information and Decision Sciences, M2  
 Karen A. Schnatterly, Strategic Management and Organization, M2  
 Rachna Shah, Operations and Management Science, M2  
 Rangopal Venkataraman, Accounting, M2  
 Weidong Xia, Information and Decision Sciences, M2  
 Mary E. Zellmer-Bruhn, Strategic Management and Organization, M2  
 Minyuan Zhao, Strategic Management and Organization, M2

**Coordinator**

Frederick R. Jacobs, AM2

**Lecturer**

Maria Carkovic, AM2  
 Gary W. Carter, AM2  
 James M. Gahlon, AM2  
 Thomas D. Legg, AM2  
 Terry Tranter, AM2

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 include an international focus).

**Prerequisites for Admission**—Applicants must have completed an undergraduate degree, in any field. 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 a copy of the Graduate School application, GMAT or GRE scores, TOEFL or IELTS 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.

**Courses**—Please refer to Accounting (Acct); Business Administration (BA); Business Law (BLaw); Finance (Fina); Information and Decision Sciences (IDSc); Insurance and Risk Management (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.

**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.

### **Ph.D. Degree Requirements**

Degree requirements vary by area of concentration. Each student's coursework is determined in consultation with an adviser, but in general a degree program includes courses in the field of specialization, in research methodology, and in a minor or supporting program. Students in all areas must complete at minimum 40 semester credits of graduate coursework.

**Accounting**—This area of concentration 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. 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 8001-8004 or Econ 8101-8104) for 8 credits, and an econometrics sequence. It is also highly recommended that students complete the macroeconomics sequence. In addition, students should complete a minimum of 8 additional elective credits in economics, statistics, accounting, or a related field.

**Information and Decision Sciences**—Students are required to complete at least 46 semester credits of degree program coursework, including 14 credits of IDSc Ph.D. seminars, 8 credits of research methodology, and 16 credits of supporting or minor field coursework. Students are required to take IDSc 8511, 8521, 8711, and 8801 sections 1 and 2. Research methods courses that students can take include regression, experimental design, multivariate statistics, and econometric modeling. Students who lack in technical and business experience in IDSc may need to take MBA courses to increase their knowledge base.

**Marketing and Logistics Management**—The department requires students to take its five seminars (20 credits total) 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 (these credits could overlap with the research methods coursework requirements).

**Operations and Management Science**—Students must complete 6 OMS Ph.D. seminars (OMS 8651, 8652, 8711, 8721, 8735, and 8745), and one graduate-level course in linear programming. Students supplement this with at least 16 credits from outside the department for a minor or supporting program. The department also recommends that students take Mgmt 8302—Seminar in Organizations Theory).

### **Strategic Management and Organization**

Students are required to take at least five core SMO Ph.D. seminars (20 credits), which must include one course from each of three areas (strategy, organization studies, ethics-international management-entrepreneurship), plus all remaining Ph.D. seminars in the student's area of specialization (strategy, organization studies). Alternatively, students may choose to combine two areas as their major area of concentration (e.g., strategy/international management, organization studies/entrepreneurship). It is highly recommended that students take the department's theory building seminar. As part of the supporting field requirement (16 credits), students must take a strong methods sequence, which can be tailored to individual student needs, as well as coursework that leads to a good understanding of the fundamentals of a specific external discipline (e.g., economics, sociology).

**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; mbt@tc.umn.edu; www.mbt.carlsonschool.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### **Professor**

R. Glen Berryman (emeritus), Accounting, Business Law, M2  
W. Bruce Erickson, Strategic Management and Organization, M2

### **Lecturer**

Charles Caliendo, M2  
Gary W. Carter, M2  
Paul G. Gutterman, M2  
Frederick R. Jacobs, M2

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.

**Courses**—Please refer to Accounting (Acct); 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.

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

### **M.B.T. Plan B Degree Requirements**

The M.B.T. requires 30 credits, including 6 credits in specified courses dealing with accounting and 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. Although not prerequisites for admission to the MBT program, these courses must be completed before the degree is granted. They can be taken concurrently with MBT program courses. Usually students who enter the program with business degrees have completed most, if not all, of this coursework.

**Final Exam**—None.

**Language Requirements**—None.

## **Cell and Developmental Biology**

See Molecular, Cellular, Developmental Biology and Genetics.

## Cellular and Integrative Physiology

**Contact Information**—Cellular and Integrative Physiology Program, 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; physio@umn.edu; [http://physiology.med.umn.edu/grad/gc\\_iidx.htm](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 Physiology and Pharmacology, School of Medicine, University of Minnesota, 1035 University Drive, Duluth, MN 55812 (218-726-7934; phsl@d.umn.edu; [www.d.umn.edu/medweb/phsl/physiology](http://www.d.umn.edu/medweb/phsl/physiology)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/stepl](http://www.grad.umn.edu/faculty_rosters/stepl).

### Regents Professor

Robert P. Heibel, Medicine, ASM

### Professor

David A. Bernlohr, Biochemistry, Molecular Biology and Biophysics, ASM

Peter B. Bitterman, Medicine, ASM

Frank B. Cerra, Surgery, ASM

William C. Engeland, Surgery, ASM

John E. Foker, Surgery, ASM

Lois J. Heller, Medical School Duluth, SM

Paul A. Iaizzo, Surgery, SM

David H. Ingbar, Medicine, SM

Hon Cheung Lee, Pharmacology, ASM

Arthur S. Leon, Kinesiology, ASM

David G. Levitt, Physiology, SM

Walter C. Low, Neurosurgery, SM

Scott M. O'Grady, Animal Science, SM

John W. Osborn, Physiology, SM

Doris A. Taylor, Physiology, SM

O. Douglas Wangensteen, Physiology, SM

### Associate Professor

Mustafa N. Al'Absi, Medical School Duluth, AM2

W. Dale Branton, Neuroscience, ASM

Janet L. Fitzakerley, Medical School Duluth, M2

Jurgen F. Fohlmeister, Physiology, SM

Stephen A. Katz, Physiology, SM

David E. Mohrman, Medical School Duluth, M2

Edward K. Stauffer, Medical School Duluth, M2

LaDora V. Thompson, Physical Medicine and Rehabilitation, SM

Lorentz E. Wittmers, Jr., Medical School Duluth, SM

Kathleen R. Zahs, Physiology, M2

### Assistant Professor

Vincent A. Barnett, Physiology, M2

### Lecturer

Lisa Carney Anderson, Physiology, 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, gastrointestinal physiology, and endocrinology.

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 a special masters program that focuses on training people in local private industries who are engaged in relevant physiological projects. People working in various biotechnology, biomedical, and bioengineering companies in the Twin Cities area and doing work in physiology may benefit from formal training. The curriculum can be blended into a part-time graduate program, allowing continued employment while working for the M.S. degree.

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. Highly qualified individuals with solid quantitative backgrounds are encouraged to apply. Additionally, 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 may apply. Also, people already affiliated with physiology graduate faculty such as appropriate undergraduate students, lab techs, or others already working in a graduate faculty laboratory are encouraged to apply for admission.

Entering Ph.D. 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 the Departments of Medicine, Surgery, Neuroscience, Neurosurgery, Biochemistry, Molecular Biology and Biophysics, Pharmacology, Physical Medicine and Rehabilitation, Kinesiology, and Animal Science.

**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 is required. For the minor, a background in mathematics, physics, chemistry, and biology acceptable to the graduate faculty, is required.

**Special Application Requirements**—For the M.S. and Ph.D., applicants must take either the General Test of the GRE or the Medical College Admission Test. In addition, all applicants need three letters of recommendation. Admission can be in either fall or spring semester.

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

**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.

### 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 encouraged 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 faculty from both campuses.

*Twin Cities campus*—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 or written project and an oral presentation of the work for the final exam. The M.S. degree is Plan A, unless there are special circumstances requiring a Plan B. 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 and 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 5101 or the equivalent plus additional courses for a total of 10 credits.

## Chemical Engineering and Materials Science and Engineering

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

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

### Regents Professor

H. Ted Davis, SM  
Lanny D. Schmidt, SM  
L. E. Scriven, SM

### Professor

Frank S. Bates, SM  
Raul Caretta, SM  
C. Barry Carter, SM  
James R. Chelikowsky, SM  
Philip I. Cohen, Electrical and Computer Engineering, ASM  
Edward L. Cussler, SM  
Prodrinos Daoutidis, SM  
Jeffrey J. Derby, SM  
Michael C. Flickinger, BioTechnology Institute, ASM  
Lorraine F. Francis, SM  
Christie J. Geankoplis, SM  
William W. Gerberich, SM  
Steven L. Girshick, Mechanical Engineering, ASM  
Wayne L. Gladfelter, Chemistry, ASM  
J. Woods Halley, Physics and Astronomy, ASM  
Wei-Shou Hu, SM  
Kenneth H. Keller, SM  
David L. Kohlstedt, Geology and Geophysics, ASM  
Timothy P. Lodge, SM  
John S. Lowengrub, Mathematics, ASM  
Christopher W. Macosko, SM  
Alon V. McCormick, SM  
Hans G. Othmer, Mathematics, ASM  
Christopher J. Palmstrom, SM  
David A. Shores, SM  
Ronald A. Siegel, Pharmacy, ASM  
J. Ilja Siepman, Chemistry ASM  
William H. Smyrl, SM  
Friedrich Srienc, SM

Robert T. Tranquillo, SM  
Michael Tsapatsis, SM  
Michael D. Ward, SM  
Karen Yin, Bio-based Products, ASM  
Michael R. Zachariah, Mechanical Engineering, ASM

### Associate Professor

Victor H. Barocas, Biomedical Engineering, ASM  
Alfonso Franciosi, Chemical Engineering, ASM  
Materials Science, SM  
C. Daniel Frisbie, SM  
Marc A. Hillmyer, Chemistry, ASM  
David C. Morse, SM  
David J. Norris, SM  
David J. Odde, Biomedical Engineering, ASM  
Claudia Schmidt-Dannert, Biochemistry, Molecular Biology, and Biophysics, ASM  
Renata M. Wentzcovitch, SM

### Assistant Professor

Yiannis Kaznessis, SM  
Efrosini Kokoli, SM  
Satish Kumar, SM  
Christopher Leighton, SM  
Jennifer Maynard, SM  
Richard B. McClurg, SM  
Beth Stadler, Electrical and Computer Engineering, ASM

### Research Associate

Greg D. Haugstad, Characterization Facility, 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 nonlinear 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. An M.S. is not a prerequisite for admissions to the Ph.D. program. Students requesting a research assistantship from the department should apply directly to the Ph.D. program. Only under special circumstances will the department admit students requesting a research assistantship to the M.S. program.

### 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 BioTechnology 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.

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

**Use of 4xxx Courses**—Chemical engineering allows MatS 4214 to be taken for graduate credit. Materials science allows MatS 4212, 4214, 4221, 4301, and 4511 to be taken for graduate credit. All other ChEn or MatS 4xxx courses must have adviser and director of graduate studies approval.

### 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; inquiry@chem.umn.edu; www.chem.umn.edu/chemphys).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

### Regents Professor

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

Lanny D. Schmidt, Chemical Engineering and Materials Science, SM

### Professor

Barry C. Carter, Chemical Engineering and Materials Science, SM

Christopher J. Cramer, Chemistry, SM

Jiali Gao, Chemistry, SM

Allen M. Goldman, Physics, SM

J. Woods Halley, Physics, SM

Cheng-Cher Huang, Physics, SM

Kenneth R. Leopold, Chemistry, SM

Sanford Lipsky, Chemistry, SM

Karin Musier-Forsyth, Chemistry, SM

Jeffrey T. Roberts, Chemistry, SM

J. Ilja Siepmann, Chemistry, SM

David D. Thomas, Biochemistry, SM

Donald G. Truhlar, Chemistry, SM

Xiaoyang Zhu, Chemistry, SM

### Associate Professor

David M. Ferguson, Medicinal Chemistry, Pharmacognosy, SM

Doreen G. Leopold, Chemistry, SM

David C. Morse, Chemical Engineering and Materials Science, SM

Renata M. Wentzcovitch, Chemical Engineering and Materials Science, SM

Darrin M. York, Chemistry, SM

### Assistant Professor

David A. Blank, Chemistry, SM

Richard M. McClurg, Chemical Engineering and Materials Science, SM

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.

**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.

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

### 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.

**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. 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; inquiry@chem.umn.edu; www.chem.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

### **Regents Professor**

H. Ted Davis, SM

### **Professor**

George Barany, SM  
 Bridgette A. Barry, Biochemistry, ASM  
 Frank S. Bates, Chemical Engineering and Materials Science, ASM  
 Victor A. Bloomfield, Biochemistry, ASM  
 Peter W. Carr, SM  
 Christopher J. Cramer, SM  
 John E. Ellis, SM  
 Jiali Gao, SM  
 Wayne L. Gladfelder, SM  
 Gary Roland Gray, SM  
 Christy L. Haynes, SM  
 Thomas R. Hoye, SM  
 Steven R. Kass, SM  
 Kenneth R. Leopold, SM  
 John D. Lipscomb, Biochemistry, ASM  
 Sanford Lipsky, SM  
 Timothy P. Lodge, SM  
 Kent R. Mann, SM  
 Karin Musier-Forsyth, SM  
 Wayland E. Noland, SM  
 Louis H. Pignolet, SM  
 Lawrence Que, Jr., SM  
 Jeffrey T. Roberts, SM  
 J. Ilja Siepmann, SM  
 Marian Stankovich, SM  
 Andreas Stein, SM  
 William B. Tolman, SM  
 Donald G. Truhlar, SM  
 Michael D. Ward, Chemical Engineering and Materials Science, ASM  
 Michael R. Zachariah, Mechanical Engineering, ASM  
 Xiaoyang Zhu, SM

### **Associate Professor**

Mark D. Distefano, SM  
 Craig J. Forsyth, SM  
 C. Daniel Frisbie, ASM  
 William B. Gleason, Laboratory Medicine and Pathology, ASM  
 Marc A. Hillmyer, SM  
 Richard Hsung, SM  
 Doreen G. Leopold, SM  
 Carston R. Wagner, Pharmacy, ASM  
 Darrin M. York, SM

### **Assistant Professor**

Edgar A. Arriaga, SM  
 David A. Blank, SM  
 Michael T. Bowser, SM  
 Philippe Bühlmann, SM  
 Kristopher McNeill, SM  
 R. Lee Penn, SM  
 T. Andrew Taton, SM  
 Gianluigi Veglia, SM

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, chemical biology, 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 University of 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 Examinations**—Student in the Ph.D. program are expected to pass four of five proficiency examinations during their first year in residence. The exams, which are at the level of an advanced undergraduate course, are in analytical chemistry, biochemistry, inorganic chemistry, organic chemistry, and physical chemistry. The exams are given during the chemistry first-year orientation program in August. In the event that a student does not pass the first exam, they are offered two more times during the academic year.

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

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

### **M.S. Degree Requirements**

M.S. students are expected to pass the proficiency exam 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 pass four out of five 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**—Twelve course credits from graduate-level chemistry courses are required for a Ph.D. minor.

## Child Psychology

**Contact Information**—Child Psychology Program, University of Minnesota, 204 Child Development Building, 51 East River Road, Minneapolis, MN 55455 (612-624-4127; fax 612-624-6373; <http://education.umn.edu/icd>).

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.

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

### **Professor**

Dale A. Blyth, 4H Youth Development Center, AM2W  
 Sandra L. Christenson, Educational Psychology, AM2  
 Andrew Collins, SM  
 Nicki R. Crick, SM  
 Byron Egeland, SM  
 Michael K. Georgieff, Pediatrics, SM  
 Harold D. Grotevant, Family Social Science, AM2  
 Megan R. Gunnar, SM  
 Susan C. Hupp, Educational Psychology, AM2  
 William G. Iacono, Psychology, ASM  
 Gloria R. Leon, Psychology, ASM  
 Michael P. Maratsos, SM  
 Ann S. Masten, SM  
 Scott R. McConnell, Educational Psychology, AM2  
 Charles A. Nelson, SM  
 Anne D. Pick (emeritus), ASM  
 Herbert L. Pick, Jr., SM  
 Maria D. Sera, SM  
 Elsa G. Shapiro, Pediatrics, AM2  
 L. Alan Sroufe, SM  
 Auke Tellegen, Psychology (emeritus), AM2  
 Paulus W. van den Broek, Educational Psychology, AM2  
 Richard A. Weinberg, SM  
 Albert Yonas, SM  
 Steven R. Yussen, SM

### **Associate Professor**

Canan Karatekin, SM  
 Monica Luciana, Psychology, ASM

### **Assistant Professor**

Kathleen Thomas, SM

### **Senior Fellow**

Martha Erickson, Children, Youth, and Family Consortium, AM2  
 Charles Oberg, Epidemiology, AM2  
 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 collaborative program options for careers in applied areas of child psychology as well. 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 (DPCS) 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 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**—The equivalent of three semester (or four quarter) courses 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 the departmental applications for graduate work, 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, and a clearly written statement of career interests, goals, and objectives. The three letters of recommendation also must be received by the deadline. The TOEFL should be submitted when applicable.

**Courses**—Please refer to Child Psychology (CPsy) in the course section of this catalog for courses pertaining to the program.

**Use of 4xxx Courses**—Child psychology Ph.D. students may include 4xxx courses as part of their supporting program coursework with director of graduate studies' approval and if the course is taught by a member of the graduate faculty in the supporting program.

### M.A. Degree Requirements

The Institute of Child Development does not offer admission for a master's degree. Students may choose to 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 is also required.

**Language Requirements**—None.

**Final Exam**—The final exam for Plan A is oral; typically, the final exam for Plan B is written.

### Ph.D. Degree Requirements

The Ph.D. degree usually requires five 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 cr), 8302 (4 cr), and 8996 (1-6 cr). Remaining credits can be taken from 4xxx (subject to their own program's approval) or 8xxx courses.

## Chinese

See Asian Literatures, Cultures, and Media.

## 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; gradsec@ce.umn.edu; www.ce.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

### Professor

Roger E. A. Arndt, SM  
Patrick L. Brezonik, SM  
Steven L. Crouch, SM  
Peter A. Cundall, ASM  
Gary A. Davis, SM  
Emmanuel M. Detournay, SM  
Andrew Drescher, SM  
Efi Foufoula-Georgiou, SM  
Catherine E. French, SM  
John S. Gulliver, SM

Jerome F. Hajjar, SM  
Joseph F. Labuz, SM  
Panos Michalopoulos, SM  
John L. Nieber, Biosystems and Agricultural Engineering, ASM  
Fernando Porté-Agel, SM  
Michael J. Semmens, SM  
Karl A. Smith, SM  
Heinz G. Stefan, SM  
Henryk K. Stolarski, SM  
Otto D. L. Strack, SM  
Vaughan R. Voller, SM

### Associate Professor

William A. Arnold, SM  
Randal J. Barnes, SM  
Bojan B. Guzina, SM  
Miki Hondzo, SM  
Raymond M. Hozalski, SM  
Lev Khazanovich, SM  
David M. Levinson, SM  
Paige J. Novak, SM  
Fernando Porté-Agel, SM  
Arturo E. Schultz, SM  
Carol K. Shield, SM  
Paul D. Capel, AM2

### Assistant Professor

Kevin J. Krizek, Urban and Regional Planning, AM2  
Timothy M. LaPara, SM  
Mihai O. Marasteanu, SM

### Senior Research Associate

Sofia G. Mogilevskaia, ASM  
Venugopal Vuruputur, AM2

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, traffic safety), 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 engineering is required.

### Special Application Requirements—

Applicants are required to submit results of the GRE in support of their applications. A preferred score of 550 on the paper-based or 213 on the computer-based TOEFL is required of foreign applicants from non-English-speaking countries. 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.

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

**Use of 4xxx Courses**—Inclusion of 4xxx department 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.

### 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 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 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, students 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 a 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; cnes@umn.edu; <http://cnes.cla.umn.edu>).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

### Regents Professor

Thomas Clayton, English, ASM

### Professor

Elizabeth Belfiore, SM  
Andrea Berlin, SM  
Frederick Cooper, Art History, ASM  
Sheila McNally, Art History, ASM  
S. Douglas Olson, SM  
Sandra Peterson, Philosophy, ASM  
Theofanis G. Stavrou, History, ASM  
Peter Wells, Anthropology, ASM

### Associate Professor

Nita Krevans, SM  
Bernard Levinson, SM  
Christopher Nappa, M2  
Oliver Nicholson, SM  
Philip Sellow, SM  
George Sheets, SM  
John Steyaert, Art History, ASM

### Assistant Professor

Ra'anan Boustan, AM2  
Lauren Monroe, AM2  
Eva Von Dassow, M2  
Amanda Wilcox, M2

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**—Classical and Near Eastern Studies (CNES) is an interdisciplinary department that brings together faculty and graduate students who might in other settings be dispersed among a wide range of programs. CNES is dedicated to rigorous philological and literary training and to the conviction that the ancient Mediterranean world is best studied as a diverse but richly integrated cultural whole. The various M.A. and Ph.D. tracks allow students to concentrate in the area and period that most appeals to them, but students are strongly encouraged to take courses across the entire range of the department's offerings and to develop a broad, multidisciplinary approach to research and teaching. Students entering the Ph.D. program with an M.A. can usually receive credit for some earlier coursework, subject to the approval of the graduate faculty and graduate school requirements. Related special facilities include the Center for Medieval Studies, the Center for Jewish Studies, and the Center for Modern Greek Studies.

**Prerequisites for Admission**—For the major track in ancient and medieval art and archaeology, a background in archaeology, art history, and history sufficient to begin graduate level studies in the discipline, and evidence of language-acquisition ability. For the major track in classics, sufficient knowledge to begin graduate reading courses in either Greek or Latin and at least intermediate ability in the other language. For the major tracks in Greek or Latin, sufficient knowledge to begin graduate reading courses in the language of the track. For the major in religions in antiquity, an undergraduate background in the field and sufficient knowledge to begin graduate reading courses in classical Hebrew, Greek, or Latin. Some course prerequisites can be made up on provisional admission.

Applications are welcome from students with undergraduate majors in fields such as ancient Near Eastern studies, art history, biblical studies, classical archaeology, classics, history, Jewish studies, linguistics, and religious studies.

**Special Application Requirements**—Applicants must send the following directly to the Department of Classical and Near Eastern Studies: department application; copy of all transcripts; copy of the GRE; three letters of recommendation from persons well acquainted with the student's academic work and professional experience; and a statement describing the student's intended course of study and professional goals. For nonnative speakers of English, a copy of the TOEFL is required. Students may be admitted in any academic term, but financial assistance is normally available only to applicants admitted for fall semester (deadline: February 10).

**Courses**—Please refer to Akkadian (Akka), Aramaic (Arm), Classical and Near Eastern Studies (CNES), 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.

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

## Ancient and Medieval Art and Archaeology Track

### M.A. Degree Requirements

The degree allows concentrations ranging broadly over the ancient and medieval periods, with an emphasis on art historical and archaeological approaches. Work in an appropriate ancient language is encouraged.

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**—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 CNES 5794, as well as 9 credits in graduate art/archaeology courses with a CNES designator.

### Ph.D. Degree Requirements

The degree allows concentrations ranging broadly over the ancient and medieval periods, with an emphasis on art historical and archaeological approaches. Graduate-level ability in an appropriate ancient language is required for graduation.

Students who continue from the M.A. program may apply those credits toward the Ph.D., with the exception of Plan A thesis credits or Plan B paper credits. A typical Ph.D. program is at least 71 credits, including at least 21 credits in the major, 12 in a 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 are required.

**Minor Requirements for Students Majoring in Other Fields**—Students must complete CNES 5794, as well as 12 credits in graduate art/archaeology courses with a CNES designator.

## Classics Track

### M.A. Degree Requirements

This program provides a broad training in the literature of ancient Greece and Rome in its cultural context. Work in Greek and Latin is supplemented by courses in a related field or area of interest.

The program requires nearly equal emphasis on courses and seminars in Greek and in Latin, as well as supporting work in a related field or area of interest. 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 both Greek and Latin as certified by a department exam on previously unseen passages is required.

**Final Exam**—The final exams are written (Greek and Latin reading proficiency) and oral (general).

**Minor Requirements for Students Majoring in Other Fields**—Students must complete CNES 5794, as well as 6 credits in graduate-level Latin courses (excluding Lat 8120) and 6 credits in graduate-level Greek courses (excluding Grk 8120).

### Ph.D. Degree Requirements

This program requires extensive advanced work in both Latin and Greek, together with some study in a related field or area of interest.

The program requires nearly equal emphasis on courses and seminars in Greek and in Latin. Students must take at least three seminars in the major, a graduate level course in archaeology, 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, with the exception of Plan A thesis credits or Plan B paper credits. 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 CNES 5794, as well as 9 graduate credits of Greek (excluding Grk 8120) and 9 graduate credits of Latin (excluding Lat 8120).

## Greek Track

### M.A. Degree Requirements

A core of advanced work in Greek is supplemented by a minor or supporting program in a related field or area of interest. 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 CNES 5794, as well as 9 graduate credits of Greek (excluding Grk 8120).

### **Ph.D. Degree Requirements**

A core of advanced work in Greek is supplemented by a minor or a supporting program in a related field or area of interest. Students must take at least three seminars in the major, a graduate level course in archaeology, 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, with the exception of Plan A thesis or Plan B paper credits. 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 CNES 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 supporting program in a related field or area of interest. 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 (Latin reading proficiency) and oral (general).

**Minor Requirements for Students Majoring in Other Fields**—Students must complete CNES 5794, as well as 9 graduate credits of Latin (excluding Lat 8120).

### **Ph.D. Degree Requirements**

A core of advanced work in Latin is supplemented by a minor or supporting program in a related field or area of interest. Students must take at least three seminars in the major, a graduate level course in archaeology, 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, with the exception of Plan A thesis credits or Plan B

paper credits. 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, normally 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 CNES 5794 and 15 graduate credits of Latin (excluding Lat 8120).

### **Religions in Antiquity Track**

#### **M.A. Degree Requirements**

The religions in antiquity track is comparative in both method and content. Although students may focus on a particular religious tradition, they will nonetheless study several ancient religions. The Plan A requires 22 credits in the major, 9 credits in a related field, plus 10 thesis credits. The Plan B requires 26 credits in the major plus 9 credits in a related field.

**Language Requirements**—Proficiency in one modern language (normally German) and M.A.-level proficiency in classical Hebrew, Greek, or Latin as demonstrated by a department exam on previously unseen passages is required.

**Final Exam**—The final exams are written (ancient language reading proficiency) and oral (general).

### **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; cls@umn.edu; <http://medtech.umn.edu/MSClinicalLab>).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

#### **Professor**

Fred S. Apple, Laboratory Medicine and Pathology, M2  
Henry H. Balfour, Jr., Laboratory Medicine and Pathology, M2  
Paul P. Cleary, Microbiology, M2  
Agustin P. Dalmaso, Laboratory Medicine and Pathology, M2  
Gary M. Dunny, Microbiology, M2  
John H. Eckfeldt, Laboratory Medicine and Pathology, M2  
Stanley L. Erlandsen, Cell Biology and Neuroanatomy, M2

Patricia Ferrieri, Laboratory Medicine and Pathology, M2

Robert P. Hebbel, Medicine, M2

Stephen S. Hecht, Laboratory Medicine and Pathology, M2

Ronald R. W. Jemmerson, Microbiology, M2

Marc K. Jenkins, Microbiology, M2

Russell C. Johnson, Microbiology, M2

Vivek Kapur, Veterinary Pathobiology, M2

John H. Kersey, Laboratory Medicine and Pathology, M2

Nigel Key, Medicine, M2

Tucker W. LeBien, Laboratory Medicine and Pathology, M2

J. Jeffrey McCullough, Laboratory Medicine and Pathology, M2

R. Scott McIvor, Laboratory Medicine and Pathology, M2

Gary L. Nelsestuen, Biochemistry, M2

Harry T. Orr, Laboratory Medicine and Pathology, M2

Gundu H. R. Rao, Laboratory Medicine and Pathology, M2

Jagdev M. Sharma, Veterinary Pathobiology, M2

Michael Y. Tsai, Laboratory Medicine and Pathology, M2

Daniel A. Vallera, Therapeutic Radiology, M2

Catherine M. Verfaillie, Medicine, M2

Carol L. Wells, Laboratory Medicine and Pathology, M2

Michael J. Wilson, Laboratory Medicine and Pathology, M2

#### **Associate Professor**

Ronald C. McGlennen, Laboratory Medicine and Pathology, M2

Timothy W. Olsen, Ophthalmology, M2

Amy P. Skubitz, Laboratory Medicine and Pathology, M2

William R. Swaim, Laboratory Medicine and Pathology, M2

#### **Assistant Professor**

Connie J. Gebhart, Veterinary Pathobiology, M2

Angela Panoskaltis-Mortari, Pediatrics, M2

Kim-Sue Tudor, Laboratory Medicine and Pathology, M2

Xinjing Wang, Laboratory Medicine and Pathology, M2

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 preferred TOEFL score of 213 computer-based and 550 paper test is required for applicants whose native language is not English.

**Courses—**Please see Clinical Laboratory Science (CLS) in the course section of this catalog for courses pertaining to the program.

**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., MedT 4104 and 4105—Principles of Diagnostic Microbiology: Lecture and Lab, MedT 4251—Hematology I: Basic Techniques, MedT 4310 and 4311—Clinical Chemistry I and II: Lecture and Lab). However, credit will not be granted if the CLS equivalent of these MedT courses was taken as part of an undergraduate degree.

**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; sph-ssc@umn.edu; www.sph.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

**Professor**

Linda H. Bearinger, Nursing, M2  
Carole J. Bland, Family Medicine and Community Health, M2  
Donna Z. Bliss, Nursing, M2  
Hanna Bloomfield, Medicine, M2  
James C. Cloyd III, Pharmacy Practice, M2  
Allan J. Collins, Medicine, M2  
Daniel Duprez, Medicine, M2  
Kristine E. Ensrud, Medicine, M2  
Richard H. Grimm, Medicine, M2

Dorothy Hatsukami, Psychiatry, M2  
Robert L. Kane, Health Services Research and Policy, M2  
Joseph M. Keenan, Family Medicine and Community Health, M2  
Nigel S. Key, Medicine, M2  
Frank Lederle, Medicine, M2  
Russell V. Luepker, Epidemiology and Community Health, M2  
Antoinette Moran, Pediatrics, M2  
Jim D. Neaton, Biostatistics, M2  
Joseph Neglia, Pediatrics, M2  
Thomas E. Nevins, Pediatrics, M2  
Mark S. Paller, Medicine, M2  
Bruce A. Peterson, Medicine, M2  
Leslie L. Robison, Pediatrics, M2  
S. Charles Schulz, Psychiatry, M2  
Elizabeth R. Seaquist, Medicine, M2  
Daniel J. Weisdorf, Medicine, M2  
Douglas Yee, Medicine, M2

**Associate Professor**

K. Scott Baker, Pediatrics, M2  
Gregory J. Beilman, Surgery, M2  
Linda J. Burns, Medicine, M2  
Patricia Fontaine, Family Medicine and Community Health, M2  
Edward W. Greeno, Medicine, M2  
James G. Gurney, Pediatrics, M2  
David R. Hardten, Ophthalmology, M2  
Timothy D. Henry, Medicine, M2  
Alan T. Hirsch, Medicine, M2  
Andrew J. W. Huang, Ophthalmology, M2  
Karen L. Margolis, Medicine, M2  
Ann C. Mertens, Pediatrics, M2  
Timothy W. Schacker, Medicine, M2  
M. Kathryn Schmitz, Epidemiology and Community Health, M2  
John William Thomas, Biostatistics, M2

**Assistant Professor**

Alan K. Berger, Medicine, M2  
Hassan N. Ibrahim, Medicine, M2  
Mark A. Pereira, Epidemiology and Community Health, M2  
Mark W. Yeazel, Family Medicine and Community Health, M2

**Senior Research Associate**

John O. Look, Diagnostic and Surgical Science, M2

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 human 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.O., 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). Students must have completed or be at an advanced stage of their clinical practice training and be affiliated with someone at the University of Minnesota who can provide advising and access to a clinical project. The admissions committee considers exceptions on an individual basis.

**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 with a preferred performance level of at least 600 (written) or 250 (computer) is required of international students who have earned all of their degrees from nonnative English speaking countries. There are three exceptions: 1) students who have taken and successfully passed the ECFMG or USMLE exams 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 are exempt from providing an official TOEFL score if they provide a transcript of these credits; 3) the MELAB has been taken as an alternative exam to the TOEFL. The GRE is not required. One of the three required recommendation letters and a 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:** faculty members at the University of Minnesota above the rank of instructor have additional administrative procedures required by the Graduate School. Contact the Graduate School Admissions Office early in the process.

For an online application, see the School of Public Health Web site at [www.sph.umn.edu/students/application/home.html](http://www.sph.umn.edu/students/application/home.html). **Note:** If you are or ever were a student in the University of Minnesota Graduate School and you are applying to any graduate or professional program in the University of Minnesota, you must complete a change of status application. See the Graduate School Web site for the appropriate form and fee at [www.grad.umn.edu/current\\_students/forms/cos.pdf](http://www.grad.umn.edu/current_students/forms/cos.pdf).

**Courses—**Please refer to the clinical research program available on the School of Public Health Web site at [www.epi.umn.edu/academic/ms\\_cr.shtm](http://www.epi.umn.edu/academic/ms_cr.shtm) for courses pertaining to the program.

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

### **M.S. Plan A Requirements**

The M.S. requires 38 credits, including 3 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 requires an active role in an ongoing approved clinical research project, and has specific requirements which are clarified in the student guidebook.

**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 6 credits. Contact the major coordinator for more information at [gradstudies@epi.umn.edu](mailto:gradstudies@epi.umn.edu).

## **Cognitive Science**

### **Minor Only**

**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; [ccs@cogsci.umn.edu](mailto:ccs@cogsci.umn.edu); <http://cogsci.umn.edu>).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

#### **Professor**

Patricia J. Bauer, Child Development, M  
Maria Gini, Computer Science, M  
Jeanette K. Gundel, Linguistics, ESL, and Slavic Languages and Literatures, M  
Keith Gunderson, Philosophy, M  
Paul E. Johnson, Information and Decision Sciences, M  
Michael B. Kac, Philosophy, M  
Daniel J. Kersten, Psychology, M  
Gordon E. Legge, Psychology, M  
Charles A. Nelson, Child Development, M  
J. Bruce Overmier, Psychology, M  
Herbert L. Pick, Jr., Child Development, M  
C. Wade Savage, Philosophy, M  
Maria D. Sera, Child Development, M  
Paulus W. van den Broek, M  
Albert Yonas, Child Development, M

#### **Associate Professor**

Charles R. Fletcher, Psychology, M  
Chad J. Marsolek, Psychology, M

#### **Clinical Associate Professor**

Mary Jo Nissen, Psychology, M

**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.

**Courses**—Please refer to the minor program office for coursework pertaining to the program.

**Use of 4xxx Courses**—4xxx courses may not be included on degree program forms for the cognitive science minor.

### **Minor Only 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**

See Speech-Language-Hearing Sciences.

## **Communication Studies**

**Contact Information**—Department of Communication Studies, University of Minnesota, 225 Ford Hall, 224 Church Street S.E., Minneapolis, MN 55455 (612-624-5800; [www.comm.umn.edu](http://www.comm.umn.edu)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

#### **Professor**

Donald R. Browne, SM  
Karlyn K. Campbell, SM  
W. Andrew Collins, ASM  
Alan G. Gross, ASM  
Laura J. Gurak, ASM  
Dean E. Hewes, SM  
Edward Schiappa, SM  
Mary M. Lay Schuster, ASM  
Robert L. Scott (emeritus), ASM  
Amy L. Sheldon, SM

Michael Sunnafrank, Communication, Duluth, AM2

Arthur E. Walzer, ASM

#### **Associate Professor**

Rosita D. Albert, SM  
Ronald W. Greene, SM  
Ascan F. Koerner, M2  
David L. Rarick (emeritus), ASM  
Mary D. Vavrus, SM  
Kirt H. Wilson, SM

#### **Assistant Professor**

Susanne M. Jones, M2

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**—Communication studies focuses on the study of communicative dimensions of human experience using humanistic and social scientific methods. This program prepares students to become researchers and teachers, offering three concentrations: communication theory, rhetorical studies, and critical media studies.

Coursework in communication theory has a social scientific orientation. Most students focus on a subarea such as small group, intercultural, electronic media, interpersonal communication, or problems (e.g., decision making, conflict resolution). 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.

Coursework in rhetoric and public address emphasizes humanistic methods and includes argumentation and persuasion, ethics, rhetorical theory and criticism, and American public address. Students may also pursue special interests in rhetorical philosophies, movements and campaigns, 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.

Coursework in critical media studies emphasizes qualitative, historical, critical, and empirical methods and includes electronic media studies, feminist media studies, ethnic and racial minorities in media, critical media literacy, political economy of media, popular culture, and media regulation and industries. Coursework outside the department is usually in the fields of political science, cultural studies, or women's studies.

**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 postsecondary academic work, and a written statement of academic and occupational objectives. Three letters of recommendation and a writing sample 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.

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

**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.

**M.A. Degree Requirements**

The degree is offered under Plan A (thesis) and Plan B (without thesis). Both plans require a minimum of 15 course credits in communication studies, including Comm 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 paper, 6 additional course credits in communication studies, and an additional 6 credits in either communication studies or related fields.

**Language Requirements—**None.

**Ph.D. Degree Requirements**

Students are expected 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; Comm 5615 and 5421 or equivalents must be included); 24 thesis credits are required.

The program should include 12 credits in research methods relevant for completing the degree and continuing a scholarly career. Under certain circumstances, foreign language courses may be used to satisfy this requirement.

**Language Requirements—**None.

**Comparative and Molecular Biosciences**

**Contact Information—**Director of Graduate Studies, Comparative and Molecular Biosciences Graduate Program, College of Veterinary Medicine, 443 VMC, 1365 Gortner Avenue, St. Paul, MN 55108 (612-624-7413; fax 612-625-4734; mvb@umn.edu; www.cvm.umn.edu /ResearchandGradProg/GradPrograms /MolecularVetBiosci).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

**Professor**

Mitchell S. Abrahamsen, Veterinary and Biomedical Sciences, SM  
 Alvin J. Beitz, Veterinary and Biomedical Sciences, SM  
 Russell F. Bey, Veterinary and Biomedical Sciences, SM  
 David R. Brown, Veterinary and Biomedical Sciences, SM  
 Cathy Sue Carlson, Veterinary Population Medicine, SM  
 Douglas N. Foster, Animal Science, SM  
 Sagar Goyal, Veterinary Population Medicine, SM  
 Richard Isaacson, Veterinary and Biomedical Sciences, SM  
 Mathur S. Kannan, Veterinary and Biomedical Sciences, SM  
 Vivek Kapur, Microbiology, SM  
 Alice A. Larson, Veterinary and Biomedical Sciences, SM  
 Samuel K. Maheswaran, Veterinary and Biomedical Sciences, SM  
 James R. Mickelson, Veterinary and Biomedical Sciences, SM  
 Thomas W. Molitor, Veterinary Population Medicine, SM  
 Michael P. Murtaugh, Veterinary and Biomedical Sciences, SM  
 Scott M. O'Grady, Animal Science, SM  
 John W. Osborn, Physiology, SM  
 Stephanie J. Valberg, Veterinary Population Medicine, SM  
 Robert Washabau, Veterinary Clinical Sciences, SM  
 Douglas J. Weiss, Veterinary and Biomedical Sciences, SM

**Associate Professor**

Yang Da, Animal Science, SM  
 Kay S. Faaberg, Veterinary and Biomedical Sciences, SM  
 Scott Fahrenkrug, Animal Science, SM  
 James R. Lokensgard, Medicine, SM  
 Moses Njenga, Veterinary and Biomedical Sciences, SM  
 Kent Reed, Veterinary and Biomedical Sciences, SM  
 Mark S. Rutherford, Veterinary and Biomedical Sciences, SM  
 Leslie Sharkey, Veterinary Population Medicine, SM  
 Anthony Tobias, Veterinary Clinical Sciences, SM  
 Bruce K. Walcheck, Veterinary and Biomedical Sciences, SM  
 Scott Wells, Veterinary Population Medicine, SM

**Assistant Professor**

Dori Borjesson, Veterinary Population Medicine, SM  
 John Collister, Veterinary and Biomedical Sciences, SM  
 Yinduo Ji, Veterinary and Biomedical Sciences, SM  
 Sagarika Kanjilal, Veterinary and Biomedical Sciences, SM  
 Laura J. Mauro, Animal Science, SM  
 Elizabeth A. McNeil, Veterinary Clinical Sciences, SM  
 Randall Singer, Veterinary and Biomedical Sciences, SM  
 Pam Skinner, Veterinary and Biomedical Sciences, SM

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 comparative and molecular biosciences (CMB) graduate program is interdisciplinary and intercollegiate, drawing Academic Health Center faculty from the Departments of Medicine, Microbiology, Physiology, Veterinary and Biomedical Sciences, Veterinary Population Medicine, and College of Agriculture, Food and Environmental Sciences are important contributors to the mission of the CMB graduate program. The program brings together both basic and clinical scientists to provide students with individualized, cutting-edge research training on the causes, mechanisms, and manifestations of disease. The research programs utilize comparative aspects of biology and pathology across all species and implement animal models for understanding human disease processes. The scientific training students experience lead to a career as an independent investigator in one of two general areas: molecular mechanisms of pathogenesis in animals (immunobiology, microbiology, pathology) or comparative biomedical sciences (genetics and genomics, cellular and molecular biology, neuroscience, physiology, and pharmacology).

**Prerequisites for Admission—**A bachelor's degree in a biological or basic science is required.

**Special Application Requirements—**

Applicants must submit scores from the GRE General Test, a CV or résumé, 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 research experience as well as 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 research assistantships awarded for the next academic year. Students are typically admitted for fall semester.

**Courses—**Please refer to Comparative and Molecular Biosciences (CMB) in the course section of this catalog for courses pertaining to the program.

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

**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 a minimum of 20 course credits and 10 thesis credits; the thesis is based on original laboratory research.

**Language Requirements—**None.

**Final Exam—**The final exam is written and 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 and research. Students typically complete 24–30 credits in the major field and 12 credits in a minor or supporting program for a recommended total of 36–42 credits. In addition, 24 thesis credits are required. All students are required to complete a science ethics course and a teaching experience.

**Language Requirements**—None.

## **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; [complit@umn.edu](mailto:complit@umn.edu); <http://complit.cla.umn.edu>).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

### **Professor**

Timothy A. Brennan, SM  
John W. Mowitz, SM  
Harvey B. Sarles, SM  
Jochen Schulte-Sasse, German, Scandinavian, and Dutch, SM  
Nicholas Spadaccini, Spanish and Portuguese Studies, AM2  
Arlene Teraoka, German, Scandinavian, and Dutch, ASM  
Jack D. Zipes, German, Scandinavian, and Dutch, ASM

### **Associate Professor**

Maria M. Brewer, French and Italian, ASM  
Robert Brown, SM  
Cesare Casarino, SM  
Keya Ganguly, SM  
Leslie Morris, German, Scandinavian, and Dutch, ASM  
Thomas A. Pepper, SM

### **Assistant Professor**

Elizabeth W. Kotz, Cultural Studies and Comparative Literature, SM  
Shaden M. Tageldin, Cultural Studies and Comparative Literature, SM

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 in comparative literature nationally 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**—Scores from the General (Aptitude) Test of the GRE are required. Applications for admission as well as applications for financial aid must be postmarked by the December 10 deadline.

**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.

**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.

### **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 proficiency in one language and basic proficiency in 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 CSDS 8901—Pedagogy of Cultural Studies and Comparative Literature, 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 students in consultation with their 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, the following language competencies are required: high proficiency in two languages and basic proficiency in a third language. The choice of languages is made with respect to the student's area of specialization and in consultation with and approval of, the adviser. Language requirements must be completed before taking the preliminary examination.

**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; [csds@umn.edu](mailto:csds@umn.edu); <http://csds.cla.umn.edu>).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

### **Professor**

W. John Archer, Cultural Studies and Comparative Literature, SM  
Timothy Brennan, Cultural Studies and Comparative Literature, SM  
Richard D. Leppert, Cultural Studies and Comparative Literature, SM  
Ellen Messer-Davidow, English, ASM  
John W. Mowitz, Cultural Studies and Comparative Literature, SM  
Paula Rabinowitz, English, ASM  
Harvey Sarles, Cultural Studies and Comparative Literature, SM  
Jochen Schulte-Sasse, German, Scandinavian, and Dutch, SM  
Arlene Teraoka, German, Scandinavian, and Dutch, ASM  
Jack D. Zipes, German, Scandinavian, and Dutch, ASM

**Associate Professor**

Robert L. Brown, Jr., Cultural Studies and Comparative Literature, SM  
 Cesare Casarino, Cultural Studies and Comparative Literature, SM  
 Maria Damon, English, ASM  
 Keya Ganguly, Cultural Studies and Comparative Literature, SM  
 Roger P. Miller, Geography, ASM  
 Leslie Morris, German, Scandinavian, and Dutch, ASM  
 Thomas Pepper, Cultural Studies and Comparative Literature, SM  
 Katherine M. Solomonson, Architecture, ASM  
 Gary C. Thomas, Cultural Studies and Comparative Literature, SM  
 Jacquelyn N. Zita, Women's Studies, ASM

**Assistant Professor**

Hisham Bizri, Cultural Studies and Comparative Literature, SM  
 Leo Chanjen Chen, Cultural Studies and Comparative Literature, M  
 Elizabeth W. Kotz, Cultural Studies and Comparative Literature, SM

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 re-associate 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 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. Applications for admission as well as applications for financial aid must be postmarked by the December 10 deadline.

**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.

**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.

**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 graduate credits, 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 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 student's program is required. Language requirement must be completed before taking the preliminary examination.

**Minor Requirements for Students Majoring in Other Fields**—A minimum of 16 is required for a Ph.D. minor and must include CSDS 8001 and 8002.

**Complementary Therapies and Healing Practices****Minor Only**

**Contact Information**—Center for Spirituality and Healing, MMC 505, 420 Delaware Street S.E., Minneapolis, MN 55455 (612-624-5166; fax 612-626-5280; www.csh.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/stepl](http://www.grad.umn.edu/faculty_rosters/stepl).

**Professor**

Linda J. Brady, M  
 Francis F. Busta (emeritus), AM  
 Richard Kingston, M  
 Ruth A. Lindquist, M  
 Barbara Leonard, M  
 Robert P. Patterson, M  
 Mariah Snyder (emeritus), AM  
 Marilyn Speedie, M  
 Mark S. Umbreit, M

**Associate Professor**

Linda L. Chlan, M  
 Laura Duckett, M  
 V. Lois Erickson, M  
 Linda Halcon, M  
 Craig A. Hassel, M  
 Mary Jo Kreitzer, M  
 Gregory Plotnikoff, M  
 Pamela J. Schreiner, M  
 Carla Tabourne, M

**Assistant Professor**

Donald R. Houge (emeritus), AM  
 Karen Lawson, M  
 Gretchen M. Zunkel, M

**Associate Clinical Specialist**

Kate M. Hathaway, AM

**Lecturer**

Miriam Cameron, M  
 Pat Culliton, M  
 Dennis McKenna, M  
 Sue M. Towey, M

**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 enhances the preparation of graduate students in health sciences and other disciplines by developing knowledge and skills in the emerging field of complementary and alternative health care. Specifically, the minor provides students with a theoretical basis for applying complementary therapies and healing practices; prepares students to research complementary therapies and healing practices; and prepares students to work collaboratively with other health professionals and patients in a multicultural, pluralistic health care 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; contact the minor program office for more information.

**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.

**Courses**—Please refer to Center for Spirituality and Healing (CSpH) in the course section of this catalog. Contact the minor program office for the most current information on relevant coursework pertaining to the program.

**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.

### Minor Requirements

Master's and doctoral students take CSpH 5101 (3 cr) and 8101 (1 cr). Master's students must take an additional 4 credits for a total of 8 credits; doctoral students must take an additional 1 credit 8xxx CSpH elective course 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.

### Postbaccalaureate Certificate

**Curriculum**—The certificate program is open to graduate students both in a major at the master's or doctoral levels or those not in a graduate program. The curriculum for the certificate program has three areas of focus:

clinical applications, spirituality, and cross-cultural health and healing. The certificate program is individualized.

**Prerequisites for Admission**—Applicants must have a bachelor's degree in a health-related field such as nursing or a graduate degree in medicine, public health, or pharmacy from an accredited U.S. institution or a foreign equivalent and a 3.00 GPA. Non-English speaking students need a TOEFL score of 550 printed test (213 for the computer-based version).

**Special Application Requirements**—In addition to the Graduate School online application, applicants must submit a letter describing their goals for obtaining the certificate and their professional qualifications. The statement should address this question: What are your short- and long-term professional goals after you complete the postbaccalaureate certificate program in complementary therapies and healing practices? Please be as specific as possible. Two letters of support are required if the individual is not currently enrolled in a graduate program at the University of Minnesota, one from an academic source and one from an employer/supervisor. A current CV is also requested. Goal statement, letters of support, and CV should be mailed to: Center for Spirituality and Healing, MMC 505, 420 Delaware Street SE, Minneapolis, MN 55455

The director of the Center for Spirituality and Healing assigns an adviser to each student as they are admitted to the certificate program. Advisers are any of the graduate faculty holding member status in the complementary therapies and healing practices minor. Students complete the Graduate School's postbaccalaureate program form, have it signed by the adviser and director of graduate studies, and filed with the Graduate School. The program must be filed before completion of 6 credits. Eligible coursework includes a minimum of 12 CSpH graduate credits or those courses from other majors or minors in the Graduate School that the CSpH faculty has approved for use in the CSpH minor. Students may transfer in up to 3 credits after approved by the CSpH director of graduate studies. Twenty percent of total credits may be taken on an S-N grade basis. The student must complete the program in no more than four years if enrolled for certificate only. Registration is required every fall and spring semester.

**Courses**—Please refer to Center for Spirituality and Healing (CSpH) in the course section of this catalog. Contact the minor program office for the most current information on relevant coursework pertaining to the program.

**Use of 4xxx Courses**—No 4xxx courses are permitted.

### Certificate Requirements

A total of twelve (12) semester credits are required to complete the certificate. Required courses: CSpH 5101—Introduction

to Complementary Therapies and Healing Practices (3 cr) and CSpH 5102—Art of Healing: Self as Healer (1 cr). Students are encouraged to choose the remaining 8 credits from courses consistent with their academic training and professional goals. The student's faculty adviser works with the student in designing a program plan that accommodates the student's unique learning objectives. To earn a certificate, the preferred GPA for all courses is 2.80.

## Composition, Literacy, and Rhetorical Studies

See Literacy and Rhetorical Studies.

## Computer Science

**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; [dgs@cs.umn.edu](mailto:dgs@cs.umn.edu); [www.cs.umn.edu](http://www.cs.umn.edu)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/stepl.asp](http://www.grad.umn.edu/faculty_rosters/stepl.asp).

### Professor

Daniel L. Boley, SM  
John V. Carlis, SM  
Vladimir Cherkassky, Electrical and Computer Engineering, ASM  
David H. Du, SM  
Ding-Zhu Du, SM  
Maria Gini, SM  
Caroline Hayes, AM2  
Ravi Janardan, SM  
Paul E. Johnson, Information and Decision Sciences, AM2  
Daniel J. Kersten, Psychology, ASM  
Larry L. Kinney, Electrical and Computer Engineering, AM2  
Joseph A. Konstan, SM  
Vipin Kumar, SM  
E. Bruce Lee, Electrical and Computer Engineering, ASM  
David J. Lilja, Electrical and Computer Engineering, ASM  
Arthur L. Norberg, SM  
Nikolaos P. Papanikolopoulos, SM  
Haesun Park, SM  
John T. Riedl, SM  
Yousef Saad, SM  
Shashi Shekhar, SM  
Eugene B. Shragowitz, SM  
Jaideep Srivastava, SM  
Anand R. Tripathi, SM  
Pen-Chung Yew, SM

### Associate Professor

Mats P. E. Heimdahl, SM  
Wei-Chung Hsu, SM  
Victoria Interrante, SM  
George Karypis, SM  
Richard Maclin, Computer Science, Duluth, AM2  
Gary Meyer, SM



Gopalan Nadathur, SM  
 Ted Pedersen, Computer Science, Duluth, AM2  
 Sachin Sapatnekar, Electrical and Computer Engineering, ASM  
 Masha Sosonkina, Computer Science, Duluth, AM2  
 Loren Terveen, SM  
 Hudson Turner, Computer Science, Duluth, AM2  
 Richard M. Voyles, SM  
 Jon Weissman, SM  
 Zhi-Li Zhang, SM

#### **Assistant Professor**

Abhishek Chandra, M2  
 Baoquan Chen, SM  
 Nicholas Hopper, M2  
 Yongdae Kim, M2  
 Donglin Liang, M2  
 Stergios Roumeliotis, M2  
 Paul Schrater, M2  
 William Schuler, M2  
 Erik Van Wyk, SM  
 Antonia Zhai, M2

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 computer science offers coursework from across a broad spectrum of theoretical and applied computer science, combined with research opportunities in nearly all areas of the field. The faculty of the graduate program advise students in such areas as algorithms and theoretical computer science; numerical, parallel, and high-performance computing; distributed computing and systems; artificial intelligence, robotics, and computer vision; databases and data mining; human-computer interaction and information systems; graphics and visualization; software engineering and programming languages; computer architecture and compilers; networking; and computer security. In addition, students may choose a course of study that integrates research in computer science with applications in other fields.

The computer science degrees include an M.C.S., M.S. (either Plan A with thesis or Plan B with project), and a Ph.D. The M.C.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. Many faculty from the Department of Computer Science and Engineering also participate in the graduate program in scientific computation.

**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. Master's and Ph.D. students are accepted for fall admission only. The application deadline is April 1. Students seeking financial aid must apply by December 15.

**Research Facilities**—Graduate students have access to a wide range of computing facilities and equipment from the powerful supercomputers in the Minnesota Supercomputer Institute and Army High Performance Computing Research Center to handheld and portable computers used in research on mobile and location-aware computing. Specialized laboratories provide support for advanced graphics and visualization, virtual reality, computer networking, and distributed robotics. More general-purpose dedicated laboratories support a wide range of research activities, and shared graduate student laboratories provide extra computing for class work and other studies.

**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.S. Coursework Only Degree Requirements**

The M.C.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 three different areas: theory, systems and applications; 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 complete 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.

#### **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 three different areas, Theory, Systems and Applications. For

Plan A, at least 10 thesis credits are required; for Plan B, three Plan B project credits are required. Students must also complete 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 minor in computer science for master's students majoring in other fields must include 9 credits of graduate courses in CSci. The colloquium credit may not be included. There is a limit of one 4xxx course and a requirement of at least one 8xxx course or a 5xxx course that has a prerequisite of a 5xxx course. A minimum GPA of 3.00 is preferred for these courses.

#### **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**—A minor in computer science for PhD students majoring in other fields must include 13 credits of graduate courses in CSci, and should include the colloquium credit. There is a limit of one 4xxx course and a requirement of at least one 8xxx course or a 5xxx course that has a prerequisite of a 5xxx course. A minimum GPA of 3.25 is preferred for these courses.

## **Conflict Management**

### **Minor Only**

**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 (612-625-4534; fax 612-625-3513; neustis@hhh.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

### **Professor**

Mario F. Bognanno, Industrial Relations, M  
 Eugene Borgida, Psychology, M  
 Paul V. Ellefson, Forest Resources, AM  
 Mark S. Umbreit, Social Work, M

### **Associate Professor**

Kristen Nelson, Forest Resources, M  
 Melissa Stone, Humphrey Institute, M

### **Lecturer**

Thomas R. Fiutak, Independent Study, M

**Curriculum**—The conflict management minor, 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.

**Courses**—Appropriate courses are selected in consultation with the minor adviser and the director of graduate studies for the minor.

**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.

### Minor Only 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, 187 McNeal Hall, University of Minnesota, 1985 Buford Avenue, St. Paul, MN 55108 (612-624-7751; consbio@umn.edu; www.consbio.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

### Professor

Ira R. Adelman, Fisheries, Wildlife, and Conservation Biology, SM  
Deborah L. Allan, Soil, Water, and Climate, SM  
Donald N. Alstad, Ecology, Evolution, and Behavior, SM  
David E. Andersen, Fisheries, Wildlife, and Conservation Biology, SM  
Dorothy H. Anderson, Forest Resources, SM  
David A. Andow, Entomology, SM  
Franklin H. Barnwell, Ecology, Evolution, and Behavior, SM  
Marvin E. Bauer, Forest Resources, SM  
Jay C. Bell, Soil, Water, and Climate, M2  
Charles R. Blinn, Forest Resources, SM  
James L. Bowyer, Bio-based Products, SM  
Thomas E. Burk, Forest Resources, SM  
Vernon B. Cardwell, Agronomy and Plant Genetics, SM  
Jim Chen, Law School, SM  
Yosef Cohen, Fisheries, Wildlife, and Conservation Biology, SM

Kendall W. Corbin, Ecology, Evolution, and Behavior, SM  
James W. Curtsinger, Ecology, Evolution, and Behavior, SM  
Edward J. Cushing, Ecology, Evolution, and Behavior, SM  
Francesca J. Cuthbert, Fisheries, Wildlife, and Conservation Biology, SM  
K. William Easter, Applied Economics, SM  
Mohamed E. El Halawani, Animal Science, SM  
Robert G. Haight, Forest Resources, SM  
Nicholas R. Jordan, Agronomy and Plant Genetics, SM  
Anne R. D. Kapuscinski, Fisheries, Wildlife, and Conservation Biology, SM  
Scott M. Lanyon, Bell Museum of Natural History, SM  
Clarence L. Lehman, Ecology, Evolution, and Behavior, SM  
Robert McMaster, Geography, SM  
L. David Mech, Fisheries, Wildlife, and Conservation Biology, SM  
Patrice A. Morrow, Ecology, Evolution, and Behavior, SM  
Claudia Neuhauser, Ecology, Evolution, and Behavior, SM  
Raymond M. Newman, Fisheries, Wildlife, and Conservation Biology, SM  
Gerald J. Niemi, Natural Resources Research Institute, Duluth, SM  
James A. Perry, Fisheries, Wildlife, and Conservation Biology, SM  
A. Stephen Polasky, Applied Economics, SM  
Anne E. Pusey, Ecology, Evolution, and Behavior, SM  
Patrick T. Redig, Veterinary Clinical Sciences, SM  
Philip J. Regal, Ecology, Evolution, and Behavior, SM  
Peter B. Reich, Forest Resources, SM  
Carl Richards, Minnesota Sea Grant Program, Duluth, SM  
Carlisle F. Runge, Applied Economics, SM  
Abdi I. Samatar, Geography, SM  
Ruth G. Shaw, Ecology, Evolution, and Behavior, SM  
Donald B. Siniff, Ecology, Evolution, and Behavior, SM  
J. L. David Smith, Fisheries, Wildlife, and Conservation Biology, SM  
Peter W. Sorensen, Fisheries, Wildlife, and Conservation Biology, SM  
George R. Spangler, Fisheries, Wildlife, and Conservation Biology, SM  
Anthony M. Starfield, Ecology, Evolution, and Behavior, SM  
Robert W. Sterner, Ecology, Evolution, and Behavior, SM  
G. David Tilman, Ecology, Evolution, and Behavior, SM  
Bruce C. Vondracek, Fisheries, Wildlife, and Conservation Biology, SM  
Robert M. Zink, Ecology, Evolution, and Behavior, SM  
**Adjunct Professor**  
David Western, Fisheries, Wildlife, and Conservation Biology, SM  
**Associate Professor**  
Neil Anderson, Horticultural Science, SM  
Gerald T. Ankley, Fisheries, Wildlife, and Conservation Biology, SM  
Robert B. Blair, Fisheries, Wildlife, and Conservation Biology, SM

Paul V. Bolstad, Forest Resources, SM  
Jeffrey Broadbent, Sociology, SM  
Jay S. Coggins, Applied Economics, SM  
David C. Fulton, Fisheries, Wildlife, and Conservation Biology, SM  
Susan M. Galatowitsch, Horticultural Science, SM  
David L. Garshelis, Fisheries, Wildlife, and Conservation Biology, SM  
Tamara Giles-Vernick, History, SM  
Jamie Grodsky, Law School, SM  
Jay T. Hatch, General Science, SM  
Sarah Hobbie, Ecology, Evolution, and Behavior, SM  
Frances R. Homans, Applied Economics, SM  
Peter A. Jordan, Fisheries, Wildlife, and Conservation Biology, SM  
Katerine Klink, Geography, SM  
Richa Nagar, Women's Studies, SM  
Kristen C. Nelson, Forest Resources, SM  
Daniel J. Philippon, Rhetoric, SM  
Andrew M. Simons, Fisheries, Wildlife, and Conservation Biology, SM  
Roderick H. Squires, Geography, SM

### Assistant Professor

Charles S. Anderson, Fisheries, Wildlife, and Conservation Biology, AM2  
Todd Arnold, Fisheries, Wildlife, and Conservation Biology, SM  
David N. Bengston, Forest Resources, SM  
Jaques Finlay, Ecology, Evolution, and Behavior, SM  
Sharon A. Jansa, Ecology, Evolution, and Behavior, SM  
Mike Kilgore, Forest Resources, SM  
Diane L. Larson, Ecology, Evolution, and Behavior, SM  
John P. Loegering, Center for Ag/Natural Resources, Crookston, M2  
Steven Manson, Geography, SM  
Karen S. Oberhauser, Fisheries, Wildlife, and Conservation Biology, SM  
Donald L. Pereira, Fisheries, Wildlife, and Conservation Biology, ASM  
Ellen E. Strong, Ecology, Evolution, and Behavior, SM  
Shinya Sugita, Ecology, Evolution, and Behavior, SM  
Edward Swain, Fisheries, Wildlife, and Conservation Biology, SM  
Susy Ziegler, Geography, SM

### Adjunct Assistant Professor

Meredith Cornett, Forest Resources, SM

### Lecturer

Thomas R. Fiutak, Educational Policy and Administration, SM

### Research Associate

Lee E. Frelich, Forest Resources, SM  
Loren M. Miller, Fisheries, Wildlife, and Conservation Biology, M2  
Ingrid E. Schneider, Forest Resources, SM  
Naomi Zeitouni, Applied Economics, SM

### Other

Jennifer Kuzma, HHH Institute of Public Affairs, SM

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. Students may select a named track, fisheries and aquatic biology, which offers an aquatic specialization. Students may also pursue a joint degree in law and conservation biology through the joint law degree program. 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./B.A. 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. Applicants to the joint law degree program must also apply to the Law School. Application deadline is January 1. Typically students only are admitted for fall semester.

**Research Facilities**—Faculty are involved in local, regional, national, and international programs of research and education. Local research facilities include Cedar Creek Natural History Area, Cloquet Forestry Center, Itasca Biological Station and Laboratories, the Bell Museum of Natural History. Fisheries and aquatic biology research is conducted in the many lakes, rivers, and streams that Minnesota is famous for and in 13,000 feet of wet-lab space on the St Paul campus with dedicated wells and water conditioning equipment. The program is strongly linked with on-campus institutes such as the Institute for Social, Economic, and Ecological Sustainability and the Interdisciplinary Center for the Study of Global Change

**Courses**—Conservation biology students take courses offered by a variety of colleges and departments across the University, including but not limited to fisheries, wildlife, and conservation biology; ecology, evolution, and behavior; soil, water, and climate; forest resources; geography; sociology; applied economics; and public policy. Acceptable

courses for the degree are chosen in consultation with the adviser.

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

### 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 electives.

**Language Requirements**—None.

**Final Exam**—The final exam is oral.

**Minor Requirements for Students Majoring in Other Fields**—A master's minor 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 in courses required as part of the major, 12 credits in a minor or supporting program, and 24 thesis credits. Students 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 doctoral minor may be earned by completing the two required courses for a major, participating in one semester of the conservation biology seminar, and completing 6 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; csdy@aem.umn.edu; www.csdy.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

### Regents Professor

Daniel D. Joseph, Aerospace Engineering and Mechanics, ASM

### Professor

Gary J. Balas, Aerospace Engineering and Mechanics, SM

Daniel L. Boley, Computer Science, SM  
Prodromos Daoutidis, Chemical Engineering and Materials Science, SM

Max Donath, Mechanical Engineering, SM  
David P. Fan, Genetics and Cell Biology, SM  
William L. Garrard, Aerospace Engineering and Mechanics, SM  
Tryphon T. Georgiou, Electrical Engineering, SM  
Maria Gini, Computer Science, SM  
Mostafa Kaveh, Electrical Engineering, SM  
John C. Kieffer, Electrical Engineering, SM  
Larry L. Kinney, Electrical Engineering, SM  
E. Bruce Lee, Electrical Engineering, SM  
Walter Littman, Mathematics, ASM  
Richard P. McGehee, Mathematics, SM  
Peter Olver, Mathematics, SM  
Nikolaos P. Papanikolopoulos, Computer Science, SM  
George R. Sell, Mathematics, ASM  
Kim A. Stelson, Mechanical Engineering, SM  
Ahmed H. Tewfik, Electrical Engineering, SM  
Yiyuan Zhao, Aerospace Engineering and Mechanics, SM

### Associate Professor

Perry Y. Li, Mechanical Engineering, SM

### Adjunct Associate Professor

Dale F. Enns, Aerospace Engineering and Mechanics, ASM

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**—Director of Graduate Studies, Department of English, University of Minnesota, 204 Lind Hall, 207 Church Street S.E., Minneapolis, MN 55455 (612-625-6366; creawrit@umn.edu; <http://english.cla.umn.edu/creativewriting/program>).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

### **Regents Professor**

Patricia M. Hampl, M2

### **Professor**

Michael Dennis Browne, M2  
Ray Gonzalez, M2  
Valerie Miner, M2  
Madelon M. Sprengnether, M2

### **Adjunct Professor**

Charles Baxter, M2

### **Associate Professor**

Maria Damon, M2  
Maria J. Fitzgerald, M2  
Julie Schumacher, M2  
Charles J. Sugnet, M2

### **Assistant Professor**

David Trever, M2

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.

**Courses**—Please refer to English: Creative Writing (EngW), English: Composition (EngC), and English: Literature (EngL), in the course section of this catalog for courses pertaining to the program.

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

### **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 an M.F.A. defense.

Required coursework includes EngW 8101, EngW 8140/50/60 (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 (7 credits); related field (6 credits); and a creative project, a book-length manuscript suitable for publication (12 credits, 8 of which are for manuscript preparation and 4 for creative project registration).

**Language Requirements**—None.

**Final Exam**—The M.F.A. defense requires students to discuss their creative work as well as a literary essay that they write in response to a booklist of 20 books chosen in consultation with creative writing 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; [wegne009@umn.edu](mailto:wegne009@umn.edu); [www.dentistry.umn.edu](http://www.dentistry.umn.edu)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

### **Professor**

Dwight L. Anderson, Oral Sciences, M2  
M. Bashar Bakdash, Preventive Sciences, M2  
Soraya M. Beiraghi, Preventive Sciences, M2  
David O. Born, Preventive Sciences, M2  
Edward C. Combe, Oral Sciences, M2  
Ralph DeLong, Oral Sciences, M2  
Anthony J. DiAngelis, Preventive Sciences, AM2  
William H. Douglas, Oral Sciences, M2  
James R. Friction, Diagnostic/Surgical Sciences, M2  
Mark C. Herzberg, Oral Sciences, M2  
James E. Hinrichs, Preventive Sciences, M2  
William F. Liljemark, Oral Sciences, M2  
Leslie V. Martens, Preventive Sciences, M2  
Karlind T. Moller, Preventive Sciences, M2  
Bruce L. Pihlstrom, Preventive Sciences, M2

Nelson L. Rhodus, Diagnostic/Surgical Sciences, M2

Charles F. Schachtele, Oral Sciences, M2

Burton L. Shapiro, Oral Sciences, M2

James Q. Swift, Diagnostic/Surgical Sciences, M2

Michael J. Till, Preventive Sciences, M2

Larry F. Wolff, Preventive Sciences, M2

### **Associate Professor**

Gary C. Anderson, Restorative Sciences, M2

James L. Baker, Restorative Sciences, M2

Walter R. Bowles, Restorative Sciences, M2

Mary E. Brosky, Restorative Sciences, M2

Pamela R. Erickson, Preventive Sciences, AM2

James R. Holtan, Restorative Sciences, M2

Ramesh K. Kuba, Diagnostic/Surgical Sciences, M2

Thomas D. Larson, Restorative Sciences, M2

Bryan S. Michalowicz, Preventive Sciences, M2

Kathleen J. Newell, Preventive Sciences, M2

Paul Olin, Restorative Sciences, M2

Joy B. Osborn, Preventive Sciences, M2

Jorge M. Perdigão, Restorative Sciences, M2

Igor J. Pesun, Restorative Sciences, M2

Maria R. Pintado, Oral Sciences, M2

Eric L. Schiffman, Diagnostic/Surgical Sciences, M2

John K. Schulte, Diagnostic/Surgical Sciences, M2

Stephen K. Shuman, Preventive Sciences, M2

Jill L. Stoltenberg, Preventive Sciences, M2

Omar A. Zidan, Restorative Sciences, M2

### **Adjunct Associate Professor**

Kate M. Hathaway, Restorative Sciences, M2

### **Assistant Professor**

John P. Beyer, Diagnostic/Surgical Sciences, M2

Darryl T. Hamamoto, Restorative Sciences, M2

Donald R. Nixdorf, Diagnostic/Surgical Sciences, M2

### **Research Associate**

John O. C. Look, Diagnostic/Surgical Sciences, M2

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 that enroll students for the M.S. degree include endodontics, orthodontics, pediatric dentistry, periodontics, prosthodontics, dental hygiene (with baccalaureate degree), and advanced education in general dentistry (AEGD). Other dental school clinical and postdoctoral programs that enroll students for the M.S. degree include those in geriatric dentistry and TMJ disorders/orofacial pain.

**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 the preferred performance level for admission. Applicants for whom English is a second language must also take the TOEFL, with a preferred performance level of 550 (paper-based) or 233 (computer-based).

**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. (Official transcripts that have been submitted directly to a clinical residency program cannot be transferred to the Graduate School for application to the M.S. program.)

**Courses**—Please refer to Dentistry (Dent) in the course section of this catalog for courses that pertain to this program. Information on additional 7xxx courses included in the M.S. curriculum can be obtained directly from the program office or School of Dentistry Web site.

**Use of 4xxx Courses**—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval. Under no circumstances will courses below 4xxx be considered for graduate credit.

### 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 in teaching and evaluation in dentistry; basic research methodology; introductory biostatistics; and 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 at least 6 credits outside the major field (either as a minor or related field 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 complete 10 additional credits of coursework and submit three Plan B papers, one of which must be oriented toward research. 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; dhagrinfo@che.umn.edu; http://dha.che.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

### Regents Professor

Joanne B. Eicher, emeritus, ASM

### Professor

William J. Angell, M2  
Marilyn R. DeLong, SM  
Denise A. Guerin, SM  
Kim K. P. Johnson, SM  
Karen L. LaBat, SM  
Becky L. Yust, SM

### Adjunct Professor

Edward G. Goetz, ASM

### Associate Professor

Marilyn Bruin, M2  
Sauman Chu, SM  
Jeffrey R. Crump, SM

Sherri A. Gahring, M2  
Delores A. Ginthner, emeritus, AM2  
Brad Hokanson, SM  
Barbara E. Martinson, SM  
Steven McCarthy, M2  
Stephanie A. Watson, SM  
Gloria M. Williams, SM  
Ann Ziebarth, SM

### Assistant Professor

James Boyd-Brent, M2  
Elizabeth Bye, M2  
Tasoulla Hadjiyanni, M2  
Daniel Jasper, M2  
Seung-Eun Lee, M2  
Fiona L. Shen, SM  
Carol C. Waldron, M2

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 studies, and interior design. The M.F.A. and M.A. degrees are available with an emphasis in interactive design. The emphasis in apparel advances both theoretical knowledge and applications for textile and apparel products related to human behavior. Students may focus on design, aesthetics, apparel product development, material culture, historic dress, social science aspects of dress, consumer behavior, and merchandising. The emphasis in design communication focuses on design theory, process, and methods related to design practice and research. Potential areas of study include multicultural communication, visual representation of information, human interaction with designed objects, social and cultural implications of design, color systems and perception, design history, and design education. Students and faculty collaboratively develop designed objects and information resources that will enhance people's lives. The emphasis in housing studies advances both theoretical and applied knowledge in the housing field. Through research experiences, students are prepared to assist people and communities in addressing housing-related issues. 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. Graduate study in interior

design emphasizes the theory, research, and specialized practice components of design as applied to people's health, safety, and welfare in the interior environment, including culture, sustainability, and issues facing design education. Advances in theoretical knowledge and study of the interactions of humans in interior environments prepare students for teaching and research positions as well as design specializations within the profession. The emphasis in interactive design provides students with experience in designing for the electronic environment. The program integrates theory with practice in the application of emergent and established technologies 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 examples of recent work. Students are admitted fall and spring semesters.

**Courses**—Please refer to Design, Housing, and Apparel (DHA) in the course section of this catalog for courses that pertain to this program.

**Use of 4xxx Courses**—No more than 30 percent 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.

### **M.A. and M.S. Degree Requirements**

Minimum requirements 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. Required courses include DHA 8181—Ethics and Research or the equivalent, and DHA 8101—Philosophical Foundations of Design, Housing, and Apparel. 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 7 credits in courses that focus on theory building and the theoretical and philosophical bases of inquiry in the discipline, including DHA 8101—Philosophical Foundations of Design, Housing, and Apparel and DHA 5399—Theory of Electronic Design; 6 credits in evaluation and analysis, including DHA 5388—Design Planning and Analysis;

27 credits in the area of emphasis, including DHA 8114—Design Studio and DHA 8181—Ethics and Research or the equivalent; 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.

### **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. Required courses include DHA 8181—Ethics and Research or the equivalent and DHA 8101—Philosophical Foundations of Design, Housing, and Apparel. 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**

### **Minor Only**

**Contact Information**—Interdisciplinary Center for the Study of Global Change, University of Minnesota, 537 Heller Hall, 271 19th Avenue S., Minneapolis, MN 55455 (612-624-0832; fax 612-625-1879; macarth@umn.edu; www.icgc.umn.edu)

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

### **Regents Professor**

Allen Isaacman, History, M  
G. Edward Schuh, Public Affairs, M  
John Sullivan, Political Science, M

### **Professor**

Ronald R. Aminzade, Sociology, M  
Ragui A. Assaad, Public Affairs, M  
Vernon B. Cardwell, Agronomy and Plant Genetics, M  
Lisa J. Disch, Political Science, M  
Raymond D. Duvall, Political Science, M  
Lawrence Jacobs, Political Science, M  
Amy K. Kaminsky, Women's Studies, M  
Anne R. D. Kapuscinski, Fisheries, Wildlife, and Conservation Biology, M  
Sally Kenney, Public Affairs, M  
Helga Leitner, Geography, M  
John W. Mowitz, Cultural Studies and Comparative Literature, M  
August H. Nimtz, Jr., Political Science, M  
James A. Perry, Fisheries, Wildlife and Conservation Biology, M  
Philip J. Regal, Ecology, Evolution, and Behavior, M  
Terry L. Roe, Applied Economics, M  
Abdi I. Samatar, Geography, M  
Eric S. Sheppard, Geography, M  
Kathryn A. Sikkink, Political Science, M  
George R. Spangler, Fisheries, Wildlife, and Conservation Biology, M  
Karen B. Thompson, M  
Ann B. Waltner, History, M  
Donald Wyse, Agronomy and Plant Genetics, M

### **Associate Professor**

Fernando E. Arenas, Spanish and Portuguese Studies, M  
Keletso E. Atkins, African American and African Studies, M  
Daphne J. Berdahl, Anthropology, M  
Elizabeth H. Boyle, Sociology, M  
Bruce P. Braun, Geography, M  
Rose Brewer, African American and African Studies, M  
Jeffrey P. Broadbent, Sociology, M  
Sarah C. Chambers, History, M  
Catherine C. Choy, American Studies, M  
Jay S. Coggins, Applied Economics, M  
Jigna Desai, Women's Studies, M  
Douglas R. Hartmann, Sociology, M  
Qadri Ismail, English, M  
Daniel Kelliher, Political Science, M  
Deborah Levison, Public Affairs, M  
Carol A. Miller, American Studies, M  
Richa Nagar, Women's Studies, M  
Kristen Nelson, Forest Resources, M  
Jean M. O'Brien-Kehoe, History, M  
Joanna O'Connell, Spanish and Portuguese Studies, M  
Jennifer L. Pierce, American Studies, M  
Ajay Skaria, History, M  
Charles J. Sugnet, English, M  
John S. Wright, African American and African Studies, M

### **Assistant Professor**

Katy Gray Brown, General College, M  
Barbara Frey, Human Rights Program, M  
Vinay Gidwani, Geography, M

Ann Hironaka, Sociology, M  
Helene Murray, Agronomy and Plant Genetics, M  
Michele Wagner, History, M

**Curriculum**—This structured interdisciplinary doctoral minor is offered in conjunction with the Interdisciplinary Center for the Study of Global Change (ICGC). 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 ICGC.

**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.

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

**Use of 4xxx Courses**—Courses used to fulfill minor requirements must be 5xxx or above.

### Minor Only 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.

## Early Childhood Policy

### Postbaccalaureate Certificate

**Contact Information**—Scott McConnell, Early Childhood Policy Certificate, Center for Early Education and Development, University of Minnesota, 215 Pattee Hall, 150 Pillsbury Dr. SE, Minneapolis, MN 55455 (612-625-3058; ecpcert@umn.edu; <http://education.umn.edu/SPS/programs/certificates/ECPolicy.html>).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

#### Professor

Barbara Leonard, Nursing, M  
Scott McConnell, Educational Psychology, M  
Richard Weinberg, Child Development, M

#### Associate Professor

Elizabeth Davis, Applied Economics, M  
Dan Kelliher, Political Science, M  
Charles Oberg, Public Health, M

#### Assistant Professor

Marcie Jeffreys, Social Work, M

**Curriculum**—The early childhood policy postbaccalaureate certificate gives students expertise in the applying research-based knowledge to public policies affecting young children and the adults who care for them. In addition to completing coursework, students in the certificate program complete two types of applied work: participation in an Individualized Learning Experience (ILE) that integrates and applies coursework through practicum experiences or individual research and participation in local discussion groups as part of the McEvoy Lecture Series on Early Childhood Policy. These three certificate components—coursework, ILE, and discussion groups—provide a vehicle for students to be part of a cohort, gain a similar set of skills, and foster connection between the university and the community.

**Admission Requirements**—The ECP certificate uses a quasi-cohort model and admission is for fall semester only. Applications are due on April 15 and can be completed online at <http://education.umn.edu/SPS/programs/certificates/ECPolicy.html>. Students should have a bachelor's degree from an accredited U.S. university or its foreign equivalent. A GPA of 3.00 is required. Students must apply for the certificate, and to the Graduate School if not already enrolled, after completing no more than one course (one appropriate course may be transferred in with faculty approval). Note that the Graduate School application deadlines are 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. For an online application or more information about Graduate School admissions see the General Information section in this catalog, or visit the Graduate School Web site.

**Certificate Requirements**—The 12-credit certificate consists of one cornerstone course: CPsy 5413/PA5490—Early Childhood and Public Policy (3 cr), one policy elective (3 cr), one open elective (3 cr), and CPsy 5414—Individualized Learning Experience (3 cr). Most courses are offered late afternoon or evening and the certificate can be completed in two to four semesters.

## East Asian Studies

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

**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; [igs@umn.edu](mailto:igs@umn.edu))

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

#### Professor

Joseph Allen, Asian Languages and Literatures, M2  
Tsan-Kuo Chang, Journalism and Mass Communication, M2  
Edward L. Farmer, History, M2  
Chin-Chuan Lee, Journalism and Mass Communication, M2  
Michael Molasky, Asian Languages and Literatures, M2  
Robert J. Poor, Art History, M2  
Ann B. Waltner, History, M2

#### Associate Professor

Jeffrey P. Broadbent, Sociology, M2  
Keya Ganguly, Cultural Studies and Comparative Literature, M2  
Christopher M. Isett, History, M2  
Daniel Kelliher, Political Science, M2  
Liping Wang, History, M2

#### Assistant Professor

Mark Anderson, Asian Languages and Literatures, M2  
Christine Marran, Asian Languages and Literatures, M2  
Hiromi Mizuno, History, M2  
Maki Morinaga, Asian Languages and Literatures, M2  
William Schaefer, Asian Languages and Literatures, M2

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 with the provision that prerequisite coursework be made up after admission.

**Special Application Requirements**—Three letters of recommendation, an academic writing sample, and a statement of purpose should be submitted to the department. GRE test scores are required. Students are admitted each semester.

**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.

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

### **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 (seven courses), including 15 credits (five courses) in the major and 6 credits (two courses) in one or more fields outside the major, and 10 thesis credits. Coursework must include 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 (five courses) in the major field and 12 credits (four courses) in one or more related fields outside of the major, which must include three proseminars/seminars. 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, Director of Graduate Studies, University of Minnesota, 100 Ecology Building, 1987 Upper Buford Circle, St. Paul, MN 55108-6097 (612-625-5700; fax 612-624-6777; EEBGrad@ cbs.umn.edu; www.cbs.umn.edu /eeb/graduateprogram).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

### **Regents Professor**

Margaret B. Davis (emeritus), AM2  
G. David Tilman, SM

### **Professor**

Donald N. Alstad, SM  
David A. Andow, Entomology, SM

Franklin H. Barnwell, SM  
Patrick L. Brezonik, Civil Engineering, SM  
James W. Curtsinger, SM  
Edward J. Cushing, SM  
Thomas C. Johnson, Geology, Duluth, SM  
Linda L. Kinkel, Plant Pathology, SM  
Scott M. Lanyon, SM  
Robert O. Megard (emeritus), AM2  
L. David Mech, Fisheries, Wildlife, and Conservation Biology, SM  
Patrice A. Morrow, SM  
Claudia Neuhauser, SM  
Raymond M. Newman, Fisheries, Wildlife, and Conservation Biology, SM  
Craig Packer, SM  
John Pastor, Duluth, SM  
Stephen Polasky, SM  
Anne E. Pusey, SM  
Philip J. Regal, SM  
Peter B. Reich, Forest Resources, SM  
Michael J. Sadowsky, Soil, Water, and Climate, SM  
Ruth G. Shaw, SM  
Michael J. Simmons, Genetics and Cell Biology, SM  
Peter W. Sorensen, Fisheries, Wildlife, and Conservation Biology, SM  
Marla Spivak, Entomology, SM  
Anthony M. Starfield, SM  
David W. Stephens, SM  
Robert W. Sterner, SM  
Bert E. Stromberg, Jr., Veterinary and Biomedical Sciences, SM  
Robert M. Zink, SM

### **Associate Professor**

James B. Cotner, SM  
Antony M. Dean, SM  
Susan M. Galatowitsch, Horticultural Science, SM  
George Heimpel, Entomology, SM  
Sarah E. Hobbie, SM  
Georgiana May, SM  
Andrew M. Simons, Fisheries, Wildlife and Conservation Biology, SM  
Susan J. Weller, Entomology, SM

### **Assistant Professor**

Mark Borrello, SM  
Jeannine Cavender-Bares, SM  
Jacques Finlay, SM  
Sharon Jansa, SM  
Jennifer King, SM  
Joseph McFadden, SM  
Helene Muller-Landau, SM  
Karen S. Oberhauser, Fisheries, Wildlife and Conservation Biology, SM  
Ellen Strong, Fisheries, Wildlife, and Conservation Biology, SM  
Shinya Sugita, SM  
Peter Tiffin, Plant Biology, SM  
George Weiblen, Plant Biology, SM

### **Other**

Lee E. Frelich, Forest Resources, SM  
Diane L. Larson, SM  
Clarence Lehman, SM

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 (EEB) links faculty and students interested in the biology of organisms from molecules to ecosystems. Studies address questions from molecular mechanisms of evolution, the interactions of organisms in social groups and populations, the distributions and abundances of species in communities and ecosystems, to global biogeochemical processes. 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; molecular evolution; systematics; population, community, and ecosystem ecology; global ecology, limnology, paleoecology, ecology of vegetation, and theoretical ecology. Opportunities for field research are available in Africa, Alaska, Central America, and other parts of the world, as well as in local ecosystems. Seminars and individually designed tutorials are an important part of student programs and provide an exciting intellectual environment.

**Prerequisites for Admission**—Courses in inorganic chemistry, organic chemistry, biochemistry, general physics, one year of college calculus, animal biology, genetics, physiology, and plant biology are strongly recommended and provide an important background to pursue graduate work in EEB. Proficiency in a foreign language is not required but is strongly recommended for students who expect to pursue field work in a country where English is not the native language. Deficiencies must be made up early in the graduate program.

**Special Application Requirements**—Students are admitted only in fall semester. Deadline for application is December 15. Three letters of recommendation evaluating the applicant's scholarship are required, plus GRE scores (the Subject Test in biology is recommended, though not required).

**Courses**—Please refer to Ecology, Evolution, and Behavior (EEB) in the course section of this catalog for courses pertaining to the program.

**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 by taking graduate courses or 4xxx courses that are approved by the director of graduate studies. One of these courses can be a graduate seminar or reading course, and one of these courses can be substituted by an advanced undergraduate course taken prior to entering into the EEB graduate 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 or laboratory 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 EEB.

### 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 related fields. Significant field or laboratory experience, proficiency in using computers in research, and competence in advanced statistics are required. Students are expected to gain some appreciation of history or philosophy of science and are required to teach a minimum of two semesters 50 percent time. 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 EEB.

## 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; econogs@econ.umn.edu; www.econ.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

### Regents Professor

John S. Chipman, SM  
G. Edward Schuh, Public Affairs, ASM

### Professor

Beth E. Allen, SM  
Michele Boldrin, SM  
Varadarajan V. Chari, SM  
Zvi Eckstein, SM  
Roger D. Feldman, Public Health, ASM  
Edward M. Foster, SM  
Thomas J. Holmes, SM  
Larry E. Jones, SM  
Patrick J. Kehoe, SM  
Timothy Kehoe, SM  
Samuel Kortum, SM  
Andrew McLennan, SM

Marcel K. Richter, SM  
Aldo Rustichini, SM  
Craig E. Swan, SM  
Jan Werner, SM

### Adjunct Professor

Ellen McGrattan, AM2  
Christopher Phelan, AM2  
James A. Schmitz, AM2  
Warren E. Weber, AM2

### Associate Professor

George D. Green, History, AM2  
Erzo G. J. Luttmer, SM

### Assistant Professor

Christina Arellano, M2  
Marco Bassetto, M2  
Mariacristina DeNardi, M2  
Andrea Moro, M2  
Vasiliki Skreta, M2  
Julia K. Thomas, M2

### Other

Simran Sahi, M2

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 31. Students are admitted fall semester only.

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

**Use of 4xxx Courses**—4xxx or 5xxx economics courses may not be included on the degree program form for the economics Ph.D. program. Students may include 4xxx, 5xxx, and 8xxx courses outside economics. Approval of the student's adviser and the director of graduate studies are needed to use 4xxx and 5xxx courses.

### 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. 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 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. 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](http://www.education.umn.edu/catalogs/catalog_intro.html).

**Education Emphases (Twin Cities campus)**—At the Ph.D. level, the education major is divided into two emphases; Recreation, Park, and Leisure Studies and Work, Community, and Family Education.

## Recreation, Park, and Leisure Studies

**Contact Information**—Director of Graduate Studies, School of Kinesiology, University of Minnesota, 220 Cooke Hall, 1900 University Avenue S.E., Minneapolis, MN 55455 (612-625-5300; fax 612-626-7700; [rpls@umn.edu](mailto:rpls@umn.edu); <http://education.umn.edu/kl>).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

### Professor

Dorothy H. Anderson, Forest Resources, ASM  
William Gartner, Applied Economics, AM2  
Mary Jo Kane, SM  
Leo H. McAvoy, Jr., SM  
John E. Rynders, Educational Psychology, AM2  
Michael G. Wade, SM

### Associate Professor

Bruce D. Anderson, SM  
Carla E. S. Tabourne, SM  
Diane M. Wiese-Bjornstal, SM

### Assistant Professor

Kenneth Bartlett, Work, Community, and Family Education, AM2  
W. Corliss Outley, SM

### Lecturer

Maurice K. Fahnestock, AM2

### Other

JoAnn Buisse, M2  
Stephan Paul Carlson, Forest Resources, AM2  
Robert Danforth, AM2

Carol A. Leitschuh, M2  
David W. Lime, Forest Resources, AM2  
Ingrid Elean Schneider, Forest Resources, AM2

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**—Ph.D. students in education with an emphasis in recreation, park, and leisure studies (RPLS) pursue an individualized program specializing in park and recreation administration, 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 University of Minnesota, Twin Cities Graduate School 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. The three letters of recommendation must be sent directly to the department. 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.

**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.

**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

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 preferred 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 8980 (2 cr).

## Work, Community, and Family Education

**Contact Information**—Professor Jim Brown, Director of Graduate Studies, Department of Work, Community, and Family Education, University of Minnesota, 210 Vocational and Technical Education Building, 1954 Buford Avenue, St. Paul, MN 55108 (612-624-1221; fax 612-624-2231; [wcfec@umn.edu](mailto:wcfec@umn.edu); [www.education.umn.edu/wcfec](http://www.education.umn.edu/wcfec))

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

### Professor

James M. Brown, SM  
Richard A. Krueger, SM  
Judith J. Lambrecht, SM  
Theodore Lewis, SM  
Gary N. McLean, SM  
Roland L. Peterson, SM  
David J. Pucel, SM  
Richard A. Swanson, SM

### Associate Professor

Rosemarie J. Park, SM  
Thomas D. Peacock, Education, Duluth, AM2  
James R. Stone III, SM  
Baiyin Yang, SM

### Assistant Professor

Kenneth R. Bartlett, SM  
Brad Greiman, M2  
Richard M. Joerger, M2  
Shari L. Peterson, SM

### Other

Barrycraig Johnsen, AM2

**Curriculum**—The program offers specializations in adult education; agricultural food and environmental education; business and industry education; human resource development; and comprehensive work and community. Students combine study and related experiences to develop, apply, analyze, synthesize, and evaluate knowledge of the purposes, practices, issues, and problems of work and community education; social, economic, historical, political, cultural, educational, technological, and psychological contexts within which work and community education exist; and types of research that contribute to or apply that knowledge to the specialization.

**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.

**Courses**—Please refer to Adult Education (AdEd), Agricultural, Food, and Environmental Education (AFEE), Business and Industry Education (BIE), 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 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.

### M.A. Degree Requirements

The M.A. is offered under Plan A and Plan B. Students in either plan complete a minimum of 30 to 34 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 12 credits in general aspects, a minimum of 20 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.

## 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; [cigs@umn.edu](mailto:cigs@umn.edu); [www.education.umn.edu/ci](http://www.education.umn.edu/ci)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

### Professor

Patricia G. Avery, SM  
 Richard W. Beach, SM  
 Carol A. Carrier, Human Resources, AM  
 John J. Cogan, Educational Policy and Administration, ASM  
 Deborah R. Dillon, SM  
 Lee Galda, SM  
 Roger T. Johnson, SM  
 Judith J. Lambrecht, Work, Community, and Family Education, ASM  
 Frances P. Lawrenz, Educational Psychology, ASM  
 David O'Brien, SM  
 R. Michael Paige, Educational Policy and Administration, ASM  
 Thomas R. Post, SM  
 S. Jay Samuels, Educational Psychology, ASM  
 Barbara M. Taylor, SM  
 Ruth G. Thomas, SM

### Associate Professor

Lisa D. Albrecht, School of Social Work, AM2  
 Kathleen Cramer, SM  
 Fred N. Finley, SM  
 Simon R. Hooper, SM  
 Patricia James, General College, AM2  
 Timothy Lensmire, SM  
 Jerry Hammond McClelland, SM  
 Rosemarie J. Park, Work, Community, and Family Education, AM2  
 Jane Plihal, SM  
 Diane J. Tedick, SM  
 Constance L. Walker, SM

### Assistant Professor

Martha H. Bigelow, SM  
 Lesa Covington-Clarkson, M2  
 Lori A. Helman, M2  
 Joan E. Hughes, M2  
 Bic Ngo, M2  
 Gillian H. Roehrig, M2  
 Bhaskar Upadhyay, M2

### Lecturer

Mary Bents, Student and Professional Services, AM2  
 L. JoAnne Buggey, M2  
 Faith M. Clover, M2  
 Aaron H. Doering, M2  
 Theresa L. Johnson, M2  
 Terrence Wyberg, M2

### Other

Tara W. Fortune, Center for Advanced Research on Language Acquisition, AM2  
 Michael Michlin, Center for Applied Research and Educational Improvement, AM  
 Donna D. Pearson, M2  
 Debra Stevens Peterson, AM2  
 Joyce A. Walker, Center for 4-H Youth Development, M2

**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 preK-12 education, in postsecondary and research settings, in educational service agencies, and in business and industry.

The M.A. and Ph.D. degrees include formal tracks in art education; elementary education; family, youth, and community; learning technologies; 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 (including ESL, foreign language, bilingual, and immersion education); and social studies education.

Students must have an interest in research in education or a related field; students plan a program of coursework that prepares them to conduct scholarly research in an area of expertise related to education, curriculum, and instruction.

**Prerequisites for Admission**—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 undergraduate coursework determined acceptable by advisers and the director of graduate studies is adequate. A master's degree is also generally required for admission to the Ph.D. program.

**Special Application Requirements**—Applicants must submit scores from the General Test of the Graduate Record Examination (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, and a clearly written statement of career interests, goals, and objectives. Master's and doctoral applications are reviewed by department faculty twice per academic year, with December 1 as the deadline for priority consideration for fellowships and teaching and research assistantships, and with March 15 as the secondary deadline.

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

**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.

### M.A. Degree Requirements

In education, curriculum, and instruction, students may pursue Plan A (with thesis) or Plan B (with one or two papers). Plan A requires 15-18 credits in the major, depending upon the formal track chosen, and a minimum

of 6 credits in one or more related fields outside the major. Plan A also requires 10 thesis credits. Plan B requires a minimum of 30 credits, which includes a minimum of 14 credits in the major and at least 6 credits in one or more related fields outside the major. Core and research course requirements are specified for Plan A and Plan B in accord with each major track and are chosen in consultation 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. There is no language requirement for other tracks.

**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 in consultation with the director of graduate studies.

### **Ph.D. Degree Requirements**

A total of 78 credits is required for the Ph.D. Requirements include three core courses (CI 8131, 8132, 8133 for 9 credits) and at least 15 other credits in the major track. 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 major track 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. There is no language requirement for other tracks.

**Minor Requirements for Students Majoring in Other Fields**—A minimum of 12 credits is required for a minor. Requirements include a demonstrated understanding of foundational knowledge related to curriculum and instruction and consultation with the director of graduate studies.

## **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; edpagrad@umn.edu; <http://education.umn.edu/edpa/>).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

### **Professor**

William M. Ammentorp, SM  
Robert H. Bruininks, SM  
David W. Chapman, SM  
John J. Cogan, SM  
Gerald W. Fry, SM  
David R. Johnson, SM  
Jean A. King, SM  
Darrell R. Lewis, SM  
Theodore Lewis, Work, Community, and Family Education, ASM  
Josef A. Mestenhauser (emeritus), ASM  
Neal C. Nickerson (emeritus), ASM  
R. Michael Paige, SM  
Karen Rose Seashore, SM  
Robert D. Tennyson, Educational Psychology, ASM  
James E. Ysseldyke, Educational Psychology, ASM

### **Associate Professor**

Melissa S. Anderson, SM  
C. Cryss Brunner, SM  
Arthur M. Harkins, SM  
Darwin D. Hendel, SM  
Byron J. Schneider, M2  
James R. Stone III, Work, Community, and Family Education, AM2  
Jennifer York-Barr, SM

### **Assistant Professor**

Nicola A. Alexander, SM  
Scott C. McLeod, SM  
Stuart S. Yeh M2

### **Lecturer**

Laura L. Bloomberg, AM  
Deanne L. Magnusson, AM2  
Joseph H. Nathan, Public Affairs, AM2  
Lynn R. Searcy, AM2  
Patricia S. Seppanen, AM2  
Kyla L. Wahlstrom, AM2  
Ann Z. Werner, AM2

### **Other**

Joyce Ann Walker, AM2

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 (EdAd), evaluation studies (ES), higher education (HiEd), and comparative and international development education (CIDE). In addition, the department offers a variety of Ed.D. programs for practicing professionals and four PK-12 administrative licensure programs.

The department also offers various certificate programs including school technology leadership and, in cooperation with other certificates (program evaluation, staff development, disability policy and services, postsecondary developmental education), an individualized concentration in youth leadership development, and minors in international education and program evaluation. See the department Web site address above for details on minors and certificate programs.

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 offers 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 (sent directly from institution(s) to the Graduate School), a current résumé, and three brief essays (personal statement, educational issue of interest, career goals). The GRE is not required for EdAd M.A. applicants but is required for application to other M.A. program tracks (CIDE, ES and HiEd) and all tracks in the doctoral degree programs (Ed.D. and Ph.D.). International students must also submit a TOEFL or IELTS score, but international applicants to the M.A. program are exempt from the GRE. All applications for admission, except those for the CIDE Ph.D., are reviewed on a monthly basis. CIDE Ph.D. applications are reviewed on January 15 and April 15. Submission of all application materials by February 15 is strongly encouraged to ensure priority consideration for assistantships awarded on March 1 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, résumé, and essays are sent directly to the

department. The Graduate School application, GRE scores, transcripts (sent directly from the institution[s]), and TOEFL/IELTS score are sent to the Graduate School.

**Centers**—College centers directed by department faculty include the Institute on Community Integration (ICI), the Minnesota Postsecondary Education Research Institute (Minnesota-PERI) and the Center for Applied Research and Educational Improvement (CAREI). These centers provide research and graduate assistantship opportunities for department graduate students.

**Courses**—Please refer to Educational Policy and Administration (EdPA) in the course section of this catalog for courses pertaining to the program.

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

### 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 to 4 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. For specific requirements see the current Student Handbook under Student Resources on the department Web site address listed above.

**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, 18 or more credits in program core courses, 12 or more credits of research methodology courses, 12 or more course credits in a supporting program or minor, and 24 thesis credits. The minimum total of course credits varies by track (see Student Handbook on the Web site for details). Preliminary written and oral exams are required. Students must complete a dissertation. 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.

**Final Exam**—The final exam is oral.

### 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 higher education. Cohorts include those in the metropolitan area, out state 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, 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 area and cohort. See the department Web site address above for requirements in specific cohorts.

Preliminary written and oral exams are required. Students must complete a professional field project that contributes to the improvement of educational policy or practice.

**Language Requirements**—None.

**Final Exam**—The final exam is an oral defense.

## 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; epsy-adm@umn.edu; www.education.umn.edu/EdPsych).

For specific track materials, contact the tracks as follows:

Counseling and Student Personnel Psychology, University of Minnesota, 206 Burton Hall, 178 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-624-6827; fax 612-624-8241; cssp-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; psyf-adm@umn.edu)

Quantitative Methods in Education, University of Minnesota, 206 Burton Hall, 178 Pillsbury Drive S.E. Minneapolis, MN 55455 (612-624-0042; fax 612-624-8241; 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; schpsych@umn.edu)

Special Education, University of Minnesota, 206 Burton Hall, 178 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-624-0367; fax 612-624-8241; sped-adm@umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

### Professor

William M. Bart, SM  
Robert H. Bruininiks, SM  
Sandra L. Christenson, SM  
Eli Coleman, Family Medicine and Community Health, ASM  
Nicki R. Crick, ASM  
Mark L. Davison, SM  
Stanley L. Deno, SM  
Byron Egeland, Child Development, ASM  
Christine A. Espin, SM  
Joan B. Garfield, SM  
Sunny Sundal Hansen (emeritus), ASM  
Michael R. Harwell, SM  
Thomas J. Hummel, SM  
Susan C. Hupp, SM  
David R. Johnson, Educational Policy and Administration, AM2  
David W. Johnson, SM  
Roger T. Johnson, Curriculum and Instruction, AM2  
Jean A. King, Educational Policy and Administration, AM2  
Frances P. Lawrenz, SM  
Rodney G. Loper, Psychiatry, AM2  
Geoffrey M. Maruyama, SM  
Scott R. McConnell, SM  
Anthony Pellegrini, SM  
Joe E. Reichle, Communication Disorders, AM2  
John L. Romano, SM  
S. Jay Samuels, SM  
Thomas M. Skovholt, SM  
Robert D. Tennyson, SM  
Paulus W. van den Broek, SM  
Patricia R. McCarthy Veach, SM  
Richard A. Weinberg, Child Development, ASM  
James E. Ysseldyke, SM

### Associate Professor

Ernest C. Davenport, SM  
Robert C. DelMas, General College, AM2  
V. Lois Erickson, SM  
Jeffrey D. Long, M2  
Jennifer J. McComas, SM  
Kristen McMaster, M2  
Michael C. Rodriguez, M2  
Susan Rose, SM  
Frank J. Symons, M2  
Kay Herting Wahl, M2

### Assistant Professor

Pearl Barner, Psychology, AM  
Lesley Craig-Unkefer, M2  
Michael P. Goh, M2  
David N. Rapp, M2  
Kay A. Thomas, International Programs, AM2  
Sherri L. Turner, M2

### Lecturer

Brian H. Abery, AM2  
Ann M. Casey, AM

Daria Courtney, AM2  
Michelle G. Everson, AM  
Matthew Lau, AM2  
Salina M. Renninger, University Counseling and  
Consulting Services, AM

### Other

Diane Coursol, AM  
Yvonne E. Godber, AM2  
Camilla Lehr, AM2  
Ronald P. Matross, AM  
Kristen N. Missall, AM2  
Judith Puncochar, AM2  
Walter Roberts, AM  
Richard Senese, Extension Services, AM  
William S. Slattery, University Counseling and  
Consulting Services, AM  
Richard J. Spicuzza, AM  
Sandra Thompson, AM  
Martha L. Thurlow, AM  
Teresa L. Wallace, AM  
Joyce D. Weinsheimer, Center for Teaching and  
Learning Services, AM2

Along with the 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**—The educational psychology program has five tracks: counseling and student personnel psychology (CSPP); school psychology; special education; and psychological foundations of education (including quantitative methods in education, learning and cognition, human relations, social psychology, personality, human development in education, and educational technology); quantitative methods in education (including measurement, evaluation, statistics, and statistics education).

**Prerequisites for Admission**—There are no special prerequisites for admission at the M.A. level in any of the four tracks, or at the Ph.D. level in school psychology or psychological foundations of education. Applicants to the CSPP doctoral track 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 track), 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. The GRE is required for all tracks; an interview is also required for those who make the initial cut in school psychology.

Applications to CSPP, school psychology, and special education are accepted for fall admission only. Applications to psychological foundations and quantitative methods in education are accepted throughout the year. Please check directly with the program offices for current deadlines.

**Courses**—Please refer to Educational Psychology (EPsy) in the course section of this catalog for courses pertaining to the program.

**Use of 4xxx Courses**—None of the five tracks allow 4xxx or 6xxx coursework to be counted toward Graduate School degree program requirements.

## 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's primary mission is to prepare counseling psychologists to bring a well-trained professional's attitude and interest to bear on the application of psychological and education knowledge. In addition to becoming skilled clinicians, students learn to be critical consumers and producers of both qualitative and quantitative research.

### M.A. Degree Requirements

Students must complete at least 48 credits, including credits in EPsy core courses (statistics, measurement, learning, and social psychology), 30 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 credits in EPsy core courses (statistics, measurement, learning, social psychology, 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 15 credits of graduate-level EPsy courses: 9 credits in psychological foundations and 6 credits in applied areas, of which at least 9 credits must be in 8xxx courses.

### Certificate of Specialist Requirements

Students must complete at least 60 credits, including 13 credits in EPsy core courses (statistics, measurement, learning, and social psychology), and 26 credits in counseling theory and practice.

**Language Requirements**—None.

**Final Exam**—The final exam is oral.

## K-12 School Counseling (For those seeking licensure only)

This licensure program is designed for professionals who already hold a master's degree in counseling or a related field and want to broaden their career development with a K-12 school counseling license. It aligns with the licensing requirements of the Minnesota Department of Education and state licensing board.

## 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. The goal of psychological foundations of education is to apply and generate knowledge of psychological processes and metrological procedures involved in learning and teaching.

The program offers M.A. and Ph.D. degrees with emphases in social psychology, personality, human development in education, 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 credits in EPsy core courses (statistics, measurement, learning, social psychology) and 6 credits in a related field or minor.

**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 credits in EPsy core courses (statistics, measurement, learning, social psychology, foundations, and research methods), 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 15 credits of graduate level courses in EPsy: 9 credits in psychological foundations and 6 in applied areas, of which at least 9 credits must be in 8xxx courses.

## Educational Psychology— Quantitative Methods in Education (QME)

Graduate Study in QME prepares students for a wide variety of careers, including positions in test publishing firms, college and university teaching and research, research and evaluation centers, public school systems, state departments of instruction, and private industry. The goal of QME is to provide students with broad but rigorous methodological skills so that they may conduct research on methodologies, may help to train others in methodology, or will have the skills necessary to conduct research in related fields.

The program offers M.A. and Ph. D. degrees with emphases in measurement, evaluation, statistics, and statistics education. Students typically choose one of these areas in addition to achieving competence in all aspects of the curriculum.

### M.A. Degree Requirements

Students must complete at least 30 credits, including credits in EPsy core courses (statistics, measurement, learning, social psychology) and 6 credits in a related field or minor.

**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 credits in EPsy core courses (statistics, measurement, learning, social psychology, 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 15 credits of graduate-level EPsy courses: 9 credits in psychological foundations and 6 credits in applied areas, of which at least 9 credits must be in 8xxx courses.

## Educational Psychology— School Psychology

School psychology is an interdepartmental program involving the Departments of Educational Psychology, 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, practica assignments, and a full-year internship.

### M.A. Degree Requirements

School psychology does not offer the M.A. as a terminal degree; rather the M.A. is required to obtain the Ed.S. or Ph.D. in educational psychology. The M.A. is offered under Plan A (thesis) and Plan B (paper) and requires at least 30 credits: credits in EPsy core courses (statistics, measurement, learning, and social psychology) 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, accountability systems, school dropouts, and school outcomes and interventions for children/adolescents at risk.

Students must complete credits in EPsy core courses (statistics, measurement, learning, social psychology, 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 15 credits of graduate-level EPsy courses: 9 credits in psychological foundations and 6 credits in applied areas, of which at least 9 credits must be in 8xxx courses.

### Certificate of Specialist Requirements

The specialist program is designed for students who want to become practitioners. It meets the Minnesota certification requirements for school psychologists.

Students must complete at least 60 credits, including credits in EPsy core courses (statistics, measurement, learning, social psychology, and research methods) and NASP requirements that are delineated in terms of 11 domains of training (e.g., Data-Based Decision-Making and Accountability, Consultation and Collaborations).

**Language Requirements**—None.

**Final Exam**—The final exam is written.

## 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, emotional behavior disorders, early childhood special education, learning disabilities, autism, and developmental 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 to 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.

### M.A. Degree Requirements

Students may emphasize consulting, college teaching, or research in one or more of the specializations.

Students must complete at least 30 credits, including credits in EPsy core courses (statistics, measurement, learning, and social psychology), 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 credits in EPsy core courses (statistics, measurement, learning, social psychology, foundations, and research methods), 12 credits in special education (EPsy 8701 and 8702 and 6 additional credits which 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 15 credits of graduate-level EPsy courses: 9 credits in psychological foundations and 6 in applied areas, of which at least 9 credits must be in 8xxx courses

### Certificate of Specialist Requirements

Students must complete at least 60 credits, including credits in EPsy core courses (statistics, measurement, learning, social psychology, 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.

## 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; graduate\_studies@ece.umn.edu; www.ece.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

### Professor

Vernon D. Albertson (emeritus), ASM  
Mussoud Amini, SM  
Stephen A. Campbell, SM  
Vladimir Cherkassky, SM  
Philip I. Cohen, SM  
E. Dan Dahlberg, Physics, ASM  
David H. Du, Computer Science and Engineering, ASM  
Tryphon T. Georgiou, SM  
Georgios Giannakis, SM  
Anand Gopinath, SM  
Jack H. Judy (emeritus), ASM  
Mostafa Kaveh, SM  
John C. Kieffer, SM  
Richard A. Kiehl, SM  
Larry L. Kinney, SM  
K. S. P. Kumar (emeritus), ASM  
Vipin Kumar, Computer Science and Engineering, ASM  
James R. Leger, SM  
David J. Lilja, SM

Zhi-Quan Luo, SM  
Christine Maziar, SM  
Ned Mohan, SM  
Jaekyun Moon, SM  
Marshall I. Nathan (emeritus), ASM  
Hal Ottesen, Rochester, ASM  
Nikolaos P. Papanikolopoulos, Computer Science and Engineering, ASM  
Keshab K. Parhi, SM  
Robert P. Patterson, Physical Medicine and Rehabilitation, ASM  
William T. Peria (emeritus), SM  
Dennis L. Polla, SM  
William P. Robbins, SM  
P. Paul Ruden, SM  
Sachin Sapatnekar, SM  
Guillermo Sapiro, SM  
Marian S. Stachowicz, Duluth, ASM  
Ahmed H. Tewfik, SM  
J. Thomas Vaughan, Radiology, Magnetic Resonance Research, ASM  
Randall H. Victora, SM  
Jian-Ping Wang, SM  
Bruce F. Wollenberg, SM  
Paul R. Woodward, Astronomy, ASM  
Pen-Chung Yew, Computer Science and Engineering, ASM  
Ofer Zeitouni, Mathematics, ASM

### Associate Professor

Mohamed-Slim Alouini, SM  
Phonda Drayton, SM  
Emad Ebbini, SM  
Douglas W. Ernie, SM  
Bruce E. Hammer, Radiology, ASM  
Ramesh Harjani, SM  
Ted K. Higman, SM  
James E. Holte, SM  
Thomas S. Lee (emeritus), ASM  
Jaijeet Roychowdhury, SM  
Nicholas D. Sidiropoulos, SM  
Gerald E. Sobelman, SM  
Joseph J. Talghader, SM  
Richard M. Voyles, Computer Science and Engineering, ASM  
Zhi-Li Zhang, Computer Science and Engineering, ASM  
Babak Ziaie, SM

### Assistant Professor

Kiarash Bazargan, SM  
Heinrich O. Jacobs, SM  
Nihar Jindal, SM  
Mihailo Jovanovic, SM  
Chris Hyung-il Kim, SM  
Bethanie J. Stadler, SM

### Adjunct

Gregory T. Cibuzar, Microtechnology Laboratory, AM  
E. Dan Dahlberg, ASM  
Demoz Gebre Egziabher, AM2  
Gabriel C. Ejebe, Carghill, AM  
Barry K. Gilbert, Mayo Clinic, ASM  
Bruce Eric Hammer, ASM  
Bin He, ASM  
Paul Jay Imbertson, AM2  
Matthew T. O'Keefe, Sistina, ASM  
Thomas Alfred Posbergh, AM2  
Robert A. Sainati, 3M, ASM  
Frank G. Soltis, IBM, ASM  
Bapiraju Vinnakota, Intel, ASM

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 international students, both those requesting financial assistance and those not needing financial assistance. For U.S. students, the GRE (General Test only) is only required for those requesting financial assistance. International students applying from within the United States should furnish letters from U.S. 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). Very few students are accepted for enrollment in spring semester or summer term. Applicants for fall semester admission should file a completed admission application with the Graduate School by December 15 for admission the following September. All students applying for graduate study should submit the Electrical Engineering Graduate Program Application form directly to the department. The form is available online at [www.ece.umn.edu](http://www.ece.umn.edu) and is also available by contacting the director of graduate studies at [graduate\\_studies@ece.umn.edu](mailto:graduate_studies@ece.umn.edu).



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

**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 4151, 4152, 4242, 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.

### 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. The program may contain up to 2 credits from seminars, special investigations, or directed studies (excluding colloquiums and practical training).

**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 toward meeting the minor requirements.

### 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 for 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 seminars or special investigations registrations (excluding colloquiums and practical training). 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 2 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.

**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. 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 (excluding colloquiums and practical training), 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 is approved.

**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. Colloquia, seminar, and special investigations credits do not count toward meeting the minor requirements.

## Elementary Education

See Education, Curriculum, and Instruction.

## 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; gradeng@umn.edu; <http://english.cla.umn.edu/graduateprogram/intro.html>).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

### Regents Professor

Thomas S. Clayton, SM  
Patricia M. Hampl, SM

### Professor

Kent R. Bales, SM  
Timothy Brennan, Cultural Studies and Comparative Literature, SM  
Michael D. Browne, SM  
Andrew Elfenbein, SM  
Genevieve J. Escure, SM  
Peter E. Firchow, SM  
Shirley N. Garner, SM  
Jill Barnum Gidmark, AM2  
Ray Gonzalez, SM  
Edward M. Griffin, SM  
David B. Haley, SM  
Michael Hancher, SM  
Gordon D. Hirsch, SM  
Karen A. Hoyle, Children's Literature Research Collections, AM2  
Ellen Messer-Davidow, SM  
Valerie J. Miner, SM  
John W. Mowitz, Cultural Studies and Comparative Literature, SM

Marcia Pankake, Library Collection Development: Arts and Humanities, AM2  
Paula Rabinowitz, SM  
Donald J. Ross, Jr., SM  
Madelon Sprengnether, SM  
John A. Watkins, SM  
Joel C. Weinsheimer, SM

### Associate Professor

Thomas E. Augst, SM  
Robert L. Brown, Jr., Cultural Studies and Comparative Literature, ASM  
Patricia A. Crain, SM  
Lois Cucullu, SM  
Maria Damon, SM  
Maria J. Fitzgerald, SM  
Qadri Ismail, SM  
Rebecca L. Krug, SM  
Josephine D. Lee, SM  
Daniel J. Philippon, Rhetoric, AM2  
Janette Scandura, M2  
Julie Schumacher, SM  
Charles J. Sugnet, SM  
John S. Wright, SM

### Assistant Professor

Siobhan Craig, M2  
Lianna H. Farber, M2  
Brian B. Goldberg, M2  
David B. Luke, M2  
David R. Treuer, M2

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: popular culture, film, television, legal documents, conduct books, and manifestoes. The Department of English 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 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.

**Courses**—Please refer to English: Creative Writing (EngW), and English: Literature (EngL) in the course section of this catalog for courses pertaining to the program.

**Use of 4xxx Courses**—A limited number of 4xxx courses may be included as appropriate for field and area requirements. Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

### 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 the 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**—The final exam is 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; iles@umn.edu; www.iles.umn.edu/esl.htm).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

### Professor

Andrew D. Cohen, M2  
Elaine E. Tarone, M2

### Associate Professor

Carol Klee, AM  
Kathryn Kohnert, AM  
Anne Lazaraton, M2

### Assistant Professor

Michael E. Anderson, M2  
Martha Bigelow, AM

### Other

Jenise Rowekamp, 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 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 and three letters of reference, are required. Nonnative speakers of English must submit either TOEFL scores (preferred 250) and TSE scores (preferred 5), or IELTS scores (preferred 7). Students may begin the program fall semester or first summer session. Applications for both admission dates are due on March 1. To be considered for special fellowship opportunities, students must apply by January 15.

**Courses**—Please refer to Teaching English as a Second Language (TESL) in the course section of this catalog for courses pertaining to the program.

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

### 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.

Plan A and Plan B students must complete 28 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 44 credits and Plan B students must complete an additional 3 credits in elective coursework for a total of 37 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. Nonnative speakers of English who are admitted to the program are considered to have fulfilled the language requirement.

**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, 1980 Folwell Ave., St. Paul, MN 55108 (612-624-3636; fax 612-625-5299; entodept@umn.edu; www.entomology.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

### Professor

David A. Andow, SM  
Mark E. Ascerno, Jr., SM  
Ann M. Fallon, SM  
Leonard C. Ferrington, SM  
Ralph W. Holzenthal, SM  
William D. Hutchison, SM  
Timothy J. Kurtti, SM  
Karen A. Mesce, SM  
Roger D. Moon, SM  
Kenneth R. Ostlie, SM  
Edward B. Radcliffe, SM  
David W. Ragsdale, SM

### Adjunct Professor

William E. Miller, SM

### Associate Professor

George E. Heimpel, SM  
Vera A. Krischik, SM  
Ian V. MacRae, SM  
Marla Spivak, SM  
Susan J. Weller, SM

### Adjunct Associate Professor

Susan Palchick-Silver, M2  
Robert C. Venette, M2

### Assistant Professor

Stephen A. Kells, SM  
George D. Weiblen, SM

### Adjunct Assistant Professor

Steven A. Katovich, M2

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, forest systems, crop and animal agriculture, human health, and the natural and urban environments.

**Prerequisites for Admission**—A bachelor's degree with a major in a biological science is a prerequisite. Preference is given to students with a broad background in the basic sciences. Admission depends primarily on applicant's undergraduate record and letters of recommendation.

### Special Application Requirements

Applicants must submit a complete set of official transcripts and a clearly written statement of career interests, goals, and objectives. Three letters of recommendation are required from persons well acquainted with the student's academic record, and must be sent directly to the department. A 3.00 GPA (on a 4.00 scale) for undergraduate work, and 3.50 for prior graduate work are preferred for admission. GRE scores are required for admission. The preferred performance level on the GRE's is about the 70th percentile in each of the Verbal and Quantitative exams; however, admissions decisions are not based solely on GRE scores. All credentials in the application packet are considered in reaching an individual admission decision for each applicant. For non-English speaking students, a minimum score on the TOEFL exam of 550 (or 213 on the computer-based exam) is preferred for admission. Students may apply at any time; however, submission of all application materials by January 15 is strongly encouraged to ensure priority consideration for fellowships awarded for the next academic year. Applications are reviewed individually when all materials are complete. Students are admitted each semester.

**Courses**—Please refer to Entomology (Ent) in the course section of this catalog for courses pertaining to the program.

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

### M.S. Degree Requirements

Requirements for the M.S., supplemental to general Graduate School requirements, 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 6 credits from other programs to make a total of at least 20 course credits for Plan A or at least 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 is recommended for students contemplating a career in entomological research.

**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 4xxx, 5xxx, or 8xxx entomology courses.

### Ph.D. Degree Requirements

Ph.D. requirements include a minimum of at least 15 course credits in entomology, including a core curriculum of fundamental entomology courses and 2 credits of graduate seminar. Additional requirements include 12 credits

from other programs, and are determined in consultation with the adviser and other members of the student's advisory committee.

**Language Requirements**—None.

**Final Exam**—The final exam is oral.

**Minor Requirements for Students Majoring in Other Fields**—The doctoral minor requires a minimum of 12 credits in 4xxx, 5xxx, or 8xxx entomology courses.

## Environmental 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 612-624-4498; sph-ssc@umn.edu; www.sph.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

Timothy R. Church, SM  
Susan G. Gerberich, SM  
Sagar M. Goyal, Clinical/Population Science, ASM  
Jordan L. Holtzman, Medicine, ASM  
Gurumurthy Ramachandran, SM  
Sheldon B. Sparber, Pharmacology, ASM  
Deborah L. Swackhamer, SM  
William Toscano, SM

### Adjunct Professor

Debora Boyle, Clinical/Population Sciences, ASM

### Associate Professor

John L. Adgate, SM  
Bruce Alexander, SM  
Lisa M. Brosseau, SM  
Colin Campbell, Pharmacology, ASM  
Ian A. Greaves, SM  
Craig Hedberg, SM  
George Maldonado, SM  
Patricia M. McGovern, SM  
Rita B. Messing, Pharmacology, AM2  
Lisa A. Peterson, SM  
Elizabeth V. Wattenberg, SM

### Adjunct Associate Professor

Alan P. Bender, Epidemiology, AM2

### Assistant Professor

L. Ronald French, Epidemiology, AM2  
Carol Ann O'Boyle, Nursing, ASM  
Peter Raynor, SM  
Matthew Simcik, SM  
Randall Singer, SM

### Adjunct Assistant Professor

Hillary M. Carpenter, AM2  
Nicole V. McCullough, AM2  
Robert R. Roy, Clinical/Population Science, AM2  
Allan N. Williams, ASM

### Instructor

Debra K. Olson, SM  
Kirk E. Smith, Clinical/Population Sciences, AM2

### Lecturer

Nancy Nachreiner, AM2

**Other**

Jeffrey H. Mandel, AM2  
Robert S. Skoglund, Clinical/Population Science, AM2

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, infectious disease, environmental and occupational epidemiology, environmental toxicology, the general environmental health program, occupational health nursing, occupational injury epidemiology and control, or the industrial hygiene program. The industrial hygiene program is accredited by the Applied Science Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012, (410-347-7700).

**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.

**Courses**—Please refer to Public Health (PubH), particularly numbers 81xx, in the course section of this catalog for courses pertaining to the program. See <http://onestop2.umn.edu/courses/tc/designators.jsp> for 61xx-71xx courses.

**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.

**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 6 credits in environmental health, including PubH 6103, 6104, and 6105.

**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 6103, 6104, and 6105.

**Epidemiology**

**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; sph-ssc@umn.edu; www.sph.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

**Professor**

Henry Blackburn, Jr. (emeritus), ASM  
Richard S. Crow, M2  
John R. Finnegan, Jr., SM  
Aaron R. Folsom, SM  
Jean L. Forster, M2  
Simone A. French, M2  
Laël C. Gatewood, M2  
Richard H. Grimm, Medicine, SM  
John H. Himes, SM  
Henry Hull, M2  
David R. Jacobs, Jr., SM  
Robert W. Jeffery, SM  
Robert L. Kane, SM  
Harry A. Lando, SM  
Arthur S. Leon, SM  
Alan R. Lifson, M2  
Russell V. Luepker, SM  
Leslie L. Lytle, SM

A. Marshall McBean, M2  
Joseph P. Neglia, M2  
Dianne Neumark-Sztainer, M2  
Cheryl L. Perry, SM  
Julie A. Ross, SM  
B. R. Rosser, M2  
Eyal Shahar, SM  
Michael T. Osterholm, SM  
Leslie L. Robison, SM  
Mary T. Story, SM

**Adjunct Professor**

Donna K. Arnett, SM  
Alexander C. Wagenaar, SM

**Associate Professor**

Kristin E. Anderson, SM  
Timothy R. Church, M2  
Myron D. Gross, M2  
James G. Gurney, M2  
Lisa J. Harnack, M2  
Craig W. Hedberg, M2  
Wendy L. Hellerstedt, SM  
Deborah J. Hennrikus, M2  
Rhonda J. Jones-Webb, M2  
DeAnn Lazovich, M2  
George Maldonado, M2  
James S. Pankow, SM  
Kathryn H. Schmitz, M2  
Pamela J. Schreiner, SM  
Traci L. Toomey, M2  
Michelle van Ryn, M2  
Beth A. Virnig, M2

**Adjunct Associate Professor**

Alan P. Bender, M2  
Kelli A. Komro, SM  
Ann C. Mertens, M2

**Assistant Professor**

Susan J. Duval, M2  
Andrew P. Flood, M2  
Michael B. Miller, M2  
Kathy L. Moser, M2  
J. Michael Oakes, M2  
Mark A. Pereira, M2  
Logan G. Spector, M2  
Lyn M. Steffen, M2

**Adjunct Assistant Professor**

Sally A. Bushhouse, M2  
Richard N. Danila, M2

**Senior Research Fellow**

Peter J. Hannan, M2

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 biological aspects of health and disease. 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 epidemiologic and public health aspects of cardiovascular disease; cancer; infectious diseases; alcohol, tobacco, and other substance abuse; maternal, child, and reproductive health; women's health; nutrition; genetic epidemiology; behavioral interventions; and epidemiologic research methods. A detailed description of the course of study may be obtained online or by contacting the major coordinator at [gradstudies@epi.umn.edu](mailto:gradstudies@epi.umn.edu).

**Prerequisites for Admission**—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 asked to apply to the master's of public health in epidemiology through the School of Public Health. Because positions in the doctoral program are limited, selection is competitive with respect to academic background and experience.

**Special Application Requirements**—The following materials are required by the department. The program's strong emphasis on methodology, quantitative aptitude is very important. This can be demonstrated by a 70th percentile on the quantitative section of the GRE and satisfactory grades in college-level quantitative courses. 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 are also required.

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 major coordinator at [gradstudies@epi.umn.edu](mailto:gradstudies@epi.umn.edu) before applying. Students begin their studies in the fall semester. Applications must be completed by January 15 of the same year for the doctoral program.

For an online application, see the School of Public Health Web site at [www.sph.umn.edu/students/application/home.html](http://www.sph.umn.edu/students/application/home.html). **Note:** Students who are or ever were a student in the University of Minnesota Graduate School and are applying to any graduate or professional program in the University of Minnesota, must complete a change of status application. See the Graduate School Web site for the appropriate form and fee at [www.grad.umn.edu/current\\_students/forms/cos.pdf](http://www.grad.umn.edu/current_students/forms/cos.pdf).

**Courses**—Please refer to the epidemiology Ph.D. program sheet available on the School of Public Health Web site for courses pertaining to the program at [www.epi.umn.edu/academic/phd\\_epi.shtm](http://www.epi.umn.edu/academic/phd_epi.shtm).

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

### M.S. Degree Requirements

Students are not admitted directly into the master's program; it is available only by special arrangement with the program. Students interested in a master's degree in epidemiology should apply for the master's of public health (M.P.H.) degree through the School of Public Health (SPH). For more information on the M.P.H. degree please go to the SPH Web site at [www.sph.umn.edu](http://www.sph.umn.edu).

**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 8 credits.

### Ph.D. Degree Requirements

Students may select one of two concentrations; both have an applied perspective that emphasizes study design, measurement, quantitative analysis, and data 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. Biological epidemiology focuses on the biological causes of diseases, especially determinants of cardiovascular disease, cancer, infectious diseases and genetic epidemiology.

The Ph.D. program includes a core curriculum of 67-72 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; 10 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 major coordinator in epidemiology for information at [gradstudies@epi.umn.edu](mailto:gradstudies@epi.umn.edu).

## 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.

**Prerequisites for Admission**—Prospective students must be in the general surgery training program and have two to three clinical years of training completed.

**Courses**—For courses pertaining to the program, please refer to Surgery (Surg) in the course section of this catalog.

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

### 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 Policy**

### **Minor Only**

**Contact Information**—Graduate Minor in Family Policy, College of Human Ecology, University of Minnesota, 290 McNeal Hall, 1985 Buford Avenue, St. Paul, MN 55108 (612-615-3116; fax 612-625-4227; fsosgradinfo@che.umn.edu; fsos.che.umn.edu/graduate/html).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

#### **Professor**

Jean W. Bauer, Family Social Science, M  
Jeffrey L. Edleson, Social Work, M  
Nancy Eustis, Public Affairs, M  
David Hollister, Social Work, M  
Jeylan T. Mortimer, Sociology, M  
Samuel Myers, Public Affairs, M  
B. Jan McCulloch, Family Social Science, M  
Kathryn Rettig, Family Social Science, M  
Becky Yust, Design, Housing, and Apparel, M

#### **Associate Professor**

Marilyn Bruin, Design, Housing, and Apparel, M  
Jeffrey R. Crump, Design, Housing, and Apparel, M  
Elizabeth (Liz) E. Davis, Applied Economics, M  
Maria Hanratty, Public Affairs, M  
Linda E. Jones, Social Work, M  
Deborah Levison, Public Affairs, M  
Joan Patterson, Epidemiology, M  
Marlene Stum, Family Social Science, M  
Ann Ziebarth, Design, Housing, and Apparel, M

#### **Assistant Professor**

Kathleen E. Hull, Sociology  
Erin L. Kelly, Sociology  
Elizabeth Lightfoot, Social Work, M

#### **Program Director**

Marcia (Marcie) Jefferys, Social Work, M

**Curriculum**—This minor is available to both master and doctoral students. The family policy minor provides a multidisciplinary academic foundation in the analysis of policies for their impact on families. Students completing the family policy minor will be knowledgeable about major public and private policies affecting families, and will understand how these policies came to be adopted, including social, economic, and political past and current influences. Participating students will develop a framework in which to analyze policies for their impact on families, and an understanding of the differential impact on diverse families.

Students may choose relevant courses from a variety of disciplines, including applied economics, family social science, housing, law, political science, public health, public policy, social work, and sociology. By integrating their knowledge across disciplines, students will develop a comprehensive understanding of how families are affected by public and private policies.

**Prerequisites for Admission**—Admission is contingent upon prior admission to a master or doctoral degree-granting program within the Graduate School. Any graduate student currently in good standing in the Graduate School may elect to complete the minor.

**Special Application Requirements**—Students formally apply to the minor by completing the Application for Family Policy Minor and submitting to the director of graduate studies, family policy minor, prior to beginning courses. The PDF form is available at [fsos.che.umn.edu/graduate.html](http://fsos.che.umn.edu/graduate.html)

**Courses**—Please contact the minor program office or [fsos.che.umn.edu/graduate.html](http://fsos.che.umn.edu/graduate.html) for information on relevant courses.

**Use of 4xxx Courses**—4xxx courses are not allowed in the minor.

### **Minor Only Requirements**

The master's minor is nine credits. FPol 8000—Family Policy Perspectives is required plus 6 credits from one of the departments or professional schools' elective courses on the course list. The doctoral minor is twelve credits. FPol 8000—Family Policy Perspectives is required plus 9 additional credits from elective courses that make a coherent plan. The dissertation must include a family policy application.

## **Family Social Science**

**Contact Information**—Department of Family Social Science, University of Minnesota, 290 McNeal Hall, 1985 Buford Avenue, St. Paul, MN 55108 (612-625-3116 or 612-625-1900; fax 612-625-4227; [fsosgrad@che.umn.edu](mailto:fsosgrad@che.umn.edu); <http://fsos.che.umn.edu/graduate.html>).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

#### **Professor**

Jean W. Bauer, SM  
Shirley L. Baugher, ASM  
Pauline E. Boss, emeritus, ASM  
Sharon M. Danes, SM  
Daniel F. Detzner, ASM  
William J. Doherty, SM  
Ann W. Garwick, AM2  
Harold D. Grotevant, SM  
M. Janice Hogan, SM  
James W. Maddock (emeritus), ASM  
B. Jan McCulloch, M2  
Kathryn D. Rettig, SM  
Paul C. Rosenblatt, SM  
William L. Turner, SM

#### **Associate Professor**

Rose M. Brewer, AM2  
Joan M. Patterson, ASM  
Beatrice E. Robinson, AM2  
Martha A. Rueter, SM  
Catherine A. Solheim, AM2  
Marlene S. Stum, SM  
Elizabeth Wieling, SM  
Virginia S. Zuiker, SM

#### **Assistant Professor**

Jodi B. Dworkin, M2  
Blong Xiong, AM2

#### **Senior Lecturer and Associate Teaching Professor**

William J. Goodman, M2

#### **Senior Lecturer and Assistant Teaching Professor**

Wayne A. Caron, M2

#### **Senior Fellow**

Martha F. Erickson, AM2

#### **Area Program Leader, Family Resource Management and Center for Personal and Family Financial Education Director**

Patricia Olson, M2

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 economic well-being, families and mental health, family diversity, and relationships and development across the life span.

**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 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 cannot earn a clinical master's degree in the Department of Family Social Science.

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.

**Special Application Requirements**—Consult the Family Social Science Graduate Program Handbook or the director of graduate studies. The Graduate Program Handbook and all materials needed for the application process may be found at [http://fsos.che.umn.edu/graduate/admissions\\_orientation.html](http://fsos.che.umn.edu/graduate/admissions_orientation.html).

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.

**Courses**—Please refer to Family Social Science (FSoS) in the course section of this catalog for courses pertaining to the program.

**Use of 4xxx Courses**—Students from other majors may take courses with instructor approval and include them on their degree programs subject to their own program's approval. 4xxx courses counted on graduate programs must be taught by a member of the graduate faculty and must include assignments that are at the graduate level.

### 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. The Plan B program is understood to be a terminal degree and is not recommended for students who intend to pursue the Ph.D. degree. 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

Courses in the Ph.D. degree program must contribute to an organized program of study and research. The program includes at least 72 credits beyond the master's degree, including 48 course credits and 24 dissertation credits. Coursework includes at least 12 credits in

a minor or supporting program; 24 credits in one of the two designated specializations of family science or marriage and family therapy; and 12 credits in core family content and advanced research methods. 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.

## Feminist Studies

**Contact Information**—Department of Women's Studies Graduate Program, University of Minnesota, 425 Ford Hall, 224 Church Street S.E., Minneapolis, MN 55455; (612)-626-0332; fax 612-624-3573; [wostgrad@umn.edu](mailto:wostgrad@umn.edu); <http://womenstudy.cla.umn.edu>.

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

### Regents Professor

Joanne Eicher, Design, Housing, and Apparel, AM2

Sara M. Evans, History, AM2

### Professor

Karlynn K. Campbell, Communication Studies, AM2

Anna Clark, History, AM2

Mary Dietz, Political Science, AM2

Lisa J. Disch, Political Science, AM2

Raymond Duvall, Political Science, AM2

Mary L. Fellows, Law School, AM2

Shirley N. Garner, English, AM2

Jane F. Gilgun, Social Work, AM2

Ruth-Ellen B. Joeres, German, Scandinavian, and Dutch, ASM

Indira Y. Junghare, Linguistics, ESL, and Slavic Languages and Literatures, AM2

Amy K. Kaminsky, Women's Studies, SM

Mary Jo Kane, Kinesiology, AM2

Ruth Karras, History, AM2

Sally J. Kenney, Public Affairs, AM2

Sally G. Kohlstedt, Geology and Geophysics, AM2

Helga Leitner, Geography, AM2

Elaine Tyler May, American Studies, AM2

Mary J. Maynes, History, AM2

Richard W. McCormick, German, Scandinavian, and Dutch, AM2

Ellen Messer-Davidow, English, ASM

Riv-Ellen Prell, American Studies, AM2

Paula Rabinowitz, English, ASM

Gloria Goodwin Raheja, Anthropology, AM2

Naomi B. Scheman, Philosophy, SM

Edward Schiappa, Communication Studies, AM2

Amy L. Sheldon, Communication Studies, AM2

Billie J. Wahlstrom, Rhetoric, AM2

Ann B. Waltner, History, AM2

### Associate Professor

Lisa Albrecht, Social Work, ASM

Walter Bocking, Medical School, AM2

Maria M. Brewer, French and Italian, AM2

Rose M. Brewer, African American and African Studies, ASM

Sarah Chambers, History, AM2

Catherine Choy, American Studies, AM2

Susan Craddock, Women's Studies, SM

Maria Damon, English, AM2

Jigna Desai, Women's Studies, M2

Roderick Ferguson, American Studies, AM2

Susanna Ferlito, French and Italian, AM2

Amy Lee, General College, AM2

Josephine Lee, English, AM2

Richa Nagar, Women's Studies, SM

Lisa A. Norling, History, AM2

Joanna O'Connell, Spanish and Portuguese Studies, AM2

Jennifer L. Pierce, American Studies, AM2

Gwendolyn Pough, Women's Studies, M2

Eileen B. Sivert, French and Italian, AM2

Gary Thomas, Cultural Studies and Comparative Literature, AM2

Karen E. Till, Geography, AM2

Eden Torres, Women's Studies, M2

Mary Vavrus, Communication Studies, AM2

Barbara Y. Welke, History, AM2

Monika Zagar, German, Scandinavian, and Dutch, AM2

Jacquelyn N. Zita, Women's Studies, SM

### Assistant Professor

Kathleen Hull, Sociology, AM2

Karen Tausig, Anthropology, AM2

### Other

Karen Brown-Thompson, AM2

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 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**—The graduate minor program is available only to students who have prior admission to a master's or doctoral degree-granting program within the Graduate School.

**Special Application Requirements**—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,

a current curriculum vitae, 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.

Students interested in the graduate minor program must submit a completed application by April 15 to be considered for admission in fall semester. Applications received after April 15 are considered as space allows. It is expected that no more than 12 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.

**Courses**—Please refer to Women's Studies (WoSt) in the course section of this catalog for courses pertaining to the program.

**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.

### M.A. Plan B Degree Requirements

Students are not admitted to the master's program, it 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. The courses required for the M.A. are the same as those required for the Ph.D.; see below. In addition, three Plan B papers and a final oral exam on these papers are required.

**Language Requirements**—None, but a second language is strongly encouraged.

**Final Exam**—The final exam is oral and is effectively identical to the Ph. D. preliminary written exam.

### Ph.D. Degree Requirement

The course and credit requirements for the Ph.D. fall into roughly two categories: interdisciplinary courses satisfying core requirements, and courses constituting or enhancing a concentration. Students take 28 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, 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. This means that a student can graduate with fewer than 55 credits when double counting is approved. 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, but a second language is strongly encouraged.

**Preliminary Exams**—Ph.D. students are expected to take a three-paper preliminary written exam (which includes an oral exam on these papers) and a preliminary oral exam on their dissertation proposal.

**Final Exam**—The final Ph.D. exam on the dissertation is oral.

**Minor Requirements for Students Majoring in Other Fields**—The graduate 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. To complete a Ph.D. minor, students must complete WoSt 8108 and 8109 and three graduate-level electives (9 credits), including at least one 5xxx or 8xxx course in women's studies and at most one feminist studies-approved graduate course from a student's home department. Students must apply for admission into the graduate minor program.

## Fisheries

See Conservation Biology.

## 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; fsgrad@umn.edu; [http://fscn.che.umn.edu/grad\\_students/fs\\_grad\\_students.html](http://fscn.che.umn.edu/grad_students/fs_grad_students.html)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

### Professor

Mrinal Bhattacharya, SM  
Linda J. Brady, SM  
Francis F. Busta (emeritus), ASM  
Agnes S. Csallany, SM  
R. Gary Fulcher, SM  
Theodore P. Labuza, SM  
Larry L. McKay, SM  
Gary A. Reineccius, SM  
Rongsheng R. Ruan, SM  
Joanne L. Slavin, AM2  
David E. Smith, SM

Sita R. Tatini, SM  
Zata M. Vickers, SM

### Associate Professor

Francisco Diez-Gonzalez, SM  
Joellen M. Feirtag, SM  
Craig A. Hassel, AM2  
Daniel J. O'Sullivan, SM  
H. William Schafer, SM

### Assistant Professor

Leonard F. Marquart, SM  
Lloyd E. Metzger, SM

### Adjunct Assistant Professor

Kayla M. Polzin, AM2  
Mary K. Schmidl, 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**—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 with laboratory, organic chemistry with laboratory, physics with laboratory, biology with laboratory, and calculus. If preparation appears inadequate, certain additional courses may be required after admission.

**Special Application Requirements**—Submission of GRE scores is required. Submission of three letters of reference is also required whether or not the prospective student is applying for financial assistance.

**Courses**—Please refer to Food Science and Nutrition (FScN) in the course section of this catalog for courses pertaining to the program.

**Use of 4xxx Courses**—Inclusion of 4xxx food science courses on degree program forms is permitted with adviser and director of graduate studies approval.

### 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.

**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 3 additional FScN credits, for a total of 12 credits. The minor must be approved by the food science director of graduate studies.

## Forestry

See Natural Resources Science and Management.

## 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; frit@umn.edu; <http://frit.umn.edu>).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

### Professor

F. R. P. Akehurst, SM  
Susan Noakes, SM, Italian, M  
Maria Paganini, SM

### Associate Professor

Daniel Brewer, SM  
Mária M. Brewer, SM  
Bruno Chaouat, M2  
Juliette Cherbuliez, M2  
Susanna Ferlito, SM, Italian, M  
Betsy Kerr, SM

Judith Preckshot, SM  
Peter H. Robinson, SM  
Eileen B. Sivert, SM

### Assistant Professor

Alan Smith, M2, Italian, M

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. Applicants have generally completed at least 18 semester credits in French or Italian literature and culture. 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 in French or in Italian. 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 audiotape 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 or equivalent English proficiency testing program. 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, in the College of Liberal Arts, 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 Humanities Institute, as well as the University's Immigration History Research Center. Students specializing in francophone literatures and cultures may pursue these interests through the African American and African studies program or the Interdisciplinary Center for the Study of Global Change.

**Courses**—Please refer to French (Fren), French and Italian (Frit), and Italian (Ital) in the course section of this catalog.

**Use of 4xxx Courses**—4xxx courses in French, Italian, or other programs may be used for graduate credit only in exceptional cases. Students should consult the director of graduate studies and adviser before registering.

### M.A. Degree Requirements

In French, students may pursue Plan A (with thesis) or Plan B (with two papers). 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. (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. (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

## French Studies

### Postbaccalaureate Certificate

**Contact Information**—French Studies Certificate, Department of French and Italian, 260 Folwell Hall, 9 Pleasant Street S.E., Minneapolis, MN 55455 (612-624-4308; fax 612-624-6021; frit@umn.edu; http://frit.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1](http://www.grad.umn.edu/faculty_rosters/step1).

#### Professor

F. R. P. Akehurst, M  
Susan Noakes, M  
Maria Paganini, M

#### Associate Professor

Daniel Brewer, M  
Mária M. Brewer, M  
Bruno Chaouat, M  
Juliette Cherbuliez, M  
Susanna Ferlito, M  
Betsy Kerr, M  
Judith Preckshot, M  
Peter H. Robinson, M  
Eileen B. Sivert, M

#### Assistant Professor

Alan Smith, M

**Curriculum**—This 15-credit graduate program is addressed primarily to secondary teachers of French but welcomes any prospective students wishing to enhance their knowledge of diverse areas of French and francophone studies, including linguistics, culture, literature, and film. Consisting of coursework only, the certificate provides the opportunity to explore in depth aspects of French and Francophone literature, culture, and language while also sharpening language skills. An additional benefit is the potential for professional advancement.

**Prerequisites for Admission**—Applicants must have a B.A. in French or equivalent (B.A./B.S. in another field but relevant professional experience or academic preparation in French language and culture) with a preferred GPA of 3.00. Applicants with considerable teaching experience or other relevant professional experience (publications, translations, work experience in France or a francophone country), who have a GPA below 3.00, are encouraged to make inquiries to the director of graduate studies.

**Special Application Requirements**—Applicants must submit the following materials: transcripts, a personal statement (in English) explaining how this certificate meets their personal or professional goals, a writing sample in French (500-1,000 word essay on applicant's topic of choice), and two letters of recommendation from individuals who can

comment knowledgeably on applicant's interest and abilities in French studies. Applications must be received by April 15 for fall semester and by October 15 for spring semester.

**Certificate Requirements**—The certificate consists of five courses (15 credits) selected according to the following formula: one course (3 credits) in French linguistics, one course (3 credits) in French or francophone literature or culture, and three elective courses (9 credits) in French/francophone language, linguistics, literature, or culture. One of the three electives may be taken in a related area outside French studies, subject to approval by the student's adviser. At least 60 percent of credits must be taken at the 5xxx and 8xxx levels and no more than two courses (6 credits) at the 4xxx level. No courses taken as part of an undergraduate program may be applied, but up to 40 percent of the work on the certificate program can be transfer credits, consistent with the Graduate School's transfer policy. Program must be completed within four years of the date of admission.

## Genetics

See Molecular, Cellular, Developmental Biology, and Genetics.

## Geographic Information Science

**Contact Information**—Master of Geographic Information Science Program, Department of Geography, University of Minnesota, 414 Social Sciences Building, 267 19th Avenue South, Minneapolis, MN 55455 (612-625-6080; fax 612-624-1044; mgis@umn.edu; [www.geog.umn.edu/graduate/mgis](http://www.geog.umn.edu/graduate/mgis)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

#### Professor

John S. Adams, M2  
Marvin E. Bauer, Forest Resources, M2  
James Bell, Soil, Water, and Climate, M2  
Dwight A. Brown, M2  
Philip J. Gersmehl, M2  
Robert B. McMaster, M2  
Shashi Shekhar, Computer Science, M2  
Richard H. Skaggs, M2

#### Associate Professor

Paul V. Bolstad, Forest Resources, M2  
Francis Harvey, M2  
Roderick H. Squires, M2

#### Assistant Professor

Martin Galanda, AM2  
Steven Manson, M2

#### Senior Cartographer

Mark Lindberg, M2

#### Associate Program Director

Susanna McMaster, M2

#### Other

William J. Craig, M2

#### Teaching Specialist

Stephen Lime, AM2  
Timothy Loesch, AM2  
Robert Maki, AM2

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 (MGIS), administered by the Department of Geography, provides graduate-level work in the theory, applications, and technology of geographic information science (GIS). Courses for the program are divided into three broad categories. Core courses provide the conceptual and theoretical underpinnings for a comprehensive, well-rounded knowledge of GIS, including an introductory seminar for entering students (GIS 8501). A set of technology courses focus on specific software and techniques of GIS. Elective courses provide additional breadth to the program by allowing students to take courses related to their area of interest.

**Prerequisites for Admission**—Admission to the program requires a bachelor's degree with a preferred GPA of 3.00. Prospective students also should have completed a college-level mathematics course, statistics course, and computer programming course.

#### Special Application Requirements

Applicants must submit a MGIS program application form; transcripts; a clearly written statement of career interests, goals, and objectives; and three letters of recommendation from persons familiar with their academic and/or employment background. The GRE is not required. All materials must be submitted by January 30 for fall semester entrance and by September 1 for spring semester entrance.

**Courses**—Please refer to Geography (Geog) and Geographic Information Science (GIS) in the course descriptions for courses pertaining to the program. Also refer to Forest Resources (FR) and Environment and Natural Resources (ENR) in the course descriptions for additional courses.

**Use of 4xxx Courses**—No more than two 4xxx courses may be included in the program without consent of the adviser and director of graduate studies.

#### MGIS Plan B Degree Requirements

The degree is offered Plan B (without thesis) and requires 35 credits of coursework, three Plan B projects, and a final examination. All students must have at least 35 credits, with a minimum of 18 credits in core and technology classes (12 credits of core courses and 6 credits of technology courses). All students are required to take Geog 5561, Geog 5563, GIS 5571, GIS 5572, an approved 8xxx geography seminar, and GIS 8501. At least 6

credits must be taken outside the geography department (Geog and GIS designators) but may include core GIS classes (e.g., FR and ENR designators). Students must submit three Plan B projects that are typically performed as part of, or extensions to, assignments completed during their course work. Report content and medium must be approved by the director of graduate studies in consultation with each student's adviser. Students may, with permission of the director of graduate studies and their adviser, substitute a single project for the three Plan B projects. Finally, students must complete a final oral examination with three faculty members.

**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 MGIS 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; willi046@umn.edu; www.geog.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

John S. Adams, SM  
Dwight A. Brown, SM  
Philip J. Gersmehl, SM  
John Fraser Hart, SM  
Lawrence M. Knopp, Jr., Geography, Duluth, AM2  
Helga Leitner, SM  
Ann R. Markusen, Public Affairs, AM2  
Judith A. Martin, SM  
Robert B. McMaster, SM  
Abdi I. Samatar, SM  
Earl P. Scott, SM  
Eric S. Sheppard, SM  
Richard H. Skaggs, SM

### Associate Professor

Bruce P. Braun, SM  
Susan L. Craddock, Women's Studies, AM2  
Jeffrey R. Crump, Design, Housing, and Apparel, AM2  
Francis J. Harvey, M2  
George L. Henderson, SM  
Katherine Klink, SM  
Roger P. Miller, SM  
Richa Nagar, Women's Studies, AM2  
Roderick H. Squires, SM  
Karen E. Till, M2  
Connie H. Weil, SM

### Assistant Professor

Vinay K. Gidwani, M2  
Timothy J. Griffis, Soil, Water, and Climate, AM2  
Kurt F. Kipfmüller, M2

Steven M. Manson, M2  
Arun Saldanha, M2  
Bryan N. Shuman, M2  
Susy S. Ziegler, M2

### Other

William J. Craig, Center for Urban and Regional Affairs, AM2  
Pat Farrell, Geography, Duluth, AM  
Scott Freundshuh, Geography, Duluth, AM  
Mark B. Lindberg, Director, University of Minnesota Cartography Lab, M2

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 discipline of geography is rooted in concepts of place, location, and scale. Geographers draw on theories and methods from diverse fields of inquiry to form synergistic overlaps among four primary areas of geographic inquiry: human geography, physical geography, nature-society relationships, and spatial analysis and mapping.

Human geography seeks to understand the creation and changing nature of places and regions, and how peoples and places are interconnected through social, economic, political, and cultural processes. Physical geography focuses on the earth's interrelated physical environmental systems (climate, vegetation, landforms, water, and soil), and the interactions between the physical environment and social, economic, and political systems. Nature-society geography examines how the human and biophysical worlds interact and affect one another in and across different societies, and how environments shape and are shaped by human and non-human processes. Geographic inquiry also addresses cartographic representation, such as new methods in geographic visualization, and undertakes fundamental and applied research into all aspects of geographic information science, including the societal dimensions of geographic technologies.

The program emphasizes research and teaching in political economy, international development, and globalization; urban geography; physical environmental systems; nature-society relationships; cultural and political landscapes; the geography of population and health; geographic information science and cartography; geographic education; and the history and philosophy of geography. In the first year of the graduate program students take a pair of core courses in geographic thought and research methodologies. Beyond this, the program is highly individualized 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 December 15 for entrance the following September. All applications are evaluated once each year in early January.

**Courses**—Please refer to Geography (Geog) in the course section of this catalog for courses pertaining to the program.

**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.

### 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 and three Plan B papers. Each student is required to take Geog 8001 and 8002, plus two additional Geog 81xx and/or Geog 82xx courses. Geog 8970 and 8980 may be used for Geog 81xx or 82xx coursework with permission of the adviser. The M.A. program usually is 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 Geog 8001 and 8002, two additional Geog 81xx and/or 82xx courses, and a third Geog 82xx course. Geog 8970 and 8980 may be used for Geog 81xx or 82xx coursework with permission of the adviser. 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 adviser. 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; gradsec@ce.umn.edu; www.ce.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

Steven L. Crouch, SM  
Peter A. Cundall, Civil Engineering, ASM  
Gary A. Davis, M2  
Emmanuel M. Detournay, SM  
Andrew Drescher, SM  
Efi Foufoula-Georgiou, SM  
Catherine E. French, SM  
Jerome F. Hajjar, SM  
Joseph F. Labuz, SM  
Karl A. Smith, SM  
Henryk K. Stolarski, SM  
Otto D. L. Strack, SM  
Vaughan R. Voller, SM

### Associate Professor

William A. Arnold, M2  
Randal J. Barnes, SM  
Bojan B. Guzina, SM  
Miki Hondzo, M2  
Raymond M. Hozalski, M  
Lev Khazanovich, SM  
David M. Levinson, M  
Paige J. Novak, M  
Fernando Porté-Agel, M2  
Arturo E. Schultz, M  
Carol K. Shield, SM

### Assistant Professor

Timothy M. LaPara, SM  
Mihai O. Marasteanu, SM

### Senior Research Associate

Sofia G. Mogilevskaia, AM2

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 preferred. 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 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 TOEFL score of at least 550 on the paper-based test or 213 on the computer-based test is required for admission. 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.

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

**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.

### 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 can 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 to 6 years following the bachelor's degree.

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; geology@umn.edu; www.geo.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Regents Professor

Herbert E. Wright, Jr. (emeritus), ASM

### Professor

E. Calvin Alexander, Jr., SM

Subir K. Banerjee, M2

Steve Colman, Geological Sciences, Duluth, ASM

R. Lawrence Edwards, SM

John W. Goodge, Geological Sciences, Duluth, ASM

Vicki L. Hansen, Geological Sciences, Duluth, ASM

Peter J. Hudleston, SM

Emi Ito, SM

Thomas C. Johnson, Geological Sciences, Duluth, ASM

David L. Kohlstedt, M2

Ronald L. Morton, Geological Sciences, Duluth, ASM

V. Rama Murthy, SM

Christopher Paola, SM

Hans-Olaf Pfannkuch, SM

William E. Seyfried, SM

James H. Stout, SM

Christian P. Teyssier, SM

Harvey Thorleifson, SM

Donna L. Whitney, SM

### Adjunct Professor

James Almendinger, AM2

Anthony C. Runkel, AM2

Wayne C. Shanks III, AM

### Associate Professor

Erik Brown, ASM

Marc Hirschmann, SM

Karen L. Kleinspehn, SM

Howard D. Mooers, Geological Sciences, Duluth, ASM

Nigel J. Wattrus, Geological Sciences, Duluth, ASM

### Assistant Professor

Timothy Demko, Geological Sciences, Duluth, ASM

Annia K. Fayon, AM2

David Fox, SM

Christina Gallup, Duluth, Geological Sciences, Duluth, ASM

Lee Penn, Department of Chemistry, AM2

Lesley Perg, SM

Bryan Shuman, Department of Geography, AM2

John Swenson, Geological Sciences, Duluth, ASM

### Senior Research Associate

Kang Ding, AM

Paul H. Glaser, AM2

Mark Zimmerman, AM2

### Other

Val W. Chandler, AM2

Mark Edlund, AM2

Daniel R. Engstrom, AM2

Michael J. Jackson, AM2

Carrie Jennings, AM2

Robert G. Johnson, AM

James D. Miller, AM2

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 structural geology, tectonics, metamorphic geology, Quaternary studies, climate and environmental change, limnology, paleontology, groundwater geology, hydrogeology, geofluids, surface processes, geomorphology, stratigraphy, sedimentology, mineralogy, experimental and theoretical petrology, experimental geochemistry, isotopic and aqueous geochemistry. 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 are required. In general, an outstanding academic record is expected.

**Special Application Requirements**—The student's statement of purpose, three letters of recommendation, and official GRE scores are required for admission and financial aid 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. Please

refer to the Graduate Programs section of the department Web site for a listing of all required applications materials.

**Courses**—Please refer to Geology and Geophysics (Geo) in the course section of this catalog for courses pertaining to the program. All courses must all be taken at 4xxx and 5xxx, with several formal courses to be included at 8xxx.

**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.

### 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 a minimum of 30 course credits consisting of at least 14 course credits in the major, 6 course credits in the related field, and 10 thesis credits. Plan B requires a minimum of 30 course credits consisting of at least 14 credits in the major and 8 credits in the related field. Plan C is the coursework-only option, which requires a minimum of 30 course credits consisting of at least 14 credits in the major and 9 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 students must pass the final oral examination in defense of their thesis. Plan B students must pass the final oral and/or written 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 a minimum of 36 course credits consisting of at least 12 course credits in the minor or supporting field. In some cases, fewer than 24 credits in the major field are acceptable provided the total is at least 36. 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.

**Final Exam**—Ph.D. students must pass the final oral examinations in defense of their thesis.

**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; geology@umn.edu; www.geo.umn.edu).

For up-to-date graduate faculty listings, see www.grad.umn.edu/faculty\_rosters/step1.asp.

### Professor

Subir K. Banerjee, SM  
David L. Kohlstedt, SM  
Bruce M. Moskowitz, SM  
V. Rama Murthy, SM  
Chris Paola, M2  
Justin Revenaugh, SM  
James H. Stout, SM  
Christian P. Teyssier, M2  
David A. Yuen, SM

### Associate Professor

Marc Hirschmann, M2  
Karen L. Kleinspehn, M2  
Renata M. Wentzcovitch, Chemical Engineering and Materials Science, AM2

### Senior Research Associate

Mark Zimmerman, AM2

### Other

Val W. Chandler, AM2  
Michael J. Jackson, AM2

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, mineral and rock physics, seismology and geostatistics. 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 are required. In general, an outstanding academic record is expected.

**Special Application Requirements**—The student's statement of purpose, three letters of recommendation, and official GRE scores are required for admission and financial aid 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. Please refer to the Graduate Programs section of the department Web site for a listing of all required applications materials.

**Courses**—Please refer to Geology and Geophysics (Geo) in the course section of this catalog for courses pertaining to the program. All courses must be taken at 4xxx and 5xxx, with several formal courses to be included at 8xxx.

**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.

### M.S. Degree Requirements

The M.S. is offered Plan A (with thesis) and Plan B (with project). Plan A requires a minimum of 30 course credits consisting of at least 14 course credits in the major, 6 course credits in the related field, and 10 thesis credits. Plan B requires a minimum of 30 course credits consisting of at least 14 credits in the major and 8 credits in the related field. Plan C is the coursework-only option which requires a minimum of 30 course credits consisting of at least 14 credits in the major and 9 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 students must pass the final oral examination in defense of their thesis. Plan B students must pass the final oral and/or written 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 a minimum of 36 course credits consisting of at least 12 course credits in the minor or supporting field. In some cases, fewer than 24 credits in the major field are acceptable provided the total is at least 36. 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.

**Final Exam**—Ph.D. students must pass the final oral examination in defense of their thesis.

**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; gsd@umn.edu; www.folwell.umn.edu/gsd).

For up-to-date graduate faculty listings, see www.grad.umn.edu/faculty\_rosters/step1.asp.

### Professor

Evelyn S. Firchow, German, Germanic Medieval, SM  
Poul Houe, Scandinavian, SM  
Ruth-Ellen B. Joeres, German, SM  
Ruth M. Karras, History, Scandinavian, AM  
Anatoly Liberman, German, Germanic Medieval, Scandinavian, SM  
Richard W. McCormick, German, SM  
James A. Parente, Jr., German, Scandinavian, Germanic Medieval, SM  
Jochen Schulte-Sasse, German, SM  
Goran K. N. Stockenstrom, Scandinavian, SM  
Arlene A. Teraoka, German, SM  
Jack D. Zipes, German, SM

### Associate Professor

Leonard L. Duroche, Sr., German, SM  
G. Lee Fullerton, German, M2  
Andreas Gailus, German, M2  
Kaaren E. Grimstad, Scandinavian, Germanic Medieval, SM  
Patrizia C. McBride, German, SM  
Charlotte A. Melin, German, SM  
Leslie Morris, German, SM  
Ray M. Wakefield, German, Germanic Medieval, SM  
Monika Zagar, Scandinavian, SM

### Assistant Professor

Eric Baker, German, M2  
Rembert Hueser, German, M2

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 (M.A. and Ph.D.), Scandinavian Studies (M.A.), Teaching (M.A.), Germanic Medieval Studies (M.A. and Ph.D.), and German and Scandinavian Studies (Ph.D.).

**Prerequisites for Admission**—A B.A. or M.A. or equivalent in German, Scandinavian, or related field (depending on the track to which one applies) is required. Students with bachelor's degrees who apply for the German track or the Germanic Medieval Studies track usually are admitted into the Ph.D. program with the understanding that the M.A. will be attained first. Students with bachelor's degrees who are interested in the German and Scandinavian Studies Ph.D. must first complete an M.A. in the German track or the Scandinavian track and should have either near-native fluency in German plus an advanced level of proficiency in a Scandinavian language or near-native fluency in a Scandinavian

language plus an advanced level of proficiency in German. 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. Applicants to the Germanic Medieval Studies M.A. should have a strong command of German; knowledge of another Germanic language is preferred. Applicants for any track whose preparatory work evidences gaps may be asked to complete supplemental work before admission.

**Special Application Requirements**—The following must be sent directly to the department: the department's Application for Graduate Study form; a statement of professional goals describing the applicant's intellectual development and plans for the future; a copy of one or more papers representative of the applicant's level of scholarly development; three letters of recommendation; and a complete set of transcripts (in addition to transcripts sent to the Graduate School). For master's program applicants, and for all students who wish to be considered for the Graduate School Fellowship, the General (Aptitude) Test of the GRE is required; the GRE is optional for applicants whose native language is not English. Students are admitted in the fall semester only. All application materials must be received by January 10.

**Use of 4xxx Courses**—A limited number of 4xxx courses may be included in degree programs of Germanic Studies majors or minors, subject to the approval of the adviser and the director of graduate studies. 4xxx courses counted on graduate programs must be taught by a member of the graduate faculty and must include work that is at the graduate level.

**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 a total of at least 12 credits (usually four courses).

## German Track

### M.A. 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 an introductory course in contemporary literary and cultural theory (CLit 8001) and an introductory course in German studies (Ger 8002), four courses in different periods of German literature, a philology course, an elective in German literature/culture, a pedagogy course, two courses outside the German track; demonstration of oral and written proficiency in German and one Plan B paper.

**Courses**—Please refer to German (Ger); German, Scandinavian, and Dutch (GSD); Dutch (Dtch); and Comparative Literature (CLit) in the course section of this catalog for courses pertaining to this track.

**Language Requirements**—Students who intend to continue in the Ph.D. program are strongly encouraged to acquire a reading proficiency in one other foreign language during their M.A. program (refer to requirements for the Ph.D.).

**Final Exam**—The final exam is oral.

### 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 for the M.A.), the dissertation seminars, and four 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 this track.

**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. 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 an introductory course in contemporary literary and cultural theory (CLit 8001), and 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, two courses outside the Scandinavian track, and one Plan B paper.

**Courses**—Please refer to German (Ger); German, Scandinavian, and Dutch (GSD); Scandinavian (Scan); and Comparative Literature (CLit) 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 two other Scandinavian languages.

**Final Exam**—The final exam is written and oral.

## Teaching Track

### M.A. 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 34 credits, including a pedagogy course; three courses on the history and structure of the German language; Ling 5505—Introduction to Second Language Acquisition; CI 5662—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 German literature and culture courses; one elective; demonstration of oral and written proficiency in German, and one Plan B paper.

**Courses**—Please refer to German (Ger); Linguistics (Ling); Curriculum and Instruction (CI); Language, Teaching, and Technology (LgTT); and Teaching English as a Second Language (TESL) in the course section of this catalog for courses pertaining to this track.

**Final Exam**—The final exam is oral.

## Germanic Medieval Studies Track

### M.A. Degree Requirements

The M.A. offers students the opportunity to do advanced work in Germanic medieval studies and prepares them with theoretical and practical tools to enter the Ph.D. track.

The M.A. requires at least 35 credits, including an introductory course on contemporary literary and cultural theory (CLit 8001) and a course introducing students to graduate studies in either German or Scandinavian (Ger 8002 or Scan 8002); four courses chosen from two of the three following groups: 1) Middle High German; 2) Old Norse; 3) Old English, Middle English, Old High German, Gothic, Old Saxon, Middle Dutch, Early Modern Dutch, Old Frisian; two courses in Germanic medieval studies; a pedagogy course; at least two courses in related fields or a designated minor; demonstrated oral and written proficiency in German, and one Plan B paper.

**Courses**—Please refer to English (EngL, EngC); Dutch (Dtch); German (Ger); German, Scandinavian, and Dutch (GSD); Scandinavian (Scan); and Comparative Literature (CLit) in the course section of this catalog for courses pertaining to this track.

Students who intend to continue in the Ph.D. program are encouraged to acquire a reading proficiency in Dutch or a modern Scandinavian language.

**Final Exam**—The final exam is written and oral.

### **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 36 credits, including four courses in Germanic Medieval Studies, two courses in a third medieval Germanic language (supplementing the two languages for the M.A.), a pedagogy course (if it has not been taken for the M.A.), the dissertation seminars, and four 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 this track.

**Language Requirement**—Reading competence in 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 (8xxx literature or theory courses above 8002) and one course from each of three Scandinavian groups: 1) Old Norse group; 2) 19th century group; 3) 20th century group. 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 for the M.A.), the dissertation seminars, and 4 courses in a designated minor or supporting program. 24 thesis credits are required.

**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**—Reading competence in one language other than German, English, or a Scandinavian language.

## **Gerontology**

### **Minor Only**

**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; [coa@umn.edu](mailto:coa@umn.edu); [www.hsr.umn.edu/coa](http://www.hsr.umn.edu/coa)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### **Professor**

Dennis A. Ahlburg, Industrial Relations, M  
Donna Z. Bliss, Nursing, M  
David O. Born, Preventative Services, M  
Pauline G. Boss, Family Social Science, M  
James C. Cloyd, Pharmacy Practice, M  
Jim Curtsinger, Ecology, Evolution, and Behavior, M  
Daniel F. Detzner, Family Social Science, M  
Richard P. DiFabio, Physical Medicine and Rehabilitation, M  
William Durfee, Mechanical Engineering, M  
Maurice W. Dysken, Psychiatry, M  
Nancy N. Eustis, Public Affairs, M  
Judith M. Garrard, Public Health, M  
Cynthia R. Gross, Pharmacy Practice, M  
David R. Guay, Pharmacy Practice, M  
Lois J. Heller, Medicine, Duluth, M  
Kenneth W. Hepburn, School of Nursing, M  
Robert L. Kane, Public Health, M  
Rosalie A. Kane, Public Health, M  
Helen Q. Kivnick, Social Work, M  
Thomas E. Lackner, Pharmacy, M  
Alice Larson, Veterinary Pathobiology, M  
Tom A. Larson, Pharmacy Practice, M  
Frank M. Lassman, Otolaryngology, AM  
Chap Le, Biostatistics, M  
Matthew K. McGue, Psychology, M  
Steven H. Miles, M  
Phyllis Moen, Sociology, M  
Jeylan T. Mortimer, Sociology, M  
Christine A. Mueller, E, Nursing, M  
Jean K. Quam, Social Work, M  
Jon Schommer, Pharmaceutical Care and Health Systems, M  
Stephen Schondelmeyer, Pharmacy Practice, M  
Virginia Seybold, Cell Biology and Neuroanatomy, M  
Marc Swiontkowski, Orthopedic Surgery, M  
David Thomas, Biochemistry, M  
Michael Wade, Kinesiology, M  
Jean Wyman, Nursing, M  
Shirley L. Zimmerman (emeritus), AM

### **Associate Professor**

Lynn Blewett, Public Health, M  
James Gambucci, Preventive Sciences, M  
Priscilla A. Gibson, Social Work, M  
Leslie A. Grant, Carlson School of Management, M  
Merrie J. Kaas, Nursing, M  
Kathleen Krichbaum, Nursing, M  
Terry Lum, Social Work, M  
James T. Pacala, Family Medicine and Community Health, M

Rosemarie J. Park, Work, Community, and Family Education, M

James R. Reinardy, Social Work, M  
Robert C. Serfass, Kinesiology, M  
Stephen K. Shuman, Preventive Sciences, M  
Marlene S. Stum, Family Social Science, M  
Carla E. S. Tabourne, Kinesiology, M  
LaDora V. Thompson, Physical Medicine and Rehabilitation, M

### **Assistant Professor**

Debra Ferrington, Ophthalmology, M  
Jeremy L. Holtzman, Medicine, M  
Teresa Kimberly, Physical Medicine and Rehabilitation, M  
Elizabeth Lightfoot, Social Work, M  
Dawn Annette Lowe, Biochemistry, M  
David Luke, English Language and Literature, M  
Teresa C. McCarthy, Family Medicine and Community Health, M

### **Clinical Assistant Professor**

Patrick W. Irvine, Medicine, M

### **Lecturer**

Wayne Caron, Family Social Science, M  
Anne Kane, Public Health, M

### **Research Associate**

Lois Cutler, Public Health, M  
Celia W. Gershenson, Psychology, M

### **Other**

Ursula Bea Krinke, Health, M  
LeAnn Snow, Physical Medicine and Rehabilitation, M

**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 medicine 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**—Students must have gained admission to a master's or doctoral degree-granting program within the Graduate School, and have prepared a minor program of coursework approved by the director of graduate studies in gerontology.

**Courses**—Courses are ordinarily taken from a designated course list provided by the Center on Aging and annually updated by the minor program. Students are welcome to identify and propose to the director of graduate studies additional courses on aging that might fulfill the minor requirements.

**Use of 4xxx Courses**—4xxx courses may not be included on degree program forms.



## Minor Only 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 8 credits, including Gero 5105—Multidisciplinary Perspectives on Aging (3 cr), or an alternative course approved by 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 (612-625-8440; fax 612-625-7166; www.hinf.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

Christopher G. Chute, SM  
 Donald P. Connelly, SM  
 Shawn Curley, Information and Decision Sciences, SM  
 Lynda B. Ellis, SM  
 David P. Fan, Genetics and Cell Biology, SM  
 Stanley M. Finkelstein, SM  
 John R. Finnegan, Jr., Epidemiology, SM  
 James R. Friction, Diagnostic/Surgical Sciences, SM  
 Laël C. Gatewood, SM  
 Paul E. Johnson, Information and Decision Sciences, SM  
 George G. Klee, M2  
 Robert P. Patterson, Physical Medicine and Rehabilitation, SM  
 Stuart M. Speedie, SM  
 Douglas R. Wholey, Health Services Research and Policy, SM  
 George L. Wilcox, Neuroscience, SM

### Associate Professor

Sandra J. Potthoff, Healthcare Management, SM  
 Edward Ratner, Medicine, M2

### Assistant Professor

Marcelline Harris, M2  
 Stephen T. Parente, Health Care Management, M2  
 George Vasmataziz, M2  
 Amy Wilson, Health Sciences Research/Policy, M2

### Other

Ernest F. Retzel, M2  
 Brian J. Westrich, M2

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.

### Health Informatics Admission Prerequisites

| Area   | Amount        | For M.H.I. | For M.S. | For Ph.D. |
|--|---------------|------------|----------|-----------|
| Biological or Life Sciences                        | 1 course      | Yes        | Yes      | Yes       |
| <b>Mathematics</b>                                 |               |            |          |           |
| Calculus or equivalent                             | two semesters | Yes        | Yes      | Yes       |
| Linear Algebra (qtr or sem)                        | 1 course      | No         | No       | Yes       |
| Computer Programming (FORTRAN, C, C++, JAVA, etc.) | 1 course      | Yes        | Yes      | Yes       |

**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, ultimately improving the health, well-being, and economic functioning of society. Students take a sequence of core courses in health informatics and biostatistics, and electives in technical and health science areas. Possible areas of emphasis include health information systems, telemedicine, bioinformatics, 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. See the prerequisites listed in the table for areas of study that 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 the Web site at [www.hinf.umn.edu](http://www.hinf.umn.edu) for current information about the program.

**Special Application Requirements**—The GRE or similar professional examination (e.g., MCAT, GMAT, PCAT) is required. Three letters of recommendation and a statement of purpose must be submitted with the application. Students are advised to apply for admission for fall semester, since spring semester admission may entail the student taking longer to complete the program.

**Courses**—Please refer to Health Informatics (HInf) in the course section of this catalog for courses pertaining to the program.

**Use of 4xxx Courses**—4xxx courses in computer science may be used to satisfy the elective requirements for the M.H.I., M.S., and Ph.D. degrees if the student has not previously taken a computer science course in the same subarea (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.

### M.H.I. Degree Requirements

The master of health informatics emphasizes the role of informatics-trained professionals as liaisons who brings both a background of medicine and a knowledge of information technology to the task of solving health care problems. The curriculum consists of 32 credits of coursework that includes: 8 credits of health informatics, 4 credits of technology-focused health administration, 3 credits of statistics and research design, 6 credits of coursework in the student's chosen area of specialization, 6 credits of electives, 2 credits of seminar, and a 3 credit capstone course in which the student completes a project directly applicable to their own work environment. The program is designed to be completed in one calendar year for full-time students and in up to three years for part-time students. Many of the classes are offered in the late afternoon and on Saturdays; classes may also meet monthly or semi-monthly. Distance learning technologies facilitate work and class participation at off-campus locations.

### 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 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 must successfully complete the introductory sequence in health informatics (HInf 5430 and HInf 5431). Ph.D. students must take the introductory sequence and one 8xxx course in health informatics.

## **Health Journalism**

**Contact Information**—Graduate Studies Office, Health Journalism M.A. Program, 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; sjmgrad@umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### **Professor**

John R. Finnegan, Jr., M2  
Russell V. Luepker, M2  
Daniel J. Sullivan, M2  
Douglas R. Wholey, M2

### **Associate Professor**

Kenneth O. Doyle, Jr., M2  
Ian A. Greaves, M2

### **Assistant Professor**

Donald Brazeal, M2  
Gary Schwitzer, M2

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 joint program of the School of Journalism and Mass Communication and the School of Public Health, the professional master's in health journalism promotes improved public communication about health matters by combining knowledge, skills, and experience from both disciplines. Professionals in journalism and public health earn an M.A. degree in health journalism. Those pursuing

other master's degrees, (e.g., master's in public health), earn the M.A. in health journalism in addition to the other degree.

**Prerequisites for Admission**—The minimum requirement for admission is a B.A. or equivalent.

**Special Application Requirements**—Applicants must submit a departmental application; a clearly written statement of career interests, goals, and objectives; three letters of recommendation; a complete set of transcripts; academic work samples; and scores from the GRE. The director of graduate studies may waive the GRE requirement for students who have at least two years of professional experience and a strong academic record. This program uses a rolling admission process: the sooner an application is received, the sooner the applicant receives a decision. The deadline for application is March 15.

**Courses**—Please refer to Journalism and Mass Communications (Jour) and Public Health (PubH) in the course section of this catalog for courses pertaining to this program.

**Use of 4xxx Courses**—Use of 4xxx courses is discouraged.

### **M.A. Degree Requirements**

A minimum of 32 credits and a capstone project are required. All students must take a minimum of 16 credits in journalism. All coursework must be taken A-F.

**Language Requirements**—Foreign language study is recommended for students who plan to work internationally.

**Final Exam**—The final examination is oral.

## **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; sph-ssc@umn.edu; [www.sph.umn.edu](http://www.sph.umn.edu)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### **Professor**

James W. Begun, Health Care Management, SM  
Jon B. Christianson, Health Care Management, SM  
Bryan E. Dowd, Public Health, SM  
Roger D. Feldman, Public Health, SM  
Judith M. Garrard, Public Health, SM  
Robert L. Kane, Public Health, SM  
Rosalie A. Kane, Public Health, SM  
John E. Kralewski, Public Health, SM  
A. Marshall McBean, Public Health, SM  
Ira S. Moscovice, Public Health, SM  
John A. Nyman, Public Health, SM  
Stuart M. Speedie, Health Informatics, SM  
Vernon E. Weckwerth, Health Care Management, SM  
Douglas R. Wholey, Public Health, SM

### **Associate Professor**

Lynn A. Blewett, Public Health, SM  
Kathleen T. Call, Public Health, SM  
Robert A. Connor, Health Care Management, SM  
Susan Bartlett Foote, Public Health, SM  
Leslie A. Grant, Health Care Management, SM  
Sandra J. Potthoff, Health Care Management, SM  
William J. Riley, Public Health, M2  
Todd H. Rockwood, Public Health, M2  
Robert James Town, Public Health, SM  
Beth A. Virnig, Public Health, SM

### **Adjunct Associate Professor**

Michael D. Finch, Public Health, SM

### **Assistant Professor**

Jean Marie Abraham, Health Care Management, M2  
Boris Bershadsky, Public Health, M2  
Michael E. Davern, Public Health, AM  
Jeremy L. Holtzman, Medicine, M  
Donna D. McAlpine, Public Health, M2  
Stephen T. Parente, Health Care Management, M2  
David M. Radosevich, Surgery, M  
Amy Reed Wilson, Public Health, M2

### **Adjunct Assistant Professor**

Yvonne Catharina Maria Jonk, Public Health, M

### **Other**

Tor Dahl, 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 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.

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**—The M.S. program does not have specific course prerequisites, but some college-level math is recommended. The Ph.D. program requires 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**—A 3.00 GPA for previous coursework is preferred. The GRE general exam is required. GRE exam scores for M.S. program applicants: 1000 (500 verbal, 500 quantitative) and 3.5 analytical writing. Ph.D. applicants: 1200 (600 verbal, 600 quantitative) and 5.0 analytical writing. Unless exempt, international students must complete the TOEFL exam with a preferred score of 600 (or 250 on the computer exam). The TOEFL is not required for students from English speaking countries, or those who have completed 16 semester credits or 24 quarter credits within the past 24 months at a recognized institution of higher learning in the United States.

The M.S. and Ph.D. programs in HSRP&A reside in the School of Public Health and all accepted students are required to obtain certain immunizations as a condition of enrollment.

All applicants submit the following: official grade transcripts from all previous academic institutions; a statement indicating reasons for seeking the health services research, policy, and administration M.S. or Ph.D. that also includes research interests; three letters of reference attesting to the applicant's academic ability and potential for a career in health services research or academia; evaluation forms to accompany each letter, résumé, or CV. Students are admitted fall semester only. The programs are full time.

For an online application, see the School of Public Health Web site at [www.sph.umn.edu/students/application/home.html](http://www.sph.umn.edu/students/application/home.html).

**Note:** If you are or ever were a student in the University of Minnesota Graduate School and you are applying to any graduate or professional program in the University of Minnesota, you must complete a change of status application. See the Graduate School Web site for the appropriate form and fee [www.grad.umn.edu/current\\_students/forms/cos.pdf](http://www.grad.umn.edu/current_students/forms/cos.pdf).

**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.

**Use of 4xxx Courses**—Use of 4xxx courses toward degree requirements requires the approval of the director of graduate study.

### M.S. Degree Requirements

The M.S. offered under Plan A is in outcomes research. Plan A requires a thesis (publishable research paper), and a final oral exam. Plan B requires an internship, project, and final oral exam. Both Plan A and Plan B are full-time, two-year programs.

Plan A requires 47-50 credits, including 31-34 core credits, 6 elective credits in one or more related fields outside the major, and 10 thesis credits. Plan B requires 46 credits, including 40 core credits and 6 elective credits in one or more related fields outside the major.

### Ph.D. Degree Requirements

The Ph.D. requires at least 76 credits, including 40 core credits in the major, a minimum of 12 credits in the minor or supporting program, and 24 thesis credits. The minor or supporting program may be in areas such as economics, statistics, sociology, bioethics, gerontology, business administration, or epidemiology.

**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.

## Hispanic and Luso-Brazilian Literature and Linguistics

**Contact Information**—Department of Spanish and Portuguese Studies, University of Minnesota, 34 Folwell Hall, 9 Pleasant Street S.E., Minneapolis, MN 55455 (612-625-5858; fax 612-625-3549).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

#### Professor

René Jara, SM  
Amy K. Kaminsky, Women's Studies, ASM  
Antonio Ramos-Gascón (emeritus), ASM  
Nicholas Spadaccini, SM  
Hernán Vidal (emeritus), ASM  
Anthony Zahareas (emeritus), ASM

#### Associate Professor

Fernando E. Arenas, SM  
Carol A. Klee, SM  
Francisco A. Ocampo, SM  
Joanna O'Connell, SM  
Luis Ramos-García, SM  
Barbara Weissberger, SM

#### Assistant Professor

Timothy Face, M2  
Ofelia Ferrán, M2

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 literature and linguistics. The Ph.D. offers four areas of emphasis: Spanish peninsular literature, Spanish-American literature, Luso-Brazilian literature, 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 desirable. The deadline for application for admission and financial aid is January 15 for fall entry. Applicants who wish to be considered for teaching assistantships or Graduate School fellowships are encouraged to apply early.

**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.

**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

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 supporting work or a minor, depending on the requirements of the minor program. The program also requires 24 thesis credits.

**Language Requirements**—Normally students have proficiency in Spanish or Portuguese and at least one other foreign language (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.

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### **Associate Professor**

Carol A. Klee, M2

Francisco A. Ocampo, M2

### **Assistant Professor**

Timothy Face, M2

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 desirable. The deadline for application for admission and financial aid is January 15 for fall entry. Applicants who wish to be considered for teaching assistantships or Graduate School fellowships are encouraged to apply early.

**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.

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

### **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**—Students must have a reading knowledge of at least one foreign language in addition to Spanish.

**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.

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### **Professor**

René Jara, M2

Antonio Ramos-Gascón (emeritus), AM2

Nicholas Spadaccini, M2

Hernán Vidal (emeritus), AM2

Anthony Zahareas (emeritus), AM2

### **Associate Professor**

Fernando E. Arenas, M2

Joanna O'Connell, M2

Luis A. Ramos-García, M2

Barbara Weissberger, M2

### **Assistant Professor**

Ofelia Ferrán, M2

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 desirable. The deadline for application for admission and financial aid is January 15 for fall entry. Applicants who wish to be considered for teaching assistantships or Graduate School fellowships are encouraged to apply early.

**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.

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

### **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**—Students must have a reading knowledge of at least one foreign language in addition to Spanish or 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; [histsdgs@umn.edu](mailto:histsdgs@umn.edu); [www.hist.umn.edu](http://www.hist.umn.edu)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### **Regents Professor**

Sara M. Evans, SM

Allen F. Isaacman, SM

### **Professor**

Frederich Asher, Art History, AM2

Bernard S. Bachrach, SM

Anna K. Clark, SM

Gary Cohen, SM

John K. Evans, SM

John M. Eyler, History of Medicine, ASM

Caesar E. Farah, SM

Edward L. Farmer, SM

Stephen C. Feinstein, Holocaust and Genocide Studies, AM

David F. Good, SM

Ruth M. Karras, SM

Sally G. Kohlstedt, History of Science and Technology, ASM

Elaine Tyler May, American Studies, SM

Lary May, American Studies, SM

Mary Jo Maynes, SM

Robert E. McCaa, SM

Russell R. Menard, SM

David W. Noble, American Studies, ASM

Carla R. Phillips, SM

William D. Phillips, Jr., SM

Kathryn L. Reyerson, SM

Steven Ruggles, SM

Joel B. Samaha, SM

Theofanis G. Stavrou, SM

James D. Tracy, SM

Rudolph J. Vecoli, SM

Ann B. Waltner, SM

Eric D. Weitz, SM

### **Associate Professor**

Catherine Asher, Art History, AM2

Keletso E. Atkins, African American and African Studies, AM2

Sarah C. Chambers, SM  
 Brenda Child, American Studies, AM2  
 Kirsten Fischer, SM  
 Tamara Giles-Vernick, M2  
 George D. Green, SM  
 Christopher M. Isett, M2  
 Erika Lee, SM  
 Patricia Lorcin, SM  
 Lisa A. Norling, SM  
 Jean M. O'Brien-Kehoe, SM  
 Ajay Skaria, SM  
 Liping Wang, SM  
 Barbara Y. Welke, SM  
 Thomas C. Wolfe, M2

#### **Adjunct Associate Professor**

Taner Akcam, AM2

#### **Assistant Professor**

Jennifer Alexander, History of Science and Technology, AM2  
 Giancarlos Casale, M2  
 David Chang, M2  
 Victoria B. Coifman, African American and African Studies, AM2  
 Tracey Deutsch, M2  
 Andrea Gallia, M2  
 Malinda Lindquist, M2  
 Michael Lower, M2  
 Patrick J. McNamara, M2  
 Hiromi Mizuno, M2  
 Kevin Murphy, M2  
 J.B. Shank, M2  
 Eva Von Dassow, Classical and Near Eastern Studies, AM2  
 Michele Wagner, M2

#### **Lecturer**

Julia Roos, AM2  
 Robert Schneiders, AM2

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; Ancient; East and South Asia; comparative women's history; medieval, early modern, and modern Europe; early modern world; Middle East, 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**—The only prerequisite for admission is a bachelor's degree. The program admits only to the Ph.D. and most students will have majored in history as an undergraduate. Preparation in at least two broad areas of history and training in at least one foreign language are strongly encouraged.

**Special Application Requirements**—The department requires the following: completion of the history department application (online submission strongly urged),

three letters of recommendation, a writing sample, statement of purpose, transcripts, GRE scores, and, for international students, TOEFL scores. The application deadline is December 1. The application and instructions may be found on the department's Web site at [www.hist.umn.edu](http://www.hist.umn.edu).

**Courses**—Please refer to History (Hist) in the course section of this catalog for courses pertaining to the program.

**Use of 4xxx Courses**—4xxx history courses are not included on degree program forms for the history graduate major or minor.

#### **M.A. Degree Requirements**

Students are only admitted to the Ph.D. program. They may complete an M.A. while studying for the Ph.D. The M.A. is offered under Plan A and Plan B. The Plan A requires six history courses (including Hist 8015), two non-history courses, ten M.A. thesis credits, and submission of a defendable thesis. The Plan B requires eight history courses (including Hist 8015), two non-history courses, and three Plan B papers (see department Web site for details).

**Language Requirements**—A reading knowledge of at least 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**—The M.A. minor in history typically involves a concentration in a single subarea of history and the completion of a minimum of three graduate courses in history (6 credit minimum). Normally, there is a representative from the history department on the student's oral examining committee.

#### **Ph.D. Degree Requirements**

The Ph.D. requires twelve history courses (including Hist 8015) (roughly 48 credits), four non-history courses (roughly 12 credits), and 24 Ph.D. thesis credits to total 72 credits.

**Language Requirements**—Reading knowledge of at least two foreign languages is required before admission to the preliminary exam. Some areas of concentration may require additional foreign languages. In some cases, quantitative methods may be considered a foreign language.

**Minor Requirements for Students Majoring in Other Fields**—The Ph.D. minor in history typically involves four to five history courses (including Hist 8015), and a written examination or substantial written project. The topic chosen must be logically related to the student's major work (must prepare for a written examination or substantial written project either in one general area and an associated subarea, or in two subareas). One or two representatives from history must serve on the student's preliminary oral examining and thesis committees. The preliminary oral exam also serves as the exam for the minor.

## History of Medicine and Biological Sciences

**Contact Information**—Program in the History of Medicine, University of Minnesota, MMC 506, 420 Delaware Street S.E., Minneapolis, MN 55455 (612-624-4416; fax: 612-625-7938; [www.med.umn.edu/history/home.htm](http://www.med.umn.edu/history/home.htm)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/stepl.asp](http://www.grad.umn.edu/faculty_rosters/stepl.asp).

#### **Professor**

C. Carlyle Clawson, Pediatrics, M2  
 John M. Eyler, SM  
 Sally Gregory Kohlstedt, History of Science and Technology, SM  
 Elaine Tyler May, American Studies, SM  
 Claus A. Pierack, Medicine, M2

#### **Assistant Professor**

Mark E. Borrello, SM  
 Jennifer L. Gunn, SM

#### **Adjunct Assistant Professor**

Jon Harkness, M2  
 David Rhees, M2  
 Jole Shackelford, M2

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 should submit a statement describing their historical interests and their goals for graduate study and ask three persons who know their academic work well to submit letters of recommendation on their behalf to the director of graduate studies for the program. It is also recommended that they submit scores from the General Test of the Graduate Record Exam and 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 December 31.

**Courses**—Please refer to History of Medicine (HMed) in the course section of this catalog for courses pertaining to the program.

**Use of 4xxx Courses**—Use of 4xxx courses is permitted only with permission of the director of graduate studies.

### 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, 12 credits of required courses in the history of medicine, plus 2 elective credits in the history of medicine, 6 credits in a minor or related field, and 10 thesis credits.

For Plan B, 12 credits of required courses in the history of medicine, plus an approved program of 12 credits 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 credits of required courses in the history of medicine, plus 9 additional elective credits in history of medicine, a minor or related field of 12 credits, and 24 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**—Program in History of Science and Technology, University of Minnesota, Tate Lab of Physics, 116 Church Street S.E., Minneapolis, MN 55455 (612-624-7069; fax 612-624-4578; HST@physics.umn.edu; <http://groups.physics.umn.edu/hsci>).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

John M. Eyler, History of Medicine, SM  
Michel Janssen, Physics, SM  
Sally Gregory Kohlstedt, Geology and Geophysics, SM  
Arthur L. Norberg, Computer Science, SM  
Robert W. Seidel, Chemical Engineering, SM  
Alan E. Shapiro, Physics, SM  
Roger H. Stuewer (emeritus), Physics, ASM

### Assistant Professor

Jennifer Karns Alexander, Mechanical Engineering, SM  
Mark E. Borrello, Ecology, Evolution, and Behavior, SM

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 four general areas: history of the physical sciences, history of the biological sciences, history of technology, and history of American science and technology. Students focus on the following approaches: conceptual development of the disciplinary fields; social, economic, and cultural contexts; the interactions among science, technology, and society; or a combination of these. The faculty's interests span the period from the Scientific Revolution into the twenty-first century.

**Prerequisites for Admission**—Students must have a bachelor's degree with a preferred 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**—In addition to the application sent to the Graduate School, a complete copy of the application must be submitted to the program including three letters of recommendation.

A writing sample and GRE scores are also recommended.

**Courses**—Please refer to History of Science and Technology (HSci) in the course section of this catalog for courses pertaining to this program.

**Use of 4xxx Courses**—Use of 4xxx courses on degree programs is subject to approval by the director of graduate studies.

### 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, technology, or American science and 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, technology, or American science and 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 each student's interests in discussion with the director of graduate studies.

## Housing Studies

### Postbaccalaureate Certificate

**Contact Information**—Housing Studies Certificate, College of Continuing Education, Student Support Services, 101 Westbrook Hall, 77 Pleasant Street S.E., Minneapolis, MN 55455 (612-624-4000; [adv@cce.umn.edu](mailto:adv@cce.umn.edu); [www.cce.umn.edu/certificates](http://www.cce.umn.edu/certificates)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

William Angell, M, Design Housing and Apparel, M

### Associate Professors

Marilyn Bruin, M, Design Housing and Apparel, M  
Jeff Crump, M, Design Housing and Apparel, M  
Becky Yust, M, Design Housing and Apparel, M  
Ann Ziebarth, M, Design Housing and Apparel, M

**Curriculum**—The housing studies certificate is designed for individuals interested, or currently working in, housing related professions to expand their knowledge in areas including housing and community development, housing policy, residential environment and energy use, rural housing issues, housing management, and housing finance.

**Prerequisites for Admission**—Students must have a bachelor's degree from an accredited U.S. university or its foreign equivalent. A preferred performance level for your undergraduate GPA of 3.00 (Students who do not have a 3.00 GPA, should describe relevant non-academic experience as well as explain any other relevant factors for the Graduate School's and program faculty's consideration.)

Students must apply for admission to the certificate with the Graduate School after completing no more than one course.

**Courses**—Required course: DHA 5471—Special Topics: Seminar for Certificate Students in Housing Studies (2 cr). Elective courses: DHA 4461, 4465, 3382, 5170, 5193, 5463, 5467, 5469, 5481, and 5484

Classes are offered on a rotating basis; students need to check the Class Schedule at <http://onestop.umn.edu/onestop/registration.html> or contact the department for schedules.

### Certificate Requirements

The certificate consists of at least 15 credits; 2 credits in the required course and at least 13 credits from the elective options. Courses are drawn primarily from the Department of Design, Housing, and Apparel. Some elective courses require prerequisites that may be waived with instructor permission following University policy.

The 4xxx courses listed under course options have been approved for inclusion in a Housing Studies Certificate Program. Students should review their plan of study with the academic adviser.

Early in the program, students should file a certificate program plan with CCE indicating the courses they plan to take, subject to faculty approval. All courses must be completed with a grade of B or better and an overall GPA of 2.80 or higher.

## Human Factors/ Ergonomics

### Minor Only

**Contact Information**—Doctoral Minor Program in Human Factors/Ergonomics, Human Factors Research Laboratory, School of Kinesiology, College of Education and Human Development, University of Minnesota, 202B Cooke Hall, 1900 University Ave S.E., Minneapolis, MN 55455 (612-626-1056).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

John C. Carmody, AM  
Arthur G. Erdman, Mechanical Engineering, AM  
Laël C. Gatewood, Laboratory Medicine and Pathology, AM  
Susan G. Gerberich, Environmental/Occupational Health, AM  
Denise A. Guerin, Design, Housing, and Apparel, AM  
Joseph A. Konstan, Computer Science, M  
Gordon E. Legge, Psychology, M  
Shashi Shekhar, Computer Science, AM  
Thomas Stoffregen, Kinesiology, M  
Michael Wade, Kinesiology, M

### Associate Professor

Karen L. LaBat, Design, Housing, and Apparel, AM

### Senior Research Fellow

Victor Koscheyev, Kinesiology, M  
Thomas Smith, Kinesiology, M

**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.

**Courses**—Please refer to Human Factors/Ergonomics (HumF) in the course section of this catalog for courses pertaining to this program.

**Use of 4xxx Courses**—Use of 4xxx courses is permitted based on adviser and director of graduate studies approval.

### Minor Only 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 Genetics

### Minor Only

**Contact Information**—Graduate Minor Program in Human Genetics, Department of Genetics, Cell Biology and Developments, University of Minnesota, 321 Church St. S.E., 6-160 Jackson Hall, Minneapolis, MN 55455 (612-624-3110; fax 612-626-6140; [www.gcd.med.umn.edu](http://www.gcd.med.umn.edu)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

Susan Berry, Pediatrics, M  
John West Day, Neurology, M  
Perry B. Hackett, Genetics, Cell Biology, Developmental Biology, M  
Richard A. King, Medicine, M  
Matt Mc Gue, Psychology, M  
R. Scott McIvor, Genetics, Cell Biology, Developmental Biology, M  
Harry T. Orr, Lab Medicine/Pathology, M  
Laura P. W. Ranum, Genetics, Cell Biology, Developmental Biology, M  
Brian George Van Ness, Genetics, Cell Biology, Developmental Biology, M  
Chester B. Whitley, Pediatrics, M

### Associate Professor

Kathleen F. Conklin, Genetics, Cell Biology, Developmental Biology, M  
Stephen C. Ekker, Genetics, Cell Biology, Developmental Biology, M  
Betsy Anne Hirsch, Laboratory Medicine/Pathology, M  
David Andrew Largaespada, Cancer Center, M  
Bonnie S. Le Roy, Genetics, Cell Biology, Developmental Biology, M  
James Scott Pankow, Epidemiology, M

### Assistant Professor

Michael D. Koob, Laboratory Medicine/Pathology, M  
Michael B. Miller, Epidemiology, M  
Kathy Lynn Moser, Medicine, M  
Nikunj V. Somia, Genetics, Cell Biology, Developmental Biology, M  
Karen-Sue Taussig, Medicine, M

**Curriculum**—The courses for the human genetics minor require a basic understanding of human and molecular genetics and some statistics.

**Prerequisites for Admission**—No specific course prerequisites are required for admission to the minor in human genetics. The following courses serve as prerequisites for the core courses that can be included in the minor: Biol 4003—Genetics (3 cr), GCD 4143—Human Genetics (3 cr), GCD 4034—Molecular Genetics (3 cr) or GCD 8121/BioC 8002—Advanced Molecular Genetics (3 cr), Stat 3011—Introduction to Statistical Analysis (3 cr), PubH 5414—Biostatistical Methods I (3 cr) and basic introduction courses to prokaryotic and eukaryotic molecular genetics. If a student has an insufficient background in a particular area the Steering Committee may recommend specific courses prior to starting the human genetics minor program. These courses do not count toward the minor requirements.

**Courses**—All students in the minor must take a basic graduate level human genetics course (such as GCD8073—Advanced Human Genetics). Additional courses to fulfill the requirements for the minor are selected from courses that are appropriate for advanced study in human genetics. Representative courses are listed in: genetics, epidemiology/public health, psychology, law. All courses for the minor cannot be from the same department/program, and students are encouraged to take at least one course that is outside of their major course area (such as taking a non-GCD course for a MCDBG student). Contact the program for specific courses for the minor program.

### **Minor Only Requirements**

A master's minor in human genetics requires nine credits, and a doctoral minor requires 12 credits.

## **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 (612-624-5810; fax 612-624-8360; hrirgrad@umn.edu; www.hrir.csom.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### **Professor**

Dennis A. Ahlburg, SM  
Richard D. Arvey, SM  
Avner Ben-Ner, SM  
Mario F. Bognanno, SM  
John W. Budd, SM  
John P. Campbell, Psychology, SM  
Zvi Eckstein, Economics, SM  
John A. Fossum, SM  
Jo-Ida C. Hansen, Psychology, SM  
Morris M. Kleiner, Public Affairs, SM  
Brian P. McCall, SM  
Jeylan T. Mortimer, Sociology, SM  
John Remington, SM  
Paul R. Sackett, Psychology, SM  
James G. Scoville, SM

Connie R. Wanberg, SM  
Yijiang Wang, SM  
Mahmood A. Zaidi, SM

### **Associate Professor**

Ross E. Azevedo, SM  
Theresa M. Glomb, SM  
Maria J. Hanratty, Public Affairs, SM  
Deniz S. Ones, Psychology, SM

### **Assistant Professor**

Joyce E. Bono, Psychology, AM2  
Stephanie L Luis, M2

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 (HRIR) 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 the core HRIR areas of staffing, training, and development; compensation and benefits; and labor relations and collective bargaining and is rooted in key concepts from the social and behavioral sciences and business such as organizational behavior and theory; labor market analysis; leadership, and strategy. 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 with key business knowledge.

**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, a résumé, GRE scores, and a clearly written statement of career interests, goals, and objectives. M.A. applicants may substitute the GMAT for the GRE. Applicants whose native language is not English must also submit score results from the TOEFL or IELTS.

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 M.A. 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 January 1. Applicants for all programs are encouraged to apply early, particularly for fall semester.

**Courses**—Please refer to Human Resources and Industrial Relations (HRIR) in the course section of this catalog for courses pertaining to the program.

**Use of 4xxx Courses**—4xxx courses are not permitted toward M.A. or Ph.D. degree requirements.

### **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, 8031, 8041, 8051, and 8071 and elective credits in HRIR. 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; three courses from among 8031, 8041, 8051, and 8071; and 12-16 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 social and behavioral sciences—applied economics, 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, the Ph.D. coordinator, 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.



## Human Rights

### Minor Only

**Contact Information**—Graduate Minor in Human Rights, Institute for Global Studies, University of Minnesota, 232 Social Science Building, 267 19th Avenue South, Minneapolis, MN 55455 (612-626-1879; fax 612-626-2242; hrp@umn.edu; http://hrp.cla.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

#### Professor

Ragui Assaad, Humphrey Institute of Public Affairs, M  
Stephen Feinstein, Holocaust and Genocide Studies, M  
Katherine Fennelly, Humphrey Institute of Public Affairs, M  
Sally Kenney, Humphrey Institute of Public Affairs, M  
Helga Leitner, Geography, M  
Dario Menanteau, Social Work, M  
Kathryn Sikkink, Political Science, M  
Hernán Vidal, Spanish and Portuguese Studies, M  
David Weissbrodt, Law, M  
Eric Weitz, History, M  
Mahmood A. Zaidi, Human Resources and Industrial Relations, M

#### Associate Professor

Elizabeth Heger Boyle, Sociology, Law, M

#### Assistant Professor

Michele D. Wagner, History, M

#### Other

Barbara A. Frey, Institute for Global Studies, M  
Karen B. Thompson, Institute for Global Studies, M  
John R. Vreyens, Agricultural, Food and Environmental Sciences, M

**Curriculum**—The human rights minor, available to master's (M.A. and M.S.) and doctoral students, provides an interdisciplinary foundation in human rights studies and practical experience in human rights work. To satisfy the core requirements, students must complete two of the four core courses, each of which is three credits (Law 6886—International Human Rights Law, Pol 8660—Theoretical Approaches to Human Rights, Pol 5485—Human Rights and Democracy in the World, and Glos 5900/Law 6058—Topics in Global Studies) and one 80 hour internship. M.A. and M.S. students must complete one additional elective course (3 credits) while doctoral and law students select at least two additional electives (totaling 6 credits) outside their major field from a designated course list. Other courses may be taken with the approval of the program director. Qualifying courses taken prior to approval of the minor will be applied retroactively.

**Prerequisites for Admission**—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 human rights. A GPA of 3.00 is required.

**Special Application Requirements**—Students should submit a letter of application that describes the student's background and motivation for applying to the minor program to the director of graduate studies. Further information may be requested by the director of graduate studies.

**Courses**—Elective courses are taken from a designated course list at [http://hrp.cla.umn.edu/academics.html#grad\\_minor](http://hrp.cla.umn.edu/academics.html#grad_minor).

**Use of 4xxx Courses**—4xxx courses may not be included on degree program forms for the minor.

### Minor Only Requirements

A master's minor in human rights requires 9 credits: 2 core courses, at least 1 elective course taken from a designated course list, and one six-week internship approved by the program director. A doctoral minor requires 12 credits: 2 core courses, at least 2 elective courses, and one six-week internship approved by the program director.

## 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; gradinfo@me.umn.edu; www.me.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

#### Professor

Sant Ram Arora, SM  
Saifallah Benjaafar, SM  
Diwakar Gupta, SM  
Caroline C. Hayes, SM  
Arthur V. Hill, Operations and Management Sciences, ASM  
Tarald O. Kvalseth (emeritus), ASM  
Patrick J. Starr, SM

#### Associate Professor

William L. Cooper, SM

#### Assistant Professor

Karen L. Donohue, Operations and Management Sciences, ASM  
Lisa A. Miller, SM

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 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 faculty members at the previous educational institution are required. Students are admitted in fall and spring semesters only; department deadlines are December 15 and October 15, respectively.

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

**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.

### 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 three of the five following courses: IE 5531, 5545, 5551, 8532 and 8541, along with 10 thesis credits.

Plan B (non-thesis) required courses include four of the five following courses: IE 5531, 5545, 5551, 8532, and 8541. Students must either take the Plan B course, IE 8951/8953, or must complete one to three Plan B papers, determined in consultation with the adviser.

**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. Four of the following five courses are required for the Ph.D. degree: IE 5531, 5545, 5551, 8532, and 8541.

**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; degrees@cdtl.umn.edu; www.cdtl.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

Gary A. Davis, M2  
Andrew Drescher, M2  
Catherine E. French, M2  
John S. Gulliver, M2  
Joseph F. Labuz, M2  
Panos G. Michalopoulos, M2  
Michael J. Semmens, M2  
Heinz G. Stefan, M2  
Vaughan R. Voller, M2

### Associate Professor

Randal J. Barnes, M2  
Robert J. Dexter, M2  
Raymond M. Hozalski, M2  
Arturo E. Schultz, M2  
Carol K. Shield, M2  
Karl A. Smith, M2

### Lecturer

Charles Hathaway, AM2  
Bradford Henry, AM2  
Peter Hilger, AM2  
Patrick Hirl, AM2  
Richard Kavaney, AM2  
Eil Kwon, AM2  
Tom Maze, AM2  
Steven Olson, AM2  
Howard Preston, AM2  
Raymond Spack, AM2  
Edward Warn, AM2

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.

**Courses**—Please refer to Infrastructure Systems Engineering (ISE) in the course section of this catalog for courses pertaining to the program.

**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.

### M.S.I.S.E. Plan B Degree Requirements

The M.S.I.S.E. in infrastructure systems engineering requires 30 credits with 23 credits in required core courses and 7 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.

## International Education

### Minor Only

**Contact Information**—Director of Graduate Studies, International Education Minor, Rosemarie J. Park, Work and Human Resource Education, College of Education and Human Development, University of Minnesota, 325L VoTech Education Building, 1954 Buford Avenue, St. Paul, MN 55108 (612-625-6267; parkx002@umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

Patricia G. Avery, Curriculum and Instruction, M  
William M. Bart, Educational Psychology, M  
David Chapman, Educational Policy and Administration, M  
John J. Cogan, Curriculum and Instruction, M  
Gerald W. Fry, Educational Policy and Administration, M  
Gary N. McLean, Work and Human Resource Education, M  
Josef A. Mestenhauser, Educational Policy and Administration, M  
R. Michael Paige, Educational Policy and Administration, M

### Associate Professor

Philip R. Goodrich, Biosystems and Agricultural Engineering, M

### Assistant Professor

Kay A. Thomas, Educational Psychology, M

### Lecturer

Deanne L. Magnusson, Educational Policy and Administration, M

**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; Human Resource Education; School of Kinesiology; and the 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. For an application form visit the International Education Minor Web site at: <http://education.umn.edu/EdPA/CIDE/minor.html> or consult with the director of graduate studies for more information.

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

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

### Minor Only 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 EdPA 5103—Comparative Education and 5124—Critical Issues in International Education (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: AFEE 5351, CI 5747, EdHD 5001, EdPA 5048, 5080, 5101, 5102, 5104, 5121, 5132, 8104, EPsy 5101, 5112, 5113, 5401, 5431, 5432, 5461, 8403, HRD 5408, 5496, WHRE 5821, Kin 5900, 8607, WHRE 8142).

## Interpersonal Relationships Research

### Minor Only

**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; wcollins@umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

**Regents Professor**

Ellen S. Berscheid, Psychology, M

**Professor**

W. Andrew Collins, Child Development, M  
 Nicki R. Crick, Child Development, M  
 Byron Egeland, Child Development, M  
 Patricia A. Frazier, Psychology, M  
 Harold D. Grotevant, Family Social Science, M  
 Dean E. Hewes, Communication Studies, M  
 Anthony D. Pellegrini, Educational Psychology, M  
 Jeffrey Simpson, Psychology, M  
 Mark Snyder, Psychology, M  
 L. Alan Sroufe, Child Development, M  
 Ruth G. Thomas, Work, Community, and Family Education, M

**Associate Professor**

Ascan F. Koerner, Communication Studies, M  
 Richard M. Lee, Psychology, M  
 Martha Rueter, Family Social Science, M

**Assistant Professor**

Susann Jones, Communications Studies, M

**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.

**Courses**—Please refer to Interpersonal Relationships Research (IREl) in the course section of this catalog for courses pertaining to the program.

**Use of 4xxx Courses**—4xxx courses, other than those required by the program, are permitted based on director of graduate studies approval.

**Minor Only 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 IREl 8001 (2 credits), 8021 (2 credits), and Psy 5204 (3 credits).

**Italian**

See French and Italian.

**Japanese**

See Asian Literatures, Cultures, and Media.

**Journalism**

See Mass Communication.

**Kinesiology**

**Contact Information**—Marta Fahrenz, Coordinator of Graduate Studies, School of Kinesiology, University of Minnesota, 223B Cooke Hall, 1900 University Avenue S.E., Minneapolis, MN 55455 (612-625-5300; fax 612-626-7700; kin@umn.edu; http://education.umn.edu/kin).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

**Professor**

Fred S. Apple, Laboratory Medicine and Pathology, ASM  
 James R. Carey, Physical Medicine and Rehabilitation, AM2  
 Richard S. Crow, Epidemiology, AM2  
 Arthur Erdman, Mechanical Engineering, AM2  
 Mary Jo Kane, SM  
 Arthur S. Leon, SM  
 Herbert L. Pick, Jr., Child Development, AM2  
 Thomas Stoffregen, SM  
 Michael Wade, SM  
 Albert Yonas, Child Development, AM2

**Associate Professor**

Donald Dengel, SM  
 Juergen Konczak, SM  
 Virgil G. Mathiowetz, AM2  
 Robert C. Serfass, SM  
 M. Kathryn Schmitz, Epidemiology, AM2  
 Diane M. Wiese-Bjornstal, SM

**Adjunct Associate Professor**

Catherine M. Kotz, Food Science and Nutrition, AM2

**Assistant Professor**

Yingjie Chen, Medicine, AM2  
 Lisa A. Kihl, M2  
 Dawn A. Lowe, Biochemistry, AM2  
 Moira A. Petit, M2  
 Stephen D. Ross, M2

**Adjunct Assistant Professor**

Daniel Kaiser, Medicine, AM2

**Lecturer**

JoAnn Buysse, M2  
 Christopher Draheim, M2  
 Stacy Ingraham, M2  
 Aynsley M. Smith, AM2  
 Thomas J. Smith, M2

**Senior Fellow**

Victor S. Koscheyev, M2

**Research Associate**

Bruce David Johnson, AM2  
 Carol A. Leitschuh, M2

**Other**

Anthony Brown, Recreational Sports, AM2  
 Paul E. Cassidy, AM2  
 Carol Gruber, Athletics, AM2

Aaron Scott Kelly, AM2

James C. Turman, Recreational Sports, AM2  
 Nicholas J. Ward, Mechanical Engineering, AM2  
 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 and health promotion, human factors/ergonomics, motor learning/development, sport management, sport psychology, or sport sociology.

**Prerequisites for Admission**—Although prospective master's students generally have an undergraduate degree in kinesiology, physical education, or sport and exercise science, others with a baccalaureate degree who have related preparation and a significant background and interest in the scientific study of physical activity may be admitted. 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 University of Minnesota Graduate School application form; a completed Division of 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 December 15 is encouraged to ensure priority consideration for admission and for teaching and research assistantships awarded for the next academic year. The three letters of recommendation must be sent directly to the department. 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; Laboratory for Health and Human Performance and Extreme Environments; Tucker Center for Research on Girls and Women in Sport.

**Courses**—Please refer to Kinesiology (Kin) in the course section of this catalog for courses pertaining to the program.

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

### **M.A. Degree Requirements**

M.A. students select an emphasis in adapted physical education, biomechanics/neural control, exercise physiology, human factors/ergonomics, 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 Kin 5981 (3 credits), Kin 8980 (1 credit), and in the related field or minor, EPsy 5261 (3 credits) or EPsy 8261 (3 credits) or equivalent. A GPA of at least 3.00 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**

Ph.D. students pursue an individualized program with an emphasis in adapted physical education, biomechanics/neural control, exercise physiology, human factors/ergonomics, 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, 144 Ralph Rapson Hall, 89 Church Street S.E., Minneapolis, MN 55455 (612-625-6860; fax 612-625-0710; gslan@umn.edu; www.cala.umn.edu /landscape\_architecture).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### **Professor**

Ann Forsyth, M2  
John F. Hart, Geography, M2  
Lance M. Neckar, M2  
Peter J. Olin, Horticultural Science, M2  
David G. Pitt, M2

### **Associate Professor**

Susan M. Galatowitsch, Horticultural Science, M2  
Clinton Hewitt, M2  
John A. Koepke, M2  
Rebecca J. Krinke, M2  
Robert D. Sykes, M2

### **Assistant Professor**

Kristine F. Miller, M2  
Laura R. Musacchio, M2

### **Adjunct Assistant Professor**

Joseph R. Favour, AM  
Jon Erik Kingstad, AM  
Richard T. Murphy, AM  
Daniel B. Shaw, AM

### **Lecturer**

Dean F. Abbott, M2  
L. Peter Macdonagh, 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 are directed toward developing professional design skills rooted in a deep understanding of the intrinsic physical and aesthetic characteristics of natural systems in the landscape. The faculty believes this is the best way for landscape architects to help people transform, conserve, rebuild, and steward the natural and cultural places within which their lives and communities unfold. Students learn to develop and apply place-based design to address local, urban, and regional landscape issues. The curriculum is structured to teach students to be professional landscape architects who use ecological systems-thinking as the basis for artistic design, and to develop in them design literacy based on ecology, art, technology, history, behavior, and place theory.

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 (non-professional) degree offering opportunity for a specialized focus within the field of landscape architecture in the context of the professional curriculum. The department also offers a dual degree with urban and

regional planning (M.L.A./M.U.R.P.) in cooperation with the Humphrey Institute of Public Affairs.

**Prerequisites for Admission**—M.L.A. program applicants must have completed a baccalaureate degree. M.S. program applicants must have completed an accredited baccalaureate or graduate 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 1 for entry the following fall in order to receive first consideration for admission, fellowships, and assistantships. In addition to completing the application requirements for the Graduate School, applicants should complete the departmental graduate application materials (available from the department office). The departmental application includes a completed departmental application form, a clearly written statement of intent that discusses the applicant's understanding of landscape architecture, goals, objectives, and career interests specific to the profession; three letters of reference (use the special form available from the department); and photocopies of all official transcripts. An 8.5 x 11 inch portfolio of examples of creative work is preferred. A portfolio is required to obtain advanced standing in design. Applicants with degrees in related design professions such as architecture, environmental design, or planning should clearly indicate their interest in being evaluated for admission with advanced standing on their departmental application form. GRE scores are preferred, but not required for entry. GRE scores can be helpful to applicants seeking fellowships and assistantships. A cumulative GPA of 3.00 or higher is preferred. Because of resource limitations, students are admitted for entry into the M.L.A. program only for the fall semester.

M.S. prospective students may apply at anytime, however application by January 1 is strongly encouraged to ensure priority consideration for fellowships and assistantships awarded for the next academic year. In addition to completing the application requirements for the Graduate School, applicants should obtain and complete the departmental graduate application materials (available from the department office). The department prefers that applicants submit GRE scores. Applicants should submit a statement of intent outlining research objectives 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. Prospective students are encouraged to contact the director of graduate studies to discuss areas of focus and potential

faculty advisers. Students may be admitted to the MS program for any academic term.

**Courses**—Please refer to Landscape Architecture (LA) in the course section of this catalog for courses pertaining to the programs.

**Use of 4xxx Courses**—Inclusion of 4xxx courses in degree programs is subject to approval by adviser and director of graduate studies.

### 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 professional landscape architects. Areas of required coursework within the program include design, technology and ecology, graphic and written communication, landscape history, and research methods. To develop a special focus or to explore areas in more depth, students are encouraged to select from among the graduate seminars offered to fulfill elective requirements. To meet the LAAB standards, 88 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 is 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.L.A./M.U.R.P. Plan B Dual Degree Requirements

This option allows students to earn both a master of landscape architecture (M.L.A.) and a master of urban and regional planning (M.U.R.P.) by careful coordination of coursework. Typically, students will be able to achieve both professional degrees in three and a half to four years by cross-counting specified courses. The specific M.U.R.P. specializations for which this option is most appropriate are land use/urban design, housing and community development, and environmental planning.

Students may elect the Plan A option as part of the dual degree, but doing so will require slightly more time to complete both degrees. Consult with the director of graduate studies for details.

To meet the LAAB standards, 88 graduate credits are required to earn an M.L.A., including 36 credits of landscape architecture studio courses, 3 credits of research issues and methods, 9 elective credits (which may be chosen from a list of selected M.U.R.P. program courses), and 40 credits of history, theory, and technology courses. A maximum of 18 credits taken to fulfill M.U.R.P. degree requirements may also be counted toward fulfillment of the M.L.A. degree requirements. Please refer to the urban and regional planning program for M.U.R.P. degree requirements.

### 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, transportation, planning of world heritage sites, and urban design.

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

### Minor Only

**Contact Information**—Meredith M. McQuaid, Associate Dean, Law School, University of Minnesota, 285 Law Building, 229 19th Avenue S., Minneapolis, MN 55455 (612-625-3025; fax 612-626-1874; lsserv@umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

#### Professor

Edward S. Adams, AM  
Stephen F. Befort, M  
Brian H. Bix, M  
David P. Bryden (emeritus), AM  
Dan Burk, M  
Ann Burkhart, AM  
Jim Chen, M  
Carol Chomsky, AM  
Laura Cooper, AM  
John J. Cound (emeritus), AM  
Barry C. Feld, M

Mary L. Fellows, AM  
Richard S. Frase, AM  
Daniel J. Gifford, AM  
Oren Gross, AM  
Kristin E. Hickman, AM  
Joan S. Howland, AM  
Peter H. Huang, AM  
Robert J. Levy (emeritus), AM  
Donald G. Marshall, (emeritus), AM  
John H. Matheson, AM  
Fred L. Morrison, AM  
Fionnuala Ni Aolain, AM  
Ruth L. Okediji, M  
Michael S. Paulsen, AM  
Gregg D. Polsky, AM  
Ferdinand P. Schoettle, Jr. (emeritus), AM  
David Stras, AM  
Michael Tonry, AM  
David Weissbrodt, AM  
Susan Wolf, M  
Judith T. Younger, AM

#### Associate Professor

Dale A. Carpenter, AM  
Guy-Uriel Charles, AM  
Jamie Anne Grodsky, AM  
Brett H. McDonnell, AM  
Myron W. Orfield, AM  
Shayna M. Sigman, AM  
Kevin K. Washburn, AM

#### Other

Beverly Balos, AM  
Maury S. Landsman, AM  
Meredith M. McQuaid, M  
Kathryn J. Sedo, AM  
Stephen M. Simon, AM  
Carl M. Warren, AM

**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. Enrollment in Law School courses is on a space-available basis, with preference given to law-degree-seeking candidates.

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

### Minor Only 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, 202 Wesbrook Hall, 77 Pleasant Street S.E., Minneapolis, MN 55455 (612-626-8724; fax 612-626-0077; mls@cce.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

Fred Amram, General College, M2  
Kent R. Bales, English, M2  
Jill Barnum, General College, M2  
Terrence Collins, General College, M2  
Daniel Detzner, General College, M2  
Stephen Feinstein, History, M2  
Gerald Fry, Education Policy and Administration, M2  
Maria Gini, Computer Science, M2  
Judith A. Martin, Geography, M2  
Victoria Mikelonis, Rhetoric, M2  
Randy Moore, General College, M2  
Philip Regal, Ecology, Evolution, Behavior, M2  
Karen Seashore, Education and Human Development, M2  
John Wallace, Philosophy, M2  
Jack Zipes, Germanic Studies, M2

### Associate Professor

Rose Brewer, Studies in Africa and the African Diaspora, M2  
Barbara Crosby, Public Affairs and Public Policy, M2  
George Green, History, M2  
Arthur M. Harkins, Educational Policy and Administration, M2  
Carol A. Miller, American Studies, M2  
Roger Miller, Geography, M2  
Lisa Norling, History, M2  
Byron Schneider, Educational Policy and Administration, M2  
Robert Silberman, Art History, M2  
Jacquelyn N. Zita, Feminist Studies, M2

### Other

Michael M. Andregg, M2  
Stephen L. Daniel, M2  
Robert Del Tredici, AM2  
Sarah Dennison, M2  
William Dikel, M2  
Margot Galt, M2  
Joseph Goldman, M2  
Isabel Gomez, M2  
Anita Gonzalez, M2  
DonnaMae J. Gustafson, M2  
John Hasselberg, M2  
Janet Hively, M2  
Jeremy F. Iggers, M2  
Jack Johnson, M2  
Judith Katz, M2  
Roseann Lloyd, M2  
Peter Lock, M2  
Justin O'Brien, M2  
Nicholas Pease, M2  
David A. Shupe, M2  
Roslye Ultan, M2

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 early evenings, and some Saturday mornings, most graduate-level courses offered during the day are also open to M.L.S. students.

**Prerequisites for Admission**—A bachelor's degree is required. The faculty committee reviewing each application looks for indications that the student can succeed in graduate study, there is a good "fit" between the M.L.S. program and the student's stated educational objectives, and the student can express him/herself well in writing. The faculty also looks for positive qualities and other experiences the student will bring to the program.

**Special Application Requirements**—A statement of purpose, letters of support, all undergraduate transcripts, transcripts from any postbaccalaureate degree or coursework, 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.

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

**Use of 4xxx Courses**—Contact the M.L.S. office prior to taking a 4xxx course.

### M.L.S. 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, advanced interdisciplinary inquiry, 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 and the director of graduate studies.

## Linguistics

**Contact Information**—Director of Graduate Studies, Linguistics, University of Minnesota, 215 Nolte Center, 315 Pillsbury Drive, S.E., Minneapolis, MN 55455 (612-624-3331; fax 612-624-4579; ILES@umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

Genevieve J. Escure, English, AM2  
Jeanette K. Gundel, SM  
Michael B. Kac, Philosophy, SM  
Michael P. Maratsos, Child Development, AM2  
John D. Nichols, American Indian Studies, AM2  
Maria D. Sera, Child Development, AM2  
Nancy J. Stenson, SM

Amy L. Sheldon, Communication Studies, SM  
Polly E. Szatrowski, AM2

### Associate Professor

Bruce T. Downing, SM  
Charles R. Fletcher, Psychology, AM2  
Betsy K. Kerr, French and Italian, AM2  
Carol A. Klee, Spanish and Portuguese Studies, AM2

### Assistant Professor

Benjamin Munson, AM2  
Hooi Ling Soh, M2

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 and use of human language and the parameters that determine degree and manner of variation across languages. These core areas constitute the foundation for other subfields of linguistics, including psycholinguistics, sociolinguistics, historical linguistics, computational linguistics, and neurolinguistics.

**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.

**Courses**—Please refer to Linguistics (Ling) in the course section of this catalog for courses pertaining to the program.

**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.

### 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 (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 36 (30 credits in the major and 6 credits in related fields). Subject to approval by the director of graduate studies, students who have already taken required courses or their equivalents

as undergraduates (or as graduates in another program), may be able to 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 cr), 4002 (3 cr), and either 5201 (3 cr) or 5302 (4 cr). 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 theoretical issues in core areas of language structure (phonology, syntax, semantics/pragmatics), language processing (cognitive processes that underlie language use) and language acquisition. The program especially emphasizes research that integrates core areas of theoretical linguistics with language processing or acquisition.

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 have completed M.A. course requirements (30 credits or less, depending on prior coursework in linguistics), a second-semester course in field methods (3 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 presentation and 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, 4002,

and either 5201 or 5302. Students who have taken 5001 or its equivalent as undergraduates do not have to substitute another course.

## Literacy and Rhetorical Studies

### Minor Only

**Contact Information**—Center for Writing, University of Minnesota, 227 Lind Hall, 207 Church Street S.E., Minneapolis, MN 55455 (612-626-7583; fax 612-626-7580; writing@umn.edu; <http://writing.umn.edu/lrs/index.htm>).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

#### Professor

Richard W. Beach, Curriculum and Instruction, M  
Karlyn K. Campbell, Communication Studies, M  
Andrew D. Cohen, Linguistics, English as a Second Language, M

Terence G. Collins, General College, M  
Hazel Dicken-Garcia, Journalism and Mass Communication, M

Edward M. Griffin, English, M

Alan G. Gross, Rhetoric, M

Laura J. Gurak, Rhetoric, M

Michael Hancher, English, M

Ruth-Ellen B. Joeres, German, Scandinavian, and Dutch, M

Earl E. McDowell, Rhetoric, M

Donald J. Ross, Jr., English, M

Edward Schiappa, Communication Studies, M

Mary M. Schuster, Rhetoric, M

Amy L. Sheldon, Communication Studies, M

Geoffrey Sirc, General College, M

Elaine E. Tarone, Linguistics, ESL, Slavic Languages and Literatures, M

Barbara M. Taylor, Curriculum and Instruction, M

Paulus W. van den Broek, Educational Psychology, M

Billie J. Wahlstrom, Rhetoric, M

Arthur E. Walzer, Rhetoric, M

#### Associate Professor

Lisa Albrecht, School of Social Work, M

Thomas E. Augst, English, M

Lee-Ann Kastman Breuch, Rhetoric, M

Daniel Brewer, French and Italian, M

Robert L. Brown, Jr., Cultural Studies and Comparative Literature, M

Patrick Bruch, General College, M

Patricia A. Crain, English, M

Rebecca L. Krug, English, M

Amy M. Lee, General College, M

Carol A. Miller, American Studies, M

Rosemarie J. Park, Work, Community, and Family Education, M

Gwendolyn Pough, Women's Studies, M

Thomas J. Reynolds, General College, M

Diane J. Tedick, Curriculum and Instruction, M

Constance L. Walker, Curriculum and Instruction, M

Kirt H. Wilson, Communication Studies, M

Thomas Wolfe, History, M

#### Assistant Professor

Richard J. Graff, Rhetoric, M

John Logie, Rhetoric, M

Thomas J. Reynolds, General College, M

#### Lecturer

Julie Kalnin, Curriculum and Instruction, M

**Curriculum**—The minor in literacy and rhetorical studies (LRS) 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 literacy theory and practice, research methods, and historical inquiry, 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 LRS.

**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.

**Special Application Requirements**—Entrance to the minor is granted by permission of the director of graduate studies in LRS and the faculty selection committee. Application materials include a completed application form, statement of purpose, curriculum vitae, relevant postsecondary transcripts, and two letters of recommendation. Applications are reviewed on a rolling basis.

**Courses**—Contact the minor program office for information on relevant coursework pertaining to the program, or view recent course recommendations at <http://writing.umn.edu/lrs/courses.htm>.

**Use of 4xxx Courses—Use of 4xxx Courses** toward degree requirements is permitted with approval from the director of graduate studies.

### Minor Only Requirements

A master's minor requires three graduate courses or seminars (9 credits minimum), one course each from the following categories: 1) literacy theory or practice, including pedagogy; 2) research methods and practices in literacy or rhetorical studies; and 3) a historical topic, e.g., history of the book, or of rhetoric, or of 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, students must take 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.

## Luso-Brazilian Literature

**Contact Information**—See Hispanic and Luso-Brazilian Literatures and Linguistics.

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Associate Professor

Fernando E. Arenas, M2

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 desirable. The deadline for application for admission and financial aid is January 15 for fall entry. Applicants who wish to be considered for teaching assistantships or Graduate School fellowships are encouraged to apply early.

**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.

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

### 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 at least one foreign language in addition to 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 (612-624-5747; fax 612-624-7510; MOT@cdtl.umn.edu; www.cdtl.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

Carl Adams, Information and Decision Sciences, M2

Massoud Amin, Electrical and Computer Engineering, M2

Philip Bromiley, Strategic Management, AM2

Norman L. Chervany, Information and Decision Sciences, M2

William K. Durfee, Mechanical Engineering, M2

W. Bruce Erickson, Strategic Management, M2

Arthur V. Hill, Operations and Management Science, M2

George John, Marketing and Logistics Management, M2

Edward J. Joyce, Accounting and Business Law, M2

Kenneth H. Keller, Public Affairs, M2

Ian H. Maitland, Strategic Management and Organization, M2

Alfred Marcus, Strategic Management and Organization, M2

Mary Nichols, Strategic Management and Organization, AM2

Dennis L. Polla, Electrical Engineering, M2

Kenneth J. Roering, Marketing and Logistics Management, M2

Kanti Kingshuk Sinha, Operations and Management Science, M2

Karl A. Smith, Civil Engineering, M2

Kelvin W. Willoughby, Management of Technology, M2

### Associate Professor

Douglas Ernie, Electrical and Computer Engineering, M2

### Assistant Professor

Frederick J. Riggins, Information and Decisions Sciences, M2

### Other

Lockwood Carlson, Management of Technology, M2

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. 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 pivotal technologies, technology forecasting, project management, management of innovation, intellectual property management, 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 proceed through the program 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 off-campus residencies, including an international residency; 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 an engineering, science, or other technology related field 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, and a statement of purpose. GRE or Graduate Management Admission Test scores are not generally required. The professional track record of the applicant weighs heavily in the admissions process. A personal interview with an admissions committee 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 (MOT 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

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

**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 (612-624-5747; fax 612-624-7510; general@cdtl.umn.edu; www.cdtl.umn.edu).

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.

**Courses**—Please refer to Manufacturing Systems (MS) in the course section of this catalog for courses pertaining to the program.

**Use of 4xxx Courses**—4xxx courses may not be included on degree program forms.

### 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 are required. 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 Student Services, School of Journalism and Mass Communication (SJMC), University of Minnesota, 110 Murphy Hall, 206 Church Street S.E., Minneapolis, MN 55455; 612-625-4054; fax 612-626-8251; sjmcgrad@tc.umn.edu.

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

Tsan-Kuo Chang, SM  
Hazel Dicken-Garcia, SM  
John Eighmey, SM  
Ronald J. Faber, SM  
David P. Fan, Genetics and Cell Biology, ASM  
John R. Finnigan, Jr., ASM  
Kathleen A. Hansen, SM  
Jane E. Kirtley, SM  
Mark Snyder, Psychology, ASM  
Daniel J. Sullivan, SM  
Daniel B. Wackman, SM

### Associate Professor

Kenneth O. Doyle, SM  
Dona B. Schwartz, SM  
Albert R. Tims, Jr., SM  
Thomas Wolfe, History, AM2

### Assistant Professor

Linus Abraham, M2  
Donald Brazeal, M2  
Jisu Huh, M2  
Marco Ijzer, MA  
Linda Jean Kenix, M2  
Gary Schwitzer, M2  
Brian Southwell, M2

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 mass communication M.A. emphasizes the theoretical study of mass communication and analysis of media systems and effects. The degree is intended for those who wish to pursue Ph.D. degrees or teaching and research careers, as well as those who seek communication related positions. 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 M.A. program. Individuals with strong social science or 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 (including health communication, advertising and political communication); media law, ethics, and history; international communication; and media management. All programs are suffused with the study of new media communication.

**Prerequisites for Admission**—The minimum requirement for admission is a B.A. or equivalent.

**Special Application Requirements**—Applicants must submit a departmental application; a clearly 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 or IELTS (academic). In addition, such students seeking teaching assistantships are required to pass the SPEAK test of spoken-English proficiency prior to appointment. Admission is considered for fall semester only; the application deadline is December 31.

**Special Facilities**—Special facilities include the Minnesota Journalism Center, the Silha Center for the Study of Media Ethics and Law, the Institute for New Media Studies, the Digital Information Resource Center (which houses the Eric Sevareid Library), and the SJMC Research Division.

**Courses**—Please refer to Journalism and Mass Communication (Jour) in the course section of this catalog for courses pertaining to this program.

### M.A. Plan A Degree Requirements

A minimum of 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**—No foreign language is required. However, for the master's program, foreign language proficiency is recommended for students interested 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 a minimum of 9 credits in a coherent area, with at least 6 credits at 8xxx.

### Ph.D. Degree Requirements

A minimum of 54 course credits and 24 thesis credits are required. Coursework must include 12 credits in required core courses. And at least 42 other graduate credits of which at least 21 credits must come from SJML courses and at least 18 credits outside the SJMC. All courses included on the Ph.D. degree program form must be graduate level (4xxx, 5xxx or 8xxx) and taken A-F.

**Language Requirements**—No foreign language is required. However, it is recommended that doctoral students pursuing international study to have or obtain, high language proficiency, or obtain it, in the appropriate area.

**Minor Requirements for Students Majoring in Other Fields**—A Ph.D. minor program consists of a minimum of 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 Materials 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 612-624-6702; gradprog@math.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

Scot Robert Adams, SM  
Stephen B. Agard, SM  
Greg William Anderson, SM  
Douglas Norman Arnold, SM  
John Robert Baxter, SM  
Sergey Germanovich Bobkov, SM  
Maury Daniel Bramson, SM  
Carne Calderer, SM  
Bernardo Cockburn, SM  
Mark F. Feshbach, SM  
Bert E. Fristedt, SM  
Paul B. Garrett, SM  
Jay R. Goldman, SM  
Lawrence F. Gray, SM  
Robert D. Gulliver, SM  
Dennis A. Hejhal, SM  
Naresh C. Jain, SM  
Dihua Jiang, SM  
Max A. Jodeit, Jr., SM  
Donald William Kahn, SM  
Harvey Bayard Keynes, SM  
Nicolai Vladimir Krylov, SM  
Nai-Chung Conan Leung, SM  
Walter Littman, SM  
Mitchell B. Luskin, SM  
Gennady Lyubeznik, SM  
Albert Marden, SM  
Richard P. McGehee, SM  
William Messing, SM  
Norman G. Meyers, SM  
Willard Miller, SM  
Richard B. Moeckel, SM  
Claudia Neuhäuser, Ecology, Evolution, and Behavior, SM  
Wei-Ming Ni, SM  
Andrew Odlyzko, SM  
Peter John Olver, SM  
Hans George Othmer, SM  
Peter Polacik, SM  
Karel L. Prikry, SM  
Victor Schorr Reiner, SM  
Fernando Leiva Reitich, SM

Peter A. Rejto, SM  
Joel L. Roberts, SM  
Mikhail V. Safonov, SM  
Fadil Santosa, SM  
Arnd Scheel, SM  
George R. Sell, SM  
Steven I. Sperber, SM  
Dennis W. Stanton, SM  
Vladimir Sverak, SM  
Jiaping Wang, SM  
Peter Joseph Webb, SM  
Dennis E. White, SM  
Ofer Zeitouni, SM

### Associate Professor

Ionut Ciocan-Fontanine, SM  
Jack Frederi Conn, SM  
David L. Frank, SM  
Hillel H. Gershenson, SM  
Markus Keel, SM  
Tian-Jun Li, SM  
Chester L. Miracle, SM  
Wayne H. Richter, SM  
Alexander A. Voronov, SM

### Assistant Professor

Gilad Lerman, SM  
Ezra Miller, SM  
Duane Q. Nykamp, SM  
Jianhong Shen, SM  
Daniel Spirn, SM  
Carlos Tolmasky, ASM

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 an emphasis in applied and industrial mathematics. The M.S. Plan B includes an emphasis in mathematics education and an emphasis in actuarial science.

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 Math 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.

**Courses**—Please refer to Mathematics (Math) in the course section of this catalog for courses pertaining to the program.

**Use of 4xxx Courses**—In exceptional cases 4xxx courses may be permitted as part of degree programs subject to director of graduate studies approval.

### 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 5xxx sequence.

### Ph.D. Degree Requirements

The School of Mathematics offers a 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.

## 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; gradinfo@me.umn.edu; www.me.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Regents Professor

Richard J. Goldstein, SM  
Benjamin Y. H. Liu (emeritus), ASM

### Professor

Roger E. Arndt, Civil Engineering, ASM  
Saifallah Benjaafar, SM  
Mrinal Bhattacharya, Biosystems and Agricultural Engineering, ASM  
John C. Bischof, SM  
Perry L. Blackshear (emeritus), ASM  
Thomas R. Chase, SM  
Jane H. Davidson, SM  
Max Donath, SM  
William K. Durfee, SM  
Arthur G. Erdman, SM  
Edward A. Fletcher (emeritus), ASM  
Steven L. Girshick, SM  
Caroline C. Hayes, SM  
Joachim V. R. Heberlein, SM  
Warren E. Ibele (emeritus), ASM  
David B. Kittelson, SM  
Barney E. Klamecki, SM  
Uwe R. Kortshagen, SM  
Thomas H. Kuehn, SM  
Francis A. Kulacki, SM  
Tarald O. Kvalseth (emeritus), SM  
Jack L. Lewis, Orthopaedic Surgery, ASM  
Susan C. Mantell, SM  
Virgil A. Marple, SM  
Peter H. McMurry, SM  
Katsuhiko Ogata (emeritus), ASM  
Sahas V. Patankar (emeritus), ASM  
Emil Pfender (emeritus), ASM  
David Y. H. Pui, SM  
Subbiah Ramalingam, SM  
James W. Ramsey, SM  
Sridharan Ramaswamy, Bio-based Products, ASM

Jeffrey T. Roberts, Chemistry, ASM  
Terrence W. Simon, SM  
Ephraim M. Sparrow, SM  
Patrick J. Starr, SM  
Kim A. Stelson, SM  
Paul J. Strykowski, SM  
Kumar K. Tamma, SM  
Robert T. Tranquillo, Biomedical Engineering, ASM  
Vaughn R. Voller, Civil Engineering, ASM

### Associate Professor

Victor H. Barocas, Biomedical Engineering, ASM  
Tianhong Cui, SM  
Sean C. Garrick, SM  
Allison Hubel, SM  
Perry Y. Li, SM  
Rajesh Rajamani, SM

### Assistant Professor

Jennifer Alexander, AM  
Joan Bechtold, Orthopedic Surgery, ASM  
Traian Dumitrica, SM  
Heinrich O. Jacobs, Electrical and Computer Engineering, ASM

### Associate Program Director

Craig R. Shankwitz, AM  
Nicholas J. Ward, AM

### Research Associate

Ramdev Kanapady, 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**—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 faculty members at the previous educational institution are required. Students are admitted in the fall and spring semesters only, the departmental deadlines for which are December 15 and October 15, respectively.

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

**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.

## 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 one 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 (without thesis), students must either take the Plan B course, ME 8951/8953, or must complete one to three Plan B papers, determined in consultation with the adviser.

**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 mechanical 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 (612-624-9919; fax 612-624-0139; medchem@umn.edu; www.pharmacy.umn.edu/medchem)

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

Yusuf J. Abul-Hajj, SM  
Patrick E. Hanna, SM  
Stephen S. Hecht, Laboratory Medicine and Pathology, SM  
Thomas R. Hoye, Chemistry, SM  
Rodney L. Johnson, SM  
Philip S. Portoghese, SM  
Rory P. Rimmel, SM  
W. Thomas Shier, SM  
Marilyn K. Speedie, SM  
Robert Vince, SM  
Carston R. Wagner, SM

### Adjunct Professor

Herbert T. Nagasawa, SM

### Associate Professor

David M. Ferguson, SM  
William B. Gleason, Laboratory Medicine and Pathology, SM  
Ramaiah Muthyala, SM  
Lisa A. Peterson, Environmental and Occupational Health, SM  
Natalia Y. Tretyakova, SM

### Assistant Professor

Robert A. Fecik, SM  
Shana J. Sturla, SM  
Chenguo Xing, SM  
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 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.

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

**Use of 4xxx Courses**—With the exception of BioC 4331, use of 4xxx courses is not permitted toward degree requirements.

### M.S. Plan A Degree Requirements

The medicinal chemistry program does not offer admission for a master's degree. Students must complete a core curriculum of advanced courses in organic chemistry (4 credits) and 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 courses (MedC 5700 and 5710, advanced medicinal chemistry courses, and other courses in the medicinal chemistry core curriculum.

## Medieval Studies

### Minor Only

**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; cmedst@umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

Ronald F. Akehurst, French and Italian, M

Bernard S. Bachrach, History, M  
Caesar E. Farah, African American and African Studies, M  
Evelyn S. Firchow, German, Scandinavian, and Dutch, M  
Donna G. Cardamone Jackson, Music, M  
Klaus P. Jankofsky, English, Duluth, M  
Ruth M. Karras, History, M  
Calvin B. Kendall, English, M  
Anatoly Liberman, German, Scandinavian, and Dutch, M  
Susan J. Noakes, French and Italian, M  
James A. Parente, Jr., German, Scandinavian, and Dutch, M  
William D. Phillips, Jr., History, M  
Kathryn L. Reyerson, History, M  
Robert P. Sonkowsky, Classical and Near Eastern Studies, M  
John A. Watkins, English, M  
Peter Wells, Anthropology, M

### Associate Professor

G. Lee Fullerton, German, Scandinavian, and Dutch, M  
Kaaren E. Grimstad, German, Scandinavian, and Dutch, M  
Nita Krevans, Classical and Near Eastern Studies, M  
Rebecca L. Krug, English, M  
Oliver Nicholson, Classical and Near Eastern Studies, M  
John W. Steyaert, Art History, M  
Ray M. Wakefield, German, Scandinavian, and Dutch, M  
Barbara Weissberger, Spanish and Portuguese, M

### Assistant Professor

Lianna Farber, English, M  
Michael T. Lower, History, M

**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 Studies; 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.

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

**Use of 4xxx Courses**—Use of 4xxx courses toward degree requirements is permitted based on director of graduate study approval.

### Minor Only Requirements

The master's minor requires 6 graduate credits: two courses in medieval studies outside the student's major department, including a Latin course (Lat 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

### Minor Only

**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; sadowsky@soils.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

#### Regents Professor

G. David Tilman, Ecology, Evolution, and Behavior, M

#### Professor

Iris D. Charvat, Plant Biology, M  
 Randall E. Hicks, Biology, Duluth, M  
 Linda L. Kinkel, Plant Pathology, M  
 Timothy J. Kurtti, Entomology, M  
 David J. McLaughlin, Plant Biology, M  
 Jean-Alex E. Molina, Soil, Water, and Climate, M  
 Philip J. Regal, Ecology, Evolution, and Behavior, M  
 Michael J. Sadowsky, Soil, Water, and Climate, M  
 Lawrence P. Wackett, Biochemistry, M

**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, microbial ecology, and theoretical 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 3301) 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.

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

**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.

### Minor Only 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 (4 cr); MicB 4111 (3 cr); MicB 4121 (3 cr); MIMP 8002 (4 cr). Additional courses: CE 8541, 8542, 8551, EEB 4601, 4609, PIPa 8102, 8103, Soil 5515, 5611.

## Microbial Engineering

**Contact Information**—M.S. Program in Microbial Engineering, University of Minnesota, 1479 Gortner Avenue, Suite 140, St. Paul, MN 55108 (bti@cbs.umn.edu; 612-625-0212; fax 612-625-1700; [www.bti.umn.edu/microbialms.html](http://www.bti.umn.edu/microbialms.html)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

#### Professor

Robert J. Brooker, Genetics and Cell Biology, M2  
 Peter W. Carr, Chemistry, M2  
 Paul P. Cleary, Microbiology, M2  
 Gary M. Dunny, Microbiology, M2  
 Lynda B. Ellis, Laboratory Medicine and Pathology, M2  
 Michael C. Flickinger, Biochemistry, M2  
 James A. Fuchs, Biochemistry, M2  
 Alan B. Hooper, Genetics and Cell Biology, M2  
 Wei-Shou Hu, Chemical Engineering and Materials Science, M2  
 R. Scott McIvor, Laboratory Medicine and Pathology, M2

Michael J. Sadowsky, Soil, Water, and Climate, M2  
 Janet L. Schottel, Biochemistry, M2  
 W. Thomas Shier, Medicinal Chemistry and Pharmacognosy, M2  
 Friedrich Srienc, Chemical Engineering and Materials Science, M2  
 Lawrence P. Wackett, Biochemistry, M2  
 Carston Wagner, Medicinal Chemistry, M2

#### Associate Professor

Antony Michael Dean, Ecology, Evolution, and Behavior, M2  
 Romas Kazlauskas, Biochemistry, M2  
 Daniel J. O'Sullivan, Food Science and Nutrition, M2  
 Claudia Schmidt-Dannert, Biochemistry, M2  
 Peter Southern, Microbiology, M2

#### Assistant Professor

Daniel R. Bond, Microbiology, M2  
 Arkady Khodursky, Biochemistry, M2  
 Jennifer Maynard, Chemical Engineering and Materials Science, M2

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. Students 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, microbiology, food science, genetics and cell biology, or pharmacognosy. The program is coordinated by the BioTechnology Institute (BTI), involving faculty from ten departments and four institutes of the University.

**Prerequisites for Admission**—A baccalaureate degree in biological sciences, microbiology, 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.

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

**Use of 4xxx Courses**—A limited number of 4xxx courses are permitted toward degree requirements based on director of graduate studies approval.

### M.S. Degree Requirements

The M.S. requires 32 credits (including 10 thesis credits) for Plan A and 32 credits (including 1-4 research credits) for Plan B. The two-year program comprises coursework in a specialized program of microbiology, molecular biology, immunology, and chemical engineering. In addition, students present two seminars and teach one laboratory course in advanced microbiology, biochemistry, molecular biology, immunology, 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, MMC 196, 420 Delaware Street S.E., Minneapolis, MN 55455 (612-624-5947; fax 612-626-0623; micab@mail.ahc.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Regents Professor

Ashley T. Haase, Microbiology, SM

### Professor

Mitchell S. Abrahamsen, Veterinary Pathobiology, SM

Khalil Ahmed, Laboratory Medicine and Pathology SM

Dwight L. Anderson, Oral Sciences, SM

Timothy W. Behrens, Medicine, SM

Judith G. Berman, Genetics, Cell Biology, and Development, SM

Peter B. Bitterman, Medicine, SM

Bruce R. Blazar, Pediatrics, SM

Paul P. Cleary, Microbiology, SM

Denis R. Clohisy, Orthopedic Surgery, SM

Agustin P. Dalmaso, Surgery, SM

Anath Das, Biochemistry, Molecular Biology, and Biophysics, SM

Gary M. Dunny, Microbiology, SM

Lynda B. Ellis, Laboratory Medicine and Pathology, SM

Dale S. Gregerson, Ophthalmology, SM

Ronald R. W. Jemmerson, Microbiology, SM

Marc K. Jenkins, Microbiology, SM

Vivek Kapur, Microbial Plant Genetics, SM

Tucker W. LeBien, Laboratory Medicine and Pathology, SM

Walter C. Low, Neurosurgery, SM

Paul T. Magee, Genetics, Cell Biology, and Development, SM

Patrick W. Mantyh, Preventive Sciences, SM

James B. McCarthy, Laboratory Medicine and Pathology, SM

R. Scott McIvor, Laboratory Medicine and Pathology, SM

Larry L. McKay, Food Science and Nutrition, SM

Matthew F. Mescher, Laboratory Medicine and Pathology, SM

Jeffrey S. Miller, Medicine, SM

Daniel L. Mueller, Medicine, SM

Sundaram Ramakrishnan, Pharmacology, SM

Michael J. Sadowsky, Soil, Water, and Climate, SM

Michel M. Sanders, Biochemistry, Molecular Biology, and Biophysics, SM

Leslie A. Schiff, Microbiology, SM

Patrick M. Schlievert, Microbiology, SM

Janet L. Schottel, Biochemistry, Molecular Biology, and Biophysics, SM

Yoji Shimizu, Laboratory Medicine and Pathology, SM

Daniel A. Vallera, Therapeutic Radiology, SM

Brian G. Van Ness, Genetics, Cell Biology, and Development, SM

Gregory M. Vercellotti, Medicine, SM

Catherine M. Verfaillie, Medicine, SM

Kenneth D. Vernick, Microbiology, SM

Lawrence P. Wackett, Biochemistry, Molecular Biology, and Biophysics, SM

Carol L. Wells, Laboratory Medicine and Pathology, SM

Douglas Yee, Medicine, SM

### Associate Professor

Sandra K. Armstrong, Microbiology, SM

Vivian J. Bardwell, Genetics, Cell Biology, and Development, SM

Paul Bohjanen, Microbiology, SM

Kathleen F. Conklin, Microbiology, SM

Kristin A. Hogquist, Laboratory Medicine and Pathology, SM

Stephen C. Jameson, Laboratory Medicine and Pathology, SM

Carol A. Lange, Medicine, SM

David A. Largaespada, Genetics, Cell Biology, and Development, SM

Louis M. Mansky, Oral Sciences, SM

Daniel J. O'Sullivan, Food Science and Nutrition, SM

Christopher A. Pennell, Laboratory Medicine and Pathology, SM

Amy P. Skubitz, Laboratory Medicine and Pathology, SM

Peter Southern, Microbiology, SM

Bruce K. Walcheck, Veterinary and Biomedical Sciences, SM

Jennifer J. Westendorf, Orthopedic Surgery, SM

### Assistant Professor

Daniel R. Bond, SM

Wade A. Bresnahan, Microbiology, SM

Dana Davis, Microbiology, SM

Michael A. Farrar, Laboratory Medicine and Pathology, SM

Patrick M. Gaffney, Medicine Hematology, SM

Jennifer L. Hall, Medicine, SM

Linda K. Hansen, Laboratory Medicine and Pathology, SM

Koho Iizuka, Medicine Hematology, SM

Elizabeth G. Ingulli, Pediatrics, SM

Dan S. Kaufman, Medicine, SM

Ameeta Kelekar, Laboratory Medicine and Pathology, SM

Nobuaki Kikyo, Medicine, SM

Alexander Khoruts, Medicine, SM

Brett K. Levay-Young, Surgery, SM

Kim C. Mansky, Diagnostic/Surgical Sciences, SM

Christian D. Mohr, Microbiology, SM

Erik J. Peterson, Medicine, SM

Stephen A. Rice, Microbiology, SM

Robert J. Sheaff, Biochemistry, Molecular Biology, and Biophysics, SM

Pamela J. Skinner, Veterinary and Biomedical Sciences, SM

Wufan Tao, Medicine, SM

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 and therapy, 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 should include 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; official 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. The MICaB program is a fall semester start only. Applications should be submitted by December 15; those received after that date are considered only if space is available in the desired program.

**Courses**—Please refer to Microbiology, Immunology, and Cancer Biology (MICa) in the course section of this catalog for courses pertaining to the program.

**Use of 4xxx Courses—Use of 4xxx Courses** on degree program forms is permitted based on director of graduate study approval.

### 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, 6-160 Jackson Hall, 321 Church St. S.E., Minneapolis, MN 55455 (612-624-7470; fax 612-626-6140; 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.

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Regents Professor

Ronald L. Phillips, Agronomy and Plant Genetics, SM

### Professor

Timothy W. Behrens, Medicine, SM  
 Judith G. Berman, SM  
 Susan A. Berry, Pediatrics, SM  
 Robert M. Brambl, Plant Biology, SM  
 Robert J. Brooker, SM  
 Robert P. Elde, Neuroscience, SM  
 Stuart F. Goldstein, SM  
 Perry B. Hackett, SM  
 David W. Hamilton, SM  
 Thomas S. Hays, SM  
 Robert K. Herman, SM  
 Ross G. Johnson, SM  
 Richard A. King, Medicine, SM  
 Ryoko Kuriyama, SM  
 Paul A. Lefebvre, Plant Biology, SM  
 Paul C. Letourneau, Neuroscience, SM  
 Richard W. Linck, SM  
 Dennis M. Livingston, Biochemistry, Molecular Biology, and Biophysics, SM  
 Paul T. Magee, SM  
 Cary N. Mariash, Medicine, SM  
 James B. McCarthy, Laboratory Medicine and Pathology, SM  
 R. Scott McIvor, SM  
 Steven C. McLoon, Neuroscience, SM  
 Matthew F. Mescher, Laboratory Medicine and Pathology, SM  
 Michael B. O'Connor, SM  
 Neil E. Olszewski, Plant Biology, SM  
 Harry T. Orr, Laboratory Medicine and Pathology, SM  
 Laura P. W. Ranum, SM  
 Janet L. Schottel, Biochemistry, Molecular Biology, and Biophysics, SM  
 Scott B. Selleck, Pediatrics, SM  
 Yoji Shimizu, Laboratory Medicine and Pathology, SM  
 Carolyn D. Silflow, Plant Biology, SM

Michael J. Simmons, SM  
 Robert L. Sorenson, SM  
 Clifford J. Steer, Medicine, SM  
 Howard C. Towle, Biochemistry, Molecular Biology, and Biophysics, SM  
 Brian G. Van Ness, SM  
 Catherine M. Verfaillie, Medicine, SM  
 Chester B. Whitley, Pediatrics, SM  
 Robin L. Wright, SM  
 Susan M. Wick, Plant Biology, SM

### Associate Professor

Vivian J. Bardwell, SM  
 Kathleen F. Conklin, SM  
 Stephen C. Ekker, SM  
 Betsy A. Hirsch, Laboratory Medicine and Pathology, SM  
 Kristin A. Hogquist, Laboratory Medicine and Pathology, SM  
 Victoria Iwanij, SM  
 Stephen C. Jameson, Laboratory Medicine and Pathology, SM  
 David A. Largaespada, SM  
 Bonnie S. LeRoy, SM  
 Louis M. Mansky, Dentistry, SM  
 M. David Marks, Plant Biology, SM  
 Linda K. McLoon, Ophthalmology, SM  
 Mary E. Porter, SM  
 Ann E. Rougvie, SM  
 Joceyn E. Shaw, SM  
 Jeffrey A. Simon, SM  
 Amy P. Skubitz, Laboratory Medicine and Pathology, SM  
 Margaret A. Titus, SM  
 Kenneth D. Vernick, Microbiology, SM  
 David A. Zarkower, SM

### Assistant Professor

Lihsia Chen, SM  
 Duncan Clarke, SM  
 Sean D. Conner, M2  
 Electra C. Coucouvanis, SM  
 Dana Davis, Microbiology, M2  
 Michael A. Farrar, Laboratory Medicine and Pathology, SM  
 William M. Gray, Plant Biology, M2  
 David T. Kirkpatrick, SM  
 Deanna Koepp, M2  
 Michael D. Koob, Medicine, M2  
 Lorene M. Lanier, Neuroscience, M2  
 Paul C. Marker, M2  
 Nancy J. Mendelsohn, AM  
 Jeffrey R. Miller, SM  
 Kathy L. Moser, Medicine, SM  
 Hiroshi Nakato, M2  
 Thomas P. Neufeld, SM  
 Sue V. Petzel, Obstetrics/Gynecology, AM  
 Anton Sanderfoot, Plant Biology, M2  
 Lisa A. Schimmenti, Pediatrics, AM2  
 William Shawlot, SM  
 Nikunj Somia, SM

### Other

Mary J. Ahrens, AM  
 Janice Baker, AM  
 Shari R. Baldinger, AM  
 Beth Conrad, AM  
 Vicki L. Couch, AM  
 Maryann V. Fox, AM  
 Katherine A. Nelson Fuhrman, AM  
 Judy Garza, AM

Joy Gustin, AM  
Bonnie A. Hatten, AM  
Beth A. Henderson-Conrad, AM  
Jennifer A. Roggenbuck, AM  
Karol R. Rubin, AM  
Alysia B. Spear, AM  
Catherine M. Walsh Vockley, 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 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; and the College of Agricultural, Food and Environmental Sciences. Special institutes in human genetics, plant molecular genetics, biological process technology, and a center for developmental biology provide opportunities for graduate study. The program administers a specialty in genetic counseling. The program participates in the Joint Degree Program in Law, Health, and Life Sciences.

**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 625 (paper based) or 263 (computer based) or higher are 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 2. Graduate studies begin in the fall semester.

**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.

**Use of 4xxx Courses—Use of 4xxx Courses** toward degree requirements is permitted only with prior written approval from the director of graduate studies.

### 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. The student's core curriculum is multidisciplinary and contributes to both major and minor field requirements.

**Language Requirements**—None.

**Minor Requirements for Students Majoring in Other Fields**—A doctoral minor typically includes the genetics core (GCD 8131 and BioC 8002 or GCD 8121 or GCD 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

See Comparative and Molecular Biosciences.

## Museum Studies

### Minor Only

**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; murdo001@umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Regents Professor

Joanne B. Eicher, M

### Professor

Robert J. Poor, AM  
Peter S. Wells, AM

### Associate Professor

Margaret K. DiBlasio, M  
Lyndel I. King, Art History, M

### Assistant Professor

David J. Rhees, AM

### Lecturer

Anita F. Cholewa, AM

### Other

Robert D. Jacobsen, AM  
Gordon R. Murdock, M  
Colleen J. Sheehy, AM

**Curriculum**—The museum studies minor offers a structured graduate curriculum for master'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.

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

**Use of 4xxx Courses**—Use of 4xxx courses towards degree requirements is permitted based on director of graduate studies approval.

### Minor Only Requirements

The master's and doctoral minors require 7 and 12 credits respectively. Each requires the introductory seminar (MSt 5011, 3 credits), the museum practices course (MSt 5012, 3 credits), and at least one credit of internship (MSt 5020). Additional credits for the doctoral minor may be internship or directed study (MSt 8993).



## Music

**Contact Information**—School of Music,  
University of Minnesota, 100 Ferguson Hall,  
2106 4th Street South, Minneapolis, MN 55455  
(phone 612-6274-0071; fax 612-624-8001;  
email mus-adm@umn.edu)

For up-to-date graduate faculty listings, see  
www.grad.umn.edu/faculty\_rosters/step1.asp.

### Professor

John E. Anderson, SM  
Lydia Artymiw, SM  
Thomas J. Ashworth, SM  
David B. Baldwin, SM  
Alexander Braginsky, SM  
Michael Cherlin, SM  
David A. Grayson, SM  
Paul A. Haack, SM  
Donna C. Jackson, SM  
Craig J. Kirchhoff, SM  
Korey B. Konkol, SM  
Alex J. Lubet, SM  
Glenda Maurice, SM  
Sally O'Reilly, SM  
Tanya Remenikova, SM  
Rebecca P. Shockley, SM  
D. Clifton Ware, Jr., SM  
Lawrence Weller, SM  
Noel Zahler, SM  
Judith L. Zaimont, SM

### Associate Professor

Akosua Addo, M2  
Dean W. Billmeyer, SM  
Mark P. Bjork, SM  
David A. Damschroder, SM  
Jean Del Santo, SM  
Charles E. Furman, SM  
Keitha Lucas Hamann, SM  
Kelley A. Harness, SM  
Young Nam Kim, SM  
Jerry Luckhardt, SM  
Peter Mercer-Taylor, SM  
Fernando A. Meza, SM  
Paul M. A. Shaw, SM

### Assistant Professor

Matthew Bribitzer-Stull, M2  
Immanuel Davis, SM  
John De Haan, M2  
Doug Geers, M2  
Mirjana Lausevic, M2  
Timothy Lovelace, SM  
Akira Mori, SM  
Kathy S. Romey, M2  
Linda Thompson, M2  
David Walsh, M2

### Instructor

Rosalind L. Laskin, AM  
John W. Miller, Jr., AM  
Dean Sorenson, AM

### Lecturer

James L. Clute, AM  
Jorja Fleezanis, AM  
Brian Grivna, AM  
Charles D. Kavalovski, AM  
Kathy Kienzle, AM  
Peter M. Lloyd, AM

| <i>Degree Objective</i>                  | <i>Additional Materials</i>  |
|--|--|
| Theory (M.A., Ph.D.)                     | Original papers (tonal and post-tonal analysis)  |
| Composition (M.A., Ph.D.)                | Original scores and recordings   |
| Musicology/Ethnomusicology (M.A., Ph.D.) | Original papers  |
| Music Education/Therapy (Ph.D.)          | Original papers (e.g., research or professional papers). Documentation of at least 3 years of teaching experience, or at least 3500 hours of clinical experience |
| Accompanying/Coaching                    | Audition/Repertoire list   |
| Conducting (D.M.A.)                      | Audition/Interview   |
| Choral Conducting (M.M.)                 | Audition/Interview   |
| Orchestral Conducting (M.M.)             | 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   |

Basil Reeve, AM  
Eugene Rousseau, SM  
John Snow, AM2  
Charles Ullery, AM  
Jeffrey W. Van, AM  
Herbert E. Winslow, AM  
Wendy Zaro-Mullins, AM

### Other

Julia Bogorad, AM  
Gary A. Bordner, AM  
Christopher Brown, AM  
Timothy Diem, AM  
Burt Hara, AM  
Barbara G. Kierig, AM  
Clara Zahler, 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 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. The School of Music also cooperates with the College of Education and Human Development in offering the master of education (M.Ed.) with an emphasis in music education/therapy. Applications for the M.Ed. are available from Student and Professional Services in the College of Education and Human Development. 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/ethnomusicology, theory and/or composition, performance, or music education/therapy. Applicants to the M.A. in music education also generally hold an appropriate teaching license.

### Special Application Requirements

—All applicants must submit three current letters of recommendation. Applicants to the musicology/ethnomusicology, theory, composition, or music education/therapy programs must submit GRE General Test scores; applicants to other programs are encouraged to submit GRE scores in order to be eligible for University fellowships. Applicants whose primary language is not English must score a minimum of 6.5 on the IELTS test or 565 (paper)/223 (computer) on the TOEFL test to be exempt from further English study (ESL)

The various degree programs also require additional application materials. See above.

For the M.M. and D.M.A. programs in performance, taped auditions may be accepted for applicants who live more than 200 miles from the Twin Cities. However, applicants are encouraged to perform a live audition if at all possible. For the M.M. and D. M.A. in conducting, a preliminary tape screening is required in both audio and video formats.

Although students may be admitted any semester, only students starting in fall semester will be considered for financial assistance. To receive Graduate School fellowship consideration, all materials must be received by January 10. Check with the School of Music for scholarship and assistantship application deadlines.

**Diagnostic Exams**—Music Theory and Music History Placement Exams 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. Individual programs may require additional diagnostic exams.

**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.

**Use of 4xxx Courses**—Use of 4xxx Courses toward degree requirements is subject to adviser and/or director of graduate studies approval.

### M.A. Degree Requirements

The master of arts in music offers emphases in musicology/ethnomusicology (Plan A and Plan B), theory (Plan B only), and composition (Plan B only).

The M.A. in music with emphasis in musicology/ethnomusicology requires 35 credits (25 course credits and 10 thesis credits) for Plan A and 31 course credits for Plan B; the emphasis in composition (Plan B only) requires 41 course credits, and the emphasis in music theory (Plan B only) requires 30 course credits. 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 M.A. degree emphases.

**Final Exam**—For the emphasis in musicology/ethnomusicology, the final exams are written and oral. For the emphases in theory and composition, the final exams are oral.

### M.M. Degree Requirements

The master of music degree offers emphases in piano, organ, voice, violin, viola, cello, double bass, violin performance and Suzuki pedagogy, 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, and choral conducting.

The M.M. 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, guitar, piano pedagogy, orchestral conducting, wind ensemble/band conducting, and choral conducting; 33 credits for organ and voice; 37 credits for violin performance and Suzuki pedagogy; 39 credits for accompanying and coaching (two recitals are required); and 44 credits for harp performance.

**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, minimum credit requirements are as follows: 89 credits for piano; 85 credits for instrumental performance, guitar, and conducting; 87 credits for organ and woodwinds; 89 credits for voice; and 91 credits for accompanying and coaching.

Inclusion of 4xxx music theory courses on degree programs for the M.M. or D.M.A. degree is subject to adviser and director of graduate studies approval. If the course is approved, it cannot be the only graduate theory course on the degree program form.

The School of Music offers two options for D.M.A. degrees.

The first option requires the minimum credits as outlined above, typically divided as follows: 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 option 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, composition, choral conducting, 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; 65 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

**Contact Information**—See Music

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

#### Professor

Paul A. Haack, M2

#### Associate Professor

Akosua Addo, M2  
Charles E. Furman, M2  
Keitha Lucas Hamann, M2

#### Assistant Professor

Linda Thompson, M2

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 has a track in music education (Plan B only). This degree also offers an emphases music therapy. The music education track involves planning, teaching, learning, and evaluating processes with musical content applied across education settings. While knowledge of acculturation

phenomena is included, applications generally are directed toward structured educational settings. The music therapy emphasis furthers the preparation of professionals who use music to accomplish therapeutic aims.

The M.A. is a research-oriented degree with coursework fairly evenly divided between scholarly skill development, musical knowledge and skills, theoretical music education and music therapy content, and applications. The School of Music also cooperates with the College of Education and Human Development in offering the master of education (M.Ed.) with an emphasis in music education/therapy. Applications for the M.Ed. are available from Student and Professional Services in the College of Education and Human Development.

**Prerequisites for Admission**—See Music.

**Special Application Requirements**—See Music.

**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.

**Use of 4xxx Courses**—Use of 4xxx Courses towards degree requirements is subject to adviser and/or director of graduate studies approval.

### M.A. Degree Requirements

The M.A. requires 30 course credits: 12 credits in music education/therapy for the major; 10 credits in music; 3 credits of electives from professional education, music, and music education/therapy; and a 5-credit research project.

**Language Requirements**—None.

**Final Exam**—The final exam is oral.

## Nanoparticle Science and Engineering

### Minor Only

**Contact Information**—Graduate Minor Program in Nanoparticle Science and Engineering, Integrative Graduate Education and Research Traineeship Program, University of Minnesota, 2101 Mechanical Engineering, 111 Church Street S.E., Minneapolis, MN 55455 (612-625-4028; fax 612-625-4344; mnanoigert@umn.edu; www.nanoigert.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

#### Professor

Stephen A. Campbell, Electrical and Computer Engineering, M

Robert Carr, Chemical Engineering and Materials Science, M

C. Barry Carter, Chemical Engineering and Materials Science, M

Jim Chelikowsky, Chemical Engineering and Materials Science, M

William Gerberich, Chemical Engineering and Materials Science, M

Steven L. Girshick, Mechanical Engineering, M

Wayne L. Gladfelter, Chemistry, M

Joachim Heberlein, Mechanical Engineering, M

James Kakalios, Physics, M

David Kittelson, Mechanical Engineering, M

Uwe Kortshagen, Mechanical Engineering, M

Alon McCormick, Chemical Engineering and Materials Science, M

Peter H. McMurry, Mechanical Engineering, M

David Y. H. Pui, Mechanical Engineering, M

Jeff Roberts, Chemistry, M

Donald G. Truhlar, Chemistry, M

Randall Victora, Electrical and Computer

Engineering, M

#### Associate Professor

C. Daniel Frisbie, Chemical Engineering and Materials Science, M

Sean Garrick, Mechanical Engineering, M

Heiko O. Jacobs, Electrical and Computer

Engineering, M

Richard B. McClurg, Chemical Engineering and Materials Science, M

R. Lee Penn, Chemistry, M

David J. Norris, Chemical Engineering and Materials Science, M

Michael Tsapatsis, Chemical Engineering and Materials Science, M

**Curriculum**—The Integrative Graduate Education and Research Traineeship program offers a minor in nanoparticle science and engineering for M.S. and Ph.D. students. The curriculum is designed to allow completion of the minor without an increase in overall course load. The minor requires one or two core courses and electives relevant to nanoparticle research. The program of courses is tailored in advance consultation between the student and director of graduate studies.

**Prerequisites for Admission**—Admission to a master's or doctoral degree-granting program in the Institute of Technology and preparation of a minor program of coursework approved by the director of graduate studies is required. Students in programs outside the Institute of Technology must be approved by the director of graduate studies.

**Use of 4xxx Courses**—4xxx courses may be included on degree program forms.

### Minor Only Requirements

M.S. students must complete NPSE 8001—Introduction to Nanoparticle Science and Engineering (3 credits) and 3 elective credits. PhD students must complete NPSE 8001 and 8002—Nanoparticle Science and Engineering Laboratory (3 credits) and 6 elective credits.

Electives must be chosen from existing courses relevant to nanoparticle research. Examples include Chem 8021—Computational Chemistry, EE 5624—Optical Electronics, ME 8361—Introduction to Plasma Technology, Phys 5701—Solid State Physics for Engineers and Scientists, ChEn 8301—Physical Rate Processes I: Transport, and MatS 8212—Solid State Reaction Kinetics.

## Natural Resources Science and Management

**Contact Information**—Lisa Wiley, College of Natural Resources, University of Minnesota, 135 Skok Hall, 2003 Upper Buford Circle, St. Paul, MN 55108 (612-624-2748; fax 612-624-6282; lwiley@umn.edu; www.cnr.umn.edu/grad/NRSMgrad).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

#### Professor

Dorothy H. Anderson, SM

Mark E. Ascerno, Jr., Entomology, ASM

Marvin E. Bauer, SM

Melvin J. Baughman, SM

William A. Befort, AM2

Robert A. Blanchette, Plant Pathology, ASM

Charles R. Blinn, SM

James L. Bowyer, SM

Kenneth N. Brooks, SM

Thomas E. Burk, SM

Stephan P. Carlson, M2

John J. Cogan, Curriculum and Instruction, AM

Edward J. Cushing, Ecology, Evolution, and Behavior, ASM

Alan R. Ek, SM

David T. Grimsrud, ASM

Robert G. Haight, AM

Gary R. Johnson, M2

Joseph G. Massey, ASM

Leo H. McAvoy, Jr., Kinesiology, ASM

John L. Nieber, Biosystems and Agricultural

Engineering, ASM

James A. Perry, SM

Alan Stephen Polasky, Applied Economics, ASM

Shri Ramaswamy, SM

Peter B. Reich, SM

C. Ford Runge, Applied Economics, ASM

Simo Sarkanen, SM

Elmer L. Schmidt, SM

J. L. David Smith, Fisheries, Wildlife, and Conservation Biology, AM2

Susan G. Stafford, SM

Alfred D. Sullivan, M2

Karen Yin, SM

#### Adjunct Professor

William A. Hendrickson, AM

Randall K. Kolka, ASM

Ronald E. McRoberts, AM

Warren Moser, AM2

John Schomaker, AM2

Elon S. Verry, ASM

Jerrold E. Winandy, AM

Gary Worry, AM

John C. Zasada, ASM

#### Associate Professor

Robert Blair, AM

Paul V. Bolstad, SM

Andrew J. David, SM

Fred N. Finley, Curriculum and Instruction, AM

Sarah E. Hobbie, Ecology, Evolution, and Behavior,

AM

Howard M. Hoganson, SM

Patrick H. Huelman, M2

Kristen C. Nelson, SM  
Michael E. Ostry, AM  
Steven J. Severtson, SM  
Thomas L. Schmidt, ASM  
Timothy M. Smith, SM  
Steven J. Taff, Applied Economics, AM2  
Ulrike W. Tschirner, SM

### **Adjunct Associate Professor**

David N. Bengston, ASM  
Erwin R. Berglund, AM2  
Stephen M. Bratkovich, ASM  
Karlyn Eckman, Institute for Global Studies, AM2  
David C. Fulton, Fisheries, Wildlife, and Conservation Biology, ASM  
Mark H. Hansen, AM2  
Pamela J. Jakes, AM2  
Joseph G. O'Brien, AM  
Brian J. Palik, AM  
Don E. Riemenschneider, AM  
Jerrilyn L. Thompson, M2

### **Assistant Professor**

Michael C. Demchik, AM2  
Daniel W. Gilmore, M2  
Michael A. Kilgore, SM  
Kristine F. Miller, Landscape Architecture, AM  
Rebecca A. Montgomery, SM  
Karen S. Oberhauser, ASM  
Harlan D. Petersen, M  
Michael J. Phillips, AM  
Michael R. Reichenbach, Cloquet Forestry Center, M  
Rubin Shmulsky, M2  
Eric K. Zenner, Forest Resources, M2

### **Adjunct Assistant Professor**

Mary M. Blickenderfer, AM  
Meredith W. Cornett, ASM  
Daniel L. Erkkila, M2  
C. Hobart Perry, AM2  
Stephanie Snyder, AM2

### **Research Associate**

Dean A. Current, M2  
Kevin J. Dodds, AM  
Lee E. Frelich, SM  
Jacek Oleksyn, AM  
Ingrid E. Schneider, SM  
Robert T. Seavey, M2  
Robert A. Stine, Cloquet Forestry Center, M2

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 tracks:

- 1) Forests (biology, ecology, conservation, and management);
- 2) economics, policy, management, and society;
- 3) assessment, monitoring, and geospatial analysis;
- 4) recreation resources, tourism, and environmental education;
- 5) forest hydrology and watershed management;
- 6) forest products; or
- 7) paper science and engineering.

**Prerequisites for Admission**—Prerequisites vary by subfield. Most admitted students have earned degrees in natural resource related majors. Applicants with exceptional academic records but no related 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 3 (for fall admission) is encouraged to ensure consideration for fellowships and assistantships. General GRE scores are required. Letters of recommendation are strongly encouraged. 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.

**Courses**—Please refer to Natural Resources Science and Management (NR), Forest Resources (FR), Environment and Natural Resources (ENR), and Bio-based Products (BP) in the course section of this catalog.

**Use of 4xxx Courses**—Inclusion of 4xxx Forest Resources (FR), Environment and Natural Resources (ENR), and Bio-based Products (BP) courses on degree program forms of natural resources science and management 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 use these 4xxx courses subject to their own program's approval.

The Natural Resources Science and Management 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.

### **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 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. In consultation with faculty members, Plan B students design a program 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. In addition, students must register for 24 thesis credits. Course selection and thesis proposals are developed by each student in consultation with the faculty adviser and are approved by the Natural Resources Science and Management Graduate Studies 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.

## 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; neurosci@umn.edu; www.neuroscience.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### **Professor**

James Ashe, Neuroscience, SM  
Karen Hsiao Ashe, Neurology, SM  
Alvin J. Beitz, Veterinary and Biomedical Sciences, SM  
David R. Brown, Veterinary Medicine, SM  
Dwight A. Burkhardt, Psychology, SM  
Marilyn E. Carroll, Psychiatry, SM  
H. Brent Clark, Laboratory Medicine and Pathology, SM  
Bianca M. Conti-Fine, Biochemistry, SM  
John W. Day, Neurology, SM  
Richard Di Fabio, Physical Therapy, SM  
Janet M. Dubinsky, Neuroscience, SM  
Timothy J. Ebner, Neuroscience, SM  
Robert P. Elde, Biological Sciences, SM  
Esam E. El-Fakahany, Psychiatry, SM  
William C. Engeland, Surgery, SM  
Martha Flanders, Neuroscience, SM  
William H. Frey, Pharmacy, SM  
Michael K. Georgieff, Pediatrics, SM  
Apostolos P. Georgopoulos, Neuroscience, SM  
Glenn J. Giesler, Jr., Neuroscience, SM  
Christopher M. Gomez, Neurology, SM  
Rolf Gruetter, Radiology, SM  
Boyd K. Hartman, Psychiatry, SM  
Bin He, Biomedical Engineering, SM  
William G. Iacono, Psychology, SM  
Paul A. Iaizzo, Anesthesiology, SM  
William R. Kennedy, Neurology, SM  
Daniel J. Kersten, Psychology, SM  
Alice A. Larson, Veterinary Medicine, SM  
Gordon E. Legge, Psychology, SM  
Paul C. Letourneau, Neuroscience, SM  
Allen S. Levine, Psychiatry, SM  
Kelvin O. Lim, Psychiatry, SM  
Walter C. Low, Neurosurgery, SM  
Patrick W. Mantyh, Preventive Sciences, SM  
Steven C. McLoon, Neuroscience, SM  
Karen A. Mesce, Entomology, SM  
Robert F. Miller, Neuroscience, SM

Charles A. Nelson, Child Development, SM  
 Eric A. Newman, Neuroscience, SM  
 Michael B. O'Connor, Genetics, Cell Biology, and Development, SM  
 Harry T. Orr, Laboratory Medicine and Pathology, SM  
 John W. Osborn, Physiology, SM  
 Hans G. Othmer, Mathematics, SM  
 J. Bruce Overmier, Psychology, SM  
 Jose V. Pardo, Psychiatry, SM  
 Richard E. Poppele, Neuroscience, SM  
 Philip S. Portoghese, Pharmacy, SM  
 Laura P. Ranum, Genetics, Cell Biology, and Development, SM  
 David A. Rottenberg, Neurology, SM  
 Peter A. Santi, Otolaryngology, SM  
 Ronald J. Sawchuk, Pharmaceutics, SM  
 Scott Selleck, Pediatrics, Genetics, Cell Biology, and Development, SM  
 Virginia S. Seybold, Neuroscience, SM  
 Donald A. Simone, Oral Sciences, SM  
 John F. Soechting, Neuroscience, SM  
 Peter W. Sorensen, Fisheries and Wildlife, SM  
 Stanley A. Thayer, Pharmacology, SM  
 David D. Thomas, Biochemistry, SM  
 Kamil Ugurbil, Radiology, SM  
 Catherine Verfaillie, Medicine, SM  
 Neal F. Viemeister, Psychology, SM  
 George L. Wilcox, Pharmacology, SM

#### **Associate Professor**

John H. Anderson, Otolaryngology, SM  
 W. Dale Branton, Neuroscience, M2  
 William Elmquist, Pharmaceutics Research, SM  
 Patricia L. Farris, Psychiatry, SM  
 S. Hossein Fatemi, Psychiatry, SM  
 Janet L. Fitzakerley, Pharmacology Duluth, SM  
 Jurgen F. Fohlmeister, Physiology, SM  
 Jon Gottesman, Neuroscience, M2  
 Sheng He, Psychology, SM  
 Christopher N. Honda, Neuroscience, SM  
 Eric Javel, Otolaryngology, SM  
 Paulo Kofuji, Neuroscience, SM  
 Juergen Konczak, Kinesiology, SM  
 Linda K. McLoon, Ophthalmology, SM  
 Moses K. Njenga, Veterinary Medicine, SM  
 Giuseppe Pellizzer, Neuroscience, SM  
 Govind T. Vatassery, Psychiatry, SM  
 Martin W. Wessendorf, Neuroscience, SM  
 Kevin D. Wickman, Pharmacology, SM

#### **Adjunct Associate Professor**

Catherine M. Kotz, Food Science and Nutrition, SM

#### **Assistant Professor**

Bagrat Amirikian, Neuroscience, M2  
 Vincent A. Barnett, Physiology, SM  
 Frank H. Burton, Pharmacology, M2  
 Lihsia Chen, Genetics, Cell Biology and Development, M2  
 Carolyn Fairbanks, Pharmaceutics, Pharmacology, and Neuroscience, SM  
 Rod M. Feddersen, Veterinary Medicine, SM  
 Jonathan Gewirtz, Psychology, SM  
 Geoffrey M. Ghose, Neuroscience, SM  
 Michael Koob, Neurology, SM  
 Naoko Koyano, Neuroscience, M2  
 Lorene Lanier, Neuroscience, SM  
 Arthur C. Leuthold, Neuroscience, M2  
 Scott M. Lewis, Neurology, M2  
 Dezhi Liao, Neuroscience, SM

Angus W. MacDonald III, Psychology, M2  
 Paul G. Mermelstein, Neuroscience, SM  
 Yasushi Nakagawa, Neuroscience, SM  
 Teresa Nick, Neuroscience, SM  
 Raghavendra B. Rao, Pediatrics, M2  
 A. David Redish, Neuroscience, SM  
 Paul R. Schrater, Psychology, SM  
 Laura S. Stone, Neuroscience, M2  
 Mark J. Thomas, Neuroscience and Psychology, SM  
 W. Gibson Wood, Pharmacology, SM  
 LiLian Yuan, Neuroscience, SM  
 Lance Zirpel, Neuroscience, SM

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 Itasca Biological Station and Laboratories. The core curriculum continues on the Twin Cities campus with NSc 5461, 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. 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.

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. Students whose native language is not English are required to take the TOEFL and obtain a minimum score of 625 or obtain 6.5 on the IELTS examination. There are no minimum GPA or GRE score requirements.

**Courses**—Please refer to Neuroscience (NSc) in the course section of this catalog for courses pertaining to the program.

**Use of 4xxx Courses**—Use of 4xxx Courses toward degree requirements is permitted based on director of graduate studies approval.

#### **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 at [www.neuroscience.umn.edu/CurStu/HandbookIntro.html](http://www.neuroscience.umn.edu/CurStu/HandbookIntro.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. The program for an individual student is developed by consultation between the student and the DGS of the Graduate Program in Neuroscience. Students are required to take one of the following core courses: Function/Structure: NSc 5561: Systems Neuroscience (4 credits) or Cellular/Molecular: NSc 5461: Cellular and Molecular Neuroscience (4 credits)

In addition, students are required to take elective neuroscience courses for a total minimum of 12 credits (including the core courses).

## **Nonprofit Management**

### **Postbaccalaureate Certificate**

**Contact Information**—Nonprofit Management Certificate, College of Continuing Education, Student Support Services, 150 Wesbrook Hall, 77 Pleasant Street S.E., Minneapolis, MN 55455 (612-624-4000; [adv@ccc.umn.edu](mailto:adv@ccc.umn.edu); [www.cce.umn.edu/certificates/mgmt/nonprofit](http://www.cce.umn.edu/certificates/mgmt/nonprofit))

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

#### **Associate Professor**

William Riley, Public Health  
 Melissa Stone, Public Affairs

#### **Lecturer**

Alice Thomas, Educational Policy and Administration  
 Victoria Van Slyke, Social Work

**Curriculum**—This interdisciplinary certificate program is designed for professionals who are employed in nonprofit organizations, especially persons who do not have a formal educational background in the business aspects of managing a nonprofit organization. Students acquire knowledge and skills in effective leadership and management, organizational development, nonprofit governance, strategic planning, policy analysis, human resource development, finance and fundraising. Jointly sponsored by the Humphrey Institute of Public Affairs, the School of Social Work, the School of Public Health, and the College of Education and Human Development, this program offers a wide array of elective courses appropriate to a broad range of nonprofit settings.

**Admission Requirements**—To be admitted to this program, applicants must have a bachelor's degree from an accredited postsecondary U.S. institution or its foreign equivalent. A cumulative GPA of 3.00 is required. Students must also have two years of paid or unpaid work experience in a nonprofit organization in one or more of the following areas: management of a budget; supervision of staff; program development, implementation, and/or evaluation; fundraising and/or grant writing; regular participation in board meetings and/or on board committees. Admissions information is available at [www.cce.umn.edu/certificates/mgmt/nonprofit](http://www.cce.umn.edu/certificates/mgmt/nonprofit).

**Certificate Requirements**—Twenty-one credits of coursework are required, including seven credits of required core courses and a minimum of 14 elective course credits selected at the discretion of the student in consultation with his or her academic adviser. Core requirements include participation in a leadership seminar (1 credit) reserved for students in the Nonprofit Management Certificate Program, and successful completion of the following courses: PA 5003—Introduction to Financial Analysis and Management (1.5 cr), PA 5251—Strategic Planning and Management (1.5 cr), PA 5101—Management and Governance of Nonprofit Organizations (3 cr).

A grade of B or better in core courses and a cumulative GPA of 2.80 or higher is required for certificate completion.

## Nursing

**Contact Information**—Courtney Striet, 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; [nurseoss@umn.edu](mailto:nurseoss@umn.edu); [www.nursing.umn.edu](http://www.nursing.umn.edu)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### **Professor**

Lyn Bearinger, SM  
Donna Bliss, SM  
Joanne Disch, AM  
Sandra Edwardson, SM  
Ann Garwick, SM  
Cynthia Gross, SM  
Susan Henly, SM  
Barbara Leonard, SM  
Jean Wyman, SM

### **Associate Professor**

Melissa Avery, SM  
Linda Chlan, M2  
Laura Duckett, SM  
Jayne Fulkerson, AM  
Linda Halcon, SM  
Helen Hansen, SM  
Merrie Kaas, SM  
Madeleine Kerr, SM  
Kathie Krichbaum, SM  
Marsha Lewis, SM  
Joan Liaschenko, SM  
Linda Lindeke, SM  
Ruth Lindquist, SM  
Christine Mueller, SM  
Cynthia J. Peden-McAlpine, SM  
Janice Post-White, SM

### **Assistant Professor**

Diane Bohn, M2  
Linda Gerdner, M2  
Laila Gulzar, M2  
Ann Jones, AM  
Mary Jo Kreitzer, AM  
Martha Kubik, AM  
Margaret Moss, M2  
Carol O'Boyle, M2  
Cheryl Robertson, M2  
Renee Sieving, AM  
Roxanne Struthers, M2  
Diane Treat-Jacobsen, SM  
Gretchen Zunkel, M2

### **Other**

Karen Alaniz, AM  
Bradley Cohen, AM  
Kathleen Fagerlund, AM  
Linda Herrick, AM  
Catherine Juve, M2  
Jennifer Peters, AM  
Mary Rowan, M2  
Kay Savik, 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 Nursing prepares advanced practice nurses, leaders, and scholars in nursing, and provides coursework to prepare postbaccalaureate students from other disciplines to become licensed nurses. The M.S. program includes the following areas of study: adult health clinical nurse specialist, children with special health care needs, family nurse practitioner, generalist, gerontological

clinical nurse specialist, gerontological nurse practitioner, nurse midwifery, nursing and health care systems administration, nursing education, pediatric clinical nurse specialist, pediatric nurse practitioner, pediatric nurse practitioner/children with special health care needs, psychiatric-mental health clinical nurse specialist, public health nursing, public health nursing/adolescent nursing, and women's health care nurse practitioner. The area of study the student chooses in the Plan B option is identified as a subprogram on the official transcript.

The Ph.D. program prepares creative and productive scholars in nursing. The postbaccalaureate certificate program is designed for students who wish to become registered nurses and currently hold a baccalaureate (or higher) degree in a field other than nursing. After successful completion of the certificate program, graduates will be eligible to sit for the registered nurse licensure examination. Completion of the graduate coursework included in the certificate program positions students for entry into a graduate degree program in nursing.

**Prerequisites for Admission**—Applicants must meet the stated requirements of the Graduate School. A successful applicant typically has an undergraduate GPA of 3.00 and a TOEFL score of 586 (240 for computer-based TOEFL). In the M.S. program, licensure as a registered nurse is required. Registered nurses who do not have a bachelor's degree with a major in nursing are considered if there is sufficient evidence of ability in health promotion, community health nursing, leadership/management, and teaching/counseling. 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. For the postbaccalaureate certificate program, a bachelor's degree in a field other than nursing is required. Seven of the Prerequisites for Admission must be completed by December 31, with the ability to complete the remaining prerequisites by the time the program starts the following fall. Prerequisite course information is available online at [www.nursing.umn.edu](http://www.nursing.umn.edu).

**Special Application Requirements**—For the postbaccalaureate certificate program, two letters of recommendation are required. Selected applicants will be invited for an interview. Admission to the program is competitive and class size is limited to 40 students. The application deadline for the postbaccalaureate program is December 15. Students may apply to the M.S. or PhD after successful completion of the postbaccalaureate certificate and the registered nurse licensure examination. Acceptance to the postbaccalaureate certificate program does not guarantee admittance to the M.S. or PhD programs in nursing.

For the M.S. degree, two 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 application deadlines for the M.S. program are August 1, November 1, and January 3. A complete application includes a School of Nursing application and a Graduate School application. For competitive nurse practitioner, clinical nurse specialist, and nurse midwifery areas of study, priority is given to applicants who submit application materials by the November 1 deadline.

For the Ph.D. degree, GRE General Test scores (must have been taken after fall 2002 that include the computer-scored analytical writing test), two letters of reference, and a profile essay are required. The application deadline for the Ph.D. program is October 1 for the following fall semester.

**Courses**—Please refer to Nursing (Nurs) in the course section of this catalog for courses pertaining to the program.

**Use of 4xxx Courses**—4xxx courses are not routinely accepted on degree program forms.

### Postbaccalaureate Certificate Requirements

This is a 16-month full-time program with no options for part-time study. The curriculum includes 5 courses (14 credits) that can be applied to the master's degree in nursing and 6 courses specifically designed for the postbaccalaureate program. After completion of the certificate program, students are eligible to take the National Council Licensing Examinations (NCLEX) for registered nurses. Graduates of the program are encouraged to apply for the M.S. in nursing (RN licensure is a requirement for entry in to the M.S. degree program). Please note that some areas of study in the M.S. program require one or more years of clinical experience prior to admission.

**Language Requirements**—None

### M.S. Degree Requirements

The M.S. program prepares students for advanced practice roles 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.

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 a minimum of 30 credits with at least 9 credits of disciplinary core courses; 9 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. Individual areas of

study vary in the number of credits required. See individual area of study information at [www.nursing.umn.edu](http://www.nursing.umn.edu) for specific course and credit requirements.

**Language Requirements**—None.

**Final Exam**—The final exam is oral.

### Ph.D. Degree Requirements

Students are required to take a minimum of 36 credits in required nursing courses in three areas: scholarly processes, nursing science, and area of concentration. The Ph.D. also requires a minimum of 12 credits in a minor or supporting field and 24 thesis credits. Students who do not have an M.S. in nursing will be required to take additional 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; [nutrgrad@umn.edu](mailto:nutrgrad@umn.edu); [http://fscn.che.umn.edu/grad\\_students/nutr\\_grad\\_students.html](http://fscn.che.umn.edu/grad_students/nutr_grad_students.html)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

Linda J. Brady, Food Science and Nutrition, SM  
 Frank B. Cerra, Surgery, ASM  
 Agnes S. Csallany, Food Science and Nutrition, SM  
 Daniel D. Gallaher, Food Science and Nutrition, SM  
 John H. Himes, Epidemiology, SM  
 Joseph M. Keenan, Family Medicine and Community Health, ASM  
 Mindy S. Kurzer, Food Science and Nutrition, SM  
 Theodore P. Labuza, Food Science and Nutrition, M2  
 Arthur S. Leon, Kinesiology, SM  
 Allen S. Levine, Food Science and Nutrition, SM  
 Mark Lyte, Surgery, ASM  
 Diane R. Neumark-Sztainer, Epidemiology, SM  
 Joseph R. Prohaska, Biochemistry and Molecular Biology, Duluth, SM  
 Marla M. Reicks, Food Science and Nutrition, SM  
 Joanne L. Slavin, Food Science and Nutrition, SM  
 Mary T. Story, Epidemiology, SM

### Adjunct Professor

Mary C. Gannon, Food Science and Nutrition, SM  
 Julie M. Jones, Food Science and Nutrition, AM

### Associate Professor

Margot P. Cleary, Hormel Institute, ASM  
 Myron D. Gross, Department of Laboratory Medicine and Pathology, SM  
 Lisa J. Harnack, Epidemiology, SM  
 Craig A. Hassel, Food Science and Nutrition, SM

Daniel J. O'Sullivan, Food Science and Nutrition, SM  
 Elizabeth J. Parks, Food Science and Nutrition, SM  
 Kathryn H. Schmitz, Epidemiology, SM  
 Cheryl F. Smith, Food Science and Nutrition, SM

### Adjunct Associate Professor

Duane Cranksaw, Food Science and Nutrition, AM2  
 Darlene G. Kelly, Food Science and Nutrition, ASM  
 Catherine M. Kotz, Food Science and Nutrition, SM  
 Patricia L. Splett, Food Science and Nutrition, AM2

### Assistant Professor

Carrie P. Earthman, Food Science and Nutrition, SM  
 Andrew P. Flood, Epidemiology, M2  
 Leonard F. Marquart, Food Science and Nutrition, SM  
 Mark A. Pereira, Epidemiology, M2  
 Susan K. Raatz, Medical School, SM  
 Shalamar Sibley, Endocrine, M2  
 Lyn M. Steffen, Epidemiology, SM

### Adjunct Assistant Professor

Mary K. Schmidl, Food Science and Nutrition, AM2  
 Alice C. Shapiro, Epidemiology, M2

### Other

Jamie S. Stang, Epidemiology, 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**—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), Departments of Pediatrics, Surgery, Psychiatry, and Family Medicine and Community Health (Medical School), Department of Kinesiology and Leisure Studies, Department of Biochemistry and Molecular Biology (University of Minnesota, Duluth), Hormel Institute (Austin), V.A. Medical Center (Minneapolis), Mayo Clinic (Rochester), Hennepin County Medical Center (Minneapolis), and Park Nicollet Institute (Minneapolis).

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, the equivalent of one year of general chemistry, one semester of organic chemistry, general biology, biochemistry, physiology, and statistics. For the doctoral program, additional prerequisite courses include calculus and physics. If there is evidence that the applicant has a good background in the sciences, some of the prerequisites can be met after admission.

**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.

**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.

**Use of 4xxx Courses**—Use of 4xxx Courses toward degree requirements is subject to adviser and director of graduate studies approval.

### 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, and 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 (4 cr).

### 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, and 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

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

**Contact Information**—Program in Occupational Therapy, University of Minnesota, 388 MMC, 420 Delaware Street S.E., Minneapolis, MN 55455 (612-626-5887; fax 612-625-7192; otprog@umn.edu; www.ot.umn.edu). Program office is in 271 Children's Rehabilitation Center, 426 Church Street S.E., Minneapolis MN, 55455.

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

James R. Carey, AM

### Associate Professor

Virgil G. Mathiowetz, M2

Erica B. Stern, M2

### Assistant Professor

Cheryl A. Meyers, M2

Michael Potegal, AM

Deborah D. Roman, AM

### Assistant Clinical Specialist

Paula Beiswenger, AM

Nancy Jo Callinan, AM

Rebecca B. Catterton, AM

Margaret A. Christenson, AM

Elin Schold Davis, AM

Jean Deming, AM

Katherine (Kay) N. Dole, AM

Beth Franzen, AM

Barbara A. Larson, AM

Susan A. Lasoff, AM

Jeanne Lins, AM

Kathleen M. Matuska, AM

Julie A. Mehr, AM

Denise M. Melander, AM

Peggy Mueller, AM

Virginia H. O'Brien, AM

Janelle Johnson Reiersen, AM

Jennifer Rosenstiel, AM

Marcia A. Sitz, AM

Margaret VanEeckhout, AM

Deborah J. Voydetich, 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 a combination of academic and clinical education that prepares students to be 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. Clinical education includes fieldwork in such areas as physical, psychosocial, and developmental disabilities. Research and scholarly projects emphasize investigation of treatment effectiveness. Applications for 2005 admissions were suspended in Fall semester 2004. Please check the Occupational Therapy Web site at [www.ot.umn.edu](http://www.ot.umn.edu) for current status of admissions.

The program is accredited by the Accreditation Council for Occupational Therapy Education (ACOTE) of the American Occupational Therapy Association (P.O. Box 31220, Bethesda, MD, 20824-1220; 301-652-AOTA). Graduates of the program may sit for the national certification exam administered by the National Board for Certification of Occupational Therapy (NBCOT). After successful completion of this exam, the individual will be an Occupational Therapist, Registered (OTR). A felony conviction may affect a graduate's ability to sit for the NBCOT certification examination or attain state licensure. Most states require licensure in order to practice; however, state licenses are usually based on the results of this certification exam.

**Prerequisites for Admission**—Applications are accepted from individuals with a bachelor's degree in any field other than occupational therapy, or from those who will have completed their bachelor's degree before entering the program. Students may be admitted pending successful completion of outstanding prerequisite coursework with the understanding that missing course(s) will be completed before beginning the program. Occasionally, under extenuating circumstances, an individual may be admitted who does not meet all of the admissions requirements.

**Special Application Requirements**—Applicants must submit a program application, including one to three references, and evidence of work or volunteer experience in occupational therapy. Prerequisite coursework in statistics, the biological sciences, developmental and abnormal psychology, and related areas is required. International students must submit evidence of English proficiency; TOEFL scores (550 minimum paper version, 213 minimum computer version), MELAB score of 80, or IELTS score of 6.5. Applications are accepted and reviewed beginning September 15th, and continue until the class is filled (rolling admissions).

**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.

**Use of 4xxx Courses**—4xxx courses cannot be used toward degree requirements.



## M.S. Plan B Degree Requirements

Students take 57 credits of predetermined academic coursework, 6 project credits (Plan B), and a minimum of 12 credits of fieldwork education. Optional fieldwork education is available in several specialty areas. Required fieldwork must be completed within 24 months of finishing academic coursework. Plan B projects must be completed within three months following fieldwork. 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).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

Alvin J. Beitz, Veterinary and Biomedical Sciences, SM  
Edward C. Combe, Oral Sciences, SM  
Ralph DeLong, Oral Sciences, SM  
William H. Douglas, Oral Sciences, SM  
Robert J. Feigl, Preventive Sciences, SM  
James R. Friction, Diagnostic/Surgical Sciences, M2  
Greg R. Germaine, Oral Sciences, SM  
Mark C. Herzberg, Oral Sciences, SM  
William F. Liljemark, Diagnostic/Surgical Sciences, SM  
Patrick W. Mantyh, Preventive Sciences, SM  
Nelson L. Rhodus, Diagnostic/Surgical Sciences, SM  
Joel D. Rudney, Oral Sciences, SM  
Charles F. Schachtele, Oral Sciences, SM  
Burton L. Shapiro, Oral Sciences, SM  
Donald A. Simone, Oral Sciences, SM  
Larry F. Wolff, Preventive Sciences, SM

### Associate Professor

Pamela R. Erickson, Preventive Sciences, SM  
Robert H. Ophaug, Oral Sciences, SM

### Assistant Professor

Mansur Ahmad, Diagnostic/Surgical Sciences, M  
Patrick M. Gaffney, Medicine, SM  
Rajaram Gopalakrishnan, Oral Sciences, SM  
Darryl T. Hammamoto, Diagnostic/Surgical Sciences, M2  
Kim Mansky, Diagnostic/Surgical Sciences, SM  
Kathy Moser, Medicine, SM  
Kylie J. Walters, Biochemistry, Molecular Biology, and Biophysics, SM

### Research Assistant

Ching-Chang Ko, Oral Sciences, SM  
Antheunis Versluis, Oral Sciences, SM

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 Sciences 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.

**Courses**—Please refer to Oral Biology (OBio) in the course section of this catalog for courses pertaining to the program.

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

## 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, 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 and programs outside 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, 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, MMC 396, 420 Delaware Street S.E., Minneapolis, MN 55455 (612-625-3200; fax 612-625-2101; [www.ent.umn.edu](http://www.ent.umn.edu)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

George L. Adams, SM  
Khalil Ahmed, ASM  
Steven K. Juhn, SM  
Frank M. Lassman, ASM

Robert H. Maisel, SM  
Robert H. Margolis, SM  
David A. Nelson, SM  
Peter A. Santi, SM

**Clinical Professor**

Michael M. Paparella, ASM

**Adjunct Professor**

Stephen L. Liston, AM

**Associate Professor**

John H. Anderson, SM  
Kathleen Ann Daly, M2  
Markus Gapanay, M2  
George S. Goding, Jr., M2  
Peter A. Hilger, M2  
David B. Hom, M2  
Samuel C. Levine, M2  
Franklin L. Rinell, M2

**Clinical Associate Professor**

Barry P. Kimberely, AM2  
James D. Sidman, AM2

**Assistant Professor**

Holly C. Boyer, M2  
David D. Hamlar, M2  
Jizhen Lin, M2  
Rick M. Odland, M2  
Frank G. Ondrey, SM

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. The admissions committee reviews previous academic records, letters of recommendation, etc.

**Courses**—Please refer to Otolaryngology (Otol) in the course section of this catalog for courses pertaining to the program.

**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.

**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. Understanding and application of basic statistics and experimental methodology are expected. Statistics coursework is usually necessary. Choice of statistics courses is made with the guidance of the director of graduate studies. 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 exams are both written and oral. A grade of 70 percent or higher is expected on a national written exam.

**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. Understanding and application of basic statistics and experimental methodology are expected. Statistics coursework is usually necessary. Choice of statistics courses is made with the guidance of the director of graduate studies. 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 exams are both written and oral. A grade of 70 percent or higher is expected on a national written exam.

**Ph.D.Otol. Degree Requirements**

The number of credits required will vary depending on preparation and the research undertaken. Most students take a total of about 55 credits. A minimum of 12 credits in the minor or supporting program, plus 24 doctoral thesis credits, are required. An advisory committee, including the student, the adviser,

and the director of graduate studies, determines coursework in the major. At least one seminar is selected from seminars such as Otol 8247, 8248, 8249, and 8250. Understanding and application of basic statistics and experimental methodology are expected. Statistics coursework is usually necessary. Choice of statistics courses is made with the guidance of the director of graduate studies. All students are expected to publish a research paper in a peer-reviewed journal. Students concurrently in an otolaryngology residency usually take five to six years to complete research, course, and dissertation requirements.

**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; pccets@umn.edu; www.pharmacy.umn.edu/pharmaceutics.

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

**Professor**

Janet M. Dubinsky, ASM  
David J. W. Grant, SM  
Ronald J. Sawchuk, SM  
Ronald A. Siegel, SM  
Raj G. Suryanarayanan, SM  
Timothy Tracy, ASM  
Timothy S. Wiedmann, SM  
Cheryl L. Zimmerman, SM

**Adjunct Professor**

Rene A. Braeckman, ASM  
Keith K. Chan, ASM  
William H. Frey II, ASM  
Aldo Rescigno, ASM

**Associate Professor**

William F. Elmquist, SM

**Adjunct Associate Professor**

Walid M. Awni, ASM  
Michael D. Karol, ASM  
Evgenyi Y. Shalaev, ASM  
Ray Skwierczynski, ASM  
Lian Yu, ASM

**Assistant Professor**

Belinda Cheung, ASM  
Carolyn A. Fairbanks, SM  
Chun Wang, ASM

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. Minor fields of particular value include biochemistry, biometry, chemistry, biomedical engineering, chemical engineering, mechanical engineering, pharmacology, and statistics.

**Prerequisites for Admission**—The pharmaceutics program considers students who possess a B.S. degree and an exceptional scholastic record from recognized colleges of pharmacy as well as from a relatively wide range of academic fields. For those individuals with a degree other than pharmacy, the program adviser may recommend additional coursework to provide the necessary background in pharmacy.

**Special Application Requirements**—In addition to undergraduate scholastic records, recent GRE scores, a statement of career goals, and three letters of recommendation are used to determine each candidate's admissibility. Minimum GRE scores of 80 percentile are preferred for the quantitative and analytical sections, as well as a preferred GPA of 3.20 from U.S. schools, and "First Class" or the equivalent on transcripts from foreign institutions. A TOEFL score of 600 or higher is preferred for applicants whose native language is not English. Fall admission is preferred, although admission in the spring semester may be considered. The deadline to apply for fall admission is December 31. (Students who want to know their chances for admission before paying the application fee can use a pre-evaluation feature on the pharmaceutics Web site at [www.pharmacy.umn.edu/pharmaceutics](http://www.pharmacy.umn.edu/pharmaceutics) to determine if their credentials are competitive.)

**Courses**—Please refer to Pharmaceutics (Phm) in the course section of this catalog for courses pertaining to the program.

**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.

### M.S. Degree Requirements

Students are not admitted directly into the M.S. program. Ph.D. pharmaceutics students may pursue an M.S. through a change of status request. Students take core courses in pharmaceutics and chemistry. In addition to the coursework, a preliminary written exam and preparation of a thesis and its defense are required. Coursework for the M.S. (Plan A only) includes 14 credits in 5xxx or 8xxx courses in the major and 6 credits in one or more related fields outside the major to comprise a minimum of 20 credits for the degree. A complete list of degree program requirements can be obtained from the director of graduate studies. Additional courses are selected in consultation with the major advisor.

**Language Requirements**—None.

**Final Exam**—The final exam is oral.

### Ph.D. Degree Requirements

The Ph.D. requires a minimum of 29 course credits in upper division or 5xxx or 8xxx courses, including 12 credits in a minor or supporting program, and language requirement (or alternatively a collateral field with a minimum of 6 credits). 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. In addition, students complete a preliminary written exam, a written research proposal based on thesis research, a preliminary oral exam, and finally a thesis and its defense.

**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; [Fider@ahc.umn.edu](mailto:Fider@ahc.umn.edu); [www.pharmacology.med.umn.edu](http://www.pharmacology.med.umn.edu)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

#### Professor

Bianca M. Conti-Fine, SM  
Richard M. Eisenberg, Duluth, SM  
Robert P. Elde, SM  
Esam E. El-Fakahany, SM  
Patrick E. Hanna, SM  
Stephen S. Hecht, SM  
Jordan L. Holtzman, SM  
Ping-Yee Law, SM  
Hon Cheung Lee, SM  
Horace H. Loh, SM  
Paul R. Pentel, SM  
Philip S. Portoghese, SM  
Jean F. Regal, Duluth, SM  
Virginia S. Seybold, SM  
Alan R. Sinaiko, M2  
Sheldon B. Sparber, SM  
Sundaram Ramakrishnan, SM  
Stanley A. Thayer, SM  
George J. Trachte, Duluth, SM  
Kendall B. Wallace, Duluth, SM  
Timothy F. Walseth, SM  
Li-Na Wei, SM  
George L. Wilcox, SM  
Wellington G. Wood III, SM  
Douglas Yee, SM

#### Associate Professor

Colin R. Campbell, SM  
Gregory J. Connell, SM  
Earl W. Dunham, SM  
Janet Lyn Fitzakerley, SM  
Hiroshi Hiasa, SM  
Edward T. Knych, Duluth, M2  
Carol A. Lange, SM  
Rita B. Messing, M2

Duanqing Pei, SM  
Lincoln Potter, ASM  
Daniel P. Romero, SM  
Sabita Roy, SM  
Ronald John Shebuski, SM  
Elizabeth V. Wattenberg, AM  
Kevin D. Wickman, SM

#### Assistant Professor

Frank H. Burton, SM  
Carolyn Ann Fairbanks, SM  
Jonathan C. Gewirtz, SM  
Jonathan S. Marchant, SM

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 and Biomedical Engineering Building, Moos Tower, Molecular and Cellular Biology, and Jackson Hall. The Basic Research Center on Molecular and Cell Biology of Drug Abuse is comprised of pharmacology program graduate faculty.

**Courses**—Please refer to Pharmacology (Phcl) in the course section of this catalog for courses pertaining to this program.

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

### 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 GPA of 3.00. 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 GPA of 3.00. 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**—Department of Philosophy, University of Minnesota, 831 Walter Heller Hall, 271 19th Avenue South, Minneapolis, MN 55455-0310 (612-625-6563; fax 612-626-8380; [umphil@umn.edu](mailto:umphil@umn.edu), [www.philosophy.umn.edu](http://www.philosophy.umn.edu))

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

Elizabeth S. Belfiore, Classical and Near Eastern Studies, ASM  
Brian Bix, Law, SM  
Norman E. Bowie, Strategic Management and Organization, ASM  
Norman O. Dahl, SM  
Marcia M. Eaton (emeritus), ASM  
B. Carl Elliott, Public Health, ASM  
Eugene Garver, Philosophy, St. John's University, ASM  
Ronald N. Giere, SM  
Jeanette K. Gundel, Linguistics, ESL, and Slavic Languages and Literatures, AM2  
Keith Gunderson, SM  
William H. Hanson, SM  
Geoffrey Hellman, SM  
Jasper S. Hopkins, SM

Michael B. Kac, SM  
Jeffrey P. Kahn, Public Health, ASM  
Douglas E. Lewis, SM  
H. E. Mason (emeritus), ASM  
Joseph I. Owens, SM  
Sandra L. Peterson, SM  
C. Wade Savage (emeritus), ASM  
Naomi B. Scheman, SM  
John R. Wallace, SM

### Associate Professor

John M. Dolan, SM  
Sarah W. Holtman, SM  
Michael D. Root, SM  
Valerie Tiberius, SM  
C. Kenneth Waters, SM  
Byeong-Uk Yi, M2

### Assistant Professor

Peter Hanks, M2  
David Martinez, American Indian Studies, AM2  
Michelle Mason, M2  
Antigone Nounou, M2

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 in 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. The departmental application for admissions and aid is available from the Committee on Admissions and Aid at the address listed above or may be downloaded from the philosophy Web site, found at [www.philosophy.umn.edu/programs/gradprogram/gradprogram.html](http://www.philosophy.umn.edu/programs/gradprogram/gradprogram.html).

Department applications should include a completed application form, personal statement, transcripts, scores from the GRE General Test, three letters of recommendation, and a writing sample. Students interested in DOVE or MacArthur Fellowships should include a statement expressing their interest. Students interested in the MacArthur Fellowship should also contact the MacArthur Program, Interdisciplinary Center for the Study of Global Change.

Applications, together with all supporting materials, must be received by January 7. The philosophy department generally admits students only for fall semester.

**Courses**—Please refer to Philosophy (Phil) in the course section of this catalog for courses pertaining to the program.

**Use of 4xxx Courses**—All philosophy 4xxx courses are available for graduate credit. Philosophy students may use any 4xxx philosophy course on their graduate degree program, but must register concurrently for a related 1 credit 8xxx workshop to receive graduate credit for the 4xxx course. Students from other majors may register for the related workshop with the permission of the instructor of the 4xxx course.

### 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. For details see Philosophy Department Degree Program: MA, available as a PDF on the philosophy Web site.

**Language Requirements**—None.

**Final Examination**—The final examination 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. Successful second-year departmental review represents passing the preliminary written examination. Successful third-year departmental review, which includes passing a three-paper examination, represents passing the preliminary oral examination. Students then write and defend a dissertation proposal and later defend a dissertation at the final oral examination. For details see Philosophy Department Degree Program: Ph.D., available as a PDF on the philosophy Web site.

**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.

## Physical Therapy

**Contact Information**—Physical Therapy Program Office, MMC 388, University of Minnesota, Minneapolis, MN 55455 (612-624-2262; fax 612-625-7192; ptquest@umn.edu; www.phyther.med.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

James R. Carey, SM  
Richard P. DiFabio, SM  
Robert P. Patterson, AM

### Associate Professor

LaDora V. Thompson, SM

### Assistant Professor

Dawn A. Lowe, SM  
Paula M. Ludewig, SM

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 physical therapy program, a division within the Department of Physical Medicine and Rehabilitation, offers a professional doctoral degree in physical therapy (D.P.T.). 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. Graduates are prepared to promote proper health care and quality of living by maximizing human movement following disease or injury or by preventing its loss. The program requires three years of year-round graduate study. Academic coursework and research activity are completed during the first seven semesters. The final two semesters are devoted to clinical internships.

**Didactic Curriculum**—During the first year of the program the curriculum involves the basic sciences, physical agents, biomechanical principles, and clerkship clinical experiences. The second year advances and integrates first-year coursework into evaluation skills, treatment techniques, and critical thinking. These tools are utilized during second-year clerkships in orthopedics, rehabilitation, and wellness.

**Clinical Curriculum**—Students complete up to 40 weeks of clinical internships in addition to clinical clerkships imbedded in the academic curriculum. The full-time internships occur during the third year of the program. Each student completes clinical affiliations in the following areas: acute hospital, outpatient, rehabilitation, and specialty area. These are under direct supervision of experienced clinical faculty and give each student the opportunity to combine theoretical skills with practical experience. Beyond direct patient care, students also develop skills and knowledge related to administration, management and supervision, education, and consultation. Graduates of the program are eligible to apply for state registration or licensure according to the laws of individual states.

**Prerequisites for Admission**—To be considered for admission, the student must complete a baccalaureate degree by June 1 of the year of application (no preferred major); an operational standard GPA of 3.00 for overall coursework and a 3.00 in the physical therapy prerequisite coursework are the preferred minimum; and the student must complete at least 100 hours of volunteer or work experience in a physical therapy setting. Applications received after June 1 will be considered for the following year. Information and applications, including a list of prerequisite coursework, are available at [www.phyther.med.umn.edu](http://www.phyther.med.umn.edu).

**Special Application Requirements**—Submission of GRE scores is required. For international students, a TOEFL score of at least 550 is required and the TSE is highly recommended (score of at least 50). The D.P.T. program accepts only applications completed online at [www.phyther.med.umn.edu](http://www.phyther.med.umn.edu).

**Courses**—Please refer to Physical Therapy (PT) in the course section of this catalog for courses pertaining to the program.

**Use of 4xxx Courses**—Use of 4xxx courses towards degree requirements is subject to adviser and director of graduate studies approval.

### D.P.T. Degree Requirements

The program requires 141 major field credits, of which 95 are core academic credits and 46 are clinical internship credits; 9 credits of research are included and an oral presentation based on this research culminates the project. No minor or related field is required. Students must maintain a cumulative GPA of 2.80 while in the program.

**Language Requirements**—None.

## 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; [grad@physics.umn.edu](mailto:grad@physics.umn.edu); [www.physics.umn.edu](http://www.physics.umn.edu)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

Benjamin F. Bayman (emeritus), ASM  
John H. Broadhurst, SM  
Charles E. Campbell, SM  
Cynthia A. Cattell, SM  
James R. Chelikowsky, Chemical Engineering and Materials Science, SM  
Hans W. Courant (emeritus), ASM  
Priscilla B. Cushman, SM  
E. Dan Dahlberg, SM  
Kris Davidson, Astronomy, SM  
Dietrich K. Dehnard (emeritus), ASM  
Jiali Gao, Chemistry, SM  
Robert D. Gehrz, Astronomy, SM  
Clayton F. Giese (emeritus), ASM  
Leonid Glazman, SM  
Allen M. Goldman, SM  
Anand Gopinath, Electrical and Computer Engineering, ASM  
Alexander Grosberg, SM  
J. Woods Halley, SM  
Kenneth Heller, SM  
Cheng-Cher Huang, SM  
Roberta Humphreys, Astronomy, ASM  
Thomas W. Jones, Astronomy, SM  
James Kakalios, SM  
Joseph I. Kapusta, SM  
Uwe R. Kortshagen, Mechanical Engineering, ASM  
Yuichi Kubota, SM  
Anatoly Larkin, SM  
Robert L. Lysak, SM  
Marvin Marshak, SM  
David Morse, Chemical Engineering and Materials Science, ASM  
Keith A. Olive, SM  
Robert O. Pepin, SM  
Earl A. Peterson, SM  
Ronald A. Poling, SM  
Serge Rudaz, SM  
Keith Ruddick, SM  
Roger W. Rusack, SM  
Mikhail Shifman, SM  
Boris Shklovskii, SM  
Evan Skillman, Astronomy, SM  
Roger H. Stuewer (emeritus), AM  
Arkady Vainshtein, SM  
Oriol T. Valls, SM  
Randall H. Victora, Electrical and Computer Engineering, ASM  
Mikhail Voloshin, SM  
Thomas F. Walsh, SM  
Walter Weyhmann (emeritus), ASM  
William Zimmermann, Jr. (emeritus), ASM

### Associate Professor

Paul A. Crowell, SM  
Eric Ganz, SM  
Shaul Hanany, SM  
Alex Kamenev, SM  
Joachim Mueller, SM  
Yong-Zhong Qian, SM  
John R. Wygant, SM

### Assistant Professor

Dan Cronin-Hennessy, SM  
Michael DuVernois, SM  
Tony Gherghetta, SM  
Marco Peloso, SM  
Michael Zudov, SM

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 experimental and theoretical studies in astrophysics and cosmology, biological physics, condensed matter physics, elementary particle physics, nuclear physics, space and planetary physics, and physics education research. Interdisciplinary study is also available with the programs in astrophysics, biological sciences, chemistry, chemical engineering and materials science, electrical and computer engineering, mechanical engineering and the history of science and technology.

**Prerequisites for Admission**—To be a physics major, 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 from persons familiar with their scholarship and research potential, a complete set of transcripts, and a clearly written statement of career interests, goals, and objectives are required. Submission of GRE scores is strongly recommended. Fall semester entry is strongly recommended for all students. Application by December 15 is strongly encouraged to ensure priority consideration for fellowships and teaching and research assistantships awarded for the next academic year.

**Required Orientation**—During the two weeks before the beginning of fall semester, new graduate students are expected to participate in the department orientation program. This includes TA training sessions, which is required if your financial support comes from TA assignments.

**Requirement for International Students**—For an international student to teach as a TA, you must pass an English test, which is given in August. If you do not pass, you will take a training course until you pass the test. The course is given in August and during the year.

**Use of 4xxx Courses**—Use of 4xxx physics courses is permitted for either major or minor degree requirements.

### 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. Any course will satisfy the minor or supporting program requirement.

**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, 250 Biological Sciences Center, 1445 Gortner Avenue, St. Paul, MN 55108 (612-625-4222; fax 612-625-1738; pbiogp@cbs.umn.edu; www.cbs.umn.edu/plantbio/gradprog).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Regents Professor

Ronald L. Phillips, Agronomy and Plant Genetics, SM

### Professor

Deborah L. Allan, Soil, Water, and Climate, SM  
Judith G. Berman, Genetics, Cell Biology, and Development, SM  
David D. Biesboer, Plant Biology, SM  
Robert M. Brambl, Plant Biology, SM  
Iris D. Charvat, Plant Biology, SM  
Jerry D. Cohen, Horticultural Science, SM

Edward J. Cushing, Ecology, Evolution, and Behavior, SM  
Anath Das, Biochemistry, Molecular Biology, and Biophysics, SM  
Gary M. Gardner, Horticultural Science, SM  
Burle G. Gengenbach, Agronomy and Plant Genetics, SM  
Florence K. Gleason, Plant Biology, SM  
Peter H. Graham, Soil, Water, and Climate, SM  
Robert J. Jones, Agronomy and Plant Genetics, SM  
Paul A. Lefebvre, Plant Biology, SM  
Pen Hsiang Li, Horticultural Science, SM  
Albert H. Markhart III, Horticultural Science, SM  
David J. McLaughlin, Plant Biology, SM  
Neil E. Olszewski, Plant Biology, SM  
James A. Perry, Forest Resources, SM  
Peter B. Reich, Forest Resources, SM  
Michael J. Sadowsky, Soil, Water, and Climate, SM  
Ruth G. Shaw, Ecology, Evolution, and Behavior, SM  
Carolyn D. Silflow, Plant Biology, SM  
D. Peter Snustad, Plant Biology, SM  
David A. Somers, Agronomy and Plant Genetics, SM  
Joseph R. Sowokinos, Horticultural Science, SM  
Kate VandenBosch, Plant Biology, SM  
Clifford M. Wetmore, Plant Biology, SM  
Susan M. Wick, Plant Biology, SM  
Nevin D. Young, Plant Pathology, SM

### Adjunct Professor

John W. Gronwald, Agronomy and Plant Genetics, SM  
Deborah A. Samac, Plant Pathology, SM  
Carroll P. Vance, Agronomy and Plant Genetics, SM

### Associate Professor

J. Stephen Gantt, Plant Biology, SM  
Susan I. Gibson, Plant Biology, SM  
Jane Glazebrook, Plant Biology, SM  
Fumiaki Katagiri, Plant Biology, SM  
Michael D. Marks, Plant Biology, SM  
Georgiana May, Plant Biology, SM  
Gary J. Muehlbauer, Agronomy and Plant Genetics, SM  
Alan G. Smith, Horticultural Science, SM  
Cindy B. Tong, Horticultural Science, SM

### Adjunct Associate Professor

Les J. Szabo, Plant Pathology, SM

### Assistant Professor

James A. Bradeen, Plant Pathology, SM  
Jeannine Cavender-Bares, Ecology, Evolution and Behavior, SM  
Julie Etterson, Biology, Duluth, SM  
William Gray, Plant Biology, SM  
Min Ni, SM  
Anton A. Sanderfoot, Plant Biology, SM  
Nathan Springer, Plant Biology, SM  
Peter Tiffin, Plant Biology, SM  
John M. Ward, Plant Biology, SM  
George Weiblen, Plant Biology, SM  
Cynthia Weinig, Plant Biology, SM

### Adjunct Assistant Professor

David Garvin, Agronomy and Plant Genetics, SM  
Rodney Venterea, Soil, Water, and Climate, SM

### Other

Arun Goyal, Biotechnology Research Program, Duluth, SM  
Kevin Silverstein, Plant Biology, M2  
Thomas K. Soulen, Plant Biology, 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 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 with 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 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 semester.

**Courses**—Please refer to Plant Biological Sciences (PBS) in the course section of this catalog for courses pertaining to the program.

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

### M.S. Degree Requirements

Course programs are planned in consultation with an advisory committee. Students are expected to take a minimum of four 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 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; [anna@umn.edu](mailto:anna@umn.edu); [www.plpa.agri.umn.edu](http://www.plpa.agri.umn.edu)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

Robert A. Blanchette, SM  
Robert Morgan Brambl, SM  
Linda L. Kinkel, SM  
Sagar V. Krupa, SM  
Philip O. Larsen, SM  
Benham E. L. Lockhart, SM  
David H. MacDonald, SM  
James A. Percich, SM  
Brian J. Steffenson, SM  
Carol E. Windels, SM  
Nevin D. Young, SM  
Richard J. Zeyen, SM

### Adjunct Professor

Martin Carson, SM  
H. Corby Kistler, SM  
James Kolmer, M2  
Deborah A. Samac, SM

### Associate Professor

Senyu Chen, M2  
Ruth Dill-Macky, SM  
James E. Kurlle, SM

### Adjunct Associate Professor

Yue Jin, M2  
Les J. Szabo, M2

### Assistant Professor

James M. Bradeen, M2  
Charla Hollingsworth, M2

### Adjunct Assistant Professor

Jennifer Juzwik, M2

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 focuses on the biology of plant-microbe interactions, and incorporates research spanning the biochemical, molecular, genetic, physiological, whole organism, population, and community levels of biological organization. Plant pathology interfaces with all plant science disciplines, and with food sciences, veterinary medicine, and ecology. Areas of concentration include molecular plant pathology (offered as a special emphasis), plant disease management, biological control of plant disease, forest pathology and microbial degradation of wood, microbial ecology, population biology, plant-microbe interactions, disease resistance, host-parasite coevolution, environmental pollution and climate change, plant-microbe mutualisms, and virology. Students have opportunities for laboratory and field research locally as well as nationally and internationally. The course of study varies with the requirements of the area of concentration and interests of the student. Students who choose the emphasis in molecular plant pathology enhance their ability to design and use molecular approaches to investigate plant disease, increase basic knowledge, and develop new strategies for disease control.

**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 each 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 include scholastic standing, potential for success in completing a Ph.D., and writing competency. Such a change in status must be approved by the student's advisory committee and the director of graduate studies after consultation with the Graduate Studies Committee. 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 or IELTS scores are required for international students. A clearly written statement of career interests as well as three letters of recommendation are required of all students and must be submitted to the department at the time of application. Students may apply at any time; however, submission of all application materials by January 15 will ensure priority consideration for fellowships and research assistantships for the next academic year. Students can be admitted any semester.

**Courses**—Please refer to Plant Pathology (PIPa) in the course section of this catalog for courses pertaining to the program, or to the department Web site at [www.plpa.agri.umn.edu](http://www.plpa.agri.umn.edu).

**Use of 4xxx Courses**—For M.S. Plan A and Ph.D. students, 4xxx courses are not permitted toward degree requirements.

### M.S. Degree Requirements

Plan A (thesis) and Plan B (without thesis) both require a minimum of 14 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. Regular attendance at weekly plant pathology seminars is expected. Internships are encouraged as part of the graduate experience; financial support is available on a competitive basis for international or domestic internships. A detailed overview of course offerings and requirements, including additional details on the molecular plant pathology emphasis, is available at [www.plpa.agri.umn.edu](http://www.plpa.agri.umn.edu).

**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 in PIPa 5xxx or 8xxx courses is required for a master's minor.

### Ph.D. Degree Requirements

The Ph.D. requires a minimum of 17 course credits in plant pathology, which may include 5xxx and 8xxx courses taken before admission to the program (with approval of the director of graduate studies), and to complete 12 credits in a minor or supporting program, and 24 thesis credits. Course requirements include enrollment in a supervised teaching or extension teaching experience. Degree programs are determined by the student and the student's advisory committee, with approval of the director of graduate studies. Regular attendance at weekly plant pathology seminars is expected. Internships are encouraged as part of the graduate experience; financial support is available on a competitive basis for international or domestic internships.

A detailed overview of course offerings and requirements, including additional details on the molecular plant pathology emphasis, is available at [www.plpa.agri.umn.edu](http://www.plpa.agri.umn.edu).

**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 in PIPa 5xxx or 8xxx is required for a doctoral minor.

## Policy Issues on Work and Pay

### Postbaccalaureate Certificate

**Contact Information**—Policy Issues on Work and Pay, 101 Westbrook Hall, 77 Pleasant Street S.E., Minneapolis, MN 55455 (612-624-4000; [adv@cce.umn.edu](mailto:adv@cce.umn.edu); [www.cce.umn.edu/certificates/mgmt/piwp](http://www.cce.umn.edu/certificates/mgmt/piwp)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

#### Professor

Stephen Befort, Law School, M  
John Budd, Human Resources and Industrial Relations, M  
Morris Kleiner, Public Affairs, M  
James Griffin Scoville, Human Resources and Industrial Relations, M

#### Associate Professor

Maria Hanratty, Public Affairs, M  
**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. Core 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, sociology, and applied economics.

**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 is offered via distance education at the University). A GPA of 3.00 is required and, for international students, a TOEFL score consistent with the Graduate School's 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).

**Use of 4xxx Courses**—4xxx courses may not be used to meet certificate requirements.

### 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 the Industrial Relations Center in the Carlson School of Management, with additional courses from the College of Liberal Arts and the Law School, and Applied Economics. Students complete 10 elective credits that allow 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 higher.

## Political Psychology

### Minor Only

**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 612-625-2078; [cspp@polisci.umn.edu](mailto:cspp@polisci.umn.edu); [www.polisci.umn.edu/polipsyc/minor/index.html](http://www.polisci.umn.edu/polipsyc/minor/index.html)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

#### Regents Professor

John L. Sullivan, Political Science, M

#### Professor

Patricia G. Avery, Curriculum and Instruction, M  
Eugene Borgida, Psychology, M  
Karlyn K. Campbell, Communication Studies, M  
Ronald J. Faber, Journalism and Mass Communication, M  
William H. Flanigan, Political Science, M  
David W. Johnson, Educational Psychology, M  
Paul E. Johnson, Information and Decision Sciences, M  
Geoffrey Maruyama, Educational Psychology, M  
R. Michael Paige, Educational Policy and Administration, M  
W. Phillips Shively, Political Science, M  
Mark Snyder, Psychology, M  
Daniel B. Wackman, Journalism and Mass Communication, M

#### Associate Professor

Guy Charles, Law, M  
James N. Druckman, Political Science, M  
Martha H. Gonzales, Psychology, M  
Wendy M. Rahn, Political Science, M  
Alexander J. Rothman, Psychology, M



Martin W. Sampson III, Political Science, M  
Albert R. Tims, Jr., Journalism and Mass  
Communication, M

#### **Assistant Professor**

Christopher Federico, Psychology, Political  
Science, M

Samantha C. Luks, Political Science, M  
Joanne Miller, Political Science, M

**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 better) two or more methodology courses. Examples include Pol 8123, 8129; Psy 8814, 8815; Stat 5021, 5302. Other courses from these and other departments are acceptable. Students should consult with the director of graduate studies prior to enrolling in a course to confirm that it satisfies this requirement. Finally, the director of graduate studies in political psychology must approve admission.

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

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

#### **Minor Only Requirements**

The doctoral minor requires a minimum of 14 graduate credits, including 8 credits in required courses and 6 credits in 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 sociocultural 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 Pol 8307, 8308 or Psy 8211, 8212—Proseminar in Political Psychology (2 cr); Pol 8311—Political Psychology and Socialization (3 cr); and Psy 8201—Social Cognition (3 cr). Contact the director of graduate studies for more details.

## **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; office@polisci.umn.edu; www.polisci.umn.edu/graduate).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

#### **Regents Professor**

John L. Sullivan, SM

#### **Professor**

Michael Barnett, SM  
Mary G. Dietz, SM  
Lisa J. Disch, SM  
Raymond D. Duvall, SM  
James Farr, SM  
William H. Flanigan, SM  
Edwin Fogelman, SM  
John R. Freeman, SM  
Lawrence R. Jacobs, SM  
Robert B. Kvavik, SM  
August H. Nimtz, Jr., SM  
Steven J. Rosenstone, SM  
William Scheuerman, SM  
Thomas M. Scott, SM  
W. Phillips Shively, SM  
Kathryn A. Sikkink, SM  
David E. Wilkins, ASM

#### **Associate Professor**

Jamie Druckman, M2  
Daniel Kelliher, SM  
Wendy M. Rahn, SM  
Martin W. Sampson III, SM  
David J. Samuels, SM

#### **Assistant Professor**

Scott Abernathy, M2  
Elizabeth Beaumont, M2  
Teri Caraway, M2  
Kathleen Collins, M2  
Songying Fang, M2  
Christopher Federico, M2  
Elisabeth Hilbink, M2  
Timothy R. Johnson, M2  
Colin H. Kahl, M2  
Ronald Krebs, M2  
Jeffrey D. Lomonaco, M2  
Samantha C. Luks, M2  
Joanne Miller, M2  
Kathryn Pearson, M2  
Jason Roberts, M2  
Dara Strolovitch, M2

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 based upon consideration of all components 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.

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

**Use of 4xxx Courses**—4xxx and 5xxx courses from other departments usually are acceptable for supporting or minor programs with approval 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.

### **M.A. Degree Requirements Plan B Only**

This program is for secondary school teachers, journalists, government employees, political professionals, and others whose ongoing professional work requires them to get further training 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 the core seminars in each of 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.

## **Population Studies**

### **Minor Only**

**Contact Information**—Minnesota Population Center, University of Minnesota, 50 Willey Hall, 225 19th Avenue South, Minneapolis, MN 55455 (612-624-5818; fax 612-626-8375; [popstudies@pop.umn.edu](mailto:popstudies@pop.umn.edu); [www.pop.umn.edu/popstudies](http://www.pop.umn.edu/popstudies)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

#### **Professor**

John S. Adams, Geography, M  
Ragui A. Assaad, Humphrey Institute of Public Affairs, M  
John M. Eyler, History of Medicine, M  
Katherine Fennelly, Humphrey Institute of Public Affairs, M  
M. Janice Hogan, Family Social Science, M  
Robert E. McCaa, History, M  
Phyllis E. Moen, Sociology, M  
Jeylan T. Mortimer, Sociology, M  
Samuel L. Myers, Jr., Humphrey Institute of Public Affairs, M  
Steven Ruggles, History, M  
Rudolph J. Vecoli, History, M

#### **Associate Professor**

Kathleen Thiede Call, Health Services Research and Policy, M  
Jeffrey R. Crump, Design, Housing, and Apparel, M  
Elizabeth E. Davis, Applied Economics, M  
Paul W. Glewwe, Applied Economics, M  
Wendy L. Hellerstedt, Epidemiology, M  
Deborah Levison, Humphrey Institute of Public Affairs, M  
Ian Ross Macmillan, Sociology, M  
Joan M. Patterson, Epidemiology, M  
John Robert Warren, Sociology, M

#### **Assistant Professor**

Michael E. Davern, State Health Access Data Assistance Center, M  
Ann Meier, Sociology, M  
J. Michael Oakes, Epidemiology, M

#### **Research Associate**

Miriam L. King, Minnesota Population Center, M

**Curriculum**—Population studies is a multidisciplinary research area at the intersection of the mathematical sciences, the health and social sciences, and public policy. The curriculum provides solid grounding in the theories and methods of demography, with additional specialized training in five interdisciplinary subject areas: historical demography, population geography, economic demography, public health demography, and family and life course demography.

**Prerequisites for Admissions**—Enrollment in the population studies minor program is contingent upon prior admission to a master's or doctoral degree-granting program within the Graduate School. Students need not formally apply to enroll in the minor; any student currently in good standing in the Graduate School may elect to complete the minor by fulfilling the requirements and filing a program completion form with the director of graduate studies.

**Special Application Requirements**—None.

**Courses**—Please refer to the minor program Web site at [www.pop.umn.edu/popstudies/](http://www.pop.umn.edu/popstudies/) for information on coursework pertaining to the program.

**Use of 4xxx Courses**—4xxx courses may not be included on degree program forms for the population studies minor.

**Language Requirement**—None.

### **Minor Only Requirements**

The minor in population studies is available to master's and doctoral students. Both a master's and doctoral minor require the core course, PA 5301—Population Methods and Issues for the United States and Third World. In addition to the core course, master's students take at least three credits and doctoral students take at least nine credits from the list of approved courses at [www.pop.umn.edu/popstudies/courses.htm](http://www.pop.umn.edu/popstudies/courses.htm). All courses should be from the same subject area and may not be in the student's major field. A total of six credits at the master's level and twelve credits at the doctoral level is required for the minor. Students must register for all courses A-F; courses taken on a pass/fail basis may not count toward the minor (with the exception of PubH 5628, which is currently offered only S-N).

## **Portuguese**

See Hispanic and Luso-Brazilian Literatures and Linguistics.

## **Program Evaluation**

### **Minor Only**

**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; [kingx004@umn.edu](mailto:kingx004@umn.edu); <http://education.umn.edu/EdPA>).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

#### **Professor**

Michael Baizerman, Social Work, Work, Community, and Family Education, Educational Policy and Administration, M  
Nancy N. Eustis, Public Affairs, M  
Judith Garrard, Health Services Research, Policy, and Administration, M  
David R. Johnson, Institute on Community Integration, M  
Jean A. King, Educational Policy and Administration  
Richard A. Krueger, Work, Community, and Family Education, M  
Frances P. Lawrenz, Curriculum and Instruction, M  
Darrell R. Lewis, Educational Policy and Administration, M  
Patricia S. Seppanen, AM

**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 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.

**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.

**Use of 4xxx Courses**—Use of 4xxx courses is not permitted.

### Minor Only Requirements

Students need a minimum of 15 credits for the doctoral minor and a 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; psyapply@umn.edu; www.psych.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Regents Professor

Ellen S. Berscheid, SM

### Professor

Richard D. Arvey, Human Resources and Industrial Relations, ASM  
Eugene Borgida, SM  
Thomas J. Bouchard, Jr., SM  
Dwight A. Burkhardt, SM  
James N. Butcher, ASM  
John P. Campbell, SM  
Marilyn E. Carroll, Psychiatry, ASM  
Sandra L. Christenson, ASM  
Mark L. Davison, Educational Psychology, ASM  
René V. Dawis, ASM

Byron Egeland, Child Development, ASM  
Patricia A. Frazier, SM  
Megan R. Gunnar, ASM  
Jo-Ida C. Hansen, SM  
Dorothy K. Hatsukami, Psychiatry, ASM  
William G. Iacono, SM  
Paul E. Johnson, Information and Decision Sciences, ASM  
Daniel J. Kersten, SM  
Thomas J. Kiresuk, Psychiatry, AM2  
Eric Klinger, Social Sciences, Morris, ASM  
Gordon E. Legge, SM  
Gloria R. Leon, SM  
Allen S. Levine, Psychiatry, ASM  
Rodney G. Loper, University Counseling and Consulting Services, ASM  
Ann S. Masten, Child Development, ASM  
Matthew K. McGue, SM  
Stephan J. Motowidlo, SM  
J. Bruce Overmier, SM  
Christopher J. Patrick, SM  
Herbert L. Pick, Jr., Child Development, ASM  
Paul R. Sackett, SM  
Jeffrey A. Simpson, SM  
Mark Snyder, SM  
Sheldon B. Sparber, Pharmacology, ASM  
L. Alan Sroufe, Child Development, ASM  
Thomas Stoffregen, Kinesiology, ASM  
Paul van den Broek, Educational Psychology, ASM  
Neal F. Viemeister, SM  
Connie R. Wanberg, Human Resources and Industrial Relations, ASM  
Richard A. Weinberg, Child Development, ASM  
David J. Weiss, SM  
James E. Ysseldyke, Educational Psychology, ASM

### Associate Professor

James P. Cleary, AM2  
Charles R. Fletcher, SM  
Theresa M. Glomb, Human Resources and Industrial Relations, AM2  
Martha H. Gonzales, SM  
William M. Grove, SM  
Sheng He, SM  
Darwin D. Hendel, Educational Policy and Administration, AM2  
Robert F. Krueger, SM  
Matt G. Kushner, Psychiatry, ASM  
Richard M. Lee, SM  
Monica Luciana, SM  
Chad J. Marsolek, SM  
Michael H. Miner, Family Medicine and Community Health, AM2  
Deniz S. Ones, SM  
Carol H. Pazandak, AM2  
Gail Burton Peterson, SM  
William N. Robiner, AM  
Alexander J. Rothman, SM

### Assistant Professor

Joyce E. Bono, SM  
Kathy J. Christensen, Neurology, AM2  
Christopher M. Federico, SM  
Celia W. Gershenson, AM2  
Jonathan C. Gewirtz, SM  
John C. Gonsiorek, AM2  
Harriett L. C. Haynes, University Counseling and Consulting Services, AM  
Wilma Koutstaal, M2  
Angus MacDonald, M2  
Patricia J. Pardo, Psychiatry, AM2

Carol B. Peterson, AM  
David N. Rapp, Educational Psychology, AM2  
Paul R. Schrater, M2  
Scott R. Sponheim, AM2  
Mark J. Thomas, M2  
Linda K. Van Egeren, AM2

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/quantitative 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/quantitative 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 December 30. 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. 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 Web site at [www.psych.umn.edu](http://www.psych.umn.edu).

To ensure full consideration for fellowships and teaching and research assistantships, submit the Graduate School application, transcripts, and application fee to the Graduate School by December 1.

**Courses**—Please refer to Psychology (Psy) in the course section of this catalog for courses pertaining to the program.

**Use of 4xxx Courses**—Certain 4xxx courses may be taken for graduate credit. Students should consult the instructor or director of graduate studies.

### 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, a minimum of 10 thesis credits, 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 612-626-0002; admissions@hhh.umn.edu; www.hhh.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Regents Professor

G. Edward Schuh, M2

### Professor

Dean E. Abrahamson (emeritus), AM2  
John S. Adams, M2  
Ragui A. Assaad, M2  
J. Brian Atwood, M2  
Michael Barnett, M2  
Richard Bolan (emeritus), AM2  
John E. Brandl, M2  
John M. Bryson, M2  
Nancy N. Eustis, M2  
Katherine Fennelly, M2  
Edward G. Goetz, M2  
Stephen A. Hoenack, M2

Kenneth H. Keller, M2  
Sally J. Kenney, M2  
Morris M. Kleiner, M2  
Robert T. Kudrle, M2  
Ann R. Markusen, M2  
Samuel L. Myers, M2

### Associate Professor

Barbara Crosby, M2  
Maria J. Hanratty, M2  
Deborah Levison, M2  
Joseph A. Ritter, M2  
Jodi R. Sandfort, M2  
Melissa M. Stone, M2

### Assistant Professor

Kevin J. Krizek, M2  
Aijun Nie, M2  
Carissa Schively, M2

### Other

Zbigniew M. Bochniarz, M2  
Harry C. Boyte, M2  
Jacqueline Copeland-Carson, AM2  
Gary M. DeCramer, M2  
Marsha A. Freeman, M2  
P. Jay Kiedrowski, AM  
Jennifer Kuzma, AM2  
Barbara L. Lukermann, AM  
Lee Munnich, M2  
Joseph H. Nathan, M2  
Timothy Penny, AM  
Sharon Sayles Belton, AM  
Paul C. Stone, 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. It is a broad, generalist program that emphasizes leadership and policy making. Completion of degree requirements is possible within a calendar year (two semesters and a summer) of full-time enrollment, or two to three years of part-time enrollment. Structured concentrations include advanced policy analysis methods; economic and community development; foreign policy and international affairs; public and nonprofit leadership and management; science, technology and environmental 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, basic competency in computers, and a U.S. bachelor's degree or foreign equivalent is 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 professional résumé. The deadline for applications is April 1 of the preceding academic year. Entry is for fall and spring semesters.

**Courses**—Please refer to Public Affairs (PA) in the course section of this catalog for courses pertaining to the program.

**Use of 4xxx Courses**—Use of 4xxx Courses on degree program forms is permitted with instructor's and adviser's permission.

### M.P.A. Degree Requirements

The M.P.A. requires 30 credits, including PA 5941—Leadership for the Common Good (4 cr), PA 8001—Transforming Public Policy (4 cr), and PA 8002—Synthesis Workshop or an equivalent capstone workshop (4 cr); 9 credits in concentration courses; 6 credits in skills courses; and 3 credits of electives.

**Language Requirements**—None.

## Public Health

### Minor Only

**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 612-624-4498; sph.ssc@umn.edu; www.sph.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

Michael Baizerman, Social Work, M  
Jeff Blaine Bender, M  
Judith M. Garrard, M  
Ann W. Garwick, Nursing, M  
Susan G. Gerberich, M  
Robert W. Jeffery, M  
Barbara J. Leonard, Nursing, M  
A. Marshall McBean, M  
Michael D. Resnick, Pediatrics, M  
Robert L. Veninga, M

### Associate Professor

Leslie A. Grant, M  
Wendy L. Hellerstedt, M  
Patricia M. McGovern, M  
Joan M. Patterson, M

**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.

**Courses**—Please refer to Public Health (PubH) in the course section of this catalog for courses pertaining to the program.

**Use of 4xxx Courses**—Use of 4xxx Courses is not permitted.

### Minor Only Requirements

The master's minor requires a minimum of 8 graduate credits; the doctoral minor requires 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. Suggested courses include PubH 6101—Environmental Health or PubH 6102 Issues in Environmental Health; PubH 6320—Fundamentals of Epidemiology or PubH 6330 Epidemiology I; and PubH 6414—Biostatistical Methods I.

If students have already taken comparable graduate-level courses in these disciplines, other public health courses can 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 an 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 612-625-3513; admissions@hhh.umn.edu; www.hhh.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Regents Professor

G. Edward Schuh, M2

### Professor

Dean E. Abrahamson (emeritus), AM2  
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J. Brian Atwood, M2  
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Richard S. Bolan (emeritus), AM2  
John E. Brandl, M2  
John M. Bryson, M2  
Nancy N. Eustis, M2  
Katherine Fennelly, M2  
Edward G. Goetz, M2  
Stephen A. Hoenack, M2  
C. David Hollister, AM  
Kenneth H. Keller, M2  
Sally J. Kenney, M2  
Morris M. Kleiner, M2  
Robert T. Kudrle, M2  
Ann R. Markusen, M2  
Samuel L. Myers, M2

### Associate Professor

Barbara Crosby, M2  
Maria J. Hanratty, M2  
Deborah Levison, M2  
Joseph A. Ritter, M2  
Jodi R. Sandfort, M2  
Melissa Stone, M2

### Assistant Professor

Kevin J. Krizek, M2  
Aijun Nie, M2  
Carissa Schively, M2

### Other

Zbigniew M. Bochniarz, M2  
Harry C. Boyte, M2  
Jacqueline Copeland-Carson, AM2  
Gary DeCramer, M2  
Marsha A. Freeman, M2  
P. Jay Kiedrowski, AM  
Jennifer Kuzma, AM2  
Barbara L. Lukermann, AM  
Lee W. Munnich, M2  
Joseph H. Nathan, M2  
Timothy Penny, AM  
Sharon Sayles Belton, AM  
Paul C. Stone, 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, technology and environmental 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, including cases presented in courses, their internships, and workshops. Dual degrees include M.P.P./juris doctor; M.P.P./master of science in health services research, policy, and administration; M.P.P./master of social work.

**Prerequisites for Admission**—Students are expected to have completed the equivalent of an introductory course in microeconomics, have basic competency in college algebra and computers, and have a U.S. bachelor's degree or foreign equivalent.

**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, a GRE official score report, and a professional resume or C.V. Students who wish to be considered for

financial aid should apply no later than January 5 of the preceding academic year. Entry is for fall semester.

**Courses**—Please refer to Public Affairs (PA) in the course section of this catalog for courses pertaining to the program.

**Use of 4xxx Courses**—Use of 4xxx Courses towards degree requirements is permitted with instructor's and adviser's permission.

### M.P.P. Degree Requirements

The M.P.P. requires 45 credits—approximately 20 credits in required core courses, a three-course concentration (9 credits minimum), and a 3-credit course to complete the professional paper. Remaining credits are taken in elective courses. A non-credit internship is also required, unless the student is exempted based on previous relevant employment. Students may pursue a minor.

**Language Requirements**—None.

**Final Exam**—Final oral presentation is required.

**Minor Requirements for Students Majoring in Other Fields**—A minor is constructed in consultation with the student's minor adviser.

## Quaternary Paleoecology

### Minor Only

**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; qpminor@umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Regents Professor

Herbert E. Wright, Jr. (emeritus), Geology and Geophysics, AM

### Professor

Subir K. Banerjee, Geology and Geophysics, M  
Dwight A. Brown, Geography, M  
Edward J. Cushing, Ecology, Evolution, and Behavior, M  
R. Lawrence Edwards, Geology and Geophysics, M  
Guy E. Gibbon, Anthropology, M  
Emi Ito, Geology and Geophysics, M  
Thomas C. Johnson, Large Lakes Observatory, Duluth, M  
Edward A. Nater, Soil, Water, and Climate, M  
Richard H. Skaggs, Geography, M  
Peter S. Wells, Anthropology, M

### Associate Professor

James Cotner, Ecology, Evolution, and Behavior, M  
Katherine Klink, Geography, M  
Martha Tappen, Anthropology, M

### Assistant Professor

David L. Fox, Geology and Geophysics, M  
Greg Laden, Anthropology, M  
Bryan N. Shuman, Geography, M  
Shinya Sugita, Ecology, Evolution, and Behavior, M  
Susy S. Ziegler, Geography, M

**Curriculum**—The faculty of the graduate minor in Quaternary Paleocology hold appointments in several departments. Students in this unique program benefit from the broad range of expertise and experience available at a large research university. From their coursework in the minor, graduate students learn techniques and approaches from other areas that can be applied to their own research.

The minor is available to master's (M.A. and M.S.) and doctoral students.

**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 (qpmminor@umn.edu) as well as a letter of recommendation from their current adviser. Application may be made at any time.

**Courses**—See <http://lrc.geo.umn.edu/QPcourses.pdf> and contact the director of graduate studies at [qpmminor@umn.edu](mailto:qpmminor@umn.edu) for information on relevant coursework.

**Use of 4xxx Courses**—Any 4xxx course included in the published list at <http://lrc.geo.umn.edu/QPcourses.pdf> may be used to satisfy the minor requirement.

### Minor Only Requirements

Students develop their curricula in consultation with their major advisers and the director of graduate studies in Quaternary paleocology. Students choose courses from two lists found at <http://lrc.geo.umn.edu/QPcourses.pdf>. Master's students must take one of the three courses from List A plus one or more courses from List B for a total of 6 credits. Ph.D. students take two of the three courses from List A plus one additional course from List B for a total of 9 credits. Some requirements may be waived depending on the student's background.

In all cases, the selected courses must be outside the student's major field for List A and outside the cluster that includes the student's major field in List B.

## Recreation, Park, and Leisure Studies

**Contact Information**—Marta Fahrenz, Coordinator of Graduate Studies, School of Kinesiology, University of Minnesota, 223B Cooke Hall, 1900 University Avenue S.E., Minneapolis, MN 55455 (612-625-5300; fax 612-626-7700; [rpls@umn.edu](mailto:rpls@umn.edu); <http://education.umn.edu/kin>).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

Dorothy H. Anderson, Forest Resources, AM2  
William C. Gartner, Applied Economics, AM2  
Mary Jo Kane, M2

Leo H. McAvoy, Jr., M2  
John E. Rynders, Educational Psychology, AM2  
Michael G. Wade, M2

### Associate Professor

Carla E. S. Tabourne, M2  
Diane M. Wiese-Bjornstal, M2

### Assistant Professor

Kenneth Bartlett, Work, Community, and Family Education, AM2  
W. Corliss Outley, M2

### Instructor

JoAnn Buysse, M2  
Stephan P. Carlson, Forest Resources, AM2  
Robert Danforth, AM2  
Maurice K. Fahnestock, AM2

### Research Associate

Carol A. Leitschuh, M2  
Ingrid E. Schneider, Forest Resources, AM2

### Senior Research Associate

David W. Lime (emeritus), Forest Resources, AM2  
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 park and recreation administration, outdoor education/recreation, 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 University of Minnesota-Twin Cities Graduate School application form; a Division of Recreation and Sport Studies 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 December 15 is strongly encouraged to ensure priority consideration as well as teaching and research assistantships awarded for the next academic year. The three letters of recommendation must be sent directly to the department. Students can be admitted any term.

**Research Facilities**—Research facilities include the Institute on Community Integration, Wilderness Inquiry, and the Tucker Center for Research on Girls and Women in Sport.

**Courses**—Please refer to Recreation, Park, and Leisure Studies (Rec) in the course section of this catalog for courses pertaining to the program.

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

### M.A. Degree Requirements

Students select an emphasis in park and recreation administration, 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, and 4 credits of a research project (Rec 8995). 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**—Program in Rehabilitation Science, MMC 388, 420 Delaware St. S.E., Minneapolis, MN 55455, (612-625-3966; fax 612-625-7192; [adamc002@umn.edu](mailto:adamc002@umn.edu); [www.rehabscience.umn.edu](http://www.rehabscience.umn.edu)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

James Carey, SM  
Richard DiFabio, SM  
Carl Kukulka, SM  
Robert Patterson, SM

### Associate Professor

Dennis Dykstra, SM  
Virgil Mathiowetz, SM  
Erica Stern, SM  
LaDora Thompson, SM

### Assistant Professor

Teresa Jacobson Kimberley, SM  
Dawn Lowe, SM  
Paula Ludewig, SM

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 rehabilitation science is a post-professional program designed to train researchers and academicians. The rehabilitation science M.S. and Ph.D. degrees are geared to occupational and physical therapists and students with related interests. The program's philosophy

provides students with 1) a strong foundation in research methodology, 2) a concentrated educational experience specifically tailored toward a student's specific research question in rehabilitation science, and 3) a working knowledge of the importance of a collaborative, interdisciplinary approach to the scientific process.

**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). A GPA of 3.00 is preferred and applicants must have 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/adviser relationship.

**Special Application Requirements**—In addition to the Graduate School's application, including personal statement and fee, applicants must submit the following materials: GRE General Test scores; official transcripts; three letters of reference; and TOEFL score for international students.

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

**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.

### M.S. Degree Requirements

Plan A (thesis) requires a minimum of 33 credits: a minimum of 14 credits in the major, including 4 credits of rehabilitation science seminar (RSC 8100) and a research design course in rehabilitation science; a minimum of 6 credits in a minor or related field; 3 credits in statistics (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 (without thesis) 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. The Graduate School requires ethics in research training. Students should work with an adviser to identify a plan to meet this requirement. For additional information, visit [www.research.umn.edu/ethics](http://www.research.umn.edu/ethics) or contact 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 seminar RSC 8100; 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. In addition to these minimum requirements, the adviser may require additional courses. The Graduate School requires ethics in research training. Students should work with an adviser to identify a plan to meet this requirement. For additional information, visit [www.research.umn.edu/ethics](http://www.research.umn.edu/ethics) or contact the program.

**Language Requirements**—None.

### Religions in Antiquity

See Classical and Near Eastern Studies.

## Religious Studies

### Minor Only

**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).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

#### Professor

Frederick M. Asher, Art History, M  
Bernard S. Bachrach, History, M  
Caesar E. Farah, African American and African Studies, M  
Jasper S. Hopkins, Philosophy, M  
Riv-Ellen Prell, American Studies, M  
Theofanis G. Stavrou, History, M  
James D. Tracy, History, M

#### Associate Professor

William W. Malandra (emeritus), ASM  
Philip H. Sellew, M

**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.

### Minor Only Requirements

The minor requires 9 credits for an M.A. and 12 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 5521—Theory and Method in Religious Studies, and choose two (M.A.) or three (Ph.D.) from the following courses to complete the program: Afro 5036, AmSt 5101, ANE 5501/2, 5503/4, Anth 5059, Arab 5542, ArtH 5795, CNES 5088/9, 5252, JwSt 5013, 5960, 5111, Phil 8081, 8550, RelA 5071, 5072, 5073, 5080, 8190, 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; [rhetoric@umn.edu](mailto:rhetoric@umn.edu); [www.rhetoric.umn.edu](http://www.rhetoric.umn.edu)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Rhetoric and Scientific and Technical Communication Graduate Faculty

#### Professor

Carol Ann Berkenkotter, SM  
Karlyn K. Campbell, Communication Studies, ASM  
Terence G. Collins, General College, AM  
Ann Hill Duin, SM  
Shirley N. Garner, English, ASM  
Michael F. Graves, Curriculum and Instruction, ASM  
Alan G. Gross, Rhetoric, SM  
Laura J. Gurak, Rhetoric, SM  
Helen E. Longino, Women's Studies, AM  
Earl E. McDowell, Rhetoric, SM  
Victoria M. Mikelonis, Rhetoric, SM  
Donald J. Ross, Jr., English, AM  
Edward A. Schiappa, Communication Studies, ASM  
Mary M. Lay Schuster, Rhetoric, SM  
Robert L. Scott (emeritus), Communication Studies, ASM  
Richard A. Swanson, Work, Community, and Family Education, ASM  
Elaine E. Tarone, ASM  
Billie J. Wahlstrom, Rhetoric, SM  
Arthur E. Walzer, Rhetoric, SM

#### Associate Professor

Lisa Albrecht, General College, AM  
Lee-Ann Kastman Breuch, SM  
Robert L. Brown, Jr., Cultural Studies and Comparative Literature, ASM

Simon Hooper, Curriculum and Instruction, AM  
Daniel J. Philippon, SM  
Thomas M. Scanlan, Rhetoric, M2

### **Assistant Professor**

Janel Anderson, M2  
Richard J. Graff, M2  
John Logie, M2  
Bernadette C. Longo, M2

### **Scientific and Technical Communication Graduate Faculty**

#### **Professor**

Carol Ann Berkenkotter, M2  
Ann Hill Duin, M2  
Alan G. Gross, Rhetoric, M2  
Laura J. Gurak, Rhetoric, M2  
Earl E. McDowell, Rhetoric, M2  
Victoria M. Mikelonis, Rhetoric, M2  
Mary M. Lay Schuster, Rhetoric, M2  
Billie J. Wahlstrom, Rhetoric, M2  
Arthur E. Walzer, Rhetoric, M2

#### **Associate Professor**

Lee-Ann Kastman Breuch, M2  
Bernadette C. Longo, M2  
Daniel J. Philippon, M2  
Thomas M. Scanlan, Rhetoric, M2

#### **Assistant Professor**

Janel Anderson, M2  
Richard J. Graff, M2  
John Logie, M2

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. in Scientific and Technical Communication is a professional degree that focuses on research and skills applicable to the practice of scientific and technical communications in the workplace. It is designed for those students planning to be technical communicators or information developers in business and industry. For more information on this degree please see [www.rhetoric.umn.edu/msstc.html](http://www.rhetoric.umn.edu/msstc.html).

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. These programs prepare 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 and research, and practice in rhetoric and scientific and technical communication, analysis of scientific or technical discourse, and course work in a minor or related field.

All M.S., M.A., and Ph.D. applicants must meet the admission requirements of the Graduate School. M.A. and Ph.D. applicants should have a strong interest in language and rhetorical theory or communication theory. A background in a science, Internet studies, environmental studies, or pedagogy and technology is helpful. M.S. students are 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. International students are encouraged to take the General Test of the GRE and to have those results forwarded to the Graduate School. 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.

**Courses**—Please refer to Rhetoric (Rhet) in the course section of this catalog for courses pertaining to the program.

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

### **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 24 course credits and Plan B requires 30 course credits and 5 project credits. Students take six courses in theory and 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 35 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 6 in a minor or related field and electives to equal 30 credits of course work. Minor or related fields and electives to equal 30 credits of course work may focus on areas such as communication studies, English, curriculum and instruction, women's studies, cognitive psychology, and history of science.

**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.

Students can 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—Beginning German. These courses are offered through the College of Continuing Education, usually in the summer.

**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. This plan requires a minimum of 21 credits in rhetoric seminars and courses—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; two courses in technical communication research and theory (6 credits), including Rhet 8011 and 8012; two or more courses (6-12 credits) in a particular area of study such as rhetoric of science and technology; feminist theory in science, technology, and communication; scientific and technical communication pedagogy; or technology and culture; 0-6 credits in research methods courses; and 12 credits in a minor or related field. Minor or supporting programs may focus on areas such as communication studies, 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 preliminary exams are both written (based on coursework and reading lists) and oral (based on the written preliminary exam). 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 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 also 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 offered through the College of Continuing Education, usually in the summer.



**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.

## 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; admissions@hhh.umn.edu; www.hhh.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Regents Professor

G. Edward Schuh, M2

### Professor

Dean E. Abrahamson (emeritus), AM2  
John S. Adams, M2  
Ragui A. Assaad, M2  
J. Brian Atwood, M2  
Michael Barnett, M2  
Richard Bolan (emeritus), AM2  
John E. Brandl, M2  
John M. Bryson, M2  
K. William Easter, AM2  
Nancy N. Eustis, M2  
Katherine Fennelly, M2  
Edward G. Goetz, M2  
Stephen A. Hoenack, M2  
Anne Kapuscinski, AM  
Kenneth H. Keller, M2  
Sally J. Kenney, M2  
Morris M. Kleiner, M2  
Robert T. Kudrle, M2  
Ann R. Markusen, M2  
Samuel L. Myers, M2  
Philip Pardey, AM2

### Associate Professor

Barbara Crosby, M2  
Maria J. Hanratty, M2  
Deborah Levison, M2  
Joseph A. Ritter, M2  
Jodi R. Sandfort, M2  
Melissa M. Stone, M2

### Assistant Professor

Kevin J. Krizek, M2  
Aijun Nie, M2  
Carissa Schively, M2

### Other

Zbigniew M. Bochniarz, M2  
Harry C. Boyte, M2  
Jacqueline Copeland-Carson, AM2  
Gary DeCramer, M2  
Marsha A. Freeman, M2  
P. Jay Kiedrowski, AM  
Jennifer Kuzma, AM2  
Barbara L. Lukermann, AM  
Lee W. Munnich, M2  
Joseph H. Nathan, M2  
Timothy Penny, AM  
Sharon Sayles Belton, AM  
Paul C. Stone, 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. An M.S./juris doctor dual degree program is available.

**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, one semester of calculus and have a U.S. bachelor's degree or foreign equivalent.

**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, a GRE official score report, and a professional résumé or C.V. Students who wish to be considered for financial aid should apply no later than January 5 of the preceding academic year. Entry is for fall semester.

**Courses**—Please refer to Public Affairs (PA) in the course section of this catalog for courses pertaining to the program.

**Use of 4xxx Courses**—Use of 4xxx courses toward degree requirements is permitted with instructor's and adviser's permission.

## M.S. Degree Requirements

The M.S., which is offered under both Plan A (thesis) and Plan B (without thesis), requires 40 credits including at least 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 are chosen in consultation with the student's adviser. Students may pursue a minor.

**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, 139 Smith Hall, 207 Pleasant St. S.E., Minneapolis, MN 55455 (612-625-0769; fax 612-626-7541; www.scicomp.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Regents Professor

Daniel D. Joseph, Aerospace Engineering and Mechanics, SM  
L. E. Scriven, Chemical Engineering and Materials Science, SM

### Professor

Ronald E. Anderson, Sociology, SM  
Douglas N. Arnold, Mathematics, SM  
Daniel L. Boley, Computer Science and Engineering, SM  
Graham V. Candler, Aerospace Engineering and Mechanics, SM  
James R. Chelikowsky, Chemical Engineering and Materials Science, SM  
J. Bernardo Cockburn, Mathematics, SM  
Christopher J. Cramer, Chemistry, SM  
Jeffrey J. Derby, Chemical Engineering and Materials Science, SM  
Timothy J. Ebner, Neuroscience, SM  
Jiali Gao, Chemistry, SM  
Efi Foufoula-Georgiou, Civil Engineering, SM  
Apostolos P. Georgopoulos, Neuroscience, SM  
Alexander Y. Grosberg, Physics and Astronomy, SM  
Thomas W. Jones, Astronomy, SM  
Daniel J. Kersten, Psychology, SM  
Vipin Kumar, Computer Science and Engineering, SM

David J. Lilja, Electrical and Computer Engineering, SM  
John S. Lowengrub, Mathematics, SM  
Mitchell B. Luskin, Mathematics, SM  
John L. Nieber, Biosystems and Agricultural Engineering, SM  
Hans G. Othmer, Mathematics, SM  
N. P. Papanikolopoulos, Computer Science and Engineering, SM  
Haesun Park, Computer Science and Engineering, SM  
Yousef Saad, Computer Science and Engineering, SM  
Guillermo R. Sapiro, Electrical and Computer Engineering, SM  
George R. Sell, Mathematics, SM  
J. Ilja Siepmann, Chemistry, SM  
Jaideep Srivastava, Computer Science and Engineering, SM  
Harlan W. Stech, Mathematics and Statistics, Duluth, SM  
David D. Thomas, Biochemistry, SM  
Luke Jon Tierney, Statistics, SM  
Donald G. Truhlar, Chemistry, SM  
Vaughan R. Voller, Civil Engineering, SM  
George L. Wilcox, Neuroscience, SM  
Paul R. Woodward, Astronomy, SM  
David A. Yuen, Geology and Geophysics, SM

### Associate Professor

Victor H. Barocas Biomedical Engineering, SM  
David M. Ferguson, Medicinal Chemistry, Pharmacognosy, SM  
Darrin M. York, Chemistry, SM

### Assistant Professor

Bagrat Amirikian, Neuroscience, M2  
George Karypis, Computer Science and Engineering, M2  
Mahesh Krishnan, Aerospace Engineering, SM  
Norman J. Troullier, Computer Science and Engineering, M2

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.

### 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.

**Courses**—Please refer to the Scientific Computation (SciC) in the course section of this catalog for courses pertaining to the program.

**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.

### 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 6 credits from the scientific computation core and at least

6 credits in a minor. Only 3 credits from courses offered in a student's minor may be counted toward the core requirements in scientific computation. A course listed in both the core requirements of scientific computation and a student's minor may not be counted under both.

**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 4 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 24 course credits is required with a minimum of 12 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 12 credits in subjects that support computational science—these can include core credits beyond the required 12 credits.
- 2) Ph.D. with minor. In addition to the core credits, this option requires 12 credits in a minor. Many minor programs require more than 12 credits; 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 6 of these in core courses with remaining credits from supplementary courses). A student may use one course from their major field to satisfy the requirement of a minor in scientific computation, provided there is no rule prohibiting this in the student's major field.

## 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; tesda001@umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

Barbara Brandt, Pharmaceutical Care and Health Systems, SM  
Robert J. Cipolle, Pharmaceutical Care and Health Systems, SM  
James C. Cloyd, Experimental and Clinical Pharmacology, SM  
Judith M. Garrard, School of Public Health, SM  
Cynthia R. Gross, Experimental and Clinical Pharmacology, SM  
David R. Guay, Experimental and Clinical Pharmacology, M2  
Ronald S. Hadsall, Pharmaceutical Care and Health Systems, SM  
Thomas E. Lackner, Experimental and Clinical Pharmacology, M2  
Tom Alan Larson, Pharmaceutical Care and Health Systems, M2  
Henry J. Mann, Experimental and Clinical Pharmacology, SM  
Peter C. Morley, Pharmaceutical Care and Health Systems, SM  
Paul L. Ranelli, Pharmaceutical Care and Health Systems, SM  
Rory P. Remmel, Medicinal Chemistry, SM  
John C. Rotschafer, Experimental and Clinical Pharmacology, M2  
Ronald Sawchuk, Experimental and Clinical Pharmacology, SM  
Jon C. Schommer, Pharmaceutical Care and Health Systems, SM  
Stephen W. Schondelmeyer, Pharmaceutical Care and Health Systems, SM  
Stuart M. Speedie, Health Informatics, Medical School, SM  
Linda M. Strand, Pharmaceutical Care and Health Systems, SM  
Timothy S. Tracy, Experimental and Clinical Pharmacology, SM  
Donald L. Uden, Pharmaceutical Care and Health Systems, M2  
Vernon E. Weckwerth, Health Services Administration, SM  
Cheryl L. Zimmerman, Pharmaceutics, SM

**Adjunct Professor**

Paul C. Langley, Pharmaceutical Care and Health Systems, ASM

Leo J. Sioris, Experimental and Clinical Pharmacology, M2

**Associate Professor**

Sidney B. Benson, Pharmaceutical Care and Health Systems, M2

Angela K. Birnbaum, Experimental and Clinical Pharmacology, SM

Richard C. Brundage, Experimental and Clinical Pharmacology, SM

William F. Elmquist, Experimental and Clinical Pharmacology SM

Brian J. Isetts, Pharmaceutical Care and Health Systems, M2

Pamala A. Jacobson, Experimental and Clinical Pharmacology, S2

Kristin K. Janke, Pharmaceutical Care and Health Systems, M2

Ayman M. Noreddin, Pharmacy Practice and Pharmaceutical Sciences, Duluth, M2

John V. St. Peter, Experimental and Clinical Pharmacology, M2

Wendy L. St. Peter, Pharmaceutical Care and Health Systems, M2

Raquel Rodriguez, Pharmaceutical Care and Health Systems, M2

Robert J. Straka, Experimental and Clinical Pharmacology, M2

Timothy P. Stratton, Pharmaceutical Care and Health Systems, SM

**Adjunct Associate Professor**

Sauwakon Ratanawijitrasin, Pharmaceutical Care and Health Systems, AM

Thomas S. Rector, College of Pharmacy, AM2

**Assistant Professor**

Margaret Artz, Experimental and Clinical Pharmacology, M2

Richard R. Cline, Pharmaceutical Care and Health Systems, M2

Mark Kirstein, Experimental and Clinical Pharmacology, M2

Michael Kotlyar, Experimental and Clinical Pharmacology, M2

Marnie L. Peterson, Experimental and Clinical Pharmacology, SM

Debra J. Skaar, Experimental and Clinical Pharmacology, M2

Marcia M. Worley-Louis, Pharmaceutical Care and Health Systems, M2

Heather E. Wynn Vezina, Experimental and Clinical Pharmacology M2

Samuel Wagner, Pharmaceutical Care and Health Systems, AM2

**Adjunct Assistant Professor**

Puree Anantachoti, Pharmaceutical Care and Health Systems, AM

Chulaporn Limwattananon, Pharmaceutical Care and Health Systems, AM

Supon Limwattananon, Pharmaceutical Care and Health Systems, AM

Craig Weinert, Experimental and Clinical Pharmacology, AM2

**Clinical Professor**

Daniel E. Keyler, Experimental and Clinical Pharmacology, AM2

**Clinical Assistant Professor**

Angeline M. Carlson, Pharmaceutical Care and Health Systems, M2

**Other**

Deborah A. Wingert, Pharmaceutical Care and Health Systems, AM2

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 performance level of 580 is preferred on the TOEFL for all international applicants whose native language is not English.

**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.

**Use of 4xxx Courses**—Use of 4xxx courses towards degree requirements is permitted with director of graduate studies approval.

**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****Minor Only**

**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; <http://education.umn.edu/edpa>).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

**Professor**

John J. Cogan, Educational Policy and Administration, M  
Jean A. King, Educational Policy and Administration, M  
Darrell R. Lewis, Educational Policy and Administration, M  
Josef A. Mestenhauer (emeritus), Educational Policy and Administration, AM  
R. Michael Paige, Educational Policy and Administration, M  
Karen Rose Seashore, Educational Policy and Administration, M

**Associate Professor**

Arthur M. Harkins, Educational Policy and Administration, M

**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 to develop a proposed course of study.

**Special Application Requirements**—The director of graduate studies in the Department of Educational Policy and Administration must approve the applicant's proposed course of study by signing the student's degree program form.

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

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

**Minor Only 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 or 1-800-779-8636; fax 612-624-3744; [jreinar@che.umn.edu](mailto:jreinar@che.umn.edu); <http://ssw.che.umn.edu>).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

**Professor**

Michael Baizerman, SM  
Jeffrey L. Edleson, SM  
Jane F. Gilgun, SM  
C. David Hollister, SM  
Rosalie A. Kane, Public Health, SM  
Helen Q. Kivnick, SM  
David J. Klaassen, AM2  
Dario Menanteu-Horta, SM  
Jean K. Quam, SM  
Ronald H. Rooney, SM  
Mark S. Umbreit, SM  
Esther Wattenberg (emeritus), ASM  
Susan Wells, SM  
Oliver J. Williams, SM

**Associate Professor**

William Bradshaw, SM  
Linda E. Jones, SM  
James R. Reinardy, SM  
Edward Taylor, M2

**Assistant Professor**

Laura Abrams, M2  
Mark G. Frenzel, AM  
Priscilla Gibson, M2  
Elizabeth Lightfoot, M2  
Yat-Sang (Terry) Lum, M2

**Instructor**

Eileen Arnold, M2

**Other**

Sonia Davila-Williams, M2  
M. J. Gilbert, M2  
Trude D. Hendrickson, M2  
Nancy J. Johnston, M2  
Nan L. Kalke, M2  
Marilyn Luptak, M2  
Janelle Rae Miedema, M2  
Megan H. Morrissey, M2  
Victoria Van Slyke, M2  
Mary Weeks, M2

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. The curriculum offers concentrations in direct or community practice.

The School of Social Work and the Humphrey Institute of Public Affairs offer two dual master's degrees: the master of social work/master of public policy (M.S.W./M.P.P.), and the master of social work/master of urban and

regional planning (M.S.W./M.U.R.P.). Dual degree students generally take coursework in each department for the first two years, and in the third year, take courses concurrently in two departments, facilitating the integration of content from both fields. Students may apply some credits taken in the dual degree programs toward requirements in both departments. Each dual degree option is a minimum sequence of three years of full-time study. Students who choose an M.S.W. concentration in direct practice will need longer than six semesters to complete both programs. Students may begin their studies in either program.

A dual master of social work/master of public health (M.S.W./M.P.H.) is offered with the School of Public Health. The M.S.W./M.P.H. degree provides exposure to a blend of course offerings in biometry, community health education, environmental health, epidemiology, health services administration, maternal and child health, and public health nutrition. The purpose of this degree is to educate and prepare professional public health social workers that are competent in the practice of professional social work with the additional outlook, skills, and expertise of public health. Students are able to complete the requirements for both degrees in approximately six to eight academic semesters or less, depending upon the number of credits carried each semester.

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. However, students gain knowledge of practice theory and research related to social work practice. 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 to the MSW program must have a background in the liberal arts that includes coursework in history and social sciences, the humanities and the arts, physical and biological sciences and mathematics and a college-level course in statistics. A college-level biology course with content on human anatomical and physiological development is also required. Strong preference is given to applicants with paid or volunteer experience in social service settings. Please review the current application packet available on the School of Social Work Web site at <http://ssw.che.umn.edu/> for the most current application requirements. 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 closely 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. Candidates for the Ph.D. program who do not have an M.S.W. may be required to take several master's level foundation courses.

**Special Application Requirements**—Three letters of recommendation, a résumé documenting social service experience, a complete set of transcripts (in addition to that required by the Graduate School), an example of academic or scholarly writing, 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 do not have an official grade point average from their undergraduate degree. GRE scores are required for admission to the Ph.D. program. The application deadline for the M.S.W. program and for the Ph.D. program is in early January. The Ph.D. program has a second review deadline in early March. Beginning students in either program are admitted fall semester only. Please check the School of Social Work Web site at <http://ssw.che.umn.edu/> for specific dates.

**Courses**—Please refer to Social Work (SW) in the course section of this catalog for courses pertaining to the program.

**Use of 4xxx Courses—Use of 4xxx Courses** toward degree requirements is permitted with director of graduate studies approval.

### 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 for the M.S.W. can be completed in two years of full-time study, or three years of part-time study, and must be completed within seven years of the date of the earliest coursework taken for the 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 for social work graduate credit 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 for social work graduate credit at the University of Minnesota.

**Language Requirements**—None.

### Ph.D. Degree Requirements

The Ph.D. program emphasizes mastery of student- 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 Program Assistant, Department of Sociology, University of Minnesota, 909 Social Sciences Building, 267 19th Avenue S., Minneapolis, MN 55455 (612-624-2093; fax 612-624-7020; [socdept@atlas.socsci.umn.edu](mailto:socdept@atlas.socsci.umn.edu)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Regents Professor

Joanne B. Eicher, Design, Housing, and Apparel, AM2

### Professor

Ronald R. Aminzade, SM

Ronald E. Anderson, SM

John Arthur, Sociology-Anthropology, Duluth, AM2

Barry C. Feld, Law School, AM2

David Knoke, SM

Candace M. Kruttschnitt, SM

Theodor J. Litman, Health Care Management, ASM

Carl P. Malmquist, SM

Dario Menanteau-Horta, Social Work, AM2

Phyllis Moen, SM

Jeylan T. Mortimer, SM

Joel I. Nelson, SM

Steven Ruggles, History, AM2

Joel B. Samaha, AM2

Joachim J. Savelsberg, SM

Karen R. Seashore, Educational Policy and Administration, AM2

Mark Snyder, Psychology, AM2

Robin S. Stryker, SM

Christopher Uggen, SM

### Associate Professor

Elizabeth H. Boyle, SM

Rose M. Brewer, African American and African Studies, AM2

Jeffrey P. Broadbent, SM

Kathleen T. Call, Public Health, AM2

Penny A. Edgell, SM

Scott R. Eliason, SM

Michael R. Goldman, SM

Douglas Hartmann, SM

Walt Jacobs, AM2

Ian R. Macmillan, SM

Jennifer L. Pierce, ASM

Rachel Schurman, M2

John R. Warren, M2

### Adjunct Associate Professor

Michael David Finch, AM2

### Assistant Professor

Joseph Gerteis, M2

Ann M. Hironaka, M2

Kathleen E. Hull, M2

Erin L. Kelly, M2

Jeffrey Robert Maahs, AM

Ann Meier, M2

Evan A. Schofer, M2

Teresa T. Swartz, M2

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; inequality—race, class, and gender law; crime and deviance; organizations, work, and markets; political sociology and social movements. 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 recommended. 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: valid GRE scores; a complete set of transcripts in addition to that required by the Graduate School; a departmental application; 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 and financial aid is December 1.

**Courses**—Please refer to Sociology (Soc) in the course section of this catalog for courses pertaining to the program.

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

### **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 six required courses or their equivalent (17 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 five required courses or their equivalent (14 credits), including two courses 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. Students must prepare for a written examination in two of the department's major research interest areas. The selections must be logically related to the student's major work. Three representatives from the sociology department must serve on the student's preliminary oral examining and prospectus hearing committees.

**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, University of Minnesota Software Engineering Center, 200 Union Street SE, 4-192 EE/CS Building, Minneapolis, MN 55455 (612-625-1381; fax 612-625-0572; [kkramer@cs.umn.edu](mailto:kkramer@cs.umn.edu); [www.msse.umn.edu](http://www.msse.umn.edu)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### **Professor**

John V. Carlis, M2  
Joseph A. Konstan, M2  
Shashi Shekhar, M2  
Jaideep Srivastava, M2

### **Associate Professor**

Mats P. E. Heimdahl, M2  
Richard M. Voyles, AM2

### **Assistant Professor**

John E. Collins, M2

### **Instructor**

Neil A. Bitzenhofer, AM2  
Michael Calvo, AM2  
Jesse D. Freese, AM2  
Richard Hedger, AM2  
Stephen Kan, AM2  
John Kruse, AM2  
Kevin Larsen, AM2  
Elizabeth M. Sisley, AM2  
John Skovbrotten, AM2  
Michael W. Wold, AM2

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.) program 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. program is an interdisciplinary program administered by the Institute of Technology's 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 (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.

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

**Use of 4xxx Courses**—Use of 4xxx Courses toward degree requirements is subject to adviser and/or director of graduate studies approval.

### **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; [dgs@soils.umn.edu](mailto:dgs@soils.umn.edu); [www.Soils.umn.edu](http://www.Soils.umn.edu)).

### **Professor**

Deborah L. Allan, SM  
James L. Anderson, SM  
Jay C. Bell, SM  
Paul R. Bloom, SM  
Terence H. Cooper, SM  
Peter H. Graham, SM  
Satish C. Gupta, SM  
Thomas Halbach, M2  
John A. Lamb, SM  
Gary L. Malzer, SM  
Jean-Alex E. Molina, SM  
John F. Moncrief, SM  
David J. Mulla, SM  
Edward A. Nater, SM  
Gyles W. Randall, SM  
George W. Rehm, SM  
Carl Rosen, SM  
Michael J. Sadowsky, SM  
Michael A. Schmitt, SM  
Jeffrey S. Strock, M2  
Mark W. Seeley, SM

### **Adjunct Professor**

John M. Baker, SM  
Charles E. Clapp, SM  
William C. Koskinen, SM  
Donald C. Reicosky, AM2  
Michael P. Russelle, SM

### **Associate Professor**

Albert L. Sims, M2  
Dong Wang, SM

**Adjunct Associate Professor**

Robert Mabagala, AM2

**Assistant Professor**

Timothy J. Griffis, M2  
Jennifer Y. King, M2

**Adjunct Assistant Professor**

Jane Johnson, AM2  
Randall Kolka, AM2  
Pamela J. Rice, AM2  
Rodney T. Venterea, AM2  
Tyson Ochsner, AM2

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](http://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, Water, and Climate (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 course 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 course in soil science.

**Language Requirement**—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 Literatures, Cultures, and Media.

**Spanish**

See Hispanic and Luso-Brazilian Literatures and Linguistics.

**Special Education**

See Educational Psychology.

**Speech-Language-Hearing Sciences**

**Contact Information**—Department of Speech-Language-Hearing Sciences, University of Minnesota, 115 Shevlin Hall, 164 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-624-3322; fax 612-624-7586; [slhs@umn.edu](mailto:slhs@umn.edu); [www.slhs.umn.edu](http://www.slhs.umn.edu)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

**Professor**

Arlene E. Carney, SM  
Karling T. Moller, SM  
David A. Nelson, SM  
Joe E. Reichle, SM  
Charles E. Speaks, SM  
Dianne Van Tasell, ASM  
Jennifer Windsor, SM

**Associate Professor**

David A. Fabry, AM  
Mary R. T. Kennedy, M2  
Kathryn Kohnert, M2  
Peggy B. Nelson, M2  
Robert S. Schlauch, SM

**Assistant Professor**

Benjamin Munson, M2  
Timothy D. Trine, AM  
Peter Watson, M2

**Clinical Specialist**

Leslie E. Glaze, M2

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 in the master’s program is speech-language pathology. Emphases in the Ph.D. programs are speech-language pathology, speech science, language science, audiology, and hearing science.

The emphases in the Au.D. program focuses on meeting the standards for certification as an audiologist by the American Speech-Language-Hearing Association. The program emphasizes outcome-based learning activities that prepare graduates to interpret research findings and incorporate them into clinical practice. Coursework and clinical education focus on diagnostic, rehabilitative techniques, technology counseling approaches and human development.

**Prerequisites for Admission**—Prospective students must have completed an undergraduate degree. Individuals from speech-language-hearing sciences or other academic areas are welcome. Students entering the M.A. program with minimal background in speech-language-hearing sciences 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. TOEFL is required for nonnative English speaking applicants. Deadline for application to the master’s and Au.D. programs is January 1; late applications are considered only if space is available. Master’s students ordinarily begin graduate study during fall semester. Review of applicants to the doctoral program is continuous.

**Courses**—Please refer to Speech-Language-Hearing Sciences (SLHS) in the course section of this catalog for courses pertaining to the program.

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

### **M.A. Degree Requirements**

Emphasis in the master’s program is speech-language pathology, which is 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, a comprehensive written examination, and an oral examination.

**Language Requirements**—None.

**Final Exam**—The final exam is oral.

**Minor Requirements for Students Majoring in Other Fields**—A minimum of 12 credits, approved by the director of graduate studies, is required for a master’s minor.

### **Au.D. Degree Requirements**

The Au.D. is a four year plan of study for students entering with a background in speech-language-hearing sciences. Students without a background should expect a more lengthy plan of study. The Au.D. requires a total of 98 semester credit hours. Ninety of these are in the major area of study. Additionally, 8 credits of related field coursework are required. Two summative evaluations must be completed including: 1) a written comprehensive examination during the third year of the program, and, 2) a written Capstone Project that includes an oral presentation and oral defense of the project.

**Language Requirements**—None.

### **Ph.D. Degree Requirements**

Emphases in the Ph.D. 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 (SLHS 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 (SLHS 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 15 credits, approved by the director of graduate studies, is required for a doctoral minor.

## **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; info@stat.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### **Professor**

Christopher Bingham, SM  
R. Dennis Cook, SM  
James M. Dickey, SM  
Morris L. Eaton, SM  
Charles J. Geyer, SM  
Douglas M. Hawkins, SM  
Glen D. Meeden, SM  
Christopher J. Nachtsheim, Operations and Management Science, SM  
Gary W. Oehlert, SM  
Ronald R. Regal, Mathematics and Statistics, Duluth, SM  
Xiaotong Shen, SM  
William D. Sudderth, SM  
Sanford Weisberg, SM

### **Associate Professor**

Birgit Grund, SM  
Tiefeng Jiang, SM  
Frank B. Martin, SM  
Peihua Qiu, SM  
Yuhong Yang, SM

### **Assistant Professor**

Singdhansu Chatterjee, M2  
Galin Jones, M2  
Lan Wang, M2

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**—Applicants to the master’s program must be familiar with basic statistical concepts and methods, and with mathematics through multivariable calculus and linear algebra. Applicants to the doctoral program must, in addition to the above, be familiar with the elements of real analysis.

**Special Application Requirements**—Two letters of recommendation are required. Applicants for financial support (assistantships) must submit scores from the GRE General Test; other applicants are encouraged to submit GRE scores. Applicants whose native language is not English must submit a TOEFL score; applicants should have a score of at least 223



(or equivalent IELTS or MELAB); those applying for assistantships should score at least 250. Applicants should begin their studies in the fall semester; spring admissions will only be considered under unusual circumstances. Those applying for assistantships should have their applications completed by January 10. Financial support is usually available only to those beginning in the fall semester.

**Courses**—Please refer to Statistics (Stat) in the course section of this catalog for courses pertaining to the program.

**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. Stat 4101-2 can be used in statistics graduate minors.

### M.S. Plan B Degree Requirements

The program prepares students for jobs in industry and the public sector and also for study at the doctoral level.

During the first year, students take a two-semester theory sequence and a two-semester methods sequence. In addition, they usually take two supporting field 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 3-credit statistical consulting course and complete their Plan B project. A total of at least 30 course credits is required. A written preliminary examination is taken at the beginning of the second year.

**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 at least 60 course credits; students entering with a master's degree must take at least 43 credits; 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 3-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.

## Strategic Communication

**Contact Information**—Graduate Studies Office, Strategic Communication M.A. Program, School of Journalism and Mass Communication, University of Minnesota, 111 Murphy Hall, 206 Church Street S.E., Minneapolis MN 55455 (612-625-4054; fax 612-626-8251; sjmcgrad@umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

John Eighmey, M2  
Ronald Faber, M2  
Daniel B. Wackman, M2

### Associate Professor

Kenneth O. Doyle, M2

### Assistant Professor

Jisu Huh, M2  
Brian Southwell, M2  
Marco Yzer, M2

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 strategic communication, new in September 2005, emerged from the 1998 Presidential Initiative in New Media. It is designed to serve working communications professionals in advertising, public relations, corporate communications, nonprofit organizations, and government. The 33-credit program is conceptually and structurally distinct from the existing academic master's degree in mass communication in that it focuses on advanced professional study of communications strategy, planning, evaluation, and creative management.

The University of Minnesota is one of only a handful of institutions to offer a professional master's program in strategic communication designed for the busy working professional.

The M.A. in strategic communication curriculum is tailored to provide the best foundation for future communications leaders, recognizing the communication industry is changing rapidly and is more volatile than ever. With the Internet in its infancy, and massive organizational and global forces reshaping the U.S. economy, communications leaders face significant challenges and can prepare themselves by in-depth study of strategic process management.

**Prerequisites for Admission**—The minimum requirement for admission is a B.A. or equivalent. Professionals in strategic communication—currently employed in an advertising, public relations or marketing firm, or in a communications function within a corporation or nonprofit organization—must

have a baccalaureate degree from an accredited U.S. institution or its foreign equivalent and at least two years' professional experience. This professional experience should be in any of the following areas: account planning, account management, advertising management, media planning or buying, media sales, promotion marketing, corporate communications, public affairs, public relations, investor relations, direct marketing, sales management, marketing management, brand management, market research, or event management.

### Special Application Requirements

Applications to both the School of Journalism and Mass Communication and the University of Minnesota Graduate School must be received before June 15. Acceptance is on a rolling basis, with a maximum of 20 students accepted. Applications are processed only when they are complete and accompanied by the application fee, which is nonrefundable.

**Courses**—Please refer to Journalism and Mass Communications (Jour) in the course section of this catalog for courses pertaining to this program.

**Use of 4xxx Courses**—Use of 4xxx courses is not permitted.

### M.A. Degree Requirements

The M.A. in strategic communication requires 33 semester credits to be completed within 24 calendar months. All students must take the same 18 course credits in communication, and complete the 6-credit individual project. In addition, 9 credits of graduate-level elective studies (at least 6 outside SJMC) must be completed.

Students must maintain a GPA of at least 3.00 and achieve a grade of B or better on their final six-credit project. Student progress is evaluated by the academic director, program coordinator, and program faculty. Students must progress each semester to continue in the program, though a student who unexpectedly must temporarily leave the program can return to the program at a later date and resume their studies at the point of departure. All coursework must be taken A-F.

**Language Requirements**—Foreign language study is recommended for students who plan to work internationally.

## Studies in Africa and the African Diaspora

### Minor Only

**Contact Information**—Department of African 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).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

**Regents Professor**

Joanne B. Eicher, Design, Housing, and Apparel, AM  
Allen F. Isaacman, History, AM

**Professor**

Samuel Myers, Public Affairs, AM  
August H. Nimtz, Jr., Political Science, AM  
Earl P. Scott, Geography, M

**Associate Professor**

Keletso E. Atkins, African American and African Studies, M  
Louis R. Bellamy, Theatre Arts, AM  
Rose M. Brewer, African American and African Studies, M  
Roderick Ferguson, American Studies, AM  
Gloria Williams, Design Housing, and Apparel, AM  
Kirt H. Wilson, Communication Studies, AM  
John S. Wright, African American and African Studies, M

**Assistant Professor**

Pearl Barner II, African American and African Studies, M  
Victoria B. Coifman, African American and African Studies, M  
Priscilla Gibson, Women's Studies, AM  
Keith A. Mayes, African American and African Studies, M  
Charles Ben Pike, African American and African Studies, M  
Gwendolyn Pough, Women's Studies, AM  
Michele Wagner, History, 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 graduate minor is administered through the Department of African 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 spring 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 African 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.

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

**Use of 4xxx Courses—Use of 4xxx Courses** towards degree requirements is subject to adviser and/or director of graduate studies approval.

**Minor Only 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 5101—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 5101—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**

**Minor Only**

**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; mcps@umn.edu; www.sst.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

**Professor**

Carl Elliott, Bioethics, M  
John M. Eyler, History of Medicine, M  
Ronald N. Giere, Philosophy, M  
Alan G. Gross, Rhetoric, M  
Laura J. Gurak, Rhetoric, M  
Keith Gunderson, Philosophy, M  
William H. Hanson, Philosophy, M  
Geoffrey Hellman, Philosophy, M  
Jeffrey P. Kahn, Bioethics, M  
Kenneth H. Keller, Center for Science, Technology, Public Affairs, M  
Sally G. Kohlstedt, Geology and Geophysics, M  
Arthur L. Norberg, Computer Science, M  
C. Wade Savage, Philosophy, M  
Naomi Scheman, Philosophy, M  
Robert W. Seidel, Charles Babbage Institute, M  
Alan E. Shapiro, Physics, M

**Associate Professor**

Bruce P. Braun, Geography, M  
Fred N. Finley, Curriculum and Instruction, M  
Michel H. Janssen, History of Science and Technology, M

Jean M. Langford, Anthropology, M  
Daniel J. Philippon, Rhetoric, M  
Michael D. Root, Philosophy, M  
C. Kenneth Waters, Philosophy, M

**Assistant Professor**

Jennifer K. Alexander, Mechanical Engineering, M  
Jennifer Lee Gunn, History of Medicine, M  
Hiromi Mizuno, History, M  
John B. Shank, History, M  
Karen Sue Taussig, Anthropology, M

**Curriculum**—Studies of science and technology (SST) deals with a rapidly expanding field that seeks to understand the conceptual foundations, historical development, and social dimensions and context of science and technology. SST faculty are drawn from a number of research and teaching units dedicated in whole or in part to the history, philosophy and social studies of science and technology. 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.

**Courses**—Please refer to Studies of Science and Technology (SST) in the course section of this catalog for courses pertaining to the program.

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

**Minor Only 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.

**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; [surgwww@umn.edu](mailto:surgwww@umn.edu)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

Roderick A. Barke, SM  
R. Morton Bolman, SM  
Henry Buchwald, SM  
Frank B. Cerra, SM  
David N. Cornfield, M2  
Bruce L. Cunningham, M2  
Agustin P. Dalmaso, SM  
David L. Dunn, SM  
William C. Engeland, SM  
John E. Foker, SM  
Rainer W. G. Gruessner, M2  
Ranjit John, M2  
Michael A. Maddaus, M2  
Arthur J. Matas, SM  
J. Ernesto Molina, M2  
William D. Payne, M2  
David A. Rothenberger, M2  
Daniel Saltzman, M2  
Sara J. Shumway, M2  
David E. R. Sutherland, SM  
Herbert B. Ward, M2

### Adjunct Professor

Arnold S. Leonard, SM  
John S. Najarian, SM

### Associate Professor

Jerome H. Abrams, M2  
Gregory J. Beilman, M2  
Angelika C. Gruessner, M2  
Steven M. Santilli, M2  
Bernhard J. Hering, M2

### Assistant Professor

Brett K. Levay-Young, M2  
Timothy D. Sielaff, SM  
Karen R. Wasiluk, SM

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 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.

**Courses**—Please refer to Surgery (Surg) in the course section of this catalog for courses pertaining to the program.

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

### 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

### Minor Only

**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; [jorda020@umn.edu](mailto:jorda020@umn.edu); [www.misa.umn.edu](http://www.misa.umn.edu)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

Deborah L. Allan, Soil, Water, and Climate, M  
David A. Andow, Entomology, M  
David D. Biesboer, Plant Biology, M  
Vernon B. Cardwell, Agronomy and Plant Genetics, M  
Iris D. Charvat, Plant Biology, M  
Sharon M. Danes, Family Social Science, M  
Peter H. Graham, Soil, Water, and Climate, M  
Jeffrey Lynn Gunsolus, Agronomy and Plant Genetics, M  
Emily E. Hoover, Horticultural Science, M

Nicholas R. Jordan, Agronomy and Plant Genetics, M  
Robert Philip King, Applied Economics, M  
Albert H. Markhart III, Horticultural Science, M  
Roger D. Moon, Entomology, M  
Kent D. Olson, Applied Economics, M  
James H. Orf, Agronomy and Plant Genetics, M  
Edward B. Radcliffe, Entomology, M  
Paul C. Rosenblatt, Family Social Science, M  
Michael P. Russelle, Soil, Water, and Climate, M  
Craig C. Sheaffer, Agronomy and Plant Genetics, M  
John M. Shutske, Biosystems and Agricultural Engineering, M  
Steve R. Simmons, Agronomy and Plant Genetics, M  
William F. Wilcke, Biosystems and Agricultural Engineering, M  
Donald Wyse, Agronomy and Plant Genetics, M

### Associate Professor

John Deen, Clinical and Population Science, M  
Ruth Dill-Macky, M  
Susan M. Galatowitsch, Horticultural Science, M  
Jeffrey H. Gillman, Horticultural Science, M  
Craig A. Hassel, Food Science and Nutrition, M  
Paul Porter, Agronomy and Plant Genetics, M  
Marla Spivak, Entomology, M

### Assistant Professor

Helene Murray, Agronomy and Plant Genetics, M  
Kristen C. Nelson, Forest Resources, M  
Chery Smith, Food Science and Nutrition, M

**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.

**Courses**—Please refer to Sustainable Agriculture Systems (SAGr) in the course section of this catalog for courses pertaining to the program.

**Use of 4xxx Courses**—4xxx courses are permitted toward minor requirements based on director of graduate studies approval.

### **Minor Only 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 Agro 5321—Ecology of Agricultural Systems (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; theatre@umn.edu; <http://cla.umn.edu/theatre>).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/stepl.asp](http://www.grad.umn.edu/faculty_rosters/stepl.asp).

### **Professor**

C. Lance Brockman, M2  
Michal Kobialka, SM

### **Associate Professor**

Louis R. Bellamy, M2  
Ananya Chatterjea, M2  
Carl L. Flink, M2  
Martin B. Gwinup, M2  
Sonja Arsham Kuflinec, M2  
Mathew J. LeFebvre, M2  
Margaret L. Maddux, M2  
Jean A. Montgomery, M2  
Elizabeth H. Nash, M2  
Joan A. Smith, M2

### **Assistant Professor**

Branislav Jakovljevic, M2  
Margaret L. Werry, M2  
Aleksandra Wolska, M2

### **Education Specialist**

Susan M. Binder, M  
Brent "Mickey" Henry, M  
Michael J. Sommers, AM  
Sherry L. Wagner-Henry, M

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. 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 GPA. 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 preferred 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 are 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. (See note regarding this degree under Degree Requirements).

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 the annual USITT conference.

The M.A./Ph.D. program requires a submitted sample of research writing.

**Courses**—Please refer to Theatre Arts (Th) and Dance (Dnce) in the course section of this catalog for courses pertaining to the program.

**Use of 4xxx Courses**—Inclusion of 4xxx theatre and dance courses on graduate degree program forms is subject to approval by the director of graduate studies. Such courses must be taught by a member of the graduate faculty. Students from other programs may include these courses with their own program's approval.

### **M.A. Degree Requirements**

The M.A. degree emphasizes academic pursuits and is considered a prerequisite for the Ph.D. The areas of study for the M.A./Ph.D. are theatre historiography, design and technical production, and directing (including management). Any of these may serve as a concentration of study, although the Ph.D. ordinarily focuses on the first. Candidates must complete coursework in both academic and performance areas.

For both Plan A and B, 30 credits are required from the following: three of the six sequence courses (8111-8116) plus 8102, totaling 12 credits; 3 credits from a course in performance conventions; 3 credits in independent seminar; 6 elective credits from inside or outside the department; 6 credits at the graduate level from outside the department (outside courses must be at least 3 credits each). For Plan A, 10 additional thesis credits (Th 8777) and an oral defense of the thesis are required. For Plan B, three papers are required.

**Language Requirements**—See the requirements for the Ph.D.

**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. (Note: at the time of this catalog printing, the M.F.A. in directing degree program is under revision. Please contact the department for further details.) 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 that a degree recipient has a knowledge and understanding of theatre historiography and practice as well as pedagogical and professional strategies for communicating and applying that knowledge. The areas of study for the M.A./Ph.D. are theatre historiography, design and technical production, and directing (including management). Any of these may serve as a concentration of study, although the Ph.D. ordinarily focuses on the first. Candidates must complete coursework in both academic and performance areas.

The core curriculum, designed to help students finish the program within five years, consists of two parts: part I—coursework (three years); and part II—research and dissertation writing. The three years of coursework are tailored so that the first two years are structured, and the third year is more open, allowing students to pursue their individual areas of interest in more depth. Students are required to successfully complete six required courses over the three-year sequence: three courses must be in specific areas of theatre historiography, to be chosen from six seminars (Th 8111-6 sequence); historiography (Th 8102); a course in performance conventions; and an independent seminar in which students refine and materialize their work. This seminar, which can take the form of an independent study, directed reading/production, or a regular course format designed by the student and the adviser, usually takes place at the beginning of the third year. Students must also take coursework in a supporting program or a minor (12 credits); and 24 thesis credits, for a minimum total of 54 credits beyond the B.A. Topics courses and seminars supplement the core curriculum. Students must demonstrate a research technique appropriate to the thesis. This could take the form of a foreign language or a discipline research methodology which might increase the total number of credits required for the degree.

**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.

**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**—Luanne Petcoff, Office Specialist, Toxicology Graduate Program, Medical School Duluth, 236 SMed, 1035 University Drive, Duluth, MN 55812 (218-726-8892; fax 218-726-8014; toxgrad@d.umn.edu.)

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

Yusuf J. Abul-Hajj, Medicinal Chemistry, Pharmacognosy, SM  
David R. Brown, Veterinary and Biomedical Sciences, SM  
Robert M. Carlson, Chemistry, Duluth, SM  
Lester R. Drewes, Biochemistry, Duluth, SM  
Vincent F. Garry, Laboratory Medicine and Pathology, SM  
Patrick E. Hanna, Medicinal Chemistry, Pharmacognosy, SM  
Michael J. Murphy, Veterinary Population Medicine, SM  
Herbert T. Nagasawa, Medicinal Chemistry, Pharmacognosy, SM  
Gerald J. Niemi, NRRI Duluth, SM  
Joseph R. Prohaska, Biochemistry, Duluth, SM  
Jean F. L. Regal, Pharmacology, Duluth, SM  
W. Thomas Shier, Medicinal Chemistry, Pharmacognosy, SM  
Sheldon B. Sparber, Pharmacology, SM  
Lawrence P. Wackett, Biochemistry, SM  
Kendall B. Wallace, Biochemistry, Duluth, SM

### Adjunct Professor

Subhash C. Basak, NRRI Duluth, AM2  
John L. Butenhoff, 3M, AM2  
Glenn G. Hardin, Veterinary Diagnostic Medicine, AM2  
Herve N. Lebrech, Veterinary Diagnostic Medicine, AM2  
John W. Nichols, Duluth, AM2  
Robert R. Roy, 3M, AM2  
Robert S. Skoglund, 3M, AM2

### Associate Professor

Gerald T. Ankley, Environmental Protection Agency, Duluth, AM2  
Anthony Kiorpes, MGI Pharma Inc., SM  
Lisa A. Peterson, School of Public Health, SM  
Mark S. Rutherford, Veterinary and Biomedical Sciences, SM  
Ashok K. Singh, Veterinary Population Medicine, SM

### Assistant Professor

Robert T. Cormier, Biochemistry, Duluth, SM  
Yinduo Ji, Veterinary and Biomedical Sciences, SM  
Geary Olson, 3M, Epidemiology  
Edward L. Perkins, Biochemistry, Duluth, SM

### Adjunct Assistant Professor

Hillary Carpenter, Minnesota Department of Health  
David Chandler, 3M  
Larry Johnson, 3M  
Verkateswarlu Pothapragada, 3M

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 characterizing the risk associated with exposures to 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; molecular toxicology and toxicogenomics; histopathology; diagnostic and analytical toxicology; drug metabolism; chemical carcinogenesis and reproductive toxicology; 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.

### 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. The application deadline is February 1.

**Courses**—Please refer to Toxicology (Txcl) in the course section of this catalog for courses pertaining to the program.

**Use of 4xxx Courses**—Use of 4xxx courses toward degree requirements is permitted with director of graduate studies' approval.

### M.S. Degree requirements

The M.S. is offered under plan A and Plan B. Plan A requires 20 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 doctoral minor requires 12 credits: 8 credits of core courses and 4 credits of advanced toxicology courses.

## **Transportation Studies**

### **Postbaccalaureate Certificate**

**Contact Information**—Transportation Studies Certificate, Information Center, College of Continuing Education, University of Minnesota, 77 Pleasant Street SE, Minneapolis, MN 55455 (612-624-4000; fax 612-625-6381; info@cee.umn.edu; cts@umn.edu; www.cts.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

#### **Professor**

John Adams, Geography, M  
Gary Davis, Civil Engineering, M

#### **Associate Professor**

Karen Donohue, Operations and Management Sciences, M  
David Levinson, Civil Engineering, M  
Gerard McCullough, Applied Economics, M

#### **Assistant Professor**

Kevin Krizek, Public Affairs, M

**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. The certificate program is structured into three program tracks to meet the core course requirement including: 1) civil engineering, 2) planning/public policy, and 3) supply chain management. Students select a minimum of two courses from two different program tracks. Students are also required to complete a one-credit intelligent transportation technology seminar as a part of their core coursework. 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 preferred performance level for your undergraduate GPA of 3.00. (If you do not meet the preferred performance level of 3.00 GPA, your application should describe relevant nonacademic experience as well as explain any other relevant factors for the Graduate School's and program faculty's consideration).

Study in any one or more of the following technical course topics, demonstrating proficiency in physical science and/or quantitative analysis: intermediate economics, theory, statistics, calculus, physics Note: One year of successful undergraduate study (with at least a 3.00 or "B" grade) in any combination of the above or other related topics. The GRE is not required.

#### **Special Application Requirements**—

Prospective students 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.

**Courses**—The core courses are structured into three program tracks. Civil engineering track: CE 5211, CE 5214; planning/public policy track: PA 8202, PA 5202/Geog5372, CE 5212; supply chain management track: Mktg 6060, OMS 6056, OMS 6072. Students select a minimum of two core courses from two different program tracks.

Students are also required to complete ME 8772/CE 8213, a one-credit intelligent transportation technology seminar, as a part of their core coursework. Elective courses consist of any combination of courses in a transportation-related subject area. The courses must be approved by the director of graduate studies. For more information on courses, please visit [www.cts.umn.edu/certificate/index.html](http://www.cts.umn.edu/certificate/index.html).

**Use of 4xxx Courses**—Use of 4xxx Courses toward requirements is subject to director of graduate studies approval.

### **Postbaccalaureate Certificate Requirements**

Completion of two of the eight 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 are required.

## **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 612-626-0002; admissions@hhh.umn.edu; www.hhh.umn.edu).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

#### **Regents Professor**

G. Edward Schuh, M2

#### **Professor**

Dean E. Abrahamson (emeritus), AM2  
John S. Adams, M2  
Ragui A. Assaad, M2  
J. Brian Atwood, M2  
Michael Barnett, M2  
Richard S. Bolan (emeritus), AM2  
John E. Brandl, M2  
John M. Bryson, M2  
Nancy N. Eustis, M2  
Katherine Fennelly, M2  
Edward G. Goetz, M2  
Stephen A. Hoenack, M2  
C. David Hollister, AM2  
Anne R. D. Kapuscinski, Fisheries, Wildlife, and Conservation Biology, AM  
Kenneth H. Keller, M2  
Sally J. Kenney, M2  
Morris M. Kleiner, M2  
Robert T. Kudrle, M2  
Ann R. Markusen, M2  
Samuel L. Myers, M2  
David G. Pitt, Landscape Architecture, AM2  
Carlisle F. Runge, Applied Economics, AM

#### **Associate Professor**

Barbara Crosby, M2  
Maria J. Hanratty, M2  
David M. Levinson, Civil Engineering, AM2  
Deborah Levison, M2  
Joseph A. Ritter, M2  
Jodi R. Sandfort, M2  
Melissa M. Stone, M2

#### **Assistant Professor**

William Craig, Geography, AM  
Kevin J. Krizek, M2  
Aijun Nie, M2  
Carissa Schively, M2

**Other**

Zbigniew M. Bochniarz, M2  
 Harry C. Boyte, M2  
 Jacqueline Copeland-Carson, AM2  
 Gary DeCramer, M2  
 Marsha A. Freeman, M2  
 P. Jay Kiedrowski, AM  
 Jennifer Kuzma, AM2  
 Barbara L. Lukermann, AM  
 Lee W. Munnich, M2  
 Joe Nathan, M2  
 Timothy Penny, AM  
 Sharon Sayles-Belton, AM  
 Paul C. Stone, 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. Dual degrees include M.U.R.P./juris doctor, M.U.R.P./master of landscape architecture, M.U.R.P./master of science in civil engineering, and M.U.R.P./master of social work.

**Prerequisites for Admission**—Students are expected to have a U.S. bachelor's degree or foreign equivalent. Basic competence in college algebra and computers is required. Introductory coursework in microeconomics and political science is recommended.

**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, a GRE official score report, and a professional résumé or C.V. Students who wish to be considered for financial aid should apply no later than January 5 of the preceding academic year. Deadline for admission only is April 1. Entry is for fall semester.

**Courses**—Please refer to Public Affairs (PA) in the course section of this catalog for courses pertaining to the program.

**Use of 4xxx Courses**—Use of 4xxx courses toward degree requirements is permitted with instructor's and adviser's permission.

**M.U.R.P. Degree Requirements**

The M.U.R.P., which is offered under coursework only and Plan A, requires 48 credits including core courses (26 credits), specialization electives (9 credits), and 10 credits of electives. Each student completes an internship in a public or private planning agency usually during the summer after the first year of the program. All students also take a capstone workshop (3 credits) that constitutes a final professional-level project. Students in the Coursework Only option complete a professional paper. Students selecting the Plan A option register for 10 thesis credits and complete a thesis. Specializations for the degree include housing and community development; regional, economic, and workforce development; transportation planning; land use/urban design planning; and environmental planning. Students may pursue a minor.

**Language Requirements**—None.

**Final Exam**—The final exam is oral for Plan A. The client presentation in the Capstone workshop fulfills the requirement for the final exam for Coursework Only.

**Veterinary Medicine**

**Contact Information**—Director of Graduate Studies, Veterinary Medicine Graduate Program, College of Veterinary Medicine, 443 VMC, 1365 Gortner Ave., St. Paul, MN 55108 (612-624-7413; fax 612-625-4734; vmedgrad@umn.edu; www.cvm.umn.edu /ResearchandGradProg/GradPrograms /VMGP).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

**Professor**

Trevor R. Ames, Veterinary Population Medicine, SM  
 P. Jane Armstrong, Veterinary Clinical Sciences, SM  
 Russell F. Bey, Veterinary and Biomedical Sciences, SM  
 David R. Brown, Veterinary and Biomedical Sciences, SM  
 Cathy S. Carlson, Veterinary Population Medicine, SM  
 James E. Collins, Veterinary Population Medicine, SM  
 Peter Davies, Veterinary Population Medicine, SM  
 Scott A. Dee, Veterinary Population Medicine, SM  
 John Deen, Veterinary Population Medicine, SM  
 Melvyn L. Fahning, Veterinary Population Medicine, SM  
 Daniel A. Feeney, Veterinary Clinical Sciences, SM  
 John Fetrow, Veterinary Population Medicine, SM  
 Douglas N. Foster, Animal Science, ASM  
 Sandra M. Godden, Veterinary Population Medicine, SM  
 Sagar M. Goyal, Veterinary Population Medicine, SM

David A. Halvorson, Veterinary and Biomedical Sciences, SM  
 Robert M. Hardy, Veterinary Clinical Sciences, M2  
 David W. Hayden, Veterinary Population Medicine, SM  
 William D. Hueston, Veterinary Population Medicine, SM  
 Richard Isaacson, Veterinary and Biomedical Sciences, SM  
 Carl R. Jessen, Veterinary Clinical Sciences, M2  
 Han S. Joo, Veterinary Population Medicine, SM  
 Mathur S. Kannan, Veterinary and Biomedical Sciences, SM  
 Vivek Kapur, Microbiology, SM  
 Jeffrey S. Klausner, Veterinary Clinical Sciences, SM  
 Jody P. Lulich, Veterinary Clinical Sciences, SM  
 Samuel K. Maheswaran, Veterinary and Biomedical Sciences, SM  
 Thomas W. Molitor, Veterinary Population Medicine, SM  
 Roger D. Moon, Entomology, ASM  
 Robert B. Morrison, Veterinary Population Medicine, SM  
 Michael P. Murtaugh, Veterinary and Biomedical Sciences, SM  
 Kakambi V. Nagaraja, Veterinary and Biomedical Sciences, SM  
 Timothy D. O'Brien, Veterinary Population Medicine, SM  
 Carl A. Osborne, Veterinary Clinical Sciences, SM  
 Phillip K. Peterson, Medicine, AM2  
 Carlos Pijoan, Veterinary Population Medicine, SM  
 David J. Polzin, Veterinary Clinical Sciences, SM  
 Michael Pullen, Veterinary Population Medicine, M  
 Patrick T. Redig, Veterinary Clinical Sciences, M2  
 Bradley E. Seguin II, Veterinary Population Medicine, SM  
 Jagdev M. Sharma, Veterinary and Biomedical Sciences, SM  
 Bert E. Stromberg, Veterinary and Biomedical Sciences, SM  
 Tracy A. Turner, Veterinary Population Medicine, SM  
 Stephanie J. Valberg, Veterinary Population Medicine, SM  
 Larry J. Wallace, Veterinary Clinical Sciences, SM  
 Robert Washabau, Veterinary Clinical Sciences, SM  
 Douglas J. Weiss, Veterinary and Biomedical Sciences, SM  
 Jonathan E. Wheaton, Animal Science, ASM  
**Clinical Professor**  
 Betty A. Heffernan, Veterinary Clinical Sciences, M2  
**Associate Professor**  
 Kay S. Faaberg, Veterinary and Biomedical Sciences, M2  
 James R. Lokensgard, Medicine, AM2  
 Moses K. Njenga, Veterinary and Biomedical Sciences, M2  
 Elaine P. Rude, Veterinary Clinical Sciences, SM  
 Mark S. Rutherford, Veterinary and Biomedical Sciences, SM  
 Abby M. Sage, Veterinary Population Medicine, M2

Leslie Sharkey, Veterinary Population Medicine, M2  
Srinand Sreevatsan, Veterinary Population Medicine, SM  
Anthony Tobias, Veterinary Clinical Sciences, SM  
Ava M. Trent, Veterinary Population Medicine, M2  
Scott J. Wells, Veterinary Population Medicine, SM

### **Associate Clinical Professor**

Lynelle Graham, Veterinary Clinical Sciences, M2  
Erin D. Malone, Veterinary Population Medicine, M2  
Paul Rapnicki, Veterinary Population Medicine, M2  
Margaret V. Root Kustritz, Veterinary Clinical Sciences, M2  
Kurt D. Rossow, Veterinary Population Medicine, SM

### **Assistant Professor**

Jeff B. Bender, Veterinary Population Medicine, SM  
Dori L. Borjesson, Veterinary Population Medicine, M2  
Connie J. Gebhart, Veterinary and Biomedical Sciences, SM  
Yinduo Ji, Veterinary and Biomedical Sciences, M2  
Elizabeth McNiel, Veterinary Clinical Sciences, M2  
Petra A. Mertens, Veterinary Clinical Sciences, M  
Claudia Munoz-Zanzi, Veterinary Population Medicine, M2  
Douglas Plager, Dermatology, AM2  
Elizabeth Pluhar, Veterinary Clinical Sciences, SM  
Kenneth P. Roberts, Urologic Surgery, AM2  
Randall Singer, Veterinary and Biomedical Sciences, SM  
Sheila M. F. Torres, Veterinary Clinical Sciences, SM

### **Assistant Clinical Professor**

Roberto Novo, Veterinary Clinical Sciences, M2  
Jane E. Quandt, Veterinary Clinical Sciences, M2

### **Instructor**

Montserrat Torremorell, Veterinary Population Medicine, AM2

### **Research Associate**

Shirin Munir, Microbiology, M

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: comparative medicine and pathology; infectious disease; population medicine; 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.

**Prerequisites for Admission**—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, may be accepted upon approval by the program advisory committee.

### **Special Application Requirements**—

Applicants must submit a clearly written statement outlining their career interests and goals, any previous research experience, and identifying the specialty track desired. Also required are a complete set of official transcripts, a CV or résumé, and three letters of recommendation from individuals knowledgeable about the applicant's academic performance. Applicants are requested but not required to take the GRE prior to consideration for admission. 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 research assistantships awarded for the next academic year. Students are typically admitted for fall semester, though spring semester admission is also available.

**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.

**Courses**—Please refer to Veterinary Medicine (VMed) in the course section of this catalog for courses pertaining to the program.

**Use of 4xxx Courses**—Use of selected 4xxx courses to meet degree requirements is acceptable with prior approval from the adviser and director of graduate studies.

### **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 10 thesis credits. Plan B requires 30 course credits; 14 credits in the major and 16 credits in a minor or related field, chosen 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 written and 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; wrs@umn.edu); and Associate Director of Graduate Studies-Duluth, Water Resources Science, 213 RLB, University of Minnesota, Duluth, MN 55812 (218-726-8891; fax 218-726-6979).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### **Professor**

E. Calvin Alexander, Jr., Earth Science Geology/Geophysics, SM  
Dorothy Anderson, Forest Resources, SM  
James L. Anderson, Soil, Water, and Climate, SM  
Roger E. A. Arndt, Civil Engineering, SM  
Marvin Bauer, Forest Resources, SM  
James C. Bell, Soil, Water, and Climate, SM  
David D. Biesboer, Plant Biology, SM  
Paul R. Bloom, Soil, Water, and Climate, SM  
Patrick L. Brezonik, Civil Engineering, SM  
Kenneth N. Brooks, Forest Resources, SM  
Charles J. Clanton, Biosystems and Agricultural Engineering, SM  
Steve M. Colman, Geological Sciences, Duluth, SM  
K. William Easter, Applied Economics, SM  
Ehsan Feroz, Accounting, Duluth, AM2  
Leonard C. Ferrington, Entomology, SM  
Efi Foufoula, Civil Engineering, SM  
Philip J. Gersmehl, Geography, SM  
Florence K. Gleason, Plant Biology, SM  
Sagar M. Goyal, Veterinary Diagnostic Medicine, SM  
John S. Gulliver, Civil Engineering, SM  
Satish C. Gupta, Soil, Water, and Climate, SM  
Emi Ito, Earth Science Geology/Geophysics, SM  
Randall Hicks, Biology, Duluth, SM  
Thomas C. Johnson, Geological Sciences, Duluth, SM  
Andrew R. Klemer, Biology, Duluth, SM



John F. Moncrief, Soil, Water, and Climate, SM  
 Howard Mooers, Geological Sciences, Duluth, SM  
 David J. Mulla, Soil, Water, and Climate, SM  
 Edward A. Nater, Soil, Water, and Climate, SM  
 Raymond M. Newman, Fisheries, Wildlife, and Conservation Biology, SM  
 John L. Nieber, Biosystems and Agricultural Engineering, SM  
 Christopher Paola, Earth Science Geology/Geophysics, SM  
 John J. Pastor, Biology, Duluth, SM  
 James A. Perry, Fisheries, Wildlife, and Conservation Biology, SM  
 Hans-Olaf Pfannkuch, Earth Science Geology/Geophysics, SM  
 Steve Polasky, Ecology, Evolution, and Behavior, SM  
 Carl Richards, Biology, Duluth, SM  
 Michael Sadowsky, Soil, Water, and Climate, SM  
 Mark W. Seeley, Soil, Water, and Climate, SM  
 Michael J. Semmens, Civil Engineering, SM  
 Peter Sorensen, Fisheries, Wildlife and Conservation Biology, SM  
 Susan Stafford, Forest Resources, SM  
 Heinz G. Stefan, Civil Engineering, SM  
 Robert W. Sterner, Ecology, Evolution, and Behavior, SM  
 Deborah L. Swackhamer, Environmental and Occupational Health, SM  
 Michael Sydor, Physics, Duluth, SM  
 Harvey Thorleifson, Minnesota Geological Survey, SM  
 Elon S. Verry, Forest Resources, ASM  
 Bruce N. Wilson, Biosystems and Agricultural Engineering, SM

#### **Adjunct Professor**

John M. Baker, Soil, Water, and Climate, SM  
 Daniel Engstrom, Earth Science Geology/Geophysics, AM2  
 Anthony Runkel, Earth Science Geology/Geophysics, AM2  
 Bruce Vondracek, Fisheries, Wildlife, and Conservation Biology, SM

#### **Associate Professor**

William Arnold, Civil Engineering, SM  
 Randal J. Barnes, Civil Engineering, SM  
 Erik T. Brown, Geological Sciences, Duluth, SM  
 James B. Cotner, Ecology, Evolution, and Behavior, SM  
 Susan M. Galatowitsch, Horticultural Science, SM  
 Frances R. Homans, Applied Economics, M2  
 Miki Hondzo, Civil Engineering, SM  
 Raymond N. Hozalski, Civil Engineering, SM  
 Katherine Klink, Geography, SM  
 Paige J. Novak, Civil Engineering, SM  
 Fernando Porte-Agel, Civil Engineering, SM  
 Elise A. Ralph, Physics, Duluth, SM  
 Gary Sands, Biosystems and Agricultural Engineering, M2  
 Steven Sternberg, Chemical Engineering, Duluth, SM  
 Jeff Strock, Soil, Water, and Climate, M2  
 Steven J. Taff, Applied Economics, SM  
 Dong Wang, Soil, Water, and Climate, SM  
 Nigel Wattus, Geological Sciences, Duluth, SM  
 Tongxin Zhu, Geography, Duluth, M2

#### **Adjunct Associate Professor**

Paul Capel, Civil Engineering, ASM  
 Mark Edlund, Earth Science Geology/Geophysics, ASM

#### **Assistant Professor**

Donn Branstrator, Biology, Duluth, SM  
 Jacques Finlay, Ecology, Evolution, and Behavior, M2  
 Christina Gallup, Geological Sciences, Duluth SM  
 Thomas Hrabik, Biology, Duluth, M2  
 Jennifer King, Soil, Water, and Climate, M2  
 Timothy LaPara, Civil Engineering, SM  
 Joseph McFadden, Ecology, Evolution and Behavior, M2  
 Kristopher McNeill, Chemistry, SM  
 Kristen Nelson, Forest Resources, SM  
 Matt Simcik, Environmental and Occupational Health, SM  
 John Swenson, Geological Sciences, Duluth, M2  
 Josef Werne, Chemistry, Duluth, M2

#### **Adjunct Assistant Professor**

James Almendinger, Fisheries, Wildlife, and Conservation Biology, AM2  
 David Fulton, Fisheries, Wildlife, and Conservation Biology, SM  
 Tyson Ochsner, Soil, Water, and Climate, AM2  
 Pamela Rice, Soil, Water, and Climate, AM2  
 Edward Swain, Fisheries, Wildlife, and Conservation Biology, AM2

#### **Senior Research Associate**

Richard Axler, Natural Resources Research Institute, Duluth, SM  
 George Host, Natural Resources Research Institute, Duluth, SM  
 Lucinda Johnson, Natural Resources Research Institute, Duluth, M2

#### **Research Associate**

Prasanna Gowda, Soil, Water, and Climate, SM  
 Euan Reavie, Natural Resources Research Institute, Duluth, M2  
 Ingrid Schneider, Forest Resources, SM

#### **Senior Fellow**

Lawrence Baker, Water Resources Center, SM

#### **Other**

Lorin Hatch, Macalaster College, AM2

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 cross-campus interdisciplinary 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 emphasis at the M.S. and Ph.D. levels: aquatic biology, environmental chemistry, hydrologic science, limnology, water management technology, water policy, water quality, and watershed science and management. Approximately 80 courses offered within 15 other graduate programs are available to students majoring in water resources science.

The goal of the program is to produce scientists with strong technical skills in disciplines relevant to water resources and 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 faculty from the following departments on the Twin Cities campus: Applied Economics; Biosystems and Agricultural Engineering; Civil Engineering; Ecology, Evolution, and Behavior; Entomology; Environmental and Occupational Health; Fisheries, Wildlife, and Conservation Biology; Forest Resources; Geography; Horticultural Science; Earth Science Geology/Geophysics; Microbiology, Plant Biology; Soil, Water, and Climate; and the Humphrey Institute of Public Affairs. It also involves faculty from the following departments on the Duluth campus: Biology, Chemical Engineering, Chemistry, Geography, Geological Sciences, Physics, and Political Science, as well as the Large Lakes Observatory and the Natural Resources Research Institute in Duluth.

**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. Students who do not have a master's degree in a related subject are admitted to the M.S. program first, even if their long-term goal is a Ph.D. degree. Availability of funding and willingness of a member of the graduate faculty to serve as an advisor are important criteria for admission to the Ph.D. 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 applicant's class rank and evaluate their ability to complete a program of graduate study, or from persons who can assess their professional or research 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 should submit results of the GRE; only rarely, under extenuating circumstances, will students be considered for admission without GRE scores. 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.

**Courses**—Please refer to Water Resources Science (WRS) in the course section of this catalog for courses pertaining to the program. Check the program Web site at <http://wrs.coafes.umn.edu> for additional course information.

**Use of 4xxx Courses**—Use of 4xxx courses is permitted for degree requirements based on approval by the advisor and the director of graduate studies.

### **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 hydrogeology); 2) environmental/water chemistry; 3) limnology; and 4) water resources policy, economics, and management, and two electives in such areas of emphasis as aquatic biology, hydrologic science, watershed science and management, and water management technology. One elective must be from an approved list of technical courses dealing with water quality science/management. A minimum of two supporting courses (at least 6 credits) outside of aquatic science also are required. Training in responsible conduct of research and ethics is also required. Approved core and area of emphasis courses are listed on the program Web site at <http://wrs.coafes.umn.edu>.

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 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 9 credits, including WRS 5101 (3 credits) or in Duluth POL 4201 (4 credits) and two of the other core courses described under M.S. degree requirements.

### **Ph.D. Degree Requirements**

Coursework is tailored to student interests, and many areas of emphasis are possible. Core courses are offered on both the Twin Cities and Duluth campuses.

Students complete coursework equivalent to that of an M.S. in water resources science, with additional coursework in an area of emphasis. 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) or in Duluth POL 4201 (4 credits), a core courses described under the M.S. degree requirements, and two electives from one of the areas of emphasis.

## **Wildlife Conservation**

**Contact Information**—Wildlife Conservation, College of Natural Resources, University of Minnesota, 135 Skok Hall, 2003 Upper Buford Circle, St. Paul, MN 55108-6146 (612-624-0734; fax 612-624-6282; [wildlife@umn.edu](mailto:wildlife@umn.edu); [www.fw.umn.edu](http://www.fw.umn.edu)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### **Professor**

Yosef Cohen, SM  
Francesca J. Cuthbert, SM  
Ralph J. Gutiérrez, SM  
Donald B. Siniff, Ecology, Evolution, and Behavior, SM  
J. L. David Smith, SM  
Anthony M. Starfield, Ecology, Evolution, and Behavior, SM

### **Adjunct Professor**

David E. Andersen, SM  
L. David Mech, SM

### **Associate Professor**

Robert B. Blair, SM  
Kristen C. Nelson, SM  
John P. Loegering, M2

### **Adjunct Associate Professor**

Glenn D. DelGiudice, SM  
David C. Fulton, SM  
David L. Garshelis, SM  
Richard O. Kimmel, M

### **Assistant Professor**

Todd Arnold AM

### **Adjunct Assistant Professor**

Alan Franklin, M2

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 science program emphasizing resource-management applications. For the M.S. degree, emphasis is on wildlife biology and related areas in ecology, animal behavior, physiology, and human dimensions 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 wildlife and social 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 (e.g., 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 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. Scores from the GRE General Test are recommended. Applications are accepted at any time; however, because the faculty review most applications in late January for admission the following fall, most applications should be sent before January 1. Admission generally requires agreement by a faculty member to serve as the advisor and available financial support; unsupported students are admitted only rarely.

**Courses**—Please refer to Fisheries and Wildlife (FW) in the course section of this catalog for courses pertaining to the program.

**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.

### **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.

**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**—Professor Jim Brown, Director of Graduate Studies, Department of Work, Community, and Family Education, University of Minnesota, 210 Vocational and Technical Education Building, 1954 Buford Avenue, St. Paul, MN 55108 (612-624-1221; fax 612-624-2231; wcf@umn.edu; www.education.umn.edu/wcfe).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/stepl.asp](http://www.grad.umn.edu/faculty_rosters/stepl.asp).

### Professor

Thomas Brothen, General College, AM  
James M. Brown, SM

Terence George Collins, General College, AM  
Jeanne Louise Higbee, General College, AM  
Judith J. Lambrecht, SM  
Theodore Lewis, SM  
Gary N. McLean, SM  
Roland L. Peterson, SM  
David J. Pucel, SM  
Richard A. Swanson, SM

### Adjunct Professor

Richard A. Krueger, Extension, SM

### Associate Professor

Laura Coffin Koch, General College, AM  
Rosemarie J. Park, SM  
Thomas Joseph Reynolds, General College, AM  
James R. Stone III, SM  
Cathrine A. Wambach, General College, AM  
Baiyin Yang, SM

### Assistant Professor

Kenneth R. Bartlett, SM  
Brad Greiman, M2  
Richard M. Joerger, M2  
Shari L. Peterson, SM

### Lecturer

John R. Vreyens, International Agricultural Programs, AM2

### Other

Barrycraig Johansen, Rochester, AM2  
Tom Peacock, Education, Duluth, AM2

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; 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 and community education; social, economic, historical, political, cultural, educational, technological, and psychological contexts within which work and community 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 résumé 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), 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 11 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.

## 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.

## Chicano Studies

### *Associate Professor*

Guillermo Rojas, E

## Neurosurgery

### *Professor*

Walter A. Hall, E

Walter C. Low, E

Robert E. Maxwell, E

Gaylan L. Rockswold, E

## Pediatrics

### *Regents Professor*

Alfred F. Michael, E

James G. White, E

### *Professor*

David M. Brown, E

Carlyle C. Clawson, E

Patricia Ferrieri, E

Edward L. Kaplan, Epidemiology, E

James H. Moller, E

Harvey Sharp, E

Warren J. Warwick, E

### *Associate Professor*

Amos S. Deinard, E

### *Assistant Professor*

Pi-Nian Chang, E

Elizabeth E. Giles, E

## Psychiatry (AdPy and CAPy)

### *Professor*

Gerald J. August, E

Marilyn E. Carroll, E

Scott J. Crow, E

Elke D. Eckert, E

William H. Frey, Pharmacy, E

Judith G. Garrard, Health Services Research,

Policy and Administration, E

Dorothy Hatsukami, Epidemiology, E

Jerome L. Kroll, E

Thomas B. Mackenzie, E

Michael K. Popkin, E

### *Associate Professor*

Michael L. Bloomquist, E

Carrie M. Borchardt, E

George Realmuto, E

### *Assistant Professor*

Daniel R. Hanson, E

## Therapeutic Radiology

### *Professor*

John J. Kersey, Pediatrics, E

Faiz M. Khan, E

Chang W. Song, E

### *Associate Professor*

Bruce J. Gerbi, E

Patrick D. Higgins, E

### *Assistant Professor*

Parham Alaei, E



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# Courses

## Course Numbers, Symbols, and Abbreviations

The courses in this catalog are not offered every semester. For a listing of courses offered in a particular semester, consult the *Class Schedule* at <http://onestop.umn.edu/onestop/registration.html>.

**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 postbaccalaureate 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. For course descriptions for 4xxx, 6xxx, and 7xxx courses, consult the list of University courses at <http://onestop2.umn.edu/courses/index.html>.

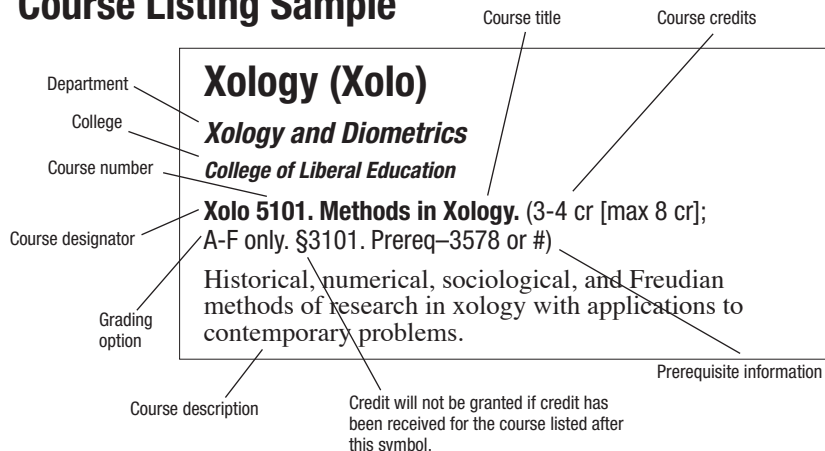
Courses at the 1000 (1xxx), 2000 (2xxx), and 3000 (3xxx) levels are for undergraduates and may not be applied to graduate programs. Courses numbered 0000 to 0999 do not carry credit.

**Course 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 course designator precedes the number of a course listed as a prerequisite, that prerequisite course is in the same discipline as the course being described.

**Course Symbols and Abbreviations**—The following abbreviations and symbols are used throughout the course descriptions of most University catalogs to denote common and recurring items of information.

- Prereq .....Course prerequisites.
- cr .....Credit.
- 1-4 cr [max 6].....The course can be taken for 1 to 4 credits and may be repeated for up to 6 credits.
- ! .....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 term 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.

### Course Listing Sample



The courses in this catalog are current as of March 18, 2005. Check online at <http://onestop2.umn.edu/courses/index.html> for the most current course information.

## Accounting (Acct)

### Department of Accounting

#### Curtis L. Carlson School of Management

**Acct 5100. Corporate Financial Reporting.** (4 cr; A-F only. Prereq—mgmt student, non-accounting major)  
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. Intermediate Accounting I.** (4 cr; A-F only. Prereq—Grade of at least B- in 2050, [mgmt major or mgmt grad student])  
Valuation, measurement, and reporting issues related to selected assets/liabilities of a firm. Theory underlying accounting issues. Applying accounting principles.

**Acct 5102. Intermediate Accounting II.** (4 cr; A-F only. Prereq—5101 [mgmt or grad mgmt student])  
Basic valuation problems encountered in financial reporting. Focuses on valuation of liabilities. Accounting for leases, pensions, and deferred taxes. Introduces consolidated financial statements.

**Acct 5125. Auditing Principles and Procedures.** (4 cr; A-F only. Prereq—[3101/5101 or 5100/6100], [accounting major or grad management student])  
Auditing financial information systems. Independent audits and internal auditing. Ethics. Legal responsibilities.

**Acct 5126. Internal Auditing.** (2 cr; A-F only. Prereq—[3101/5101 or 5100/6100], 3001)  
Financial and operational auditing. Standards. Managing the function.

**Acct 5135. Fundamentals of Federal Income Tax.** (4 cr; A-F only. Prereq—[2050 or MBA 6030], [mgmt or grad mgmt student])  
U.S. federal system of taxation. Concepts of gross income, deductions, credits. Analysis of structure of Internal Revenue Code, its provisions with respect to specific areas of law. Interrelationships between legislative, judicial, and administrative authority. Methods, tools, and techniques to conduct tax research.

**Acct 5160. Financial Statement Analysis.** (2 cr; A-F only. Prereq—[5100/6100 or 3101/5101], [accounting or finance major])  
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; A-F only. Prereq—[5102, mgmt or grad mgmt student])  
Theory underlying the preparation of consolidated financial statements, as well as the mechanical computations needed to prepare the statements themselves.

**Acct 5236. Introduction to Taxation of Business.** (2 cr; A-F only. Prereq—5135, acct major)  
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. Prereq—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; A-F only. Prereq—5102, [mgmt or grad mgmt student])  
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; A-F only. Prereq—2050, mgmt student)  
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; A-F only. Prereq—5102, acct major, #)  
Topics vary.

**Acct 8801. Empirical Research in Capital Markets.** (4 cr. Prereq—Business admin PhD student or #)  
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]. Prereq—Business admin PhD student or #)  
Topics vary.

**Acct 8811. Information Economics I.** (4 cr. Prereq—Business admin PhD student or #)  
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. Prereq—Business admin PhD student or #)  
Information in capital markets; asset pricing with asymmetric information; economics of disclosure and information acquisition.

**Acct 8821. Experimental Economics.** (4 cr. Prereq—Business admin PhD student or #)  
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. Prereq—Business admin PhD student or #)  
Heuristics and biases in information processing, auditor judgment, mental accounting, and decision aids.

**Acct 8892. Readings in Accounting.** (1-8 cr [max 16 cr]. Prereq—Business admin PhD 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]. Prereq—Business admin PhD 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 5001. Survey: Human Resource Development and Adult Education.** (3 cr. \$HRD 5001)  
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/recruiting undereducated adults. Role of family, schools, community, and state/local government. New social action approaches required for licensure.

**AdEd 5202. Assessment of Adult Literacy.** (3 cr. Prereq—\$: 5224, 5225, 5226)  
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/gender differences. English as second language. Evaluation of commercial materials/software.

**AdEd 5211. Introduction to the Undereducated Adult.** (1 cr; A-F only)  
Definitions of literacy in workplace, community, and family. Issues: poverty/welfare, ethnicity, cultural diversity, social class, language/learning, immigrants.

**AdEd 5212. Introduction to Adult Literacy in the Workplace.** (1 cr; A-F only. Prereq—5211)  
Review workplace literacy programs, funding, program planning, and needs assessment. Reaching/recruiting workers. Role of employers and the unions. Writing for low literacy employees.

**AdEd 5213. Introduction to Adult Literacy in the Community.** (1 cr; A-F only. Prereq—5211)  
Reviews role of the community programs in the United States in literacy building, the family in developing literacy skills, correctional education in reintegrating offenders back into community. Integrating people with disabilities through community literacy programs. Literacy/development in developing countries. Reaching/recruiting indigenous, migrant, and immigrant groups. Social action approaches to literacy education.

**AdEd 5224. Formal Assessment of Adult Literacy.** (1 cr; A-F only. Prereq—5211)  
Assessment of adult English/literacy skills needed for work, family, community, and continuing education. Formal testing policy, techniques, standardized tests. Underlying assumptions about testing, cultural bias, and interpretation of formal tests. Test preparation programs.

**AdEd 5225. Informal Assessment of Adult Literacy.** (1 cr; A-F only. Prereq—5211)  
Informal assessment of adult English/literacy skills for work, family, community, and further education. Informal testing techniques, setting educational goals, formal versus informal assessment.

**AdEd 5226. Advanced Assessment of Adult Literacy.** (1 cr; A-F only. Prereq—5211, 5224, 5225)  
Applications and case studies. Educational planning for work, family, and community.



**AdEd 5233. Methods of Teaching Beginning Adult Literacy.** (1 cr; A-F only. Prereq–5211)  
Learning English and literacy as an adult: initial approaches to teaching reading, writing, and communications skills. Theories of learning and curriculum design. Technology as a teaching tool: teaching students with disabilities or with cultural/gender differences.

**AdEd 5234. Methods of Teaching Intermediate Adult Literacy.** (1 cr; A-F only. Prereq–5211, 5233)  
Learning English/literacy as an adult. Intermediate approaches to teaching reading, writing, and communications skills. Emphasizes communication/comprehension in oral/written English. English reading and oral communication skills for workplace. Evaluating commercial materials/software.

**AdEd 5235. Methods of Teaching Advanced Adult Literacy.** (1 cr; A-F only. Prereq–5211, 5234)  
Advanced approaches to teaching reading, writing, and communication skills. Preparing students for college and continuing education. Reading/study skills. English in workplace and on Internet. Problem solving, analytical thinking. Technology as teaching tool. Evaluating commercial material/software.

**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 5401. Distance Learning in Adult Education and Training.** (3 cr; A-F only. \$HRD 5401)  
Distance learning concepts, theory, history, present practice, delivery systems, course design, major issues, and future directions.

**AdEd 5612. Managing and Consulting in Human Resource Development and Adult Education.** (3 cr. \$HRD 5612. Prereq–5001 or HRD 5001)  
Theory of managing/consulting in human resource development and adult education. Assessment of role requirements. Experimentation with practical management/consultation processes/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; A-F only. \$HRD 8001. Prereq–5001 or HRD 5001)  
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 [max 9 cr])

**AdPy 8205. Special Assignments.** (1-16 cr [max 16 cr])

**AdPy 8206. Research.** (1-16 cr [max 16 cr])

**AdPy 8249. Clinical Neuropsychopharmacology.** (1-15 cr [max 15 cr]. Prereq–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 anti-anxiety 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 anorexiant, 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 [max 24 cr])

## Aerospace Engineering and Mechanics (AEM)

*Department of Aerospace Engineering and Mechanics*

*Institute of Technology*

**AEM 5245. Hypersonic Aerodynamics.** (3 cr; A-F only. Prereq–4202, [grad student or upper div IT])  
Importance/properties of hypersonic flow. Hypersonic shock and expansion-wave relations. Local surface inclination methods. Approximate/exact methods for hypersonic inviscid flow fields. Viscous flow: boundary layers, aerodynamic heating, hypersonic viscous interactions, computational methods. Hypersonic propulsion and vehicle design.

**AEM 5251. Computational Fluid Mechanics.** (3 cr; A-F only. Prereq–[4201 or equiv], [CSCI 1113 or equiv], [IT upper div or grad student])  
Introductory concepts in finite difference and finite volume methods as applied to various ordinary/partial differential model equations in fluid mechanics. Fundamentals of spatial discretization and numerical integration. Numerical linear algebra. Introduction to engineering and scientific computing environment. Advanced topics may include finite element methods, spectral methods, grid generation, turbulence modeling.

**AEM 5401. Intermediate Dynamics.** (3 cr. Prereq–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 5431. Trajectory Optimization.** (3 cr; A-F only. Prereq–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 5441. Structural Dynamics.** (3 cr; A-F only. Prereq–3031, 4301, [grad student or IT upper div])  
Frequency and time domain analysis of multi-degree of freedom mechanical systems. Natural frequencies, normal modes of vibration. Free and forced vibrations of strings, rods, and shafts beams. Introduction to finite elements in structural dynamics. Design project.

**AEM 5451. Optimal Estimation.** (3 cr; A-F only. Prereq–[Math 2243, Stat 3021] or equiv, 4311) or #)  
Basic probability theory. Batch/recursive least squares estimation. Filtering of linear/non-linear systems using Kalman and extended Kalman filters. Applications to sensor fusion, fault detection, and system identification.

**AEM 5495. Topics in Aerospace Systems.** (1-4 cr [max 4 cr]; A-F only. Prereq–A)  
Topics of current interest. Individual projects with faculty sponsor.

**AEM 5501. Continuum Mechanics.** (3 cr. Prereq–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; A-F only. Prereq–4501 or equiv, Math 2263 or equiv or #)  
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 5651. Aeroelasticity.** (3 cr; A-F only. Prereq–4202, 4301, [grad student or IT upper div])  
Static aeroelastic phenomena, torsional divergence of a lifting surface, control surface reversal. Aeroelastic flutter, unsteady aerodynamics. Problems of gust response, buffeting. Design project.

**AEM 8000. Seminar: Aerospace Engineering and Mechanics.** (1 cr [max 4 cr]; S-N only. Prereq–DGS consent)

**AEM 8201. Fluid Mechanics I.** (3 cr. Prereq–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. Prereq–8201)  
Analysis of incompressible viscous flow; creeping flows; boundary layer flow.

**AEM 8203. Fluid Mechanics III.** (3 cr. Prereq–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.** (3 cr [max 4 cr]. Prereq–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. Prereq–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. Prereq–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; A-F only. Prereq–8201, 8202)  
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. Prereq–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. Molecular Gas Dynamics.** (3 cr. §ME 8361. Prereq-[4201 or equiv], [4203 or equiv], [ME 3324 or equiv]) Kinetic theory of gases, Boltzmann equation, Maxwell-Boltzmann distribution, collisions, transport properties. Introduction to quantum mechanics. Statistical thermodynamics, classical/quantum statistics. Partition functions and thermodynamic properties. Irreversible thermodynamics.

**AEM 8241. Perturbation Methods in Fluid Mechanics.** (3 cr. Prereq-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. Prereq-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 8253. Computational Methods in Fluid Mechanics.** (3 cr; A-F only. Prereq-4201) Spatial discretization. Spectral methods. Temporal discretization. Nonlinear sources of error. Incompressible Navier-Stokes equations. Compressible Navier-Stokes equations.

**AEM 8261. Nonlinear Waves in Mechanics.** (3 cr. Prereq-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. Prereq-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]. Prereq-Δ) Includes individual student projects completed under guidance of a faculty sponsor.

**AEM 8333. FTE: Master's.** (1 cr. Prereq-Master's student, adviser and DGS consent)

**AEM 8400. Seminar: Aerospace Systems.** (1 cr [max 4 cr]; S-N only. Prereq-Aerosp Eng grad student) Developing program of research in aerospace Systems. Discussions of current research/topics of interest.

**AEM 8401. Modern Feedback Control.** (3 cr. Prereq-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  $H^\infty$ . Applications.

**AEM 8421. Robust Multivariable Control Design.** (3 cr. Prereq-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  $H^\infty$  optimal control design and structural singular value  $\mu$  techniques.

**AEM 8426. Optimization and System Sciences.** (3 cr; A-F only. Prereq-8401, IT grad student) 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 8442. Navigation and Guidance Systems.** (3 cr; A-F only. Prereq-Exposure to [linear algebra, differential equations, probability, statistics]) Fundamental principles of navigation. Algorithms, performance analysis of navigational systems. Radio-navigation systems (DME,VOR,ILS). Satellite navigation systems (GPS,GLDNASS). Inertial navigation systems mechanization, error analysis.

**AEM 8444. FTE: Doctoral.** (1 cr. Prereq-Doctoral student, adviser and DGS consent)

**AEM 8495. Advanced Topics in Aerospace Systems.** (1-4 cr [max 8 cr]; A-F only. Prereq-Δ) Individual student projects completed under guidance of a faculty sponsor.

**AEM 8500. Research Seminar in Mechanics of Materials.** (1-3 cr [max 12 cr]; A-F only. Prereq-#) 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]; A-F only. Prereq-5501 or #) 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; A-F only. Prereq-5503) Contact stresses, finite deformations, and other topics.

**AEM 8523. Elastodynamics.** (3 cr; A-F only. Prereq-4581 or 5501 or #) 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; A-F only. Prereq-5503 or #) 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. Prereq-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. Prereq-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 8551. Multiscale Methods for Bridging Length and Time Scales.** (3 cr; A-F only. Prereq-Basic knowledge of [continuum mechanics, atomic forces], familiarity with partial differential equations, grad student in [engineering or mathematics or physics]) Classical/emerging techniques for bridging length/time scales. Nonlinear thermoelasticity, viscous fluids, and micromagnetics from macro/atomic viewpoints. Statistical mechanics, kinetic theory of gases, weak convergence methods, quasicontinuum, effective Hamiltonians, MD, new methods for bridging time scales.

**AEM 8595. Selected Topics in Mechanics and Materials.** (1-4 cr [max 8 cr]. Prereq-Δ) Includes individual student projects completed under guidance of a faculty sponsor.

**AEM 8601. Finite Element Methods in Computational Mechanics.** (3 cr. Prereq-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. Prereq-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]. Prereq-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]. Prereq-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]. Prereq-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 Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq-Max 18 cr per semester or summer; 24 cr required)

## Afro-American Studies (Afro)

*Department of African American and African 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 5101. Seminar: Introduction to Africa and the African Diaspora.** (3 cr)

Comparative frameworks, related theories, and pivotal texts in study of Africa and African Diaspora.

**Afro 5103. African History from the Perspective of the African Diaspora.** (3 cr; A-F only)

Writings and intellectual networks of major Black thinkers whose historical/ethnographic works on Africa span period from 19th to 20th century. Thinkers such as David Walker, Henry Highland Garnet, Martin R. Delany, J.W.C. Pennington, George Washington Williams, Alexander Crummell, W.E. B. Dubois, Carter G. Woodson, William Leo Hansberry .

**Afro 5120. Social and Intellectual Movements in the African Diaspora.** (3 cr; A-F only. §Afro 3120)

Political, cultural, and historical linkages between Africans, African-Americans, and African-Caribbean. Development of black socio-political movements and radical intellectual trends in late 19th/20th centuries within African Diaspora. African independent struggles against colonialism. Black resistance in Suriname, Guyana, and the Caribbean against colonialism/racism. Protest organizations, intellectual discourses, and radical movements in the United States and Europe.

**Afro 5181. Blacks in American Theatre.** (3 cr. §Th 5181)

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 Theatre: 1960-Present.** (3 cr. §Th 5182)

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. §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. Prereq—Grad or #)

The novel in contemporary Africa in English, French and African languages. Non-English language works in translation.

**Afro 5401. Field Studies in African American and African Studies.** (1-6 cr [max 6 cr]. Prereq—African American or African Studies major or minor, #)

Supervised field study/internship focused on African American or African culture(s), language(s), and development.

**Afro 5405. The African American Child.** (3 cr. §Afro 3405)

Research carried out by African American psychologists and behavioral/social scientists, and by experts on African American child/youth development.

**Afro 5429. Slavery in Africa and in the Americas, 1400 to 1880.** (3 cr; A-F only. §Afro 3429)

History of slavery in Africa and the New World. Indigenous institutions of unfree labor in West Africa. Origins of European slave trade in West Africa and South Africa. Development of plantation societies in South America, the Caribbean, and the United States. Comparative approach to understanding New World slavery and slavery on the African subcontinent. Focuses on religion, creolization, and antislavery resistance.

**Afro 5437. History of East Africa.** (3 cr; A-F only. §Afro 3437, Hist 3437, Hist 5437)

Major themes in history of East Africa, from era of early human cultural development to present. Methods that historians use to reconstruct history. Varying interpretations/constructions of history over time.

**Afro 5478. Contemporary Politics in Africa and the Colonial Legacy.** (4 cr; A-F only. §Afro 4478, Pol 4478, Pol 5478.

Prereq—Pol 1054 or Pol 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, prospects for effective democracy.

**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 African American Novel.** (3 cr. §Engl 5593)

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. §Engl 5597)

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. §Arth 5655)

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 African American Studies.** (3 cr)

Classic works in African American studies. Conceptual frameworks. Multidisciplinary focus.

**Afro 5702. Proseminar: Major Figures in African American Studies.** (3 cr)

Major figures from various fields in African American studies. Bio-critical focus.

**Afro 5741. Minorities and Mass Media.** (3 cr; A-F only.

Prereq—jour major or minor, Jour 3004, Δ) Analysis of relationships between mass media and communities of color in the United States. Focuses on issues of content and control.

**Afro 5756. Social and Cultural History of Blacks in Sports.** (3 cr. §Afro 3756)

Social/cultural contexts surrounding eras of athletes such as Jack Johnson, Jackie Robinson, Joe Louis, Jesse Owens, Althea Gibson, Wilma Rudolph, Muhammad Ali, Michael Jordan, and Tiger Woods. Impact of these athletes on national/international events. Periods when it was not uncommon for black entertainers/athletes to become involved in politics and community activism.

**Afro 5864. Proseminar: African-American History.** (3-4 cr [max 4 cr]. Prereq—#)

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 [max 4 cr]. Prereq—#)

Construction of a detailed research agenda, locating appropriate depositories of primary materials and secondary sources, and developing appropriate methodologies and frameworks.

**Afro 5866. The Civil Rights and Black Power Movement, 1954-1984.** (3 cr; A-F only. §Afro 3866)

The "second reconstruction." Failure of Reconstruction, abdication of black civil rights in 19th century. Post-1945 assault on white supremacy via courts/state, grass-roots southern movement in 1950s/1960s. Black struggle in north and west, emphasis on Black Power by new organizations/ideologies/leaders. Ascendancy of Reagan, conservative assault on movement.

**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 African American and African Studies.** (1-3 cr [max 9 cr])

Topics specified in *Class Schedule*.

**Afro 5993. Directed Study.** (1-3 cr [max 3 cr]. Prereq—#)

Guided individual reading/study for qualified seniors and graduate students.

**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. Prereq—#)

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 [max 9 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.** (3 cr)

Development of community school program in agriculture, agribusiness, and environmental science. Program to meet graduation outcomes and determine student needs.

**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 5116. Coordination of SAE Programs: Work-based Learning.** (2 cr; A-F only. Prereq—Agricultural education major or #)

Principles/techniques for coordinating work-based learning. Supervised agricultural experience in agricultural education. Historical/philosophical roots of experiential learning, integration with classroom instruction, legal aspects, record keeping, coordination techniques, current agreement laws.

**AFEE 5118. Strategies for Managing and Advising the FFA Organization.** (2 cr; A-F only. Prereq—Agricultural education major or #)

Principles/techniques to advise an FFA chapter. Historical/philosophical basis of FFA, organization/structure. Integration with classroom instruction, public relations, recruitment, and administration of FFA chapters.

**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 [max 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. §WCPE 5341)

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. §WCPE 5351)

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 5405. Advanced Farm Financial Analysis Methodology and Concepts.** (1 cr)

Farm financial analysis concepts, whole entity financial analysis issues/tools, enterprise analysis options/methodologies. Evaluation of industry standardization efforts. Analysis of where each option fits.

**AFEE 5407. Application of Advanced Farm Financial Analysis Tools and Methods.** (1 cr)

Use of advanced farm financial analysis tools/methodology to analyze financial performance of actual farm businesses. Case farms are used to apply whole entity financial analysis tools/concepts and enterprise analysis methodologies.

**AFEE 5409. Seminar: Teaching Strategic Farm Business Planning.** (1 cr [max 4 cr]; A-F only)

Teaching strategic business planning to farm managers and agricultural professionals. Philosophy of strategic management, components of a strategic business plan. Materials/tools to apply strategic farm business planning in educational programs. Students apply strategic planning methods/concepts to case farm businesses.

**AFEE 5411. Seminar: Farm Financial Planning Teaching Tools and Methods.** (1 cr [max 4 cr]; A-F only)

Preparation to teach farm financial planning to farm managers and agricultural professionals. Principles/concepts of long range financial planning and short range cash flow planning. Farm planning software tools, case farm situations, practical farm planning experience.

**AFEE 5413. Seminar: Teaching Effective Use of Commodity Marketing Tools.** (1 cr [max 4 cr]; A-F only)

Teaching commodity marketing tools to farm managers and agricultural professionals. Commodity marketing tools, including cash forward contracts, futures, and options, and how to use them to enhance price and protect income. How to choose marketing tools, given financial/market conditions.

**AFEE 5415. Seminar: Teaching Commodity Marketing Strategies.** (1 cr [max 4 cr]; A-F only)

Teaching commodity market planning to farm managers and agricultural professionals. Development of marketing plans to enhance price and protect income. Introduction to tools to simulate implementation of plans against actual price scenarios.

**AFEE 5993. Directed Study in Agricultural Education and Extension.** (1-9 cr [max 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 [max 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]. Prereq—AgEd 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]; A-F only. Prereq—AgEd student doing Plan B research, Δ)

Select problems, prepare bibliographies, analyze and interpret data, and prepare manuscripts on studies.

## 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. Prereq—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 5121. Applied Experimental Design.** (4 cr. §Ent 5121. Prereq—Stat 5021 or equiv or #)

Principles of sampling methodologies, experimental design, and statistical analyses. Methods/procedures in generating scientific hypotheses. Organizing, initiating, conducting, and analyzing scientific experiments using experimental designs and statistical procedures.

**Agro 5311. Research Methods in Crop Improvement and Production.** (1 cr; S-N only. Prereq—applied plant sciences grad)

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; A-F only. §Ent 5321. Prereq—[3xxx or above] course in [Agro or AnSc or Ent or Hort or PIPA or Soil] or #)

Ecological approach to problems in agricultural systems. Formal methodologies of systems inquiry are developed/applied.

**Agro 5999. Special Topics: Workshop in Agronomy.** (1-6 cr [max 6 cr]. Prereq—Jr or sr or grad student)

Workshops on various topics in agronomy and plant genetics. Presenters/faculty may include guest lecturers/experts. Topics specified in *Class Schedule*.

**Agro 8005. Supervised Classroom or Extension Teaching Experience.** (2 cr; S-N only. §BAE 8005, Hort 8005, PIPA 8005, Soil 8005. Prereq—Grad SEng major, #)

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; A-F only. §Hort 8201. Prereq—Stat 5301 or equiv)

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. Prereq—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. Prereq—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. Prereq—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; A-F only. \$Hort 8270. Prereq—Grad major in [applied plant sci or agro or ent or hort or plant brdg or plant path or soil] or #) Reports/discussions of problems and investigational work.

**Agro 8280. Current Topics in Applied Plant Sciences.** (1 cr; S-N only. Prereq—Grad major in agro or applied plant sciences or ent or hort or plant brdg or plant path or soil or #) Topics presented by faculty or visiting scientists.

**Agro 8305. Physiological Ecology of Plants in Natural and Managed Ecosystems.** (4 cr; A-F only. \$Hort 8305. Prereq—BioC 3021, [Biol 1001 or Biol 1002], Biol 1009) 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; A-F only. Prereq—Grad major in agro or applied plant sciences or ent or hort or plant brdg or plant path or soil or #) 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. Prereq—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]; S-N only. \$Hort 8900. Prereq—#) 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. Prereq—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. Prereq—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]. Prereq—5011, 5022) Survey of Akkadian literature, including literary, legal, historiographical, and sacred texts. Topics specified in *Class Schedule*.

## American Indian Studies (Amln)

*Department of American Indian Studies*

*College of Liberal Arts*

**Amln 5107. The Structure of Anishinaabemowin, the Ojibwe Language.** (3 cr; A-F only. \$Amln 3107. Prereq—3104) Analysis of grammatical structures of Anishinaabemowin.

**Amln 5108. History of Anishinaabemowin, the Ojibwe Language.** (3 cr; A-F only. \$Amln 3108. Prereq—3107 or #) Historical development of Anishinaabemowin.

**Amln 5109. Anishinaabe Literature.** (3 cr; A-F only. \$Amln 3109. Prereq—3107 or 5107 or #) Readings in Anishinaabe oral literature.

**Amln 5141. American Indian Language Planning.** (3 cr; A-F only. \$Amln 3141. Prereq—3103 or 3123 or #) Planning for maintenance/revitalization of North American indigenous languages. Condition/status of languages. Documentation, cultivation, literacy, education.

**Amln 5301. American Indian Intellectuals.** (3 cr) Major works produced by two most important generations of American Indian intellectual history. 1890-1934 Transition Period, in which Charles Eastman, Zitkala-Sa, Luther Standing Bear, and Arthur Parker defined American Indian culture and history as integral parts of contemporary American society. Impact of 1968-1975 Red Power movement and its continuing influence on American Indian Studies, as exemplified by works of Vine Deloria, Jr., N. Scott Momaday, Paula Gunn Allen, and Gerald Vizenor.

**Amln 5303. American Indians and Photography.** (3 cr. \$Amln 3303) Historical/comparative overview of photos in which American Indian people are central subjects. Primary features of images in American Indian photos. Relationships among those involved in making/viewing photos. Ways in which photos are interpreted. Relation of photos to social contexts in which they are produced and to agencies of those who stand behind their making.

**Amln 5402. American Indians and the Cinema.** (3 cr; A-F only) Representations of American Indians in film, historically/contemporarily. What such representations assert about Native experience and cultural viability. What they reflect about particular relationships of power.

**Amln 5409. American Indian Women: Ethnographic and Ethnohistorical Perspectives.** (3 cr. \$Amln 3409, WoSt 3412) Comparative survey of ethnographic/ethnohistorical writings by/about American Indian women.

**Amln 5890. Problems in American Indian History.** (3 cr. \$Hist 5890. Prereq—#) 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.

**Amln 5920. American Indians and the Supreme Court.** (3 cr; A-F only) Role/practice of U. S. Supreme Court as a policy-making institution when dealing with indigenous nations and their citizens.

## 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]; S-N only. Prereq—Fluency in ASL, # required) 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. Prereq—#) 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 5402. American Indians in the Cinema.** (3 cr; A-F only) Representations of American Indians in film, historically/contemporarily. What such representations assert about Native experience and cultural viability. What they reflect about particular relationships of power.

**AmSt 5920. Topics in American Studies.** (1-4 cr [max 9 cr]) Topics specified in *Class Schedule*.

**AmSt 8201. Historical Foundations of American Studies.** (3 cr. Prereq—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; A-F only. Prereq—grad AmSt major or # or Δ) 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]; A-F only. Prereq—#) 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; A-F only. Prereq—#) 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]; A-F only. Prereq—#) 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. Prereq—#) 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. Prereq—#) Interdisciplinary study of connections between literary expression and history, particularly as they articulate themes in American culture.

**AmSt 8333. FTE: Master's.** (1 cr. Prereq—Master's student, adviser and DGS consent)

**AmSt 8401. Practicum in American Studies.** (3 cr; A-F only. Prereq-#)  
Training in teaching undergraduate courses in American studies.

**AmSt 8444. FTE: Doctoral.** (1 cr. Prereq-Doctoral student, adviser and DGS consent)

**AmSt 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq-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]. Prereq-Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**AmSt 8801. Dissertation Seminar.** (3 cr; S-N only. Prereq-AmSt doctoral student beginning dissertation work)  
Conceptualizing the research problem for the dissertation and structuring the process of writing a chapter of it.

**AmSt 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq-Max 18 cr per semester or summer; 24 cr required)

**AmSt 8920. Topics in American Studies.** (3 cr [max 9 cr]; A-F only)  
Topics specified in *Class Schedule*.

**AmSt 8970. Independent Study in American Studies.** (1-9 cr [max 9 cr]. Prereq-#, Δ)  
Independent study of interdisciplinary aspects of American civilization under guidance of faculty members of various departments.

## Anesthesiology (Anes)

*Department of Anesthesiology*

*Medical School*

**Anes 5587. Adv Clinical Physiology I for Nurse Anesthetists.** (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; A-F only. Prereq-Advanced Clinical Physiology I for Nurse Anesthetists)

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; A-F only. Prereq-General chemistry or #)  
Chemical equilibrium, organic chemistry, physics of fluids/gases, anesthetic applications.

**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]; A-F only. Prereq-#)  
Topics vary. See *Class Schedule* or department. Topics may use guest lectures/experts.

**AnSc 5200. Statistical Genetics and Genomics.** (4 cr. §CMB 5200. Prereq-[Stat 3021 or equiv], [Biol 4003 or equiv])  
Linkage analysis for mapping genes with codominance, dominance, imprinting inheritance modes, linkage/transmission disequilibrium. Radiationhybrid mapping. Parentage testing. Testing/estimation of candidate gene effects. Experimental designs, statistical analysis for mapping quantitative trait loci (QTL) with additive, dominance, and epistasis effects, and for gene expression studies using microarrays. QTL analysis of gene expression data for mapping transcriptional regulation factors.

**AnSc 5327. Endocrine and Reproductive Physiology.** (2 cr. Prereq-2301, BioC 3021)  
Endocrine system. Synthesis, structure, actions, and regulation of hormones. Major endocrine glands/tissues, including the hypothalamus, anterior/posterior pituitary, thyroid, parathyroid, pancreas, adrenal cortex and medulla, gastrointestinal tract, and gonads. Emphasizes metabolic/reproductive endocrinology.

**AnSc 8111. Genetic Improvement of Animals.** (3 cr. Prereq-#)  
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. Prereq-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.** (3 cr. §CMB 8335. Prereq-BioC 4332, Biol 4003)  
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 8134. Ethical Conduct of Animal Research.** (2 cr; A-F only. §VMED 8134. Prereq-Grad student or prof school student or #)

Ethical considerations in use of animal subjects in agricultural, veterinary, and biomedical research. Federal, state, and University guidelines relating to proper conduct for acquisition/use of animals for laboratory, observational, epidemiological, and clinical research. Regulatory requirements, bases for what is deemed proper conduct. Societal impact on scientific investigations utilizing animal subjects.

**AnSc 8194. Research in Animal Genetics.** (1-3 cr [max 3 cr]. Prereq-#)  
Research in quantitative genetics, cytogenetics, molecular genetics, and other areas related to animal breeding.

**AnSc 8211. Animal Growth and Development.** (3 cr. Prereq-#)  
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 [max 3 cr]. Prereq-#)  
Research in selected areas.

**AnSc 8311. Animal Bioenergetics.** (3 cr; A-F only. Prereq-BioC 4331 recommended, #)  
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 8312. Protein Metabolism.** (3 cr; A-F only. Prereq-BioC 4331)  
Basic and applied concepts of protein metabolism in farm animals.

**AnSc 8320. Concepts and Developments in Nutritional Physiology.** (3 cr [max 6 cr]; A-F only. Prereq-#)  
Review and critical evaluation of pertinent scientific literature.

**AnSc 8330. Concepts and Developments in Ruminant Nutrition.** (1-2 cr [max 2 cr]; A-F only. Prereq-#)  
Review and critical evaluation of recent research reports.

**AnSc 8333. FTE: Master's.** (1 cr. Prereq-Master's student, adviser and DGS consent)

**AnSc 8340. Concepts and Developments in Swine Nutrition.** (2 cr [max 4 cr]; A-F only. Prereq-#)  
Review and critical evaluation of scientific literature.

**AnSc 8394. Research in Animal Nutrition.** (1-3 cr [max 3 cr]. Prereq-#)  
Research in selected areas: topics and animal species determined by consultation.

**AnSc 8411. Physiology of Reproduction.** (3 cr; A-F only. Prereq-3305 or equiv)  
Emphasis is on gametogenesis, conception, and implantation.

**AnSc 8421. Physiology of Fertilization and Gestation.** (3 cr. Prereq-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. Prereq-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. Prereq-Doctoral student, adviser and DGS consent)

**AnSc 8451. Reproductive Endocrinology.** (2 cr; A-F only. Prereq-3305 or 3327 or equiv, BioC 3021)  
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 [max 3 cr]. Prereq-#)  
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.** (1-2 cr [max 12 cr]; S-N only. Prereq-#)  
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 [max 3 cr]. Prereq-#)  
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]. Prereq-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]. Prereq-Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**AnSc 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq-Max 18 cr per semester or summer; 24 cr required)

## Anthropology (Anth)

*Department of Anthropology*

*College of Liberal Arts*

**Anth 5008. Advanced Flintknapping.** (3 cr; A-F only. Prereq-[3008 or 5269] or #)  
Hands-on training in techniques of advanced stone tool production, artifact reproduction, and lithic experimental design for academic/artistic purposes.

**Anth 5025. Cultural Semantics.** (3 cr)  
Understanding cultures and cognitive classification systems through lexical semantics.

**Anth 5027. Origins of European Civilization.** (3 cr. §Anth 3027W)  
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; A-F only. Prereq–Sr or grad or #)

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 5031. Science as Cultural Practice.** (3 cr. Prereq–Sr or grad student or #)

Ethnographic, historical and sociological accounts of scientific practice. How facts are constructed/ negotiated. Social, cultural, and political influences on scientific methods. How scientific projects articulate with hierarchies of race/gender. International differences in scientific practice.

**Anth 5033. Feminist Anthropology.** (3 cr. Prereq–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. §Anth 3041, Anth 8213. Prereq–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 5043. Colonialism and Culture.** (3 cr; A-F only. §GloS 5643)

Making of culture as colonial/anthropological object of knowledge. Relationship between colonial knowledge/formation of academic disciplines (especially anthropology). Colonial/postcolonial transformations of colony, nation, and metropole.

**Anth 5045. Urban Anthropology.** (3 cr. Prereq–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 5221. Anthropology of Material Culture.** (3 cr; A-F only)

Material culture as a social creation, studied from multiple perspectives (e.g., social anthropology, archaeology, primatology). Conceptions of how humans articulate with material world they construct.

**Anth 5244. Skeletal Materials for Archaeologists.** (4 cr; A-F only. §Anth 8244. Prereq–#)

How anthropologists use fossil bones to answer questions of past human diet, behavior, and environments. Basics of skeletal-element/species identification of humans and large mammals. Project where students analyze a small assemblage of bones. Emphasizes scientific method, data analysis using computers.

**Anth 5269. Analysis of Stone Tool Technology.** (4 cr; A-F only. Prereq–1001 or 3001 or #)

Practical lab experience. How to analyze archaeological collections of stone tools to learn about human technological behavior in past. Students analyze archaeological/experimental collections, make stone tools themselves.

**Anth 5980. Topics in Anthropology: History of Anthropology.** (3 cr [max 6 cr])

Topics specified in *Class Schedule*.

**Anth 5990. Topics in Archaeology.** (3 cr [max 9 cr]; A-F only. Prereq–#)

Topics specified in *Class Schedule*.

**Anth 8001. Foundations of Social and Cultural Anthropology.** (5 cr; A-F only. Prereq–Grad anth major or #)

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.** (5 cr; A-F only. Prereq–8001)

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 8004. Foundations of Anthropological Archaeology.** (3 cr. Prereq–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. Prereq–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. §Anth 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. §Anth 4021)

Self, emotion, cognitive processes, and child development in cross-cultural perspective.

**Anth 8211. Symbolic Anthropology.** (3 cr. §Anth 4019)

Advanced introduction to semiotic, structuralist, and interpretive approaches in anthropology. Reviews classic foundations and recent developments.

**Anth 8213. Ecological Anthropology.** (3 cr. §Anth 3041, Anth 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. Prereq–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 8219. Grant Writing.** (2 cr. Prereq–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]. Prereq–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]; A-F only. Prereq–Anth grad student or #)

Training seminar on research development, coordination, grant management, field/laboratory research management, and fundraising.

**Anth 8244. Skeletal Materials.** (4 cr; A-F only. §Anth 5244. Prereq–#)

How anthropologists use fossil bones to answer questions of past human diet, behavior, and environments. Skeletal element and species identification (of humans, large mammals). Students analyze small assemblage of bones for class project. Emphasizes scientific method, data analysis using computers.

**Anth 8333. FTE: Masters.** (1 cr. Prereq–Master’s student, adviser and DGS consent)**Anth 8444. FTE: Doctoral.** (1 cr. Prereq–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]. Prereq–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]. Prereq–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 Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq–Max 18 cr per semester or summer; 24 cr required)**Anth 8991. Independent Study.** (1-18 cr [max 18 cr]. Prereq–#)

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 [max 18 cr]. Prereq–#)**Anth 8993. Directed Study.** (1-18 cr [max 18 cr]. Prereq–#)

Directed Study

**Anth 8994. Directed Research.** (1-18 cr [max 18 cr]. Prereq–#)

## Applied Economics (ApEc)

### Department of Applied Economics

### College of Agricultural, Food and Environmental Sciences

**ApEc 5031. Methods of Economic Data Analysis.** (3 cr. Prereq–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 5032. Economic Data Analysis for Managerial and Policy Decisions.** (3 cr. Prereq–[5031 or #, familiarity with SAS])

Statistical/econometric methods for the analysis of large data sets to support managerial/policy decisions. Methods for organizing, accessing, and ensuring the quality of data. Estimation techniques include panel data methods, limited dependent variable models, and time series analysis. Emphasizes clarity of reporting and design of procedures for maintaining/updating data estimates.

**ApEc 5151. Applied Microeconomics: Firm and Household.** (3 cr. Prereq–3001 or Math 1271 or Math 2243 or equiv or grad student or #)  
Quantitative techniques for analysis of economic problems of firms and households. Links between quantitative tools and economic analysis. Regression analysis, mathematical programming, and present value analysis.

**ApEc 5152. Applied Macroeconomics: Income and Employment.** (3 cr. Prereq–3001 or Math 1271 or Math 2243 or equiv or grad student or #)  
Static general equilibrium open economy models and simple business cycle models that examine economic growth, business cycles, and fiscal and monetary policy. Input-output analysis and large scale econometric models. Sources/properties of economy and sector-wide data. Empirical applications.

**ApEc 5321. Regional Economic Analysis.** (3 cr. Prereq–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. Public Finance.** (3 cr; A-F only. Prereq–3001 or Econ 3101 or PA 5021)  
Which services should the public sector provide? Which level of government should provide them? How should governments fund those services? Which types of taxes should be levied and on whom? Applying economic theory/analysis to spending, revenue, and tax policy issues facing governments.

**ApEc 5451. Food Marketing Economics.** (3 cr; A-F only. \$ApEc 4451W. Prereq–Grad student)  
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 5481. Futures and Options Markets.** (3 cr. \$ApEc 4481. Prereq–grad student)  
Economic concepts related to futures/options trading. Hedging, speculation.

**ApEc 5511. Labor Economics.** (3 cr. Prereq–[[3001 or Econ 3101 or PA 5021], [PA 5032 or equiv], grad student] or #)  
Theoretical foundations of labor markets. 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 5581. Human Capital and Household Economics.** (3 cr. Prereq–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. Economic Aspects of Environmental Management.** (3 cr; A-F only. Prereq–[Sr or grad student] in [biological science or conservation biology or ecology or fisheries or forestry or public affairs or water resources or wildlife conservation] or CLA or #)  
Economist approach to environmental problems such as water/air pollution. Application of supply/demand concepts to evaluation of environmental resources. Methods of evaluation. Analysis of pollution control policies from economic point of view.

**ApEc 5651. Economics of Natural Resource and Environmental Policy.** (3 cr. Prereq–[[3001 or Econ 3101], [4611 or Econ 3611 or NRES 3261W]] or #)  
Economic analyses, including project evaluation of current natural resource/environmental issues. Emphasizes intertemporal use of natural resources, natural resource scarcity/adequacy, environmental quality, and mechanisms for pollution control and their implications for public policy.

**ApEc 5711. U.S. Agricultural and Environmental Policy.** (3 cr. Prereq–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. Economics of Science and Technology Policy.** (3 cr. Prereq–[[5151 or ¶5151], PA 5022] or #)  
Economics of technical change, research, and technology. Productivity. Methods for evaluating impacts of R&D. Intellectual property rights.

**ApEc 5731. Economic Growth and International Development.** (3 cr. Prereq–3002 or [Econ 3101, Stat 3022]; Econ 4211 recommended)  
Economics of research/development. Technical change, productivity growth. Impact of technology on institutions. Science/technology policy.

**ApEc 5751. Global Trade and Policy.** (3 cr. Prereq–3001 or Econ 3101 or PA 5021)  
Trade policies of import/export nations, gains from trade, trade negotiations/agreements. Free trade and common market areas. Exchange rate impacts. Primary commodities and market instability. Current trade issues.

**ApEc 5811. Cooperative Organization.** (3 cr. Prereq–3001 or Econ 3101 or PA 5021 or #)  
Application of economic analysis to cooperative form of organization. Producer/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.

**ApEc 5891. Independent Study: Advanced Topics in Farm and Agribusiness Management.** (1-4 cr [max 4 cr]. Prereq–#)  
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]. Prereq–#)  
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. Prereq–[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. Prereq–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; A-F only. Prereq–Econ 5151 or [Econ 8001, Econ 8002] or #)  
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 8205. Applied Game Theory.** (3 cr; A-F only. Prereq–[8101, 8102, 8103, 8104] or [Econ 8001, Econ 8002, Econ 8003, 8004] or #)  
Topics in game theory, application to economic problems. For each topic, important theory/equilibrium concepts are followed by extensive applications. Focuses on static/dynamic games of complete/incomplete information, evolutionary games.

**ApEc 8211. Econometric Analysis I.** (4 cr. Prereq–[[Stat 4102 or Stat 5102], Ph.D. student] or #)  
Classical multiple linear regression, stochastic regressors, heteroscedasticity, autocorrelated disturbances, panel data, discrete dependent variables.

**ApEc 8212. Econometric Analysis II.** (4 cr. Prereq–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. Prereq–Master's student, adviser and DGS consent)

**ApEc 8401. Consumer Behavior and Policy.** (2 cr; A-F only. Prereq–Econ 5151 or [Econ 8001, Econ 8002] or [Econ 8101, Econ 8102] or #)  
Analytical/empirical treatments of consumer behavior. Household decision making. Demand for quality characteristics. Review of basic consumer theory, policy-related issues, experimental economics, consumer-survey techniques. Types of data available to analyze consumer behavior and household decisions.

**ApEc 8402. Information and Behavioral Economics.** (2 cr; A-F only. Prereq–[8401, Econ 8001, Econ 8002] or [Econ 8101, Econ 8102] or equiv or #)  
New theories of consumer behavior that combine economic and psychological models. Influence of information on consumer choice over time and under uncertainty. Expected, unexpected utility theory, information economics, bounded rationality, prospect theory, choice over time, and rational addiction with applications to empirical work.

**ApEc 8403. Demand Analysis and Household Economics.** (2 cr; A-F only. Prereq–[8211, 8212, Econ 5151] or [Econ 8001, Econ 8002] or [Econ 8101, Econ 8102] or [Econ 8201, Econ 8202, Econ 8203, Econ 8204] or #)  
Household/individual behavior. Consumer demand analysis, education, and other issues. Static demand theory/estimation, dynamic demand theory/estimation, equivalence scales, intrahousehold allocation of consumption, analysis of education issues.

**ApEc 8404. Labor Economics and Human Capital.** (2 cr; A-F only. Prereq–[8403, Econ 8001, Econ 8002] or [Econ 8101, Econ 8102] or #)  
Topics in applied microeconomics related to labor supply and human capital. Focuses on household decisions and resulting outcomes in labor market. Household labor supply. Estimation of labor supply/earnings functions. Theory of human capital, wage structure/determination, and impacts of tax/transfer policies.

**ApEc 8444. FTE: Doctoral.** (1 cr. Prereq–Doctoral student, adviser and DGS consent)

**ApEc 8601. Natural Resource Economics.** (3 cr. Prereq–[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. Prereq–Econ 8004 or Econ 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]. Prereq—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. Prereq—Econ 8002 or Econ 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. Prereq—8230, Econ 8002 or Econ 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 8703. Microeconomic Analysis of Economic Development.** (3 cr; A-F only. Prereq—Econ 8001-04 or Econ 8101-04, and ApEc 8211-8212 or #. Concurrent registration is ok)

Topics concerning microeconomics of economic development in low-income countries. Focuses on behavior of agricultural households, poverty, inequality, education, health/nutrition, and evaluation of development programs.

**ApEc 8777. Thesis Credits: Master's.** (1-18 cr [max 50 cr]. Prereq—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]; S-N only. Prereq—Ag and applied econ MS student)

**ApEc 8801. Production Economics.** (2 cr; A-F only. Prereq—[Econ 8001, Econ 8002, Econ 8003] or [Econ 8101, Econ 8102, Econ 8103] or equiv or #)

Aspects of production theory. Axiomatic representations of multi-output technologies. Input, output, and directional distance functions. Cost, revenue, and profit functions and duality. Input/output separability. Jointness/non-jointness in production. Index numbers, measures of efficiency/productivity.

**ApEc 8802. Financial Economics.** (2 cr; A-F only. Prereq—[8211, Econ 5151] or [Econ 8001, Econ 8002] or #)

Major theories of asset pricing under assumptions of uncertainty, competitive markets, and symmetric information. Equilibrium/arbitrage models of financial markets with econometric applications. Pricing/use of derivatives.

**ApEc 8803. Marketing Economics.** (2 cr; A-F only. Prereq—[Econ 8001, Econ 8002] or [Econ 8101, Econ 8102] or #)

Review of market structure, conduct, and performance. Market interdependency over space/time. Product forms. Issues pertaining to market failures/interventions.

**ApEc 8804. Managerial Economics.** (2 cr. Prereq—[8202, Econ 5151] or [Econ 8001, Econ 8002] or [Econ 8101, Econ 8102] or #; Majors must register A-F basis)

Analysis of managerial decisions by organizations and individual entrepreneurs. Application of dynamic programming to investment and resource allocation decisions. Economics of business organization, including boundaries of the firm, mechanisms for vertical coordination, and economic implications of alternative ownership structures.

**ApEc 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—Max 18 cr per semester or summer; 24 cr required)

**ApEc 8901. Graduate Seminar: M.S. Program.** (1 cr; S-N only. Prereq—ag and applied econ MS student) 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; S-N only. Prereq—ag and applied econ PhD student) 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 [max 6 cr]. Prereq—#)

Special seminars or individual work on subjects suited to needs of students.

## Applied Plant Sciences (APSc)

### College of Agricultural, Food and Environmental Sciences

**APSc 8123. Research Ethics in the Plant and Environmental Sciences.** (.5 cr; S-N only. SPLPA 8123, SOIL 8123.

Prereq—Grad student)

Ethics training to graduate students enrolled in plant/environmental graduate research programs and fulfill requirement for training in responsible conduct of research. Course meets during first seven weeks of spring semester.

**APSc 8333. FTE: Master's.** (1 cr. Prereq—Master's student, adviser and DGS consent)

**APSc 8444. FTE: Doctoral.** (1 cr. Prereq—Doctoral student, adviser and DGS consent)

**APSc 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq—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]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**APSc 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—Max 18 cr per semester or summer; 24 cr required)

## Arabic (Arab)

### Department of African American and African 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) 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.** (3 cr [max 4 cr]. Prereq—3102 or equiv or #)

Advanced readings in classical and modern Arabic. Compositions based on texts.

**Arab 5102. Advanced Arabic II.** (3 cr [max 4 cr]. Prereq—5101 or #)

Readings of Arabic texts. Writing compositions based on texts. Continuation of 5101.

**Arab 5491. Classical Islamic Civilization.** (3 cr. \$Arab 3491, Hist 3491, MELC 3491)

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. The 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. \$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. \$Arab 3541, Hist 3541, MELC 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. \$Arab 3542, Hist 3542, MELC 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. \$Arab 3543, Hist 3543, MELC 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 [max 4 cr]. \$Arab 3544, Hist 3544, MELC 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]. Prereq—5102 or #)

Readings and discussion of selected works in Arabic. Topics specified in *Class Schedule*.

**Arab 5992. Directed Readings.** (1-3 cr [max 3 cr]. Prereq—#) Individual research and readings for advanced students.

**Arab 8333. FTE: Master's.** (1 cr. Prereq—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. Prereq—1 yr Hebrew or Arabic or #)

Biblical Aramaic — grammar, fluency in reading Biblical Aramaic and Old Aramaic inscriptions.

**Arm 5012. Syriac.** (3 cr. Prereq—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; A-F only. Prereq—5122, 5241, BA Arch major; students must submit thesis plan in semester before writing thesis)

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; A-F only. Prereq—For undergrads 5122, BA Arch major; for grads 8255, M Arch major or #)

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 5282. Undergraduate Architecture Studio II.** (6 cr; A-F only. Prereq—college or A)

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 5291. Accelerated Undergraduate Architecture Studio I.** (6 cr; A-F only. Prereq—#)

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; A-F only. Prereq—5291, accelerated status) or #)

Architectural problems. Emphasizes development of structures as integral part of design, site planning, design process.

**Arch 5350. Topics in Architectural Representation.** (1-3 cr [max 3 cr]; A-F only. Prereq—[5321, [Arch major or M. Arch major]] or #)

Selected topics in architectural representation.

**Arch 5352. AutoCAD II.** (3 cr. \$LA 5352. Prereq—For undergrads 5351, Arch major; for grads M Arch major or #; may not be taken for graduate 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; A-F only.

Prereq—For undergrads 5281 or 5351, Arch major; for grads M Arch major or #)

Introduction to 3-D studio for architectural modeling, rendering, and animation. Video recording and editing.

**Arch 5371. Computer Methods I.** (1 cr; S-N only. \$LA 5371. Prereq—¶8251, M Arch major or #)

Introduction to current techniques, computer programs, and their application to architectural computing.

**Arch 5372. Computer Methods II.** (1 cr; S-N only. \$LA 5372. Prereq—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; S-N only. \$LA 5373. Prereq—5372, ¶8253, M Arch major or #)

Advanced techniques, computer programs, and their application to architectural computing in design, theory, and technology.

**Arch 5374. Computer Methods IV.** (1 cr. Prereq—5373, ¶8254, M Arch major or #)

Advanced architectural computing applications in design, history, theory, representation, and technology.

**Arch 5410. Topics in Architectural History.** (3 cr [max 12 cr]; A-F only. Prereq—For undergrads 3412, Arch major; for grads M Arch major or #)

Advanced study in architectural history. Readings, research, and seminar reports.

**Arch 5411. Principles of Design Theory.** (3 cr; A-F only. Prereq—M Arch major or #)

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 5421. Architecture and Interpretation: The Cave and the Light.** (3 cr. Prereq—[3411, 3412] or #)

Historical/hermeneutical investigation of iconography of grotto. Intertwined themes of descent into earth and ascent to light, from earliest strata of human culture to present day.

**Arch 5445. Suburbia.** (3 cr. Prereq—3412 or arch major or #)

Suburbia from origins in 18th-century England to present. Historical changes and present challenges, especially in America. Ideology, mythology, planning, development, geography, transportation, the family. Specific sites/designs. Representations in film, television, popular literature, and music.

**Arch 5446. Architecture Since World War II: Postwar Experimentation, Aesthetics, and Politics of Architecture.** (3 cr. Prereq—3412 or #)

Avant-garde responses to post-war consciousness of social issues/meaning in architecture. Eroding communal identity, common man, architectural symbolism, monumentality, critical regionalism, place/technology in form making, popular culture, rise of theory.

**Arch 5450. Topics in Architectural Theory.** (1-3 cr [max 9 cr]; A-F only. Prereq—Arch major or M Arch major or #)

Selected topics in architectural theory and criticism.

**Arch 5451. Architecture: Defining the Discipline.** (3 cr; A-F only. Prereq—M Arch major or #)

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; A-F only. Prereq—M Arch major or #)

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 5455. Typology and Architecture: Theories of Analysis and Synthesis.** (3 cr; A-F only. Prereq—5411, M Arch major, #)

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; A-F only. Prereq—3412, Arch major or grad student or #)

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. Prereq—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. Prereq—For undergrads 3412, Arch or Amln 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. Architecture and Ecology.** (4 cr; A-F only. Prereq—[5281, LA 3501, arch major] or #)

Introduction to theories/practices of ecological approaches to architectural design. Ecological context, implications/opportunities of architecture. Historical/theoretical framework for ecological design thinking. Issues studied at a variety of scales: site/community, building scale, component scale. Fundamental theories, concepts, principles, strategies, and design tools addressed at each scale.

**Arch 5511. Construction Materials in Architecture.** (3 cr; A-F only. Prereq—M Arch or #)

Building materials, assemblies, and construction operations shaping building designs. Material properties for design/detailing of building systems, elements, and components. Implications in design applications. Modeling, hands-on building experiences.

**Arch 5512. Building Methods in Architecture.** (3 cr; A-F only. Prereq—5511, M Arch major or #)

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; A-F only. Prereq—M Arch major or #)

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; A-F only. Prereq—M Arch major or #)

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; A-F only. Prereq—5512, M Arch major or #)

Design principles, construction methods, and document production for masonry structures.

**Arch 5539. Daylighting and Architecture Design.** (3 cr; A-F only. Prereq—5514, M Arch major or #)

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 5550. Topics in Technology.** (1-3 cr [max 6 cr]. Prereq—#)

Selected topics in architecture technology, including construction, environmental management, energy performance, lighting, or materials.

**Arch 5561. Building Production Processes.** (3 cr. Prereq—M Arch major or #)

Document production, contract execution, building project management. Construction industry organization, scheduling, consultant relations, legal/code restraints, contractual stipulations, budget/project resource allocations. Case studies, hands-on experiences.

**Arch 5571. Architectural Structures I: Wood and Steel Design.** (3 cr; A-F only. Prereq—M Arch or #)  
Influence of history/culture on architecture/structure. Structural mechanics, analysis, form finding, and design by experimental, qualitative/intuitive, and quantitative methods. Vector-/form-active structural systems, funicular structures. Bending/compression elements, plates/grids. Tensile architecture, shells. Traditional construction materials.

**Arch 5572. Architectural Structures II: Concrete and Masonry Design.** (3 cr; A-F only. Prereq—5571, M Arch major or #)  
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; A-F only. \$Arch 3611. Prereq—Grad student or upper level undergrad student)  
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; A-F only. Prereq—M Arch major or #)  
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; A-F only. Prereq—M Arch major or #)  
Legal subject matter relevant to the work of architects and design professionals.

**Arch 5645. Real Estate Development in Architecture.** (3 cr. Prereq—For undergrads BA 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.** (1-4 cr [max 8 cr]. Prereq—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 [max 3 cr]. Prereq—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. Prereq—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. Prereq—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. Prereq—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; A-F only. Prereq—BED major or M Arch major or LA grad major or #)  
Art/design of creating city, neighborhood, and development plans. Public policies, planning tools/processes, and physical models used by design professionals and private/civic institutions to shape physical environment.

**Arch 5721. Proseminar in Metropolitan Design.** (3 cr; A-F only. \$LA 5721. Prereq—[[5711 or equiv], enrollment in CMD prog] or #)  
Reading seminar. Evolution of the contemporary city. Dynamics that created contemporary urban spatial patterns. Planning/design theories that have guided public interventions in the built environment. Thematic texts, classroom discussions.

**Arch 5750. Topics in Urban Design.** (1-4 cr [max 4 cr]; A-F only. Prereq—Arch major)  
Special topics in theory/practice of urban design.

**Arch 5790. Special Topics in Metropolitan Design.** (3 cr [max 6 cr]; A-F only. \$LA 5790. Prereq—Enrollment in CMD prog or #)

**Arch 5993. Directed Study.** (1-4 cr [max 3 cr]; A-F only. Prereq—#)  
Guided individual reading or study.

**Arch 8101. Subjects and Methods in Architecture.** (2 cr; S-N only. Prereq—Grad Arch major or #)  
The discipline of architecture.

**Arch 8250. Advanced Topics in Design.** (1-6 cr [max 6 cr]; S-N only. Prereq—Admitted to 3+ track for MArch prog or #)  
Design studio.

**Arch 8251. Graduate Architectural Design I.** (6 cr; A-F only. Prereq—Grad Arch major or #)  
Fundamental architectural problems involving design as a creative inquiry. Individual and collaborative effort.

**Arch 8252. Graduate Architectural Design II.** (6 cr; A-F only. Prereq—8251, grad Arch major or #)  
Fundamental architectural problems involving design as a creative inquiry. Individual and collaborative effort.

**Arch 8253. Graduate Architectural Design II.** (6 cr; A-F only. Prereq—8252, grad arch major or #)  
Fundamental architectural problems involving design as a creative inquiry. Individual and collaborative effort.

**Arch 8254. Graduate Architectural Design IV.** (6 cr; A-F only. Prereq—8253, grad Arch major or #)  
Fundamental architectural problems involving design as a creative inquiry. Individual and collaborative effort.

**Arch 8255. Graduate Architectural Design III.** (6 cr [max 8 cr]; A-F only. Prereq—8254, grad Arch major or #)  
Fundamental architectural problems involving design as a creative inquiry. Individual and collaborative effort.

**Arch 8295. Directed Graduate Architectural Design.** (6 cr; A-F only. Prereq—8251, grad Arch major or #)

**Arch 8333. FTE: Master's.** (1 cr. Prereq—Master's student, adviser and DGS consent)

**Arch 8350. Advanced Topics in Representation.** (1-3 cr [max 3 cr]; A-F only. Prereq—5311, grad Arch major or #)  
Theory and practice of visual representation in architecture.

**Arch 8450. Topics in Theory.** (1-3 cr [max 3 cr]; A-F only. Prereq—5411, grad Arch major or #)

**Arch 8494. Directed Research in Architectural History.** (1-3 cr [max 3 cr]; A-F only. Prereq—Grad Arch major or #)

**Arch 8550. Topics in Technology.** (1-3 cr [max 3 cr]; A-F only. Prereq—Grad arch major or #)  
Special topics in theory/practice of architecture technologies.

**Arch 8650. Topics in Architectural Practice.** (1-3 cr [max 3 cr]; A-F only. Prereq—Grad Arch major or #)

**Arch 8750. Topics in Urban Design.** (1-3 cr [max 3 cr]; A-F only. Prereq—Grad Arch major or #)

**Arch 8777. Thesis Credits: Master's.** (1-18 cr [max 50 cr]. Prereq—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. Prereq—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. Prereq—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. Prereq—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]. Prereq—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]. Prereq—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]. Prereq—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]. Prereq—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]. Prereq—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]. Prereq—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]. Prereq—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]. Prereq–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]. Prereq–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]. Prereq–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]. Prereq–BFA candidate or #)  
Various ideologies, cultural strategies that influence practice/interpretation of art. Emphasizes diversity of viewpoints. Application of issues in developing final BFA exhibition.

**Arts 5402. Artists' Books.** (4 cr. Prereq–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. §Arts 3403. Prereq–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. Prereq–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. Prereq–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 5444. Bachelor of Fine Arts Exhibition.** (1 cr; S-N only. Prereq–BFA candidate, sr, #)  
Final solo or small group exhibition and artist's statement developed in consultation with faculty adviser. Visual documentation of work and statement as appropriate to media.

**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]. Prereq–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]. Prereq–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]. Prereq–3505 or #)  
Distinct expressive qualities of handmade paper, its versatility as contemporary art form. Independent research pursued in consultation with instructor.

**Arts 5610. Interactivity: Advanced Digital Processes.** (4 cr [max 12 cr]. Prereq–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. Time Arts: Advanced Video.** (4 cr [max 12 cr]. Prereq–3602)  
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 5630. Time Arts: Advanced 2-D Animation.** (4 cr [max 12 cr]. Prereq–3603 or #)  
Individual projects and further development of a personal voice and critical thinking in time-based art. Creating digital 2-D animation with emphasis on vector and layer-based raster animation techniques. Compositing 2-D animation with video.

**Arts 5640. Time Arts: Advanced 3-D Animation.** (4 cr [max 12 cr]. Prereq–3604 or #)  
Advanced exploration of modeled objects in modeled space and time. Compositing of animated images with video images. Individual projects, expansion of personal voice and visual clarity within the framework of 3-D imagery and time-based artwork.

**Arts 5710. Advanced Photography.** (4 cr [max 12 cr]. Prereq–two semesters 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]. Prereq–[3801, 3802, 3810] or #)  
Critical discourse of aesthetics. History of, contemporary issues in clay and criticism. Independent, advanced projects.

**Arts 5821. Ceramic Materials Analysis.** (4 cr. Prereq–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]. Prereq–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]. Prereq–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]. Prereq–major, #)  
Independent study project designed by student in consultation with instructor.

**Arts 8100. Drawing and Painting: Theory and Practice.** (3 cr [max 12 cr]. Prereq–Art MFA 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. Prereq–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 8410. Studio Critique.** (3 cr [max 6 cr]; A-F only. Prereq–8400)  
Studio based critique to foster critical dialogue about art practice across media/disciplines. Colloquium for ideas/theories that migrate between artistic practices and influence studio work.

**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]. Prereq–Art MFA 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. §CNES 5103. Prereq–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. §CNES 5108. Prereq–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. §CNES 5111. Prereq–Jr or sr or grad student, 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. Prereq—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 5112. Archaic and Classical Greek Art.** (3 cr. Prereq—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 Periclean Athens.
- Arth 5120. Field Research in Archaeology.** (3-6 cr [max 6 cr]. §Arth 5120, CLCV 5120, CNES 5120. Prereq—#)  
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. §CNES 5172. Prereq—One 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. §CNES 5182. Prereq—One 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. Prereq—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.** (4 cr. §CNES 5252. Prereq—One 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 5301. The Visual Culture of the Atlantic World.** (3 cr; A-F only. Prereq—Grad student or #)  
Visual culture of Atlantic world, from Columbus to American Revolution. Visual objects, practices considered in context of Europe's colonization of the Americas. Slavery, religious conflict, international commerce, and production of scientific knowledge addressed in terms of their impact upon visual imagery.
- Arth 5302. Print Culture in Early Modern Europe.** (3 cr; A-F only)  
Cultural history of printed images in Europe from their emergence in 15th century through about 1750. Book illustration, reproductive printmaking. History of print connoisseurship. Prints and scientific knowledge. Role of print culture in major social/political events such as Protestant Reformation.
- Arth 5324. 15th-Century Painting in Northern Europe.** (3 cr. Prereq—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 5340. Practicum in Archaeological Field and Computer Techniques.** (3 cr. §Arth 3340, CiCv 3340, CNES 3340, CNES 5340. Prereq—One course in ancient art/archaeology or #)  
Methods for excavation of Old/New World sites. Meets at archaeometry/computer lab for part of semester and at selected site in Minnesota for day-long sessions for 9 to 10 weeks.
- Arth 5411. Gender and Sexuality in Art Since 1863.** (3 cr)  
History of art from late 19th to early 21st century. How gender/sexuality have been central to that period's artistic production, art criticism, and aesthetic theorization. How gender/sexuality are important themes for artists. How the writing of history reveals assumptions about gender/sex. Critical reading/writing.
- Arth 5413. Alternative Media: Video, Performance, Digital Art.** (3 cr; A-F only. Prereq—3464 or #)  
In-depth examination of development of alternative media in 20th/21st century art. Video technologies. Performance, time based art. Digital art.
- Arth 5417. Twentieth Century Theory and Criticism.** (3 cr. Prereq—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 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 5466. Contemporary Art.** (3 cr. Prereq—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 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 5655. African American Cinema.** (3 cr. §Afro 5655)  
African American cinematic achievements, from silent films of Oscar Micheaux through contemporary Hollywood and independent films. Class screenings, critical readings.
- 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 BCE to 300 CE.** (3 cr)  
Sculpture/architecture, from Indus Valley civilization through Kushana period.
- Arth 5776. Redefining Tradition: Indian Art, 400 to 1300.** (3 cr)  
India's art/architecture, from earliest free-standing temples through 13th century. Focuses on temples, associated sculpture. Mural painting, beginnings of Islamic architecture in India.
- Arth 5777. The Diversity of Traditions: Indian Art 1200 to Present.** (3 cr. Prereq—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)  
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.** (3-4 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.** (2-4 cr [max 12 cr])  
Topics specified in *Class Schedule*.
- Arth 5993. Directed Study.** (1-4 cr [max 12 cr]; A-F only. Prereq—#)
- Arth 5994. Directed Research.** (1-4 cr; A-F only. Prereq—#)
- Arth 8001. Art Historiography: Theory and Methods.** (3 cr; A-F only)  
Key texts, from Renaissance to present, from western/non-western fields, relating to history/criticism of both art and visual culture. Focuses on recent critical theory, its re-examination of assumptions underlying the discipline.
- Arth 8200. Seminar: Medieval Art.** (3 cr [max 12 cr])  
Focus on a major art historical theme, artist, period, or genre.

**Arth 8320. Seminar: Issues in Early Modern Visual Culture.** (3 cr; A-F only)  
Issues in visual culture of Europe and the Americas, 1500-1750. Topics vary, may include representation of body, collectors/collecting, impact of Reformation, image/book, art/discovery, early modern vision/visuality.

**Arth 8333. FTE: Master's.** (1 cr. Prereq—Master's student, adviser and DGS consent)

**Arth 8340. Seminar: Baroque Art.** (3 cr [max 12 cr]. Prereq—#)  
Topics vary.

**Arth 8400. Seminar: Issues in 19th-Century Art.** (3 cr [max 12 cr]. Prereq—#)  
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: Contemporary Art.** (3 cr [max 12 cr]; A-F only. Prereq—#)  
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. Prereq—Doctoral student, adviser and DGS consent)

**Arth 8520. Seminar: American Art and Material Culture.** (3 cr [max 12 cr]. \$AmSt 8520. Prereq—#)  
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]. Prereq—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]. Prereq—#)  
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]. Prereq—#)  
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]. Prereq—3 cr art history, #)  
Selected problems and issues in history of South Asian art. Topic varies by offering.

**Arth 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—Max 18 cr per semester or summer; 24 cr required)

**Arth 8920. Seminar: Film History and Criticism.** (3 cr [max 12 cr]. Prereq—#)  
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]. Prereq—3 cr art history, #)  
Theoretical or topical issues; topic varies.

**Arth 8970. Directed Studies.** (1-3 cr [max 12 cr]. Prereq—#)

## Asian Languages and Literatures (ALL)

*Department of Asian Languages and Literatures  
College of Liberal Arts*

**ALL 5343. Lovers, Clowns, and Acrobats: An Introduction to Chinese Drama.** (4 cr)  
Traditional Chinese drama/theater. Students read/discuss major masterpieces of Chinese drama in English translation. Major secondary scholarship. Theatrical practices of modern opera (especially Beijing opera) through in-class viewings. Focuses on representation of gender/romance.

**ALL 5357. Chinese Cinematic Realisms.** (4 cr)  
Various styles of realism in Chinese cinemas (mainland, Taiwan) from silent era to present. Theories of realism, conceptions of “the Real” applied in close readings of major films, placed in historical context. China’s negotiation of modernity during 20th century.

**ALL 5374. Representing the Past: Chinese Myth, Legend, and Ideology.** (4 cr)  
Analysis of texts that contain early Chinese myths, legends, and historical narratives in their construction of an understandable world. How such materials have been incorporated into different cultural formations from later periods, including contemporary popular culture. How they have figured into the construction of China and Chineseness in 20th Century.

**ALL 5433. Women’s Writing in Premodern Japan in Translation.** (4 cr; A-F only)  
Genji monogatari, a lengthy narrative, Makura no soshi, a collection of vignettes, and poetry. Gendered writing system/authorship, narrative techniques. Sexuality/figure of author. Strategies of fictionality.

**ALL 5436. 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.

**ALL 5466. Japanese Popular Culture in a Global Context.** (4 cr)  
What happens when one nation’s popular culture begins to permeate others. Japanimation, manga, fashion, and music. Relationship of popular culture to nation(alism), ethnicity, gender, and identity. Effects of popular culture on consumers, socialization. Ways that consumption affects us personally.

**ALL 5476. Japanese Minority Literatures.** (4 cr; A-F only. Prereq—One 3xxx course in modern [Meiji or later] Japanese literature)  
Fiction/poetry by Okinawans, zainichi (Japanese of Korean descent) writers, and authors from outcaste burakumin. Interrogation of “minority literature” as theoretical construct. Alteration of what constitutes “Japanese literature.” Relationships between a group’s historical experiences and literary representation.

**ALL 5477. Kurosawa, Masculinity, and Cold War.** (4 cr. Prereq—Advanced undergrad or grad student)  
Akira Kurosawa’s work as a film director. Emphasizes revising dominant interpretations of Japanese film/masculinity in context of pre-WWII Japanese and Cold War Japanese-U.S. situation. Politics of culture, class, social agency, and gender coding.

**ALL 5636. South Asian Women Writers.** (4 cr; A-F only. Prereq—Grad student or advanced undergrad)  
Survey of South Asian women’s writing, from early years of nationalist movement to present. Contemporary writing includes works by immigrant writers. Concerns, arguments, and nuances in works of women writing in South Asia and diaspora.

**ALL 5900. Topics in Asian Literature.** (1-4 cr [max 16 cr])  
Topics specified in *Class Schedule*.

**ALL 5920. Topics in Asian Culture.** (1-4 cr [max 16 cr])  
Topics specified in *Class Schedule*.

**ALL 5990. Directed Study.** (1-4 cr [max 16 cr]. Prereq—#, Δ, □)  
Individual reading/study, with guidance of a faculty member, on topics not covered in regular courses.

## Astronomy (Ast)

*Department of Astronomy  
Institute of Technology*

**Ast 5012. The Interstellar Medium.** (4 cr. Prereq—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. \$Phys 5022. Prereq—[2001, Phys 2601] or #)  
Large-scale structure/history of universe. Introduction to Newtonian/relativistic world models. Physics of early universe, cosmological tests, formation of galaxies.

**Ast 5201. Methods of Experimental Astrophysics.** (4 cr. Prereq—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. Prereq—#)  
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. Prereq—#)  
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. Prereq—#)  
Stellar structure, evolution, and star formation. Emphasizes contemporary research.

**Ast 8031. Astrophysical Fluid Dynamics.** (4 cr. Prereq—#)  
Contemporary topics. Numerical techniques for modeling astrophysical fluids and plasmas. Supernovae shocks, convection, astrophysical jets, and cloud dynamics.

**Ast 8041. Comparative Planetology.** (4 cr. Prereq—#)  
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. Prereq—#)  
Content, structure, evolution, and dynamics of Milky Way Galaxy. Emphasizes recent observations from space-/ground-based telescopes.

**Ast 8061. Radio Astronomy.** (4 cr. Prereq—#)  
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. Prereq—#)  
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. Prereq—#)  
Role of gravity in cosmology. Background, recent research advances.

**Ast 8110. Topics in Astrophysics.** (2-4 cr [max 4 cr]. Prereq—#)

**Ast 8120. Topics in Astrophysics.** (2-4 cr [max 4 cr]. Prereq—#)

**Ast 8200. Astrophysics Seminar.** (1-3 cr [max 3 cr]. Prereq—#)

**Ast 8333. FTE: Master's.** (1 cr. Prereq—Master's student, adviser and DGS consent)

**Ast 8444. FTE: Doctoral.** (1 cr. Prereq—Doctoral student, adviser and DGS consent)

**Ast 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq—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]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**Ast 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—Max 18 cr per semester or summer; 24 cr required)

**Ast 8990. Research in Astronomy and Astrophysics.** (1-4 cr [max 4 cr]. Prereq—#)  
Research under supervision of a graduate faculty member.

## Bio-based Products (BP)

### College of Natural Resources

**BP 5001. Chemistry of Plant Materials.** (4 cr; A-F only. \$BP 4001. Prereq—Grad student or #)  
Chemical principles underlying structure, properties, processing, and performance of plant materials.

**BP 5002. Fundamentals of Bio-renewable Resources.** (3 cr; A-F only. Prereq—Grad student or sr who has undergrad training in engineering or physical or biological science or degrees in agriculture or economics)  
Science/engineering of converting bio-renewable resources into bioenergy and biobased products. Defining resource base. Physical/chemical properties of bio-renewable resources. Biobased products. Methods of production for bio-renew resources. Processing technologies for fuels, chemicals, fibers, and energy. Environmental impacts. Economics of biobased products and bioenergy.

**BP 5102. Residential Indoor Air Quality.** (3 cr; A-F only. \$BP 3102. Prereq—Grad student or #)  
Indoor air pollution issues found in residential structures, especially in the north central region of the United States. Pollutant descriptions, including measurement techniques and typical ranges of concentrations. Health effects. Pathways, transport mechanisms. Control strategies including mitigation and prevention.

**BP 5301. Surface and Colloid Science in Bio-based Products Manufacturing.** (3 cr. \$BP 4301. Prereq—Grad student or #)  
Principles of surface and colloid science, their application to manufacturing/performance of bio-based products.

**BP 5302. Organisms Impacting Bio-based Products.** (3 cr. \$BP 4302. Prereq—Grad student or #)  
Organisms and their importance to bio-based products: deterioration, control, bioprocesses for benefit.

**BP 5303. Bio-Based Materials Science.** (3 cr. \$BP 4303. Prereq—Grad student or #)  
Basic principles of materials science, their application to bio-based materials.

**BP 5305. Pulp and Paper Technology.** (3 cr. \$BP 4305W. Prereq—Grad student or #)  
Pulping processes, fiber refining/processing, paper manufacturing, fiber/paper properties, paper recycling. Water requirements, effluent treatment. Chemical/mechanical pulping, pulp preparation, secondary fiber, de-inking, wet end additives. Lab problems/exercises supplemented by lectures. Online course.

**BP 5313. Pulp and Paper Unit Operations.** (4 cr. \$BP 4313. Prereq—Grad student or #)  
Application of principles of momentum, heat, and mass transfer to unit operations in pulp/paper industry. Fluid transport, filtration, sheet formation, sedimentation, drainage, pressing, heat exchange, evaporation, washing, bleaching, humidification/drying, chemical/energy recovery. Computer simulation of multiple-stage systems. Online course.

**BP 5314. Papermaking Processes and Process Engineering Laboratory.** (3 cr. \$BP 4314. Prereq—Grad student or #)  
Theory/practice of design/operation of paper machines and associated finishing/converting equipment. Experiments illustrate/apply principles of momentum, heat, and mass transfer. Operation/performance optimization of pilot-plant paper machine. Process engineering studies of industrial production systems. Online course.

**BP 5320. Applied Statistics for Process Industries: Measurement, Analysis, and Control.** (3 cr. \$BP 4320. Prereq—Grad student or #)

Presented through the Internet. Basic concepts and most frequently used methods in statistical process control, analysis of variances, experiment design, and regression analysis. Online course.

**BP 5362. Pulping and Bleaching.** (4 cr. \$BP 4362W. Prereq—Grad student or #)  
Chemistry/technologies in producing paper-making raw material. Focuses on wood pulping/bleaching, including non-wood fibers and recycled fiber materials. Online course.

**BP 5401. Bio-based Products Engineering.** (4 cr; A-F only. \$BP 4401. Prereq—Grad student or #)  
Unit operations of bio-based products engineering/manufacture.

**BP 5402. Bio-based Products Engineering Lab I.** (1 cr; A-F only. \$BP 4402. Prereq—Grad student or #)  
Laboratory exercises in bio-based products engineering.

**BP 5403. Bio-based Products Engineering Lab II.** (1 cr; A-F only. \$BP 4403. Prereq—Grad student or #)  
Laboratory exercises in bio-based products engineering.

**BP 5404. Bio-based Composites Engineering.** (3 cr; A-F only. \$BP 4404. Prereq—Grad student or #)  
Properties of bio-based composites.

**BP 5405. Process Control and Simulation.** (3 cr. \$BP 4405. Prereq—Grad student or #)  
Fundamental principles in system dynamics/control. Emphasizes process systems and problems faced by process engineers.

**BP 5412. Manufacturing and Applications of Bio-based Products.** (4 cr. \$BP 4412W. Prereq—Grad student or #)  
Manufacturing processes, end-use applications of bio-based products.

**BP 5413. A Systems Approach to Residential Construction.** (3 cr. \$BP 4413. Prereq—Grad student or #)  
Dynamic/interrelated issues of energy, moisture control, indoor air quality in residential bldgs. Emphasizes design, construction, and operational aspects to provide an energy efficient, durable structure, and healthy living environment. Interaction between moisture and wood products within building system.

**BP 5414. Advanced Residential Building Science.** (3 cr. \$BP 4414. Prereq—Grad student or #)  
Building science theory, advanced applications for residential buildings. Focuses on heat/mass transfer.

**BP 5415. Advanced Residential Building Science Lab.** (1 cr; A-F only. \$BP 4415, BP 4416, BP 5416. Prereq—Grad student or #)  
Concurrent with 4334. Exercises on advanced applications of heat/mass transfer to predict performance of residential buildings.

**BP 5416. Building Testing & Diagnostics.** (2 cr. \$BP 4415, BP 4416, BP 5415. Prereq—Grad student or #)  
Theoretical basis for performance testing. Diagnostics applications for residential structures. Focuses on existing structures and retrofit/remedial applications. Digital differential pressure gauges, blower doors, airflow hoods/grids, duct pressure testing, infrared thermography. Hands-on sessions for equipment use, problem solving.

**BP 5503. Marketing of Bio-based Products.** (4 cr; A-F only. \$BP 3503. Prereq—Grad student or #)  
Introduction to marketing function as it relates to current/emerging bio-based products industries (building materials, paper, fuels, etc.). Product positioning, pricing, promotion, and channel management within strategic planning and environmental marketing management.

**BP 5504. Bio-based Products Development and Management.** (3 cr; A-F only. \$BP 4504W. Prereq—Grad student or #)

Concepts of new product development and product management and their application to bio-based products.

**BP 8300. Research Problems.** (1-10 cr [max 10 cr]. Prereq—#)  
Independent research under faculty guidance.

**BP 8303. Advanced Topics in Panel Products Technology.** (2 cr. Prereq—4307)  
Particle/fiber processing, additives, press cycle, design of panels for specific end uses.

**BP 8304. Advanced Topics in Wood Drying.** (2 cr. Prereq—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.

**BP 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.

**BP 8307. Advances and Methods in Forest Products Pathology and Preservation.** (2 cr. Prereq—4303)  
Principles of wood protection, methods of evaluating preservatives. Emphasizes international developments.

**BP 8311. Mechanics of Wood and Wood Composites.** (2 cr. Prereq—#)  
Advanced topics on behavior of wood composites.

## Biochemistry (BioC)

### Department of Biochemistry, Molecular Biology, and Biophysics

### College of Biological Sciences

**BioC 5001. Biochemistry, Molecular and Cellular Biology.** (5 cr. \$BioC 6001. Prereq—undergrad course in biochemistry, #)  
Integrated course in biochemistry, molecular biology, cell biology, and developmental biology.

**BioC 5309. Biocatalysis and Biodegradation.** (3 cr. \$MicE 5309. Prereq—chemistry through organic chemistry, knowledge of wordprocessing, e-mail, access to World Wide Web, access to college-level science library)  
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. Microbial Biochemistry and Biotechnology: Proteins.** (3 cr; A-F only. \$MicB 5352. Prereq—[[3021 or 4331 or Biol 3021 or MicB 4111], [Biol 3301 or MicB 3301]] or #)  
Protein biotechnology. Microorganisms used as hosts for protein expression, protein expression, and engineering methods. Production of enzymes of industrial interest. Applications of protein biotechnology in bioelectronics. Formulation of therapeutic biopharmaceuticals.

**BioC 5353. Microbial Biochemistry and Biotechnology: Small Molecules.** (3 cr; A-F only. Prereq—[[3021 or 4331 or Biol 3021 or MicB 4111], [Biol 3301 or MicB 3301]] or #)  
Small molecule biotechnology. Screening strategies for drug discovery. Secondary metabolite and antibiotic biosynthesis. Combinatorial methods for generating new pharmaceutically active natural products. Production of organic acids and vitamins. Introduction to metabolic engineering.

**BioC 5361. Microbial Genomics and Bioinformatics.** (3 cr. Prereq—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 5401. Advanced Metabolism and Its Regulation.** (3 cr. Prereq–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. §Phsl 5444. Prereq–Biol/BioC 3021 or 4331 or Phsl 3061 or #)  
Muscle structure/function: molecular mechanism by which force is generated.

**BioC 5527. Introduction to Modern Structural Biology.** (4 cr. Prereq–[intro biochemistry, intro physics] or physical chemistry or #)  
Methods employed in modern structural biology to elucidate macromolecular structures. Primary focus on X-ray diffraction, nuclear magnetic resonance (NMR) spectroscopy and mass spectrometry. Principles underlying structural biology and structure/function relationships.

**BioC 5528. Spectroscopy and Kinetics.** (4 cr. Prereq–Intro physical chemistry or equiv; intro biochemistry recommended)  
Biochemical dynamics from perspectives of kinetics and spectroscopy. Influence of structure, molecular interactions, and chemical transformations on biochemical reactions. Focuses on computational, spectroscopic, and physical methods. Steady-state and transient kinetics. Optical and magnetic resonance spectroscopies.

**BioC 5531. Macromolecular Crystallography I: Fundamentals and Techniques.** (1 cr; S-N only. Prereq–[[One organic chemistry or biochemistry course], [two calculus or college physics courses]] or instr approval)  
Macromolecular crystallography for protein structure determination/engineering. Determining macromolecule structure by diffraction.

**BioC 5532. Macromolecular Crystallography II: Techniques and Applications.** (1 cr; S-N only. Prereq–5531)  
Determining structure of macromolecule by diffraction. Using software in macromolecular crystallography.

**BioC 8002. Molecular Biology and Regulation of Biological Processes.** (4 cr [max 5 cr]. Prereq–BMBB or MCDB&G grad student 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 8084. Research and Literature Reports.** (1 cr [max 5 cr]; S-N only. Prereq–Grad BMBB major or #)  
Current developments.

**BioC 8184. Graduate Seminar.** (1 cr [max 5 cr]; S-N only. Prereq–grad BMBB major or DGS consent)  
Reports on recent developments in the field and on research projects in the department.

**BioC 8213. Selected Topics in Molecular Biology.** (4 cr. §GCD 8213. Prereq–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. Prereq–8002 or #)  
Cell signaling, metabolic regulation in development. Prokaryotic/eukaryotic systems used as models for discussion. Literature-based course.

**BioC 8290. Current Research Techniques.** (1-3 cr [max 9 cr]; S-N only. Prereq–Grad BMBB major)  
Research project carried out in laboratory of a staff member.

**BioC 8333. FTE: Master's.** (1 cr. Prereq–Master's student, adviser and DGS consent)

**BioC 8401. Ethics, Public Policy, and Careers in Molecular and Cellular Biology.** (1 cr [max 2 cr]; S-N only. Prereq–Grad student [in BMBB or MCDB&G])  
Ethics of scientific investigation from viewpoint of western scientific enterprise. Relationship between science, culture, and public policies. Careers in molecular/cellular biology. Nontraditional career tracks. Invited speakers, case studies, small-group discussions, lectures.

**BioC 8444. FTE: Doctoral.** (1 cr. Prereq–Doctoral student, adviser and DGS consent)

**BioC 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq–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]. Prereq–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**BioC 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq–Max 18 cr per semester or summer; 24 cr required)

## Bioinformatics (Binf)

*Department of Laboratory Medicine and Pathology*

*Medical School*

**Binf 5480. Bioinformatics Journal Club.** (1 cr [max 12 cr]; S-N only)  
Bioinformatics Journal Club

**Binf 5490. Topics in Bioinformatics.** (1-6 cr [max 12 cr]. Prereq–#)  
Independent or group study in bioinformatics.

## Biology (Biol)

*College of Biological Sciences*

*College of Biological Sciences*

**Biol 5407. Ecology.** (3 cr. §Biol 3407, Biol 3807, EEB 3001. Prereq–[[1001 or 1009 or equiv], [Math 1142 or Math 1271 or equiv], grad] or inst consent)  
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. §Biol 3409. Prereq–[[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 5511. Teaching the Biological Sciences.** (3 cr; A-F only. Prereq–6 cr in the life sciences)  
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]. Prereq–BA or BS in science or science education or elementary education 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. Prereq–[[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 (BME)

*Biomedical Engineering Institute of Technology*

**BME 5001. Advanced Biomaterials.** (3 cr; A-F only. Prereq–3301 or MatS 3011 or grad student or #)  
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.

**BME 5041. Tissue Engineering.** (3 cr. Prereq–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.

**BME 5101. Advanced Bioelectricity and Instrumentation.** (3 cr. Prereq–[[IT upper div, grad student] or #)  
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.

**BME 5102. Bioelectric Measurements and Therapeutic Devices II.** (3 cr. Prereq–5101 or #)  
Theory/application of electrical stimulation in areas of therapeutic/functional neuromuscular stimulation and pain control, cardiac pacing, defibrillation, tissue healing, and electrotherapy. Safety of electric fields. Electrical tissue impedance measurements.

**BME 5151. Biomedical MEMS.** (4 cr; A-F only. Prereq–Analog circuit principles, basic electromagnetic theory)  
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.

**BME 5201. Advanced Biomechanics.** (3 cr. Prereq–[[3001 or equiv], [IT upper div or grad student]] 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.

**BME 5212. Tissue Mechanics.** (2 cr; A-F only. Prereq–5201 or AEM 5501)  
Fundamental principles of continuum mechanics applied to physiological systems. Systematic consideration of individual tissues and organs. Relationships among histology, anatomy, physiology, and mechanical function in these tissues. Changes in mechanical properties related to pathology. Emphasizes tissues in the cardiovascular system.



**BMEEn 5311. Advanced Biomedical Transport Processes.** (3-4 cr [max 4 cr]. §ChEn 5753, ME 5381. Prereq—IT upper div or grad student or #; [ChEn 5103 or ME 5342] recommended) 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.

**BMEEn 5351. Cell Engineering.** (3 cr. Prereq—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.

**BMEEn 5371. Biomedical Applications of Heat Transfer in Humans.** (3-4 cr [max 4 cr]. Prereq—Phsl 3061, Phsl 3071, Phsl 5061)

Overview of physiology underlying thermoregulation in humans, clinical applications of heat transfer in humans, framework for design project.

**BMEEn 5401. Advanced Functional Biomedical Imaging.** (3 cr; A-F only. Prereq—IT upper div or grad student or #) Functional biomedical imaging modalities. Principles/applications of representative functional imaging technologies that offer high spatial resolution or temporal resolution. Emphasizes principles and methodological foundations of bioelectromagnetic imaging and magnetic resonance imaging. Other functional biomedical imaging modalities.

**BMEEn 5444. Muscle.** (3 cr)  
Muscle structure/function: molecular mechanism by which force is generated.

**BMEEn 5501. Biology for Biomedical Engineers.** (3-4 cr [max 4 cr]. Prereq—Engineering upper div or grad student) Concepts of cell/tissue structure/function. Basic principles of cell biology. Tissue engineering, artificial organs.

**BMEEn 5502. Pathobiology of Medical Devices.** (3 cr; A-F only. Prereq—IT upper division or grad student)  
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.

**BMEEn 5910. Special Topics in Biomedical Engineering.** (1-4 cr [max 4 cr])

**BMEEn 5920. Special Topics in Biomedical Engineering.** (2-4 cr [max 4 cr])

**BMEEn 8333. FTE: Master's.** (1 cr. Prereq—Master's student, adviser and DGS consent)

**BMEEn 8401. New Product Design and Business Development.** (4 cr; A-F only. §Entr 6041, Entr 6087, ME 8221, OMS 6061. Prereq—[IT grad student or CSOM grad student], some design experience; 8401, 8402 must be taken same yr) 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.

**BMEEn 8402. New Product Design and Business Development.** (4 cr; A-F only. §ME 8222. Prereq—§ME 8222; 8401)  
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.

**BMEEn 8444. FTE: Doctoral.** (1 cr. Prereq—Doctoral student, adviser and DGS consent)

**BMEEn 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.

**BMEEn 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.

**BMEEn 8630. Biomedical Engineering Graduate Student Seminar.** (1 cr [max 3 cr]; S-N only. Prereq—Grad BMEEn major)  
Student presentations of current thesis research or other areas of biomedical engineering.

**BMEEn 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq—Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

**BMEEn 8710. Directed Research.** (1-3 cr [max 3 cr])

**BMEEn 8720. Internship in Biomedical Engineering.** (3 cr; S-N only. Prereq—Grad BMEEn major)  
Supervised lab or industrial experience unrelated to student's normal academic or employment experience.

**BMEEn 8777. Thesis Credits: Master's.** (1-18 cr [max 50 cr]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**BMEEn 8820. Plan B Project.** (3 cr. Prereq—BMEEn MS student)  
Project chosen by student and adviser to satisfy M.S. Plan B project requirement. Written report required.

**BMEEn 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—Max 18 cr per semester or summer; 24 cr required)

**BMEEn 8900. Special Topics in Biomedical Engineering.** (1-4 cr; A-F only)  
Topics in biomedical engineering.

**BMEEn 8910. Independent Study.** (1-3 cr [max 3 cr]. Prereq—Grad BMEEn 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)

### Medical School

**BMSc 8444. FTE: Doctoral.** (1 cr. Prereq—Doctoral student, adviser and DGS consent)

**BMSc 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq—Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

**BMSc 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—Max 18 cr per semester or summer; 24 cr required)

**BMSc 8990. Research: Biomedical Sciences.** (1-7 cr [max 42 cr]; S-N only. Prereq—Enrollment in MD/PhD program)  
Content determined by interest of student in consultation with staff.

## Biophysical Sciences (BPhy)

### School of Physics and Astronomy

### Institute of Technology and Medical School

**BPhy 5138. Research Seminar.** (1-5 cr [max 5 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. §TRad 7170. Prereq—#)

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. §TRad 7171. Prereq—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. §TRad 7172. Prereq—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. §TRad 7173. Prereq—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. §TRad 7174. Prereq—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. Prereq—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. Prereq—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]. Prereq—#)  
Individualized study under faculty direction.

**BPhy 8294. Directed Research in Biophysical Sciences and Medical Physics.** (1-12 cr [max 12 cr]. Prereq—#)  
Individualized research under faculty direction.

**BPhy 8333. FTE: Master's.** (1 cr. Prereq—Master's student, adviser and DGS consent)

**BPhy 8444. FTE: Doctoral.** (1 cr. Prereq—Doctoral student, adviser and DGS consent)

**BPhy 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq—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]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**BPhy 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—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 [max 5 cr]. Prereq-#) Advanced individual-study project. Application of engineering principles to specific problem.

**BAE 5203. Environmental Impacts of Food Production.** (3 cr. \$AgET 5203. Prereq-intended for non-engineering students) Crop production intensity, animal raising options, food processing waste alternatives, pest control.

**BAE 5212. Safety and Environmental Health Issues in Plant and Animal Production and Processing.** (3 cr; A-F only. \$AgET 5212. Prereq-grad student or sr or #) Safety/health issues in food production, processing and horticultural work environments using public health, injury control, and health promotion frameworks: regulation, engineering, education. Traumatic injury, occupational illness, ergonomics, pesticide health effects, biotechnology, air contaminants.

**BAE 5513. Watershed Engineering.** (3 cr. Prereq-3023, upper div IV) 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; S-N only. Prereq-#) 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]; S-N only. Prereq-8001 or #8001 or equiv) Organization/critique of seminars on new developments in biosystems and agricultural engineering.

**BAE 8003. Research Seminar II.** (1 cr [max 2 cr]; S-N only. Prereq-8002 or equiv) Moderate and critique seminars in biosystems and agricultural engineering.

**BAE 8005. Supervised Classroom or Extension Teaching Experience.** (2 cr; S-N only. \$Agro 8005, Hort 8005, PIPa 8005, Soil 8005. Prereq-#) 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; A-F only. Prereq-Stat 3021 or equiv, computer programming course) 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 [max 6 cr]. Prereq-5095)

**BAE 8303. Machinery Modeling.** (3 cr. Prereq-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. Prereq-Master's student, adviser and DGS consent)

**BAE 8444. FTE: Doctoral.** (1 cr. Prereq-Doctoral student, adviser and DGS consent)

**BAE 8513. Hydrologic Modeling of Small Watersheds.** (3 cr. Prereq-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; A-F only. Prereq-[CSci 5301 or equiv], [[Math 5512, Math 5513] or equiv], [Soil 5232 or equiv], computer programming) Mathematical study of coupled heat, moisture, and chemical transport in porous media. Derivation of governing equations for coupled heat, moisture, and chemical transport. Derivation of numerical solution techniques to solve coupled equations. Comparison of numerical solutions to analytical solutions.

**BAE 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq-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. Prereq-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]. Prereq-Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**BAE 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq-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. Prereq-Doctoral student, adviser and DGS consent)

**BA 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq-Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

**BA 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq-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 Computer Applications.** (3 cr) Instructional uses of computers and representative business/marketing education applications, including word processing, databases, spreadsheets, and graphics.

**BIE 5012. Advanced Word Processing.** (3 cr. Prereq-5011 or equiv) Develop/apply solution methods for office problems using word processing software including advanced editing, printing, and desktop publishing capabilities.

**BIE 5013. Spreadsheet Analysis Using Computers.** (3 cr. Prereq-5011 or equiv) Using spreadsheets to analyze data, monitor business records, and create models.

**BIE 5014. Database Computer Applications.** (3 cr. Prereq-5011 or equiv) Business needs for computerized databases. Using database software to develop, maintain, and prepare reports.

**BIE 5015. Integrated Computer Applications in Business and Marketing Education.** (3 cr. Prereq-[5011, 5012, 5013, 5014] or equiv) Realistic business computer problems requiring integration of two or more application packages. Pedagogical issues of learning/teaching advanced computer applications.

**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; A-F only. Prereq-3111, 3112, 3121, 3122) 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. Prereq-#) Students select/study technical processes/principles based on subjects they plan to teach, integrate specialized technical instruction in advanced/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; A-F only. Prereq-3112) 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 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 and Marketing Concepts.** (3 cr; A-F only) Recent research/developments in teaching business concepts related to economics, business organization/management, business law, entrepreneurship, marketing, international business, information systems, accounting, risk management, and personal finance.

**BIE 5457. Methods of Teaching Business Employment and Marketing Employment.** (3 cr; A-F only) Recent research/developments in teaching for business employment. Administrative support positions, accounting/information processing, marketing, sales, computer operations, 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.** (3 cr; A-F only)

Introduction to conceptual models for design/delivery of business/marketing education programs in secondary/postsecondary schools, in adult education settings, and in business/industry. Preparing programs of instruction for secondary/postsecondary level. Making decisions regarding course content.

**BIE 5596. Occupational Experience in Business and Industry.** (1-10 cr [max 10 cr]; S-N only. Prereq-#)

Observation/employment in business/industry to develop technical/occupational competencies. Includes 100 clock hours of supervised work experience per credit.

**BIE 5597. Internship: Business and Industry Education.** (1-8 cr [max 12 cr]; S-N only. Prereq-#)

Practical experience in business or industry as a professional educator or supervisor. Requires an integrative paper.

**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. \$HRD 5624)

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. \$HRD 5625)

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. \$HRD 5626)

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. \$HRD 5627)

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. \$HRD 5628. Prereq-5011 or equiv)

Designing, creating, and presenting information using multimedia resources in business settings.

**BIE 5662. Computer Training in School and Industry Settings.** (3 cr. \$HRD 5662. Prereq-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 5801. The Business of Tourism.** (3 cr; A-F only)

Introduction to major theories, concepts, skills, and techniques influencing tourism business/industry.

**BIE 5802. Education and Human Resource Development Through Tourism.** (3 cr; A-F only)

Policies/practices of education and human resource development in tourism industry.

**BIE 5803. Tourism Studies Capstone Seminar.** (3 cr; S-N only. Prereq-Tourism studies major)

Students present, critique, and discuss implications of supporting programs for tourism.

**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]; S-N only. Prereq-Adviser approval)

Individual research in business and industry education.

## 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]. Prereq-Jr or sr or grad student or #)

Research/practice on therapies, delivery of complementary therapies, regulatory issues.

**CSpH 5101. Introduction to Complementary Healing Practices.** (3 cr. Prereq-Jr or sr or grad student or #)

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 5102. Art of Healing: Self as Healer.** (1 cr. Prereq-Jr or sr or grad student or #)

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 5111. Ways of Thinking about Health.** (2 cr. Prereq-Jr or sr or grad student or #)

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 5115. Cultural Knowledge, Health, and Contemporary Cultural Communities.** (3 cr. Prereq-Jr or sr or grad student or #)

How personal cultural experience affects one's view of health, illness, and healing and one's professional practice. Wisdom of cultural communities. Cultural construct underpinning the medical system. Role of culture in interaction between practitioner and patient. Reconnecting to cultural heritage in healing.

**CSpH 5201. Spirituality and Resilience.** (2 cr. Prereq-Jr or sr or grad student or #)

Links between resilience and spirituality. Applications of resilience/health realization model to students' personal/professional lives. Review of literature, theory, and research.

**CSpH 5211. Peacemaking and Spirituality: A Journey Toward Healing and Strength.** (2-3 cr [max 3 cr]; A-F only. Prereq-Jr or sr or grad student or #)

Influence of spirituality upon process of resolving conflict and making peace in intense interpersonal/intrapersonal conflicts in multiple health care and social work settings, including in families, between patients/clients and nurses/social workers, within communities, among friends, between co-workers, or within ourselves.

**CSpH 5215. Forgiveness and Healing: A Journey Toward Wholeness.** (2 cr. Prereq-Jr or sr or grad student or #)

Impact of forgiveness on process of inter-/intra-personal healing. Forgiveness/healing in health care and social work settings from multiple spiritual/secular traditions.

**CSpH 5221. Significant Spiritual Texts of the 20th Century.** (3 cr. Prereq-Jr or sr or grad student or #)

Diverse "spiritual classics" (i.e., elements of western canon that have proven over time to be resources of values). Resources of meaning for inner-life healers. How to establish a personal library for life-long journey of spiritual development.

**CSpH 5225. Meditation: Integrating Body and Mind.** (2 cr. Prereq-Jr or sr or grad student or #)

Meditation as a physical, emotional, intellectual, and spiritual inquiry. Students examine a variety of texts and develop ability to enter a state of calm, meditative awareness.

**CSpH 5226. Advanced Meditation: Body, Brain, Mind, and Universe.** (1 cr. Prereq-[5225, [Jr or sr or grad student]] or #)

Students work to integrate meditation practice into daily life, cultivating awareness of the fundamental oneness of body, brain, mind, and universe. Mind-body interactions in health. "Hard problem" of consciousness in brain science. Emergence of compassion, wisdom, and healing in non-discursive awareness.

**CSpH 5301. Cultures, Faith Traditions, and Health Care.** (2 cr; A-F only. Prereq-Jr or sr or grad student or #)

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 5311. Introduction to Traditional Chinese Medicine.** (2 cr; A-F only. Prereq-Jr or sr or grad student or #)

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 5315. Traditional Tibetan Medicine: Ethics, Spirituality, and Healing.** (2 cr. Prereq-Jr or sr or grad student or #)

Ethics, spirituality, and healing from perspective of traditional Tibetan medicine. Belief that illness results from imbalance and that treating illness requires correcting underlying imbalance. How to apply these principles, integrate them into clinical practice, and consult with a traditional Tibetan doctor.

**CSpH 5317. Yoga: Ethics, Spirituality, and Healing.** (2 cr. Prereq-[5101, 5315] or #)

Ethics, spirituality, and healing from perspective of yoga, an ancient Indian discipline. Students test the claim that systematic yoga practice leads to optimal health. Evaluating yoga's philosophy, scientific evidence, practical application. Students propose research-based programs for integrating yoga into personal/professional life.

**CSPH 5321. Public Health Priorities in the Developing World.** (2 cr. §INMD 7567. Prereq—Jr or sr or grad student or #) 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 5325. Latinos: Culture and Health.** (3 cr. Prereq—Jr or sr or grad student or #) How Latino world view (cosmovision) affects health and compares with U.S. perspective. Differences in perception of time, family involvement, community “belonging,” gender roles, and communication styles. Folkloric beliefs. Specific issues such as AIDS, pregnancy, women’s issues, pharmacy, and nutrition. Health issues of workers. Cultural competency.

**CSPH 5331. Foundations of Shamanism and Shamanic Healing.** (2 cr; S-N only. Prereq—Jr or sr or grad student or #) 3.5-day retreat intensive. Shamanic philosophies, ritual etiquette. Core beliefs common to all shamanic healing practices. Cross-cultural healing beliefs/practices, unique psychology for understanding them, their use with contemporary healing practices and for personal growth.

**CSPH 5332. Global Healing Traditions: Amazonia Plant Spirit Medicine.** (2 cr; S-N only. Prereq—[5331, [grad student or jr or sr in health science or practicing health professional]] or #) Non-biomedical traditional healing paradigms as practiced in other parts of the world. Focuses on indigenous healing practices in Peru as directed by a local shaman.

**CSPH 5401. People, Plants, and Drugs: Introduction to Ethnopharmacology.** (3 cr. Prereq—Jr or sr or grad student or #) Biologically active substances used in traditional cultures. Ethnopharmacology’s past, current, and potential contributions to human knowledge. Concrete examples.

**CSPH 5405. Plants in Human Affairs.** (4 cr. Prereq—Jr or sr or grad student or #) Twelve-day, intensive course. Introduction to ethnobotany/ethnopharmacology. Lectures, field trips, presentations by local experts.

**CSPH 5411. Dietary Supplements: Regulatory, Scientific, and Cultural Perspectives.** (3 cr. Prereq—Jr or sr or grad student or #) 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 5421. Botanical Medicines in Complementary Healthcare.** (3 cr. Prereq—Jr or sr or grad student or #) Widely-used botanical medicines from biomedical perspective. Alternative therapeutic systems presented according to bodily systems/processes. Evidence for therapeutic use. Botanical characteristics, traditional uses, chemical properties, dosage, hazards/safety issues, quality control.

**CSPH 5431. Functional Nutrition: An Expanded View of Nutrition, Chronic Disease, and Optimal Health.** (2 cr. Prereq—[Jr or sr or grad student] in Health Sciences or #) Principles of nutrition related to metabolic function. Model attempts to reduce chronic disease by looking for underlying causes/triggers and to intervene to restore function and achieve optimal health. Emphasizes importance of nutrition as a component of self-care.

**CSPH 5501. Therapeutic Use of Plant Essential Oils.** (3 cr. Prereq—Jr or sr or grad student or #; intended for students in health sciences or practicing health professionals; [basic science, health science knowledge, computer skills, internet skills] recommended) Fundamentals of essential oil therapy for licensed health professionals. History, scientific basis, practice issues, use of 30 essential oils in clinical practice. Controlled use of essential plant oils for specific, measurable physiological/psychological therapeutic outcomes. Topical application, inhalation.

**CSPH 5511. Interdisciplinary Palliative Care: An Experiential Course in a Community Setting.** (2 cr) Multidisciplinary student teams partner with interdisciplinary community hospice teams in delivery of care to patients in a variety of settings. Series of seminars employs self-analysis/case studies.

**CSPH 5521. Therapeutic Landscapes.** (3 cr. Prereq—[Jr or sr or grad student] in [health sciences or therapeutic recreation or horticulture or landscape architecture] or health professional or #) Principles of therapeutic design for specific population requirements. Therapeutic landscape design. Incorporates interdisciplinary interaction between horticulture, landscape architecture, and health science departments.

**CSPH 5522. Therapeutic Horticulture.** (3 cr. Prereq—5101 or Hort 5072 or #) Central elements of therapeutic horticulture in context of multiple health care settings. Evidence-based history, principles, precepts, and practical application of therapeutic horticulture. Various plant/plant-related modalities from current research findings are related to populations, using therapeutic horticulture as a treatment intervention.

**CSPH 5523. Applications in Therapeutic Horticulture.** (2 cr. Prereq—CSPH 5521 or CSPH 5522) How to develop comprehensive program plans in therapeutic horticulture. Evidence-based principles, facilitation techniques in therapeutic horticulture. Systematic programming through documentation, assessment, program development techniques, and evaluation. Leadership training, program plan components, book reviews, reading assignments, comprehensive exam.

**CSPH 5533. Introduction to Energy Healing.** (2 cr. Prereq—Jr or sr or grad student or #) Healing techniques (Therapeutic Touch, Reiki, acupuncture, reflexology, magnets, homeopathy) that use energetic systems in the body to enhance the body’s ability to heal. Scientific theories. Students interact with practitioners and have the opportunity to experience feeling “energy.”

**CSPH 5535. Reiki Healing.** (1 cr; S-N only. Prereq—Jr or sr or grad student or #) History, principles, precepts, and practical application of Reiki energy healing. Alternative energy healing modalities, current research findings. Activation of the Reiki energy, hand positions to perform a treatment. Students provide Reiki treatments, discuss findings.

**CSPH 5536. Advanced Reiki Healing: Level II.** (1 cr. Prereq—5535) Principles/application of Reiki energy healing. Four levels of healing. Emphasizes healing at spiritual level. Activation of Reiki energy. Symbols that allow for energy transfer through space/time. Using second level Reiki energy for both distance healing and standard Reiki treatment. Students provide Reiki treatments, discuss findings. Current literature, research findings.

**CSPH 5541. Integrative Psychotherapy.** (3 cr. Prereq—5102, [grad student or #]) In depth, experiential-based training. Support for students to practice integrative psychotherapy, mindfulness meditation, and related mind/body approaches to clinical work. Multiple client/patient populations, issues, and settings.

**CSPH 5545. Mind-Body Healing Therapies.** (2 cr; A-F only. Prereq—Grad student or jr or sr or #) Philosophies/paradigms. Four modalities commonly used in allopathic nursing, medicine and other health professions (biofeedback, hypnosis, imagery/visualization, meditation). Experiential and group discussion format.

**CSPH 5555. Introduction to Body and Movement-based Therapies.** (2 cr. Prereq—Jr or sr or grad student or #) Theories/approaches of selected somatic therapies, including dance, movement, and body-based therapies. Historic/theoretical perspectives on use of movement, dance, and somatic re-patterning. Demonstrations of techniques. Application of techniques to specific populations/settings.

**CSPH 5601. Music, Health and Healing.** (2 cr. Prereq—Jr or sr or grad student or #) Music therapy, music medicine, music psychotherapy. Techniques/interventions. Hypotheses/rationale related to interventions. Related research.

**CSPH 5611. Healthy Humor.** (1 cr. Prereq—Jr or sr or grad student or #) Use of humor to enhance communication, treatment, and relationships with patients. How to create a positive work environment and outlook. Physiologic effects/benefits of humor/laughter. Humor and spirituality. Connection between positive outlook and health.

**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 8101. Critiquing and Synthesizing Complementary and Alternative Medicine (CAM) Research.** (1 cr) Seminar. Students critically evaluate peer-reviewed literature in CAM research. Emphasizes identifying strengths/weaknesses of published research and synthesizing findings from multiple studies.

**CSPH 8191. Independent Study in Complementary Therapies and Healing Practices.** (1-6 cr. Prereq—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. §MELC 5311. Prereq—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. §CAS 3526, MELC 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. §CAS 3532, MELC 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. Persian Fiction in Translation.** (3 cr. §CAS 3601, MELC 3601, MELC 5601. Prereq-§: 3601, MELC 5601) Impact of westernization on Iran, from 1920s to present. Materials produced by Iranian writers, film makers, and intellectuals. Internal/external forces that bind contemporary Iranian society to world civilization. Works of Hedayat (especially *Blind Owl*), Chubak, Al-i Ahmad, Daneshvar, and Behrangi are analyzed/interpreted.

**CAS 5602. Persian Poetry in Translation.** (3 cr. §CAS 3602, MELC 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 [max 10 cr]. Prereq-#, □)

## Chemical Engineering (ChEn)

*Department of Chemical Engineering and Materials Science*

*Institute of Technology*

**ChEn 5104. Coating Process Fundamentals.** (2 cr; A-F only. Prereq-4003, 4102, #)

Viscous flow and rheology of polymer solutions and particulate suspensions. Capillarity, wetting. Electrostatic effects. Phase change, colloidal transformations, mass/heat transfer in drying. Kinetics in curing. Stress and property development in solidifying polymeric coatings. Illustrations drawn from theoretical modeling, flow visualization, and stopped-process microscopy.

**ChEn 5221. Introduction to Polymer Chemistry.** (3 cr; A-F only. §Chem 5221, Chem 8221, MatS 5221, MatS 8221. Prereq-[Chem 2302, Chem 3501] or #)

Condensation, radical, ionic, emulsion, ring-opening, metal-catalyzed polymerizations. Chain conformation, solution thermodynamics, molecular weight characterization, physical properties.

**ChEn 5531. Electrochemical Engineering.** (3 cr. §MatS 5531. Prereq-[MatS 3011 or #], [upper div IT or grad student])

Fundamentals of electrochemical engineering. Electrochemical mass transfer electrokinetics, thermodynamics of electrochemical cells, modern sensors. Formation of thin films and microstructured materials. Computer-based problems.

**ChEn 5595. Special Topics.** (1-4 cr [max 4 cr])  
New or experimental special topics.

**ChEn 5751. Biochemical Engineering.** (3 cr; A-F only. Prereq-4002, ¶4003, ¶4102)

Chemical engineering principles applied to analysis/design of complex cellular/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; A-F only. §ChEn 8752. Prereq-Engineering background, #)

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 Transport Processes.** (4 cr; A-F only. §BMEn 5311, ME 5381. Prereq-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; A-F only. Prereq-4002)

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; A-F only. Prereq-4002)

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; A-F only. Prereq-Physical chemistry)

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; A-F only. Prereq-Chemical engineering grad student or #)

Equations of change of mass, momentum, angular momentum. Kinematics of deformation, convective transport. Applications to fluid statics/dynamics of Newtonian fluids. Examples of exact solutions of Navier-Stokes equations, useful simplifications.

**ChEn 8102. Principles and Applications of Rheology.** (2 cr; A-F only. Prereq-8101)

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; A-F only. §ChEn 5103, MatS 8219. Prereq-Chemical engineering grad student or #)

Geometry/topology of porous materials. Fundamentals of flow, transport, and deformation. One-/two-phase Darcy flows, convective dispersion in microporous materials. Relations of macroscopic properties/behavior to underlying microscopic structures/mechanisms. Nanoporous materials.

**ChEn 8104. Coating Process Fundamentals.** (2 cr; A-F only. Prereq-Chemical engineering grad major or #)

Process functions. Viscous flow and rheology of polymer solutions and particulate suspensions. Capillarity, wetting. Electrostatic effects. Phase change, colloidal transformations, mass/heat transfer in drying. Kinetics in curing. Stress and property development in solidifying polymeric coatings. Illustrations drawn from theoretical modeling, flow visualization, and stopped-process microscopy.

**ChEn 8115. Electron Microscopy of Soft Matter.** (2 cr; A-F only. Prereq-Chemical engineering or materials science/engineering grad major or #)

Operation principles of transmission electron microscope (TEM) and scanning electron microscope (SEM). How these instruments are applied in study of soft materials (e.g., liquid, semi-liquid material systems). Unique specimen preparation techniques, low image contrast, electron-beam radiation-damage, and limited signal-to-noise ratio. TEM/SEM digital imaging.

**ChEn 8201. Applied Mathematics I: Linear Analysis.** (3 cr; A-F only. §ChEn 4701. Prereq-Chemical engineering grad student or #)

Integrated approach to solving linear mathematical problems. Linear algebraic equations. Linear ordinary and partial differential equations using theoretical/numerical analysis based on linear operator theory.

**ChEn 8202. Applied Mathematics II: Nonlinear Analysis.** (2 cr; A-F only. Prereq-[Grad-level course in linear analysis, chemical engineering grad major] or #)

Nonlinear mathematical problems. Nonlinear ordinary and partial differential equations using theoretical/numerical analysis.

**ChEn 8301. Physical Rate Processes I: Transport.** (3 cr; 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/predictions. Mass transfer coupled with chemical reaction.

**ChEn 8302. Physical Rate Processes II: Mass Transfer.** (3 cr; A-F only. Prereq-Chemical engineering grad student or #)

Applications of mass transfer. Membranes, including gas separation and reverse osmosis. Controlled drug release. Dispersion, including examples of pollution modeling. Adsorption/chromatography. Coupled heat/mass transfer, including cooling towers. Double-diffusive effects.

**ChEn 8333. FTE: Master's.** (1 cr. Prereq-Master's student, adviser and DGS consent)

**ChEn 8401. Physical and Chemical Thermodynamics.**

(3 cr; A-F only. Prereq-[Undergraduate [engineering course or chemistry course in thermodynamics], Chemical engineering grad student] or #)

Principles of classical thermodynamics. Introduction to nonequilibrium thermodynamics, with applications in chemical engineering and materials science.

**ChEn 8402. Statistical Thermodynamics and Kinetics.** (3 cr; A-F only. Prereq-Chemical engineering grad student or #)

Introduction to statistical mechanical description of equilibrium and non-equilibrium properties of matter. Emphasizes fluids, classical statistical mechanics.

**ChEn 8444. FTE: Doctoral.** (1 cr. Prereq-Doctoral student, adviser and DGS consent)

**ChEn 8501. Chemical Rate Processes: Analysis of Chemical Reactors.** (3 cr; A-F only. Prereq-[Course in chemical reactor engineering, chemical engineering grad student] or #)

Design of reactors for heat management and with catalytic processes. Steady state and transient behavior. Polymerization, combustion, solids processing, and environmental modeling. Design of multiphase reactors.

**ChEn 8502. Process Control.** (3 cr; A-F only. Prereq-Chemical Engineering grad major or #)

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; A-F only. Prereq-Chemical engineering grad student or #)

Description/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]. Prereq-Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

**ChEn 8752. Quantitative Biology for Engineers.** (3 cr; A-F only. §ChEn 5752. Prereq-Chemical engineering grad student or #)

Structural basis of biological systems. Communication between cells and environment. Gene expression. Proteins, their functional classes. Metabolic pathways, their reactions. From gene/genome to physiology. Biological fundamentals of biotechnology. Genomics/proteomics as technologies. Biotechnology and society: ethics, law, public policy. Biotechnology-based commercial enterprises. Readings, two reports, final presentation.

**ChEn 8777. Thesis Credits: Master's.** (1-18 cr [max 50 cr]. Prereq-Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**ChEn 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq-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: Finite Element Methods of Computer-aided Analysis.** (1 cr; A-F only. Prereq—Chemical engineering grad student or #)

Fundamentals of finite element method as applied mathematics. How to construct finite element codes and put them into operation.

**ChEn 8993. Directed Study.** (1-12 cr [max 12 cr])**ChEn 8994. Directed Research.** (1-12 cr [max 12 cr])**ChEn 8995. Special Topics.** (1-4 cr [max 4 cr])

New or experimental courses offered by department or visiting faculty.

## Chemical Physics (ChPh)

**Institute of Technology**

**ChPh 8333. FTE: Master's.** (1 cr. Prereq—Master's student, adviser and DGS consent)

**ChPh 8444. FTE: Doctoral.** (1 cr. Prereq—Doctoral student, adviser and DGS consent)

**ChPh 8602. Chemical Physics Seminar.** (1 cr. Prereq—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]. Prereq—Max 18 cr per semester or summer; doctoral student who has not passed prefinal oral)

**ChPh 8777. Thesis Credits: Master's.** (1-18 cr [max 50 cr]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**ChPh 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—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. Prereq—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. Prereq—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.** (3 cr [max 4 cr]. §Chem 8201. Prereq—[[3502 or equiv], 4701] 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; A-F only.

Prereq—Grad student or #)

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.** (3 cr [max 4 cr]. §Chem 8221, ChEn 5221, MatS 5221, MatS 8221. Prereq—[2302, 3501] or #)

Condensation, radical, ionic, emulsion, ring-opening, metal-catalyzed polymerizations. Chain conformation, solution thermodynamics, molecular weight characterization, physical properties.

**Chem 5223. Polymer Laboratory.** (2 cr. §MatS 5223W.

Prereq—§MatS 5223; 5221 or 8221 or ChEn 4214 or #)

Synthesis, characterization, and physical properties of polymers. Free radical, condensation, emulsion, anionic polymerization. Infrared spectroscopy/gel permeation chromatography. Viscoelasticity, rubber elasticity, crystallization.

**Chem 5245. Introduction to Drug Design.** (3 cr; A-F only.

§MEDC 5245, Phar 6245. Prereq—2302 or equiv)

Concepts that govern design/discovery of drugs. Physical, bioorganic, medicinal chemical principles applied to explain rational design and mechanism of action drugs.

**Chem 5311. Chemistry of Industry.** (3 cr [max 4 cr].

Prereq—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. Prereq—[2302 or equiv], #)

Fundamental concepts, reactions, reagents, structural/stereochemical issues, and mechanistic skills for organic chemistry.

**Chem 5322. Advanced Organic Chemistry.** (3 cr. Prereq—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. Prereq—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.

Prereq—2302 or equiv)

Application of nuclear magnetic resonance, mass, ultraviolet, and infrared spectral analyses to organic structural problems.

**Chem 5412. Chemical Biology of Enzymes.** (3 cr.

Prereq—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. Prereq—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 5541. Dynamics.** (3 cr. §Chem 8541. Prereq—Undergrad physical chem course, #)

Hamilton's/Lagrange's equations of motion. Normal modes and molecular rotation. Langevin equation and Brownian motion. Time correlation functions, collision theory, cross-sections, energy transfer. Molecular forces and potential energy surfaces. Classical electrostatics.

**Chem 5551. Quantum Mechanics I.** (3 cr. §Chem 8551.

Prereq—Undergrad physical chem course, #)

Review of classical mechanics. Postulates of quantum mechanics, with applications to determination of single particle bound state energies and scattering cross-sections in central field potentials. Density operator formalism, with applications to description of two-level systems, two-particle systems, entanglement, and Bell inequality.

**Chem 5715. Physical Inorganic Chemistry.** (3 cr. Prereq—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. Prereq—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. Prereq—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.

Prereq—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; A-F only.

Prereq—Chem grad student or #)

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. Data collection, correction/refinement, structure solutions, generation of publication materials, use of Cambridge Crystallographic Structure Database.

**Chem 8011. Mechanisms of Chemical Reactions.** (4 cr.

Prereq—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. Prereq—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 8025. Introduction to Graduate Research.** (1-2 cr [max 2 cr]; S-N only. Prereq—Grad student in chem)

New areas of chemistry, hands-on exposure to graduate research. Students rotate through up to two different labs for seven weeks. Labs are run by chemistry graduate faculty members.

**Chem 8066. Professional Conduct of Chemical Research.**

(1 cr; S-N only. Prereq—Chem grad student)

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 [max 4 cr]; A-F only. Prereq—Grad chem major)

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 [max 4 cr]; A-F only. Prereq-Grad chem major)  
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. Analytical Separations and Chemical Equilibria.** (4 cr. Prereq-#)  
Advanced treatment of principles of analytical chemistry, chemical equilibria, and dynamics. Chromatographic and other modern analytical scale separation techniques. Emphasizes column dynamics and retention mechanisms.
- Chem 8152. Analytical Spectroscopy.** (4 cr. Prereq-Grad chem major or #)  
Survey of analytical spectroscopic methods. Design/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. Extracting Signal From Noise.** (5 cr; A-F only. Prereq-[4101 or equiv], differential equations course)  
Use of analog/digital electronics and computational methods in experiments. Passive circuits, operational amplifiers, filters, oscillators and Laplace transform techniques in analysis, domain conversion for data acquisition/control, statistics, experimental design. Introduction to chemometrics, Fourier analysis, convolution/deconvolution, curve fitting.
- Chem 8155. Advanced Electroanalytical Chemistry.** (2 cr. Prereq-8151)  
Polarography, galvanostatic and potentiostatic methodology, coulometry, linear scan and cyclic voltammetry and pulse methods.
- Chem 8157. Bioanalytical Chemistry.** (4 cr; A-F only)  
Theory and practical aspects of analytical methods used in determination/characterization of biologically important materials. Enzymatic/kinetic methods in study of proteins, carbohydrates, lipids, and nucleic acids.
- Chem 8159. Nuclear Magnetic Resonance Spectroscopy.** (4 cr. Prereq-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 [max 4 cr]. Prereq-Grad chem major or #)  
Topics (and availability) vary by year depending on instructor and development of the field.
- Chem 8201. Materials Chemistry.** (4 cr; A-F only. §Chem 5201. Prereq-[4701, 3502] 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 8211. Physical Chemistry of Polymers.** (3 cr [max 4 cr]. §MatS 8211. Prereq-undergrad physical chem course)  
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 8221. Introduction to Polymer Chemistry.** (4 cr. §Chem 5221, ChEn 5221, MatS 5221, MatS 8221. Prereq-[2302, 3501] or #)  
Condensation, radical, ionic, emulsion, ring-opening, metal-catalyzed polymerizations. Chain conformation, solution thermodynamics, molecular weight characterization, physical properties.
- Chem 8280. Special Topics in Materials Chemistry.** (2-4 cr [max 4 cr]. Prereq-Grad chem major or #)  
Topics (and availability) vary by year depending on instructor and development of the field.
- Chem 8321. Organic Synthesis.** (4 cr. Prereq-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. Prereq-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. Prereq-Master's student, adviser and DGS consent)
- Chem 8352. Physical Organic Chemistry.** (4 cr. Prereq-5011 or 8011 or 2302 or equiv)  
Fundamental concepts and mechanistic tools for understanding/analyzing organic reaction mechanisms. Solvation, reactive intermediates, gas phase chemistry, photochemistry, strained-ring chemistry.
- Chem 8361. Interpretation of Organic Spectra.** (4 cr. Prereq-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 [max 4 cr]. Prereq-Grad chem major or #)  
Topics (and availability) vary by year depending on instructor and development of the field.
- Chem 8411. Introduction to Chemical Biology.** (4 cr. Prereq-2302 or equiv)  
Chemistry of amino acids, peptides, proteins, lipids, carbohydrates, and nucleic acids. Structure, nomenclature, synthesis, and reactivity. Overview of techniques used to characterize these biomolecules.
- Chem 8412. Chemical Biology of Enzymes.** (4 cr. Prereq-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. Prereq-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. Prereq-Doctoral student, adviser and DGS consent)
- Chem 8480. Special Topics in Biological Chemistry.** (2-4 cr [max 4 cr]. Prereq-Grad chem major or #)  
Topics (and availability) vary by year depending on instructor and development of the field.
- Chem 8541. Dynamics.** (4 cr. §Chem 5541. Prereq-Undergrad physical chem course)  
Hamilton's/Lagrange's equations of motion. Normal modes and molecular rotation. Langevin equation and Brownian motion. Time correlation functions, collision theory, cross-sections, energy transfer. Molecular forces and potential energy surfaces. Classical electrostatics.
- Chem 8551. Quantum Mechanics I.** (4 cr. §Chem 5551. Prereq-Undergrad physical chem course)  
Review of classical mechanics. Postulates of quantum mechanics with applications to determination of single particle bound state energies and scattering cross-sections in central field potentials. Density operator formalism with applications to description of two level systems, two particle systems, entanglement, and Bell inequality.
- Chem 8552. Quantum Mechanics II.** (4 cr. Prereq-8551)  
Rotational/point-group symmetries. Perturbation, variation, semi-classical approximation. Hamiltonian of charged particles in electromagnetic fields (Landau levels, Aharonov-Bohm effect, atomic hyperfine interactions). Time-dependent perturbation (radiative, non-radiative transitions). Quantization of electromagnetic field and multiphoton processes. Identical particles. Hartree-Fock, density-functional, and second-quantization.
- Chem 8561. Thermodynamics, Statistical Mechanics, and Reaction Dynamics I.** (4 cr. Prereq-undergrad physical chem course)  
Two-part sequence. Thermodynamics, equilibrium statistical mechanics, ensemble theory, partition functions. Applications, including ideal gases/crystals. Theories of simple liquids, Monte Carlo, and molecular dynamics simulations. Reaction dynamics from microscopic viewpoint.
- Chem 8562. Thermodynamics, Statistical Mechanics, and Reaction Dynamics II.** (4 cr. Prereq-8561)  
Two-part sequence. Thermodynamics, equilibrium statistical mechanics, ensemble theory, partition functions. Applications, including ideal gases/crystals. Theories of simple liquids, Monte Carlo, and molecular dynamics simulations. Reaction dynamics from microscopic viewpoint.
- Chem 8580. Special Topics in Physical Chemistry.** (2-4 cr [max 4 cr]. Prereq-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; S-N only. Prereq-Grad chem major or #)  
Weekly seminar series on modern chemical topics.
- Chem 8602. Seminar Presentation: Modern Problems in Chemistry.** (1 cr; A-F only. Prereq-Grad chem major or #)  
Weekly seminar series on modern chemical topics presented by students.
- Chem 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq-Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)
- Chem 8700. Advanced Concepts in Medicinal Chemistry: Combinatorial Methods in Chemical Biology.** (2 cr; A-F only. §MedC 8700, Phar 6247H. Prereq-[2302 or equiv], [BioC 4331 or equiv])  
Principles of current combinatorial methods for generation of biological/chemical libraries. Emphasizes utility in biology and in drug design. Material is drawn from primary literature.
- Chem 8715. Physical Inorganic Chemistry.** (4 cr. Prereq-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. Prereq-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. Prereq-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. Prereq-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]. Prereq-Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**Chem 8780. Special Topics in Inorganic Chemistry.** (2-4 cr [max 4 cr]. Prereq—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 [max 4 cr]. Prereq—Grad chem major or #)  
Topics (and availability) vary depending on instructor and development of the field.

**Chem 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—Max 18 cr per semester or summer; 24 cr required)

## Chicano Studies (Chic)

*Department of Chicano Studies*

### College of Liberal Arts

**Chic 5920. Topics in Chicana(o) Studies.** (3 cr. Prereq—Sr or grad student)  
Multidisciplinary themes in Chicano studies. Issues of current interest.

**Chic 5993. Directed Studies.** (1-3 cr [max 16 cr]. Prereq—#)  
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 5623. Assessment and Treatment Interventions: 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; S-N only. Prereq—Upper div)  
Clinical characteristics of anorexia, bulimia nervosa in children/adolescents. Etiological factors, multidimensional treatment approaches.

**CAPy 5627. Workshop: Disruptive Behavioral Disorders II.** (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; S-N only. Prereq—Upper div)  
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 retraining, 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 & Treatment of Children With Psychiatric Problems.** (1 cr)

**CAPy 5644. Workshop: Child Abuse/Neglect and Childhood Psychopathology: Implications for Assessment/Treatment.** (1 cr)

Types of abuse/neglect. Effects of abuse on children's psychological development. Child, parent/family, and social factors that place children at risk for abuse/neglect. Assessment/intervention approaches for working with abused children and their families.

**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)

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; A-F only. Prereq—#)

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: Perspectives on Diagnosis, Assessment, and Developmental Course.** (1 cr. §CAPy 5620, CAPy 5669. Prereq—Upper div)

ADHD, from its earliest presentation to its later adult manifestations. Clinical depression, diagnostic criteria. Disorders that commonly coexist with ADHD. Standard assessment procedures for making a diagnosis. Developmental changes in clinical procedures.

**CAPy 5661. Aggression, Disruption, and Oppositional Behavior in Children and Adolescents.** (1 cr)

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. Prevention of Violence and Antisocial Behavior in Children and Adolescents: Concepts, Principles.** (1 cr. §CAPy 5670)

Description/epidemiology of antisocial behavior in children/adolescents. Developmental theories of antisocial behavior. Application of principles/methods of prevention science.

**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; S-N only. Prereq—Upper div)  
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/Family/Contextually-Focused Interventions: Aggression/Misconduct in Children/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. Reducing barriers, making interventions culturally compatible.

**CAPy 5669. Attention Deficit Hyperactivity Disorder Throughout the Life Span: Current Perspectives on Treatment.** (1 cr. §CAPy 5620, CAPy 5660)

Standard medication, psychosocial, and educational interventions. Recent advances in long-acting stimulant medications. Setting up behavioral programs in home/school. Educational accommodations in school. Coaching. Cognitive-behavioral/neurofeedback therapies.

**CAPy 5670. Preventing Violence and Antisocial Behavior in Children and Adolescents: Interventions, Practices.** (1 cr. §CAPy 5662. Prereq—Community and school-based intervention programs aimed at the prevention of antisocial behavior are reviewed and evaluated)

Community-/school-based intervention programs aimed at preventing antisocial behavior.

## Child Psychology (CPsy)

*Institute of Child Development*

### College of Education and Human Development

**CPsy 5413. Early Childhood and Public Policy.** (3 cr)  
State, federal, and international policies and legislative activity touching first five years of a child's life. Family, community, and institutional roles in promoting children's social, cognitive, and emotional development. Issues related to health, mental health, poverty, developmental delays, and special needs.

**CPsy 5414. Individualized Learning Experience in Early Childhood and Public Policy.** (1-3 cr [max 3 cr]. Prereq—Early Childhood Policy Certificate student, #)

Individualized, applied learning experience. Focuses on early childhood policy development, research, or evaluation. Students attend an early childhood policy lecture series and participate in small discussion groups and follow-up activities.



**CPsy 8301. Developmental Psychology: Cognitive Processes.** (4 cr. Prereq–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. Prereq–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. Prereq–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; S-N only. Prereq–CPsy doctoral student or #) 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 [max 2 cr]. Prereq–CPsy doctoral student or #) Problems/issues in teaching introductory child psychology.

**CPsy 8333. FTE: Master's.** (1 cr. Prereq–Master's student, adviser and DGS consent)

**CPsy 8360. Seminar: Developmental Psychology.** (1-3 cr [max 21 cr]. Prereq–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. Prereq–Doctoral student, adviser and DGS consent)

**CPsy 8606. Advanced Developmental Psychopathology.** (3 cr. Prereq–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]. Prereq–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]. Prereq–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**CPsy 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq–Max 18 cr per semester or summer; 24 cr required)

**CPsy 8980. Research Seminar in Child Psychology.** (1-3 cr [max 15 cr]. Prereq–Doctoral student) Participation in organized research group in developmental psychology.

**CPsy 8993. Directed Study in Child Psychology.** (1-4 cr [max 4 cr]. Prereq–Doctoral student or #)

**CPsy 8994. Research Problems in Child Psychology.** (1-6 cr [max 15 cr]. Prereq–Doctoral student or #) Individual empirical investigation.

**CPsy 8996. Directed Field Experiences in Child Psychology.** (1-6 cr [max 6 cr]; S-N only. Prereq–Doctoral student, #) 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. Prereq–3032 or 3112) Introduction to the sources and approaches of research in language and literature.

**Chn 5015. Chinese Philosophical/Historical Texts.** (4 cr. Prereq–3112) Readings from major texts in Chinese philosophical and historical traditions.

**Chn 5018. Chinese Religious Texts.** (4 cr. Prereq–3112) Traditional Chinese religious systems through selected texts.

**Chn 5040. Readings in Chinese Texts.** (2-4 cr [max 12 cr]; A-F only. Prereq–3032 or equiv or #) Students read authentic materials of various types to increase reading/speaking ability. Topics specified in *Class Schedule*.

**Chn 5120. Topics in Chinese Linguistics.** (4 cr [max 8 cr]. Prereq–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]. Prereq–3032) Studies of representative literary works from May 4, 1919 to the present.

**Chn 5240. Topics in Chinese Poetry.** (4 cr [max 8 cr]. Prereq–3112) Selected major Chinese poets and poetic forms.

**Chn 5242. 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]. Prereq–3032 or 3112) Studies of traditional and modern Chinese fiction.

**Chn 5260. Topics in Premodern Chinese Prose.** (4 cr [max 8 cr]) Studies of representative Chinese prose writings of the pre-modern period.

**Chn 5393. Directed Study.** (1-5 cr [max 18 cr]. Prereq–#, □) Guided individual reading or study.

**Chn 8320. Seminar in Chinese Linguistics.** (4 cr. Prereq–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. Prereq–Master's student, adviser and DGS consent)

**Chn 8430. Seminar in 20th-Century Chinese Literature.** (4 cr. Prereq–#) 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. Prereq–#) 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. Prereq–Doctoral student, adviser and DGS consent)

**Chn 8450. Seminar in Chinese Fiction and Narrative Theory.** (4 cr; A-F only. Prereq–5105 or equiv or #) 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]) Individual study/research with guidance of a faculty member.

**Chn 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq–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]. Prereq–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**Chn 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq–Max 18 cr per semester or summer; 24 cr required)

## Civil Engineering (CE)

*Department of Civil Engineering*

*Institute of Technology*

**CE 5094. Civil Engineering Research.** (1-4 cr [max 4 cr]. Prereq–#) Research or independent study in concrete, structural steel, soils, hydraulics, hydrology/municipal, environmental, or transportation problems. Investigations, reports, tests, designs.

**CE 5170. Internet Based Study.** (1-5 cr [max 15 cr]; A-F only. Prereq–Upper div IT) Internet based teaching with bi-weekly exercises on topic of concern.

**CE 5180. Special Topics.** (1-4 cr [max 4 cr]; A-F only. Prereq–#) Topics vary depending on faculty and student interests.

**CE 5211. Traffic Engineering.** (3 cr. Prereq–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. Transportation Policy, Planning, and Deployment.** (3 cr. Prereq–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. Prereq–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. Prereq–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. Prereq–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. Prereq–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; A-F only. \$GeoE 5311. Prereq–Upper div IT or grad, 4301, GeoE 4301 or #) 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; A-F only. \$GeoE 5321. Prereq—Upper div IT or grad, 4301 or GeoE 4301) 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; A-F only. \$GeoE 5331. Prereq—Upper div IT or grad, 4301 or #) Soil and rock response in triaxial testing; drained and undrained behavior; elastic and plastic properties. Modeling stresses, strains, and failure in geomechanics problems.

**CE 5341. Wave Methods for Nondestructive Testing.** (4 cr; A-F only. Prereq—[AEM 2021, AEM 3031] or #) 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 5351. Advanced Mathematics for Civil Engineers.** (3 cr; A-F only. Prereq—[[Math 2263 or Math 2374 or equiv], [sr or grad student] in civil engineering]] or #) Emphasizes skills relevant for civil engineers. Mathematical principles explained in an engineering setting. Applications from various areas in civil engineering.

**CE 5411. Applied Structural Mechanics.** (3 cr; A-F only. Prereq—[Grade of at least C- in 4401, [upper div IT or grad student]] or #) Principal stresses and failure criteria in 3 dimensions. Introduction to plane elasticity, energy methods, torsion of beams, and bending of unsymmetrical beams.

**CE 5412. Prestressed Concrete Design.** (3 cr; A-F only. Prereq—[Grade of at least C- in 4401, [upper div IT or grad student]] or #; 4412 recommended) Design of prestressed concrete structures. Time dependent effects, behavior, flexure, shear, torsion, deflections, continuous systems.

**CE 5413. Masonry Structures.** (3 cr; A-F only. Prereq—[Grade of at least C- in 3401, [upper div IT or grad student]] or #; 4401 recommended) Masonry materials and their production. Mortars, grouts. Design of unreinforced, reinforced, and prestressed masonry structural systems. Walls, columns, lintels, arches. Codes/specifications, testing, inspection.

**CE 5541. Environmental Water Chemistry.** (3 cr [max 4 cr]; A-F only. Prereq—3501, Chem 1021, Chem 1022) 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; A-F only. Prereq—3501, Chem 1021, Chem 1022) 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; A-F only. Prereq—3501, [upper div or grad] student) 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; A-F only. Prereq—upper div IT or grad or #) 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; A-F only. Prereq—8401 or #) 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]. Prereq—#) Research or independent study in concrete, structural steel, soils, hydraulics, hydrology, and municipal, environmental, or transportation problems. Investigations, reports, tests, or designs.

**CE 8200. Seminar: Transportation.** (1 cr [max 3 cr]; S-N only) Content depends on instructor and student. Sample topics: traffic safety, traffic flow theory, transportation materials, transportation planning, transportation economics.

**CE 8211. Theory of Traffic Flow.** (4 cr) Definitions/measurements of basic traffic flow parameters, fundamental relationships. Macroscopic continuum and microscopic traffic flow models. Shockwaves and applications. Flow, speed, headway, and other statistical distributions of traffic parameters. Gap availability/acceptance. Simulation of traffic flow. Traffic control theory, queuing theory, applications.

**CE 8212. Advanced Travel Demand Modeling and Supply Analysis.** (3 cr. Prereq—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 8213. Advanced Transportation Technologies Seminar.** (1 cr; S-N only. \$SME 8772) Advantaged technologies specifically related to transportation. Topics drawn from core science/technology areas of human factors, intelligent vehicles, traffic modeling/management, sensing, communications, and controls.

**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. Prereq—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 8216. Urban Traffic Operations.** (3 cr) Capacity analysis techniques for urban streets, optimal traffic signal timing, coordination, real time control. Traffic signal hardware, including detectors/controllers. Operational techniques for traffic management. Use of computer program packages in traffic engineering practice. Freeway operations/control.

**CE 8231. Advanced Pavement Engineering.** (3 cr. Prereq—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 8233. Advanced Bituminous Materials Characterization.** (3 cr. Prereq—[3402, grad student] or #) Applications of viscoelasticity, rheology, elastoplasticity, and fracture mechanics to bituminous materials characterization. Lectures, discussions of advanced research reading assignments, laboratory assignments.

**CE 8300. Seminar: Geomechanics.** (1-3 cr [max 4 cr]; S-N only. \$GeoE 8300) Presentations on various topics.

**CE 8301. Fracture of Geomaterials.** (3 cr; A-F only. \$GeoE 8301. Prereq—IT grad student, 5321, GeoE 5321 or #) 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; A-F only. \$GeoE 8302. Prereq—IT grad student, CE 4300 or #) 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; A-F only. \$GeoE 8311. Prereq—IT grad student, 4311 or GeoE 4311 or #) 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; A-F only. \$GeoE 8321. Prereq—IT grad student, 5321 or GeoE 5321 or #) 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; A-F only. \$GeoE 8322. Prereq—IT grad student, 4301 or #) 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; A-F only. \$GeoE 8331. Prereq—IT grad student, 5321 or GeoE 5321) 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. Prereq—Master's student, adviser and DGS consent)

**CE 8336. Boundary Element Methods I.** (3 cr; A-F only. \$GeoE 8336. Prereq—IT grad student) 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; A-F only. \$GeoE 8337. Prereq—8336, GeoE 8336 or #) Transient and nonlinear problems.

**CE 8341. Dynamics of Soils and Foundations.** (4 cr; A-F only. Prereq—Basic courses in soil mechanics/dynamics or #) Vibration or single-/multi-degree-of-freedom systems. Dynamic soil properties. Wave propagation in continuous media. Foundation dynamics. Liquefaction. Introduction to seismology/earthquakes.

**CE 8351. Advanced Groundwater Mechanics I.** (3 cr; A-F only. §GeoE 8351. Prereq–4351 or GeoE 4351, IT grad student or #)

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; A-F only. §GeoE 8352. Prereq–4351, IT grad student or #)

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; A-F only. §GeoE 8361. Prereq–IT grad student or #)

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; A-F only. Prereq–4411 or #)

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; A-F only. Prereq–8401 or #; offered alt yrs)

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; A-F only. Prereq–5411 or #; offered alt yrs)

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; A-F only. Prereq–IT grad or #)

Static analysis of thin elastic shells based on Love's postulates. Membrane and bending theories. Thermal stresses in cylinders. Buckling of shells of revolution. Offered alternate years.

**CE 8421. Structural Dynamics.** (3 cr; A-F only. Prereq–[3401, AEM 2012] or #; ¶4411 recommended)

Response of discrete/continuous systems to dynamic loading. Formulation/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; A-F only. Prereq–8421 or #)

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; A-F only. Prereq–IT grad student or #)

Classification of discrete/continuous conservative/nonconservative systems. Buckling analysis of, e.g., structural members, frameworks, and plates by classical/numerical methods. Offered alternate years.

**CE 8432. Analysis of Thin-Walled Members.** (3 cr; A-F only. Prereq–5411 or #; offered alt yrs)

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; A-F only. Prereq–4413 or #; offered alt yrs)

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; A-F only. Prereq–4411, 4413 or #; offered alt yrs)

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. Fatigue and Fracture of Steel Structures.** (3 cr; A-F only. Prereq–4401 or #; offered alternate years)

Fracture mechanics, ductile fracture, ferrous metallurgy, welding, S-N curves of steel structures. Emphasizes design/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. Prereq–Doctoral student, adviser and DGS consent)

**CE 8451. Behavior of Reinforced Concrete Structures.** (3 cr; A-F only. Prereq–4412 or #)

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; A-F only. Prereq–[4412, 4413] or #)

Structural design standards/methods. Uncertainties in structural design. Basic probabilistic concepts, statistical distributions. Resistance/load statistics. First-/second-order reliability methods, systems reliability. Development of probability-based design codes. Offered alternate years.

**CE 8490. Special Topics.** (1-3 cr [max 3 cr]; A-F only. Prereq–#)

Topics vary depending on faculty and student interests.

**CE 8500. Environmental Seminar.** (1 cr [max 3 cr]; S-N only. Prereq–Grad CE major or #)

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; A-F only. Prereq–3502 or equiv or #)

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; A-F only. Prereq–8501 or #)

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; A-F only. Prereq–3502, 3501 or equiv or #)

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; A-F only. Prereq–4541, 4531)

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; A-F only. Prereq–4502, 4501 or #)

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; A-F only. Prereq–Stat 3021 or equiv or #)

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; A-F only. Prereq–8506)

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; A-F only. Prereq–3502 or equiv)

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; A-F only. Prereq–3502 and 4501 or #)

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 8521. The Atmospheric Boundary Layer.** (4 cr; A-F only. Prereq–IT or COAFES grad student or #)

Land-atmosphere interactions and turbulent transport in the atmospheric boundary layer (ABL), the lowest part of the atmosphere. ABL development and dynamics. Turbulence, surface energy balance, spectral analysis, similarity theory. Flow over homogeneous and heterogeneous surfaces. Atmospheric stability, measurement, simulation of turbulent fluxes.

**CE 8541. Aquatic Chemistry.** (3 cr; A-F only. Prereq–4541 or #)

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; A-F only. Prereq-[4541, 5541] or #)  
Structural characteristics and physico-chemical properties of organic contaminants in aquatic systems. Emphasizes PCBs, PAHs, dioxins, insecticides, herbicides, and chlorinated solvents. Factors affecting their transport/transformation. Structure- and property-activity relationships, their use in predicting organic chemical behavior.

**CE 8551. Environmental Microbiology: Molecular Theory and Methods.** (4 cr; 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; A-F only. Prereq-Grad CE major or #, exposure to basic environ engr and microbiol)  
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; A-F only. Prereq-4551 or #)  
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; A-F only. Prereq-One sem grad work or #)  
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/dispersion. Chemical/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]. Prereq-One sem grad work or #)  
Models for transport/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.

**CE 8563. Industrial Waste Treatment.** (3 cr; A-F only. Prereq-3501, 4501, 4502, or equiv or #)  
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; A-F only. Prereq-3502 or #)  
Lab and field methods and instruments for measuring hydraulic pressure, velocity, and discharge.

**CE 8572. Computational Environmental Fluid Dynamics.** (4 cr; A-F only. Prereq-Grad student in IT or COAFES or #)  
Finite difference methods, their application to solution of one-/two-dimensional problems in environmental fluid dynamics. Stability, convergence, consistency, and accuracy of numerical schemes. Navier-Stokes equations, their physical meaning, and their numerical solution. Turbulence modeling: RANS and LES.

**CE 8581. Research and Professional Ethics in Water Resources and Environmental Science.** (.5 cr; S-N only. \$WRS 8581. Prereq-[Environmental engineering or water resource science] grad student or #)  
Ethics of water resources science and environmental engineering research/practice. Societal responsibility, plagiarism, recording-keeping, authorship, confidentiality, conflicts of interest, professional relationships, fraud, reporting misconduct. Meets during first eight weeks of spring semester.

**CE 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq-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]. Prereq-Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**CE 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq-Max 18 cr per semester or summer; 24 cr required)

## Classical and Near Eastern Studies (CNES)

### College of Liberal Arts

**CNES 5013. Introduction to Roman Law.** (3 cr)  
Survey of Roman law from social and historical perspectives. Basic concepts of Roman private law and legal procedure.

**CNES 5051. Before Herodotus: History and Historiography of Mesopotamia and the Ancient Near East.** (3 cr; A-F only. \$Hist 5051. Prereq-Prev coursework in Ancient Near Eastern history recommended)  
Historical method/sources for Ancient Near Eastern history. Seminar. Emphasizes historical tradition and historiographic texts of Mesopotamia and neighboring regions of Ancient Near East. Secondary emphasis on their relationship to the works of classical historians such as Herodotus. Use of these sources in modern historiography of Ancient Near East.

**CNES 5070. Topics in Ancient Religion.** (3 cr [max 18 cr]. \$RelA 5070. Prereq-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*.

**CNES 5071. Greek and Hellenistic Religions.** (3 cr. \$CNES 3071, RelA 3071. Prereq-#)  
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.

**CNES 5072. The New Testament.** (3 cr. \$CNES 3072, RelA 3072, RelA 5072)  
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.

**CNES 5080. New Testament Proseminar.** (3 cr [max 18 cr]. \$RelA 5080. Prereq-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*.

**CNES 5081. Classical Epic in Translation.** (3 cr)  
Homer's Iliad and Odyssey. Virgil's Aeneid. Cultural context of epic. Development of the hero. Epic style. Poetics of epic.

**CNES 5083. Ancient Comedy.** (3 cr)  
Greek/Roman comic drama (e.g., Aristophanes, Menander, Plautus, Terence).

**CNES 5103. Hellenistic and Early Roman Art and Archaeology.** (3 cr. \$Arth 5103. Prereq-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.

**CNES 5108. Greek Architecture.** (3 cr. \$Arth 5108. Prereq-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.

**CNES 5111. Prehistoric Art and Archaeology of Greece.** (3 cr. \$Arth 5111. Prereq-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.

**CNES 5112. Archaic and Classical Greek Art.** (3 cr. Prereq-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.

**CNES 5120. Field Research in Archaeology.** (3-6 cr [max 6 cr]. \$Arth 5120, CLCV 5120. Prereq-#)  
Field excavation, survey, and research at archaeological sites in the Mediterranean area. Techniques of excavation and exploration; interpretation of archaeological materials.

**CNES 5172. House, Villa, Tomb: Roman Art in the Private Sphere.** (3 cr. \$Arth 5172. Prereq-Intro art history course or #)  
Architecture, painting, and sculpture of urban houses, country estates, and tombs in Roman world. Relationships between public/private spheres and literary/physical evidence. Usefulness of physical evidence in illuminating gender roles.

**CNES 5182. Art and the State: Public Art in the Roman Empire.** (3 cr. \$Arth 5182. Prereq-Intro art history course or #)  
eOrigins of Roman public art. Use in maintaining community. Exploitation by first emperor, Augustus. Development/diffusion through later empire. Varying capabilities to adjust to demands of a Christian Empire.

**CNES 5251. Archaeology of Herodian Israel.** (3 cr; A-F only. \$RelA 5251, RelS 5251. Prereq-One course in [archaeology or ancient history] or grad student)  
Archaeological sites in Israel dating to era of Herod the Great (37-4 BC). Palaces and religious edifices. Remains from Jewish/gentile settlements throughout the kingdom. Course readings consist of contemporary literary sources and excavation reports.

**CNES 5252. History of Early Christian Art in Context.** (4 cr. \$Arth 5252. Prereq-3xxx art history course or #)  
Role played by art in formation of early Christian/Byzantine communities and in establishing their relationships with Pagan world and early Islam.

**CNES 5340. Practicum in Archaeological Field and Computer Techniques.** (3 cr. \$Arth 3340, Arth 5340, CLCV 3340, CNES 3340. Prereq-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.

**CNES 5502. Ancient Israel: From Conquest to Exile.** (3 cr. \$CNES 3502, Hist 3502, RelA 3502. Prereq-Knowledge of Hebrew not required; 5501 recommended)  
Israelite history in context of what is known from Egyptian, Canaanite, and Mesopotamian sources. Focuses on issues raised by archaeological data related to Israelite conquest of Canaan.

**CNES 5503. History and Development of Israelite Religion I.** (3 cr. \$ANE 3503, ANE 5503, CNES 3503, RelA 3503, RelA 5503)  
Survey of the evolution of Israelite religion. Cultic practices. Law and religion. Prophecy. Religion and historiography. Relationship to surrounding religious systems.

**CNES 5701. Studies in Semitic Linguistics and Inscriptions.** (3 cr. Prereq–Adv Hebrew or Adv Arabic or #)  
Survey of comparative Semitic linguistics. Emphasizes Northwest Semitic. Reading of Phoenician, Moabite, and Judean inscriptions.

**CNES 5713. Introduction to Ugaritic.** (3 cr. Prereq–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.

**CNES 5794. Introduction to Classical and Near Eastern Studies.** (1 cr; S-N only. Prereq–Grad major or minor or #)  
Introduction to core research materials and reference materials in the various disciplines which make up classical studies.

**CNES 5940. Topics in Classical Literature.** (3 cr [max 9 cr]. Prereq–Two literature courses or #)  
Additional work for graduate credit. Topics specified in *Class Schedule*. Meets with 3940.

**CNES 5950. Aspects of Classical Culture.** (1-3 cr [max 12 cr])  
Topics specified in *Class Schedule*. Meets with 3950.

**CNES 5993. Directed Studies.** (1-4 cr [max 12 cr]. Prereq–#, Δ, □)  
Guided individual reading or study.

**CNES 5994. Directed Research.** (1-12 cr [max 12 cr]. Prereq–#, Δ, □)  
Guided individual research.

**CNES 5996. Directed Instruction.** (1-12 cr [max 12 cr]. Prereq–#, Δ, □)  
Guided individual research.

**CNES 8190. Seminar: Issues in Ancient Art and Archaeology.** (3 cr [max 12 cr]. \$ArH 8190, Clas 8190)  
Selected issues, with special attention to current scholarly disputes. Topics specified in *Class Schedule*.

**CNES 8333. FTE: Master's.** (1 cr. Prereq–Master's student, adviser and DGS consent)

**CNES 8444. FTE: Doctoral.** (1 cr. Prereq–Doctoral student, adviser and DGS consent)

**CNES 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

**CNES 8777. Thesis Credits: Master's.** (1-18 cr [max 50 cr]. Prereq–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**CNES 8888. Thesis Credits: Doctoral.** (1-24 cr [max 100 cr]. Prereq–Max 18 cr per semester or summer; 24 cr required)

**CNES 8950. Topics in Classical & Near Eastern 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; A-F only. \$MedT 4064. Prereq–#)  
Principles of blood grouping, antibody identification, compatibility testing, serology, and immunology.

**CLS 5065. Introduction to Clinical Immunohematology: Laboratory.** (2 cr; A-F only. \$MedT 4065. Prereq–#)  
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 [max 2 cr]; A-F only. \$MedT 4090. Prereq–#)  
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; A-F only. \$MedT 4100. Prereq–Microbiology course with lab, biochem course)  
Lab diagnosis of viral, fungal, and parasitic infections. Lecture.

**CLS 5104. Principles of Diagnostic Microbiology: Lecture.** (2 cr; A-F only. \$MedT 4104. Prereq–One microbiology course with lab, one biochemistry course, #)  
Current techniques used in lab diagnosis of infectious disease. Isolating/identifying bacteria and yeasts. Antimicrobial susceptibility testing. Lecture.

**CLS 5105. Principles of Diagnostic Microbiology: Laboratory.** (2 cr; A-F only. \$MedT 4105. Prereq–One microbiology course with lab, one biochemistry course, #)  
Current techniques used in lab diagnosis of infectious disease. Isolating/identifying bacterial/yeasts. Antimicrobial testing. Laboratory.

**CLS 5120. Seminar: Clinical Laboratory Science.** (1 cr [max 3 cr]; S-N only. Prereq–#)  
Current literature. Presentation/discussion of research.

**CLS 5121. Journal Presentations.** (1 cr [max 2 cr]; S-N only. Prereq–1st yr CLS grad student)  
Critical analysis, evaluation, discussion of current journal articles in student's specialty area.

**CLS 5125. Practicum Teaching.** (1-2 cr [max 2 cr]; A-F only. Prereq–#)  
Supervised teaching experience, develop skills using instructional materials, tests, and measurements.

**CLS 5127. Introduction to Management and Education I.** (1 cr; A-F only. \$MedT 4127W. Prereq–#)

**CLS 5129. Elements of Laboratory Administration.** (2 cr; A-F only. Prereq–#)  
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; A-F only. Prereq–#)  
Supervised experience and assignment of specific problems related to lab service and management in health care institutions.

**CLS 5135. Advanced Clinical Microbiology.** (3 cr; A-F only. Prereq–#)  
Observation, study, and practice in special problems, advanced techniques, and methodology.

**CLS 5140. Techniques for Teaching.** (2 cr; A-F only. Prereq–#)  
Developing objectives, classroom activities, and evaluation criteria for medical technology education.

**CLS 5155. Advanced Clinical Hematology.** (3 cr; A-F only. Prereq–#)  
Observation, study, and practice in special problems, advanced techniques, and methodology.

**CLS 5165. Advanced Clinical Immunohematology.** (3 cr; A-F only. Prereq–#)  
Observation, study, and practice in special problems, advanced techniques, and methodology.

**CLS 5175. Advanced Clinical Chemistry.** (3 cr; A-F only. Prereq–#)  
Observation, study, and practice in special problems, advanced techniques, and methodology.

**CLS 5251. Hematology I: Basic Techniques.** (3 cr; A-F only. \$MedT 4251. Prereq–#)  
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; A-F only. \$MedT 4252. Prereq–5251 or MedT 4251)  
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; A-F only. \$MedT 4253. Prereq–5251 or MedT 4251)  
Theory and application of specific concepts and techniques in hemostasis and coagulation. Lecture and lab.

**CLS 5310. Clinical Chemistry I: Lecture.** (2 cr; A-F only. \$MedT 4310. Prereq–organic chem course with lab biochem course, #)  
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; A-F only. \$MedT 4311. Prereq–One organic chemistry course with laboratory; one biochemistry course, #)  
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; A-F only. \$MedT 4320. Prereq–Organic chem course with lab, biochem course, 5310 or MedT 4310, #)  
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; A-F only. \$MedT 4321. Prereq–Organic chem course with lab, biochem course, 5310 or MedT 4310, #)  
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]; A-F only. Prereq–#)  
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]; S-N only. Prereq–#)  
Departmental research seminar series.

**CLS 5865. Departmental Seminar.** (1 cr [max 10 cr]; S-N only. Prereq–#)  
Departmental clinical lab research seminar series.

**CLS 8193. Advanced Topics in Clinical Chemistry.** (2 cr. Prereq–#)  
Includes use of molecular approaches to diagnosis and risk assessment of selected diseases.

**CLS 8194. Research on Clinical Laboratory Problems.** (1-3 cr [max 3 cr]. Prereq–#)  
Individual research project in a selected area.

**CLS 8293. Educational Administration in Medical Technology.** (2 cr. Prereq–#)  
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. Prereq–Master's student, adviser and DGS consent)

**CLS 8777. Thesis Credits: Master's.** (1-18 cr [max 50 cr]. Prereq–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

## Cognitive Science (CgSc)

### College of Liberal Arts

**CgSc 8000. Seminar: Philosophy of the Cognitive Sciences.** (3 cr [max 6 cr]. \$Phil 8640. Prereq—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; S-N only. Prereq—Grad cog sci minor or #) 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]. Prereq—Grad cog sci minor or #) Lectures and in-depth discussion on a topic.

## Communication Studies (Comm)

### Department of Communication Studies

### College of Liberal Arts

**Comm 5110. Special Topics in Communication Theory.** (3 cr [max 6 cr]) Advanced theoretical problems. See department office for current offering.

**Comm 5210. Contemporary Problems in U.S. Electronic Media.** (3 cr. Prereq—3211) Problems affecting U.S. commercial and educational electronic media. Audiences; race/gender issues; regulation.

**Comm 5220. Television Genres.** (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.

**Comm 5233. 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.

**Comm 5261. Communicative Processes in Electronic Media.** (3 cr. Prereq—3211 or #) Organizational practices of media communicators. Media content as link between communicators and audiences. How viewers use/process media content.

**Comm 5401. Advanced Theories of Communication.** (3 cr. Prereq—3401 or grad) Survey of major theoretical approaches to communication including, positivism, constructivism, and systems.

**Comm 5402. Advanced Interpersonal Communication.** (3 cr. Prereq—3401 or 3402) Social scientific approaches to interpersonal communication. Theory, research findings.

**Comm 5404. Language and Culture.** (3 cr. Prereq—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.

**Comm 5406. Communication and Gender.** (3 cr. Prereq—One women's studies course, #) 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.

**Comm 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.

**Comm 5411. Small Group Communication Research.** (3 cr; A-F only. Prereq—3411 or #) Survey of small group communication research; theory and practice. Group decision-making and leadership.

**Comm 5421. Quantitative Methods in Communication Research.** (3 cr; A-F only. Prereq—3401 or #) Social scientific methods used in studying human communication. Optional data processing laboratory for additional credit.

**Comm 5431. The Process of Persuasion.** (3 cr. Prereq—3431) Communication campaigns (e.g., advertising, political) illustrating persuasive processes and theories. Research paper required.

**Comm 5441. Communication in Human Organizations.** (3 cr. Prereq—9 cr social science, 3441 or #) Communication in organizational settings. Organizational structure and dynamics and their effect upon the communication process. Individual projects.

**Comm 5451. 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.

**Comm 5461. Conversation Analysis.** (3 cr. \$Ling 5461. Prereq—Ling 3001 or Ling 5001) Discourse processes in dyadic and multiparty conversation. Application of concepts through analysis of conversations.

**Comm 5462. Field Research in Spoken Language.** (3 cr. \$LING 5462. Prereq—5461, Ling 3001 or Ling 5001) Transcribing and analyzing verbal communication and movement related to it. Applying concepts to recorded conversations.

**Comm 5611. Survey of Rhetorical Theory.** (3 cr. Prereq—1101) Survey of rhetorical theory from ancient to contemporary period; application of theory to public discourse.

**Comm 5615. Introduction to Rhetorical Criticism.** (3 cr. Prereq—1101; 3601 recommended) Analysis of public discourse using various theoretical perspectives.

**Comm 5617. History and Criticism of U.S. Public Discourse: 1630-1865.** (3 cr. Prereq—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.

**Comm 5618. History and Criticism of U.S. Public Discourse: 1865-1950.** (3 cr. Prereq—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.

**Comm 5970. Directed Study.** (1-3 cr [max 6 cr]; S-N only. Prereq—Nine 3xxx-5xxx Spch cr, #, □) Guided individual reading or study.

**Comm 5994. Communication Research Practicum.** (1-3 cr [max 9 cr]; S-N only. Prereq—#) Students participate in research group.

**Comm 8110. Seminar: Advanced Speech Problems.** (3 cr [max 15 cr]. Prereq—Undergrad degree in spch-comm or equiv) Evaluation of research methods in speech-communication.

**Comm 8210. Seminar: Selected Topics in U.S. Electronic Media.** (3 cr [max 6 cr]. Prereq—5210 or #; offered when feasible) Literature survey; evaluating research on topics; conducting independent research project on a particular topic.

**Comm 8211. Critical Communication Studies: History, Theory, Method.** (3 cr) Qualitative research methods for studying media institutions, texts, audiences, and contexts.

**Comm 8231. Seminar: National and International Electronic Media Systems.** (3 cr. Prereq—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.

**Comm 8333. FTE: Master's.** (1 cr. Prereq—Master's student, adviser and DGS consent)

**Comm 8402. Seminar: Interpersonal Communication.** (3 cr. Prereq—5402 or #) Evaluate and develop new perspectives for analyzing, diagnosing, and managing interpersonal communication problems.

**Comm 8403. Seminar: Emotion and Communication.** (3 cr) Major theories of emotion and the role of emotion in communication.

**Comm 8406. Seminar: Language and Gender Research.** (3 cr. Prereq—5406) Readings and research on current issues. Data collected to test hypotheses and apply theory.

**Comm 8411. Seminar: Small Group Communication Theory.** (3 cr) Research problems and methods.

**Comm 8444. FTE: Doctoral.** (1 cr. Prereq—Doctoral student, adviser and DGS consent)

**Comm 8451. Seminar: Intercultural and Diversity Research.** (3 cr. Prereq—#) Development of ideas/methods for research project, M.A. Plan B project, or Ph.D. dissertation.

**Comm 8452. Seminar: Methods of Intercultural/Diversity Facilitation.** (3 cr. Prereq—4451 or 5452 recommended) Theories of and techniques for managing effective intercultural communication and diversity. Intercultural training.

**Comm 8502. Seminar: Communication Theory Construction.** (3 cr. Prereq—5421 or #) Logic of communication theory development and modification from a social scientific perspective. Types of communication theories.

**Comm 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.

**Comm 8504. Seminar: Rhetorical Criticism.** (3 cr. Prereq—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.

**Comm 8606. Seminar: Rhetorical Analysis of Campaigns and Movements.** (3 cr. Prereq—5431, 5617 or 5618, 10 cr soc sci or #) Literature and methodology in historical and contemporary rhetorical campaigns and movements.

**Comm 8611. Seminar: Rhetoric.** (3 cr [max 6 cr]. Prereq—5611 or #) History/criticism of rhetorical theory. Research in rhetoric.

**Comm 8625. Seminar: Communication Ethics.** (3 cr; A-F only. Prereq—Ethics course or #) Independent research on communication ethics in interpersonal, group, organizational, intercultural, and media settings. Theories of ethics and methods of analysis.

**Comm 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 18 cr]. Prereq—Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

**Comm 8777. Thesis Credits: Master's.** (1-18 cr [max 18 cr]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**Comm 8888. Thesis Credit: Doctoral.** (1-24 cr [max 24 cr]. Prereq—Max 18 cr per semester or summer; 24 cr required)

**Comm 8994. Directed Research.** (1-3 cr [max 6 cr]; S-N only) Supervised research project.

## Comparative and Molecular Biosciences (CMB)

### College of Veterinary Medicine

**CMB 5180. Ecology of Infectious Diseases.** (3 cr \$PubH 6180. Prereq—[MVB or VMed] grad student or #)

Ways in which host, agent, and environmental interactions influence transmission of infectious agents. Environmental dissemination, eradication/control, evolution of virulence, analytical/molecular tools.

**CMB 5200. Statistical Genetics and Genomics.** (4 cr; A-F only. \$AnSc 5200)

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 and single cell typing. Design issues in linkage analysis, parentage testing, and marker polymorphism.

**CMB 5594. Directed Research in Molecular Veterinary Biosciences.** (1-4 cr [max 4 cr]; A-F only. Prereq—Jr)

Special project, addressing specific issue in veterinary medicine, under guidance of faculty member.

**CMB 8100. Research Rotation in Molecular Veterinary Biosciences.** (4 cr [max 8 cr]; A-F only. Prereq—1st yr MVB grad student)

Directed research laboratory rotations. Experimentation, supplemental reading, research presentations under guidance of faculty member who is potential thesis adviser. Taught by program faculty.

**CMB 8134. Ethical Conduct of Animal Research.** (2 cr; A-F only. Prereq—[Grad or professional school] student or #)

Ethical considerations in the use of animal subjects in agricultural, veterinary, and biomedical research. Federal, state, and University guidelines relating to proper conduct for acquisition/use of animals for laboratory, observational, epidemiological, and clinical research. Regulatory requirements. Bases for proper conduct. Societal impact on scientific investigations utilizing animal subjects.

**CMB 8201. Mechanisms of Animal Health and Disease I.** (3 cr; A-F only. Prereq—1st yr MVB grad student or approval of crse coordinator)

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.

**CMB 8202. Mechanisms of Animal Health and Disease II.** (3 cr. Prereq—8201)

Multi-perspective approach to critically evaluating journal articles, as done for peer-reviewed journals. Aspects of host/pathogen interactions, including molecular/genetic mechanisms of host resistance and pathogenesis.

**CMB 8333. FTE: Master's.** (1 cr. Prereq—Master's student, adviser and DGS consent)

**CMB 8335. Molecular Biology Techniques.** (3 cr. \$AnSc 8131.

Prereq—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.

**CMB 8351. Drug-Receptor Interactions.** (2 cr; A-F only.

Prereq—[Chem 1011-1012 or equiv, CVM 6055 or equiv, calculus through differential equations] or #) 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.

**CMB 8361. Neuro-Immune Interactions Inter.** (3 cr. \$NSc 8026, Psy 8026. Prereq—[MicB 5218 or equiv], [INSc 5561 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. Course is offered fall of even-numbered years.

**CMB 8371. Mucosal Immunobiology.** (3 cr; A-F only. \$MICa 8371, OBIO 8371. Prereq—MICa 8001 or equiv or #)

Host immune processes at body surfaces. Innate/adaptive immunity at mucosal surfaces. Interactions/responses of various mucosal tissues to pathogens. Approaches to target protective vaccination to mucosal tissues. Lectures, journal.

**CMB 8394. Research in Comparative Biomedical Sciences.** (1-6 cr [max 18 cr]. Prereq—Grad MVB major)

Directed research determined by student's interests, in consultation with faculty mentor.

**CMB 8444. FTE: Doctoral.** (1 cr. Prereq—Doctoral student, adviser and DGS consent)

**CMB 8481. Advanced Neuropharmaceutics.** (3 cr; A-F only. \$NSc 8481, Phm 8481. Prereq—#)

Pharmaceutical/pharmacological issues specific to direct drug delivery to CNS. Emphasizes/integrates topics pertinent to neuropharmacology, neuropharmacokinetics, and drug delivery.

**CMB 8494. Research in Molecular Mechanisms of Disease.** (1-6 cr [max 18 cr]. Prereq—Grad MVB major)

Directed research determined by student's interests, in consultation with faculty mentor.

**CMB 8550. Molecular Veterinary Biosciences Seminar.** (1 cr [max 8 cr]; S-N only. Prereq—Biol sciences grad student)

Student and faculty presentations of their own research or a directed topic.

**CMB 8560. Research and Literature Reports.** (1 cr [max 8 cr]; S-N only. Prereq—Grad MVB major or #)

Current developments in cellular and molecular mechanisms of animal health and disease.

**CMB 8570. Comparative Biomedical Sciences Seminar.** (1 cr [max 8 cr]; S-N only. Prereq—Biol sciences grad student)

Weekly seminar by primarily outside speakers discussing current issues.

**CMB 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq—Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

**CMB 8777. Thesis Credits: Master's.** (1-18 cr [max 50 cr]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**CMB 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—Max 18 cr per semester or summer; 24 cr required)

## Comparative Literature (CLit)

### Department of Cultural Studies and Comparative Literature

### College of Liberal Arts

**CLit 5331. Discourse of the Novel.** (3 cr. \$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. \$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. \$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]. Prereq—#)

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. Prereq—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. Prereq—Doctoral student, adviser and DGS consent)

**CLit 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq—Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

**CLit 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—Max 18 cr per semester or summer; 24 cr required)

**CLit 8901. Pedagogy of Cultural Studies and Comparative Literature.** (3 cr. \$CSDS 8901. Prereq—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]. Prereq—#)

**CLit 8994. Directed Research in Comparative Literature.** (1-4 cr [max 12 cr]. Prereq—#)

## 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. §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. §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. §CLit 5751, CSCL 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]. Prereq-#)

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. Prereq-Master's student, adviser and DGS consent)

**CSDS 8404. International Hierarchy.** (3 cr. §Pol 8404)

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. Prereq-Doctoral student, adviser and DGS consent)

**CSDS 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq-Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

**CSDS 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq-Max 18 cr per semester or summer; 24 cr required)

**CSDS 8901. Pedagogy of Cultural Studies and Comparative Literature.** (3 cr. §CLit 8901. Prereq-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 [max 15 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]. Prereq-#)

**CSDS 8994. Directed Research in Comparative Studies in Discourse and Society.** (1-4 cr [max 4 cr]. Prereq-#)

## Computer Engineering (CmpE)

*Department of Electrical and Computer Engineering*

### *Institute of Technology*

**CmpE 8333. FTE: Master's.** (1 cr. Prereq-Master's student, adviser and DGS consent)

**CmpE 8777. Thesis Credits: Master's.** (1-18 cr [max 50 cr]. Prereq-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. Prereq-4061 or #)

Conceptual foundation of operating system designs and implementations. Relationships between operating system structures and machine architectures. UNIX implementation mechanisms as examples.

**CSci 5104. System Modeling and Performance Evaluation.** (3 cr. Prereq-5103 or #)

Techniques for modeling computing systems for performance evaluation through analytical/simulation techniques. How to model computing systems and communications protocols to evaluate their performance under different operating conditions.

**CSci 5105. Foundations of Modern Operating Systems.** (3 cr. Prereq-5103 or #)

Advanced concepts that build foundations of modern operating systems. Advanced scheduling algorithms, distributed communication/synchronization, consistency/replication models, distributed file systems, security, protection/virtualization, OS architectures.

**CSci 5106. Programming Languages.** (3 cr. Prereq-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. Fundamentals of Computer Graphics I.** (3 cr. §CSci 4107. Prereq-[4041 or #], fluency in C/C++, mastery of basic concepts in linear algebra)

Fundamental algorithms in computer graphics. Emphasizes programming projects in C/C++. Scan conversion, hidden surface removal, geometrical transformations, projection, illumination/shading, parametric cubic curves, texture mapping, antialiasing, ray tracing. Developing graphics software, graphics research.

**CSci 5108. Fundamentals of Computer Graphics II.** (3 cr. Prereq-5107 or #)

Advanced topics in image synthesis, modeling, and rendering. Image processing, image warping, global illumination, non-photorealistic rendering, texture synthesis. Parametric cubic surfaces, subdivision surfaces, acceleration techniques, advanced texture mapping. Programming is in C/C++.

**CSci 5109. Visualization.** (3 cr. Prereq-1902, 4041 or equiv or #)

Fundamental theory/practice in data visualization. Emphasizes programming applications. Volume visualization, vector field visualization, information visualization, multivariate visualization, visualization of large datasets, visualization in immersive virtual environments, and perceptual issues in effective data representation. Projects are implemented in C++ using VTK or similar visualization API.

**CSci 5115. User Interface Design, Implementation and Evaluation.** (3 cr. Prereq-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. Prereq-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. Advanced Internet Programming.** (3 cr. §CSci 4131. Prereq-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 5143. Real-Time and Embedded Systems.** (3 cr. Prereq-[4061 or #], experience with C language)

How to control robots and video game consoles. Lecture, informal lab.

**CSci 5161. Introduction to Compilers.** (3 cr. Prereq-4011 or #)

Theories and mechanisms of programming language processing tools. Generalcompiler organization: lexical scanner, syntax parser, symbol table, internal program representation, code generator. Relationship between design and implementation. Run-time memory management mechanism.

**CSci 5204. Advanced Computer Architecture.** (3 cr. Prereq-4203 or EE 4363)

Instruction set architecture, processor microarchitecture, memory, I/O systems. Interactions between computer software and hardware. Methodologies of computer design.

**CSci 5211. Data Communications and Computer Networks.** (3 cr. §CSci 4211. Prereq-[4061 or #], basic knowledge of [computer architecture, operating systems, probability])

Fundamental concepts, principles, protocols, and applications of computer networks. Layered network architectures, data link protocols, local area networks, network layer/routing protocols, transport, congestion/flow control, emerging high-speed networks, network programming interfaces, networked applications. Case studies using Ethernet, Token Ring, FDDI, TCP/IP, ATM, Email, HTTP, and WWW.

**CSci 5271. Introduction to Computer Security.** (3 cr. Prereq-4061 or equiv or #)

Concepts of computer, network, and information security. Risk analysis, authentication, access control, security evaluation, audit trails, cryptography, network/database/application security, viruses, firewalls.

**CSci 5283. Computer-Aided Design I.** (3 cr. Prereq-2021 or #)

CAD for digital systems. Emphasizes VLSI. Hardware description languages, synthesis, simulation, test generation.



- CSci 5302. Analysis of Numerical Algorithms.** (3 cr. Prereq–2031 or #)  
Additional topics in numerical analysis: interpolation, approximation, extrapolation, numerical integration/differentiation, numerical solutions of ordinary differential equations.
- CSci 5304. Computational Aspects of Matrix Theory.** (3 cr. Prereq–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 5403. Computational Complexity.** (3 cr. Prereq–4041 or #)  
Computational models, complexity measures in each model, and related complexity classes.
- CSci 5421. Advanced Algorithms and Data Structures.** (3 cr. Prereq–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 5451. Introduction to Parallel Computing: Architectures, Algorithms and Programming.** (3 cr. Prereq–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 5471. Modern Cryptography.** (3 cr. Prereq–[2011, 4041, [familiarity with number theory or finite fields]] or #)  
Introduction to cryptography. Theoretical foundations, practical applications. Threats, attacks, and countermeasures, including cryptosystems and cryptographic protocols. Secure systems/networks. History of cryptography, encryption (conventional, public key), digital signatures, hash functions, message authentication codes, identification, authentication, applications.
- CSci 5481. Computational Techniques for Genomics.** (3 cr. Prereq–4041 or #)  
Techniques to analyze biological data generated by genome sequencing, proteomics, cell-wide measurements of gene expression changes. Algorithms for single/multiple sequence alignments/assembly. Search algorithms for sequence databases, phylogenetic tree construction algorithms. Algorithms for gene/promoter and protein structure prediction. Data mining for micro array expression analysis. Reverse engineering of regulatory networks.
- CSci 5511. Artificial Intelligence I.** (3 cr. Prereq–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 5512. Artificial Intelligence II.** (3 cr. §CSci 5519. Prereq–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. §CSci 5512W. Prereq–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. Prereq–[2031, 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 5523. Introduction to Data Mining.** (3 cr. Prereq–4041 or equiv or #)  
Data pre-processing techniques, data types, similarity measures, data visualization/exploration. Predictive models (e.g., decision trees, SVM, Bayes, K-nearest neighbors, bagging, boosting). Model evaluation techniques, Clustering (hierarchical, partitional, density-based), association analysis, anomaly detection. Case studies from areas such as earth science, the Web, network intrusion, and genomics. Hands-on projects.
- CSci 5541. Natural Language Processing.** (3 cr. Prereq–5511 or #)  
Elements of linguistic analysis for speech and unstructured text. Phonology, syntactic parsing, semantic interpretation, information extraction. Techniques for modeling uncertainty in linguistic analysis: probabilistic models, Hidden Markov Models (HMMs), Dynamic Bayes Nets (DBNs), Probabilistic Context-Free Grammars (PCFGs), Discounting and backoff smoothing, Maximum entropy modeling. Elements of information theory: entropy, perplexity, metrics for comparing models.
- CSci 5551. Introduction to Intelligent Robotic Systems.** (3 cr. Prereq–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 microbotics.
- CSci 5552. Sensing and Estimation in Robotics.** (3 cr. Prereq–[5551, Stat 3021] or #)  
Bayesian estimation, maximum likelihood estimation, Kalman filtering, particle filtering. Sensor modeling and fusion. Mobile robot motion estimation (odometry, inertial, laser scan matching, vision-based) and path planning. Map representations, landmark-based localization, Markov localization, simultaneous localization/mapping (SLAM), multi-robot localization/mapping.
- CSci 5561. Computer Vision.** (3 cr. Prereq–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. §CSci 4707, INET 4707. Prereq–4041 or #)  
Concepts, database architecture, alternative conceptual data models, foundations of data manipulation/analysis, logical data models, database designs, models of database security/integrity, current trends.
- CSci 5708. Architecture and Implementation of Database Management Systems.** (3 cr. Prereq–4707 or 5707 or #)  
Techniques in commercial/research-oriented database systems. Catalogs. Physical storage techniques. Query processing/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. Prereq–[1902, 2011] or #)  
Advanced introduction to software engineering. Software life cycle, development models, software requirements analysis, software design, coding, maintenance.
- CSci 5802. Software Engineering II.** (3 cr. Prereq–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]. Prereq–#; may be repeated for cr)  
Lectures and informal discussions on current topics in computer science.
- CSci 5991. Independent Study.** (1-3 cr [max 9 cr]. Prereq–#; may be repeated for cr)  
Independent study arranged with CS faculty member.
- CSci 5994. Directed Research.** (1-3 cr [max 9 cr]. Prereq–#; may be repeated for cr)  
Directed research arranged with faculty member.
- CSci 5996. Curricular Practical Training.** (1 cr [max 3 cr]; S-N only. Prereq–[CSci or CompE] major, #)  
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. Prereq–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. Foundations of Distributed Computing.** (3 cr. Prereq–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. Prereq–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. Prereq–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 8205. Parallel Computer Organization.** (3 cr. §EE 8367. Prereq–5204 or EE 5364 or #)  
Design/implementation of multiprocessor systems. Parallel machine organization, system design. Differences between parallel, uniprocessor machines. Programming models. Synchronization/communication. Topologies, message routing strategies. Performance optimization techniques. Compiler, system software issues.
- CSci 8211. Advanced Computer Networks and Their Applications.** (3 cr. Prereq–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 8271. Security and Privacy in Computing.** (3 cr; A-F only. Prereq-[5211, 5103] or #; 5471 or EE 5248 or Math 5248 or equiv recommended)

Recent security/privacy issues in computer systems/networks. Threats, attacks, countermeasures. Security research, authentication, network security, wireless security, computer system security, anonymous system, pseudonym, access control, intrusion detection system, cryptographic protocols. How to pursue research in security and design secure systems.

**CSci 8283. Research Problems in Computer-Aided Design for Electronic Design.** (3 cr. Prereq-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. Prereq-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. Prereq-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. Prereq-Master's student, adviser and DGS consent)

**CSci 8363. Numerical Linear Algebra in Data Exploration.** (3 cr. Prereq-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. Prereq-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 8442. Computational Geometry and Applications.** (3 cr. Prereq-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, advanced topics.

**CSci 8444. FTE: Doctoral.** (1 cr. Prereq-Doctoral student, adviser and DGS consent)

**CSci 8481. Parallel Algorithms for Numeric and Non-numeric Problems.** (3 cr. Prereq-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. Prereq-5511 or #)

Introduction to Artificial Neural Networks (ANNs). Network architectures and learning rules; design of ANNs.

**CSci 8551. Intelligent Agents.** (3 cr. Prereq-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]. Prereq-Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

**CSci 8701. Overview of Database Research.** (3 cr. Prereq-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. Prereq-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 8715. Spatial Databases and Applications.** (3 cr. Prereq-4707 or 5707 or GIS 5571 or GIS 5573)

Motivation, Models of spatial information, querying spatial data, processing strategies for spatial queries, multi-dimensional storage/access methods, spatial graph datasets, spatial data mining, trends (e.g., spatio-temporal databases, mobile objects, raster databases).

**CSci 8725. Databases for Bioinformatics.** (3 cr. Prereq-4707 or 5707 or #)

DBMS support for biological databases, data models. Searching integrated public domain databases. Queries/analyses, DBMS extensions, emerging applications.

**CSci 8760. Plan B Project.** (3 cr; S-N only. Prereq-CSci MS student, #)

Project arranged between student and faculty.

**CSci 8777. Thesis Credits: Master's.** (1-18 cr [max 50 cr]. Prereq-Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**CSci 8801. Advanced Software Engineering.** (3 cr. Prereq-5801 or #)

Software reusability, internet/intranet programming, software reengineering, and software safety.

**CSci 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq-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]. Prereq-#)

Lectures and informal discussions.

**CSci 8991. Independent Study.** (1-3 cr [max 3 cr]. Prereq-#)

**CSci 8994. Directed Research in Computer Science.** (1-3 cr [max 9 cr]. Prereq-#)

## Conservation Biology (CBio)

### College of Biological Sciences

**CBio 8001. Conservation Biology Seminar.** (1 cr [max 6 cr]; S-N only. Prereq-#)  
Topics vary.

**CBio 8004. Economic and Social Aspects of Conservation Biology.** (3 cr. Prereq-CBio student or #)

Economic/social aspects of conservation biology. Ecological economics, human dimension of conservation biology, values of conserving species/ecosystems.

**CBio 8093. Directed Study Experience.** (1-5 cr [max 6 cr]; S-N only. Prereq-#)

Directed Study Experience

**CBio 8095. Contemporary Problems in Conservation Biology.** (1 cr [max 3 cr]; S-N only. Prereq-8004, FW 8452, #)

Comprehensive review of conservation biology issue. Written exam.

**CBio 8333. FTE: Master's.** (1 cr. Prereq-Master's student, adviser and DGS consent)

**CBio 8444. FTE: Doctoral.** (1 cr. Prereq-Doctoral student, adviser and DGS consent)

**CBio 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq-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]. Prereq-Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**CBio 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq-Max 18 cr per semester or summer; 24 cr required)

## Control Science and Dynamical Systems (CSDy)

### Institute of Technology

**CSDy 8444. FTE: Doctoral.** (1 cr. Prereq-Doctoral student, adviser and DGS consent)

**CSDy 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq-Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

**CSDy 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq-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]; S-N only. Prereq-CSDy or IT grad)  
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. Prereq-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 5154. 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. §CSDS 5301)

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. §CSDS 5302)

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. Discourse of the Novel.** (3 cr. §CLit 5331)

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. §CLit 5555)

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 5835. Richard Wagner's "Der Ring des Nibelungen": Music, Myth, and Politics.** (3 cr. Prereq-#)

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]. Prereq-#, □)

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 [max 3 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 [max 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 [max 3 cr]; A-F only. Prereq-Grad student 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; A-F only. Prereq-Initial lic students majoring in art ed)

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 [max 3 cr]; A-F only. Prereq-Grad student)

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; S-N only. Prereq-Licensure student in art ed)

Observation of, participation in, and supervisory experiences with various types and levels of art classes.

**CI 5111. Introduction to Elementary School Teaching.** (3 cr; A-F only. Prereq-Foundations of ed major or elem ed initial lic)

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 5133. Curriculum Planning and Design.** (3 cr; A-F only. Prereq-Grad student 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; A-F only. Prereq-Grad student 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. Prereq-MEd or PhD 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 5141. Reflective Teaching and Professional Ethics.** (3-4 cr [max 4 cr]. Prereq-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 5145. 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.

**CI 5147. Language, Culture, and Education.** (3 cr; A-F only. Prereq-MEd or grad student)

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 [max 4 cr]. Prereq-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 Curriculum: Instruction and Assessment.** (3 cr; A-F only. Prereq-Grad students only)

Current research/issues that cross disciplinary boundaries in curriculum development, instructional practices, and assessment methods. Interrelations among curriculum, instruction, and assessment within framework of constructivist learning theory. Individual classroom practices/theories.

**CI 5162. Peer Coaching for Teachers.** (1-2 cr [max 2 cr]; A-F only. Prereq-Teaching experience or #)

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; A-F only. Prereq-Elem teaching exper or #)

Theory and practice in teaching students with learning difficulties across the curriculum.

**CI 5177. Practical Research.** (3 cr; A-F only. Prereq-CI Med student, or CI or EdPA Teacher Leadership Med student)

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. §EDPA 5361. Prereq-CI or EdPA teacher leadership Med 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.** (3-8 cr [max 16 cr]; S-N only. Prereq—Foundations of education and elem ed initial licensure 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]; S-N only. Prereq—Foundations of ed major or elem ed initial licensure only)  
Supervised experience in elementary classrooms.

**CI 5186. School-Related Projects.** (1-4 cr [max 4 cr]; A-F only. Prereq—MEd student)  
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 [max 3 cr]; S-N only. Prereq—MEd student in elem or early childhood ed)  
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]. Prereq—Grad student 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. Prereq—[MEd student in ECE or ECSE] or #)  
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. Prereq—Student in early childhood ed or 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; A-F only. Prereq—MEd student in early childhood ed or early childhood special ed, or #)  
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 5254. Kindergarten Methods.** (2 cr; A-F only. Prereq—Foundations of Education/Elementary Education or M.Ed./ILP Elementary Education)  
Purpose of kindergarten, its place in elementary program. Curriculum appropriate for needs of age group, including children with special needs. Assessment procedures, role of classroom teacher.

**CI 5281. Student Teaching in Early Childhood Education.** (3-6 cr [max 6 cr]; S-N only. Prereq—MEd student in early childhood ed or early childhood special ed)  
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 [max 12 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; A-F only)  
Designing/planning for technology integration in K-12 contexts. Focuses on school, district, state, and national levels. School visits, guest speakers, school-focused technology planning project.

**CI 5342. School Technology Planning.** (1 cr; A-F only)  
How to establish plans for use of technology that support K-12 instruction and student learning. Facilitating ongoing comprehensive planning for technology integration. Identifying priorities for technology planning.

**CI 5343. School Technology Funding.** (1 cr; A-F only. Prereq—[Mac or PC] with 128 MB RAM, [Windows [NT or 2000 or XP] or Mac [OS 9 or OS 10]], [Pentium 2 or faster], Internet connectivity, up-to-date [Netscape, Internet Explorer], virus protection software; Certificate in School Technology Leadership or #)  
Developing a multi-year funding strategy for establishing K-12 technology integration in accordance with a technology vision/plan.

**CI 5344. Facilitating Technology Integration in Classrooms I.** (1 cr; A-F only)  
Intersection of student learning theories and research base on effective technology practices. Video cases of technology-supported teaching, peer teaching exercise.

**CI 5345. Facilitating Technology Integration in Classrooms II.** (1 cr; A-F only. Prereq—[5344 or #], [Mac or PC] with 128 MB RAM, [Windows [NT or 2000 or XP] or Mac [OS 9 or OS 10]], [Pentium 2 or faster], Internet connectivity, up-to-date [Netscape, Internet Explorer], virus protection software; Certificate in School Technology Leadership or #)  
Technology-supported teaching/learning at one's educational site. Preparing a vision statement for technology's role in student learning. How to assume an advocacy role in establishing technology use for instruction/learning.

**CI 5346. Staff Technology Development and Support.** (1 cr. SEDPA 5306. Prereq—[Mac or PC] with at least 256 MB of RAM, [Windows NT 2000 or XP or Mac OS 9 or 10], Pentium [2 or faster], internet connection, up-to-date version of [Netscape, Internet Explorer], virus protection software; Certificate in School Technology Leadership or #)  
How to lead organization in designing, implementing, evaluating, improving, and sharing approaches to staff development. Technology-related staff development. Facilitating development through use of technology.

**CI 5351. Technology Tools for Educators.** (3 cr; A-F only. Prereq—Basic knowledge of Macintosh operating system and a word processing program)  
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. Prereq—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 Multimedia Development.** (3 cr. Prereq—Competent computer user; 5362 recommended)  
Students develop computer-based multimedia materials using a state-of-the-art programming language. Principles of multimedia design. Potential of multimedia and eLearning.

**CI 5364. Computer-Based Instruction: Games and Simulation.** (3 cr; A-F only. Prereq—5363)  
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 5365. Contemporary Software Development Issues and Tools.** (2 cr. Prereq—Familiar with standard computer/Internet operations)  
Software used in multimedia design/development. Uses of the software, intricacies of interface, relevant programming principles. Introduction to developing multimedia applications.

**CI 5367. Interactive Multimedia Instruction.** (3 cr; A-F only. Prereq—Knowledge of principles and procedures of CBI design and one multimedia authoring system)  
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; A-F only. Prereq—Children's lit course or #)  
Evaluate survey of books for children. Research related to children's reading interests. Response to literature, instructional strategies.

**CI 5402. Introduction to Special Collections.** (3 cr; A-F only. Prereq—Children's lit course)  
Uses Children's Literature Research Collection as research material. Study of manuscripts, original art, and letters.

**CI 5403. Creative Writing For and By Children.** (3 cr; S-N only. Prereq—Children's lit course or #)  
Aspects of writing/illustrating children's literature or children's own writing. May feature authors/illustrators of children's books.

**CI 5405. Middle School Language Arts Methods.** (2 cr. Prereq—Elem ed licensure student)  
Introduction to the unique needs of middle school students in the language arts classroom. Language arts content and pedagogical skills. Adolescent development/psychology. Field placement in a middle school language arts classroom.

**CI 5410. Special Topics in the Teaching of Literacy.** (1-3 cr [max 12 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; A-F only. Prereq—5411 or 5451)  
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; A-F only. Prereq—5412)  
Assessment and tutoring of individual children who have difficulty reading in school.

- CI 5415. Literacy Development in the Primary Grades.** (3 cr; A-F only. Prereq–Elem teaching exper or #)  
Theory/practice of integrated teaching of reading, literature, writing, and language in primary classroom settings. Uses national/state language arts standards and assessment protocols to examine primary literacy curricula.
- CI 5416. Literacy Development in the Intermediate Grades.** (3 cr; A-F only. Prereq–Elem teaching exper or #)  
Theory/practice of integrated teaching of reading, literature, writing, and language in intermediate classroom settings. Uses national/state language arts standards and assessment protocols to examine intermediate literacy curricula.
- CI 5418. Whole Language Teaching and Learning in the Elementary School.** (3 cr; A-F only. Prereq–MEd or grad student, minimum one yr of teaching exper)  
Theory, research, and politics of whole language teaching. Applications for developing an elementary school whole language curriculum.
- CI 5422. Teaching Writing in Schools.** (3 cr; A-F only. Prereq–Initial licensure or MEd or grad student)  
Theory/practice of teaching writing in schools. Focuses on how race, gender, and social class impact teaching/learning.
- CI 5424. Reading, Language Arts, and Literature: Primary.** (3 cr; A-F only. Prereq–Elem ed init lic)  
Curricular/methodological issues of reading, language arts, and children’s literature. Evaluating children’s literature, emergent literacy, response to literature, reading/writing processes, strategy instruction for word recognition/comprehension, authentic assessment strategies, teaching diverse students.
- CI 5431. Introduction to Instructional Leadership in K-12 Reading.** (3 cr; A-F only. Prereq–Minnesota license valid for classroom teaching in pre-kindergarten, [adult basic education or grades kindergarten through 6 or 1 through 6 or 5 through 8 or 9 through 12 or kindergarten through 12])  
K-12 curriculum in reading, major theories/research that motivate curriculum. Major instructional principles, alignments needed, resources available.
- CI 5432. Instructional Leadership in Reading in Kindergarten and the Elementary Grades.** (3 cr; A-F only. Prereq–5431)  
Research-based reading instruction for elementary grades. How to help other teachers improve practice. Characteristics of effective schools within context of improving students’ reading achievement.
- CI 5433. Instructional Leadership in Reading for the Middle and Secondary Grades.** (3 cr; A-F only. Prereq–5432)  
Curriculum/instruction for middle/secondary school students.
- CI 5434. Professional Development and Evolving Practice in K-12 Reading.** (3 cr; A-F only. Prereq–5433)  
Developing e-portfolio to assess competence in standards for teaching K-12 reading. Evolving teaching practices. Applications of current technologies.
- CI 5435. Instructional Leadership in Preventing Reading Difficulties.** (3 cr; A-F only. Prereq–5434)  
Research-based reading interventions for struggling readers. How to help other teachers improve their practice. Theory/research behind preventing reading difficulties. Principles/techniques for assessing reading difficulties and students’ progress.
- CI 5441. Teaching Literature in the Secondary School.** (2-3 cr [max 3 cr]; A-F only. Prereq–Fall, English initial licensure only, 2 cr; other sections, 3 cr)  
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 Middle and Secondary Grades.** (3 cr; A-F only. Prereq–Fall, English initial licensure)  
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; A-F only. Prereq–Spring, English initial licensure 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; A-F only. Prereq–5461)  
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; A-F only. Prereq–English initial licensure)  
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; A-F only. Prereq–Elem ed initial licensure only)  
Curricular and methodological issues of reading, language arts, and children’s literature. Evaluating children’s literature, response to literature, reading/writing processes, strategy instruction for word recognition/comprehension, authentic assessment strategies, teaching diverse students in upper elementary grades.
- CI 5496. Directed Experiences in Teaching English.** (8 cr; S-N only. Prereq–MEd/initial licensure students in English ed only)  
Student teaching/clinical experience for English post-baccalaureate students only.
- CI 5500. Special Topics: Outdoor Science Education.** (1-8 cr [max 12 cr]. Prereq–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; A-F only. Prereq–Elem ed initial licensure only)  
Methods and materials for teaching science and health at the elementary school level.
- CI 5504. Elementary School Science: Materials and Resources.** (3 cr. Prereq–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 5505. Middle School Science Methods.** (2 cr. Prereq–Elem ed licensure student)  
Methods of planning/teaching inquiry-based science. Students observe, analyze, and teach inquiry-based lessons.
- CI 5531. Teaching Middle School Science.** (4 cr; A-F only. Prereq–initial licensure student in science ed)  
Methods of planning/teaching science to middle school students.
- CI 5532. Teaching Secondary School Science.** (4 cr; A-F only. Prereq–Admission to initial licensure program in science)  
Methods of planning and teaching science for secondary school students.
- CI 5533. Current Developments in Science Teaching.** (3 cr; A-F only. Prereq–[MEd, initial licensure, grad student] or #)  
Using curriculum standards to design science courses.
- CI 5534. Studies in Science Education.** (3 cr [max 4 cr]; A-F only. Prereq–M.Ed., init lic, or #)  
Improvement of science teaching through the application of research findings.
- CI 5535. Foundations of Science Education.** (3 cr; A-F only. Prereq–M.Ed., grad student, or #)  
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. Prereq–[MEd 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 5537. Principles of Environmental Education.** (3 cr; A-F only. Prereq–Undergrad in NRES or M.Ed. or grad student in education or #)  
Critical review of Environmental Education, its history, theories, curricula, teaching methods, and assessment practices. Development of an exemplary unit plan for teaching environmental studies.
- CI 5540. Special Topics: Science Education.** (1-8 cr [max 12 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; A-F only. Prereq–initial licensure in science ed)  
Supervised clinical experience in middle school science teaching.
- CI 5597. Clinical Experience in Secondary School Science Teaching.** (4-8 cr [max 8 cr]; S-N only. Prereq–initial licensure or #)  
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; A-F only. Prereq–SLC initial licensure 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; A-F only. Prereq–SLC initial licensure 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; A-F only. Prereq–SLC initial licensure 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. Prereq–initial licensure 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. Prereq–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.** (1-4 cr [max 12 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 5671. Content-Based Second Language Curriculum, Instruction, and Assessment.** (3 cr. Prereq–#)

Instruction/curriculum models for immersion, bilingual, and ESL teachers. Balancing content and language goals. Standards, assessment. Using technology to support content-based curriculum and assessment.

**CI 5672. Language-Focused Instructional Practices and Strategies.** (3 cr. Prereq–#)

Keeping a language development focus while teaching content in second language. Materials development, proactive/reactive instructional techniques, choice of form. Linguistic complexity and developmental stage of student.

**CI 5693. Directed Study in Second Languages and Cultures.** (1-4 cr [max 4 cr]. Prereq–#)

Individual or group work on curricular, instructional, or assessment problems.

**CI 5696. Practicum: Teaching World Languages and Cultures in Elementary Schools.** (2 cr. Prereq–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. Prereq–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. Prereq–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 [max 8 cr]; A-F only. Prereq–SLC initial licensure program 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; A-F only. Prereq–5111 or equiv, elem ed initial licensure only)

Content and organization of elementary social studies programs; programs of understanding, improving the learning situation, and effective use of materials.

**CI 5705. Middle School Social Studies Methods.** (2 cr. Prereq–Elem ed licensure student)

Introduction to the unique needs of middle school students in the social studies classroom. Social studies content and pedagogical skills. Adolescent development/psychology. Field placement in a middle school social studies classroom.

**CI 5731. Social Studies for the In-Service Elementary/Middle School Teacher.** (3 cr; A-F only. Prereq–Elem/middle school teaching exper or #)

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; A-F only. Prereq–Social studies initial licensure student)

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; A-F only. Prereq–Secondary social studies initial licensure student)

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.** (3 cr; A-F only. Prereq–Secondary social studies initial licensure student)

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 [max 3 cr]; A-F only. Prereq–Secondary social studies initial licensure student)

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 Inservice 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; A-F only. Prereq–MEd or grad student)

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 5782. Clinical Experiences in Teaching Social Studies.** (1-8 cr [max 7 cr]; S-N only. Prereq–MEd/initial licensure student)

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 5902. Family Education Perspectives.** (3 cr; A-F only)  
Origins, evolution, and critique of alternative perspectives on family education. Implications for educators, programs, and participants.
- CI 5904. Contemporary Family Education.** (3 cr; A-F only)  
Contemporary conditions of and transitions in family life. Emphasizes implications for educators and educational programs.
- CI 5906. Program Planning in Family Education.** (3 cr; A-F only)  
Curriculum research/theory. Alternative perspectives, their concomitant implications for families. Development of and evaluation of family education curriculum/programs.
- CI 5908. Family and Work Relationships.** (3 cr)  
Interactions of work/family roles, responsibilities, and aspirations. Resources, legal aspects, gender.
- CI 5912. Sexuality Education.** (3 cr)  
Development, delivery, and evaluation of sexuality education curriculum/programs.
- CI 5914. Education for Family Communication.** (3 cr)  
Development, delivery, and evaluation of curriculum/programs related to family communication.
- CI 5922. Family and Consumer Sciences Curriculum in Grades 5-12.** (3 cr. Prereq-ILP student)  
Examination, development, and implementation of family and consumer sciences curriculum in grades 5-12.
- CI 5923. Educational Strategies in Family Education.** (3 cr)  
Examination, development, and implementation of a variety of educational strategies.
- CI 5924. Family and Consumer Sciences Student Teaching I.** (1 cr §WCCE 5696. Prereq-ILP student)  
Initial experiences in family/consumer sciences teaching profession. Observations of school organization/administration, seminars, relationship building with cooperating teachers, reflections on personal involvement as beginning student teachers.
- CI 5925. Family and Consumer Sciences Student Teaching II.** (2 cr. §WCCE 5697. Prereq-5924)  
Part-time supervised teaching experience in family/consumer sciences programs. On-campus seminars emphasize reflective teaching practice and student learning in context of middle/high schools.
- CI 5926. Family and Consumer Sciences Student Teaching III.** (8 cr. §CI 5927, WCCE 5699. Prereq-5925)  
Full-time supervised teaching experience in family/consumer sciences programs. On-campus seminars.
- CI 5927. Family and Consumer Sciences Student Teaching IV.** (1 cr. §CI 5926, WCCE 5699. Prereq-5926)  
Full-time supervised student teaching experience in family/consumer sciences programs.
- CI 5932. Introduction to Parent Education.** (1 cr)  
Philosophy, history, and models of parent education. Ethical, critically reflective professional practice.
- CI 5934. Practice of Parent Education I.** (3 cr; A-F only)  
Reflection on and critique of practice of parent education. Culturally/linguistically diverse parent experiences. Observation of community-based programs. Professional skills/responsibilities.
- CI 5935. Practice of Parent Education II.** (3 cr; A-F only. Prereq-5934 or FE 5701 or Δ)  
Development of curriculum, teaching strategies, group facilitation skills, and assessment techniques. Observation of parent education classes/programs.
- CI 5936. Advanced Practice of Parent Education.** (3 cr. Prereq-5935 or FE 5702 or Δ)  
Evolving perspectives of parent education. Emphasizes psycho-dynamic, conceptual-change approaches. Reflective/dialogic approaches for working with parents in understanding beliefs and examining their origins/consequences. Issues related to diversity, self-awareness, ethics, and evaluation.
- CI 5937. Parent-Child Interaction.** (3 cr)  
Analysis and critique of parent-child interaction theory/research. Implications for parent-child relationships and parents'/children's development. Application in professional work with families.
- CI 5938. Reflective Dialogue in Parent Education.** (3 cr; A-F only)  
Concepts, theories, teaching-learning processes, and materials for using reflective dialogue in parent education. Implementation of reflective dialogue parent education in participants' settings.
- CI 5939. Parent Education Practicum.** (1-4 cr [max 4 cr]. Prereq-5935 or FE 5702 or Δ)  
Supervised parent education field assignments designed according to licensure requirements and individual student needs, interests, and prior competencies.
- CI 5952. Everyday Lives of Youth.** (3 cr; A-F only. Prereq-YDL student or #)  
How youth as idea and as lived-reality are understood in scholarship, public discourse, and professional practice. Building a critical practice of work with or on behalf of youth.
- CI 5954. Experiential Learning: Pedagogy for Community and Classroom.** (3 cr)  
Relationship between experience and learning in community and school settings. Emphasizes intentional application of experiential learning theory/practice to educational program development.
- CI 5956. Organizational Approaches to Youth Development.** (3 cr; A-F only. Prereq-YDL Med student or #)  
Historical contexts, theoretical frameworks, organizational practices, and public policies that shape nonformal educational experiences of youth in community-based or school-linked settings.
- CI 5958. Community: Context for Youth Development Leadership.** (3 cr; A-F only)  
Issues/policies in family, school, and community that drive the professional practice of community-based youth work. Practical projects explore what it means to be local, to build social capital for youth, and to involve youth in community change.
- CI 5960. Seminar in Youth Development Leadership.** (1-4 cr [max 4 cr]; S-N only. Prereq-YDL student or #)  
Group study of topics/issues. Course proposal, educational program development. Students participate in co-created learning experience with a group of peers. Four-course sequence.
- CI 5962. Leadership Field Experience: Youth Development.** (4 cr. Prereq-YDL student or #)  
Demonstration of leadership in practice. Project on youth, experiential pedagogy, and community/program settings. Focuses on public policy, advocacy, evaluation, pedagogical issues, program design, curriculum development, or applied research.
- CI 5993. Directed Study in Family, Youth, and Community.** (1-3 cr [max 9 cr].  
Self-directed study in areas not covered by regular courses. Specific program of study is jointly determined by student and advising faculty member.
- CI 5996. Internship in Family, Youth, and Community.** (1-6 cr [max 6 cr].  
Involvement in work experience focused on educational competencies in family, youth, and community settings. Nature/extent of responsibilities are defined by position the student assumes.
- CI 8075. Seminar: Art Education.** (2 cr; A-F only. Prereq-Educ grad student or #)  
Reports, evaluation of problems, and review of recent literature.
- CI 8079. Research in Art Education.** (3 cr; A-F only. Prereq-Educ grad student or #)  
Current research agenda. Helps students identify research questions and choose appropriate methodologies.
- CI 8095. Problems: Art Education.** (1-12 cr [max 12 cr]. Prereq-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]. Prereq-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; A-F only. Prereq-Doctoral student)  
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. Prereq-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. Prereq-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; A-F only. Prereq-CI PhD or MA student or #)  
Central concepts, ideas, and debates in professional field of curriculum. Curriculum in general education.
- CI 8132. Curriculum and Instruction Core: Teaching Theory and Research.** (3 cr; A-F only. Prereq-CI PhD or MA student or #)  
Overview of research on teaching: historical perspective, modern research/findings, implications for practice/research.
- CI 8133. Research Methods in Curriculum and Instruction.** (3 cr; A-F only. Prereq-CI PhD or MA student or #)  
Survey of educational research methods, comparison of underlying assumptions/procedures.
- CI 8148. Conducting Qualitative Studies in Educational Contexts.** (3 cr. Prereq-CI MA or PhD student or #)  
Introduction to use of qualitative research methods. Ethnography, sociolinguistics, symbolic interactionism. Emphasizes observation.
- CI 8149. Qualitative Research: Coding, Analysis, Interpretation, and Writing.** (3 cr; A-F only. Prereq-[8133, 8148, grad student, completion of a qualitative research study] or #)  
How to code/analyze field notes. Individual/group interviews, multimedia using NUDIST NVivo software. Students interpret analyzed material and complete an article length document that includes a review of related research/methodology.
- CI 8150. Research Topics Curr & Instruc.** (1-6 cr [max 12 cr]. Prereq-[M.A. or Ed.D. or Ph.D.] student or #)  
Special topics, current research trends in curriculum/instruction. Research review, subject integration, curriculum contexts, development, implementation, data collection, analysis, evaluation.

**CI 8161. Planning a Research Experience I.** (2 cr. Prereq–8133, CI PhD student or #)  
Designing research questions, initiating literature reviews, and selecting a research methodology.

**CI 8162. Planning a Research Experience II.** (2 cr. Prereq–8133, CI PhD 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. Prereq–CI PhD student or #)  
Goals, instructional strategies, evaluation procedures, and professional considerations.

**CI 8195. Problems: Improvement of Instruction.** (1-6 cr [max 6 cr]. Prereq–#)  
Independent research in curriculum and instruction.

**CI 8196. Practicum in Teaching in Colleges of Education.** (1 cr. Prereq–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]; A-F only. Prereq–MA student)  
Directs students to completing Plan B paper for M.A. degree.

**CI 8198. Problems: Teacher Education.** (1-6 cr [max 12 cr]. Prereq–#)  
Independent research.

**CI 8333. FTE: Master's.** (1 cr. Prereq–Master's student, adviser approval, DGS approval)

**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]. Prereq–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]. Prereq–#)  
Independent research.

**CI 8400. Special Topics in Children's and Young Adult Literature.** (1-6 cr [max 6 cr]. Prereq–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]. Prereq–#)  
Research at all levels; topics vary by offering and may include research designs, trends, and specific studies.

**CI 8412. Research in Reading.** (3 cr. Prereq–#)  
Significant literacy research; critical analysis of methodology and findings, appraising research methods, population limitations, and educational implications.

**CI 8421. Research in Composition.** (3 cr. Prereq–#)  
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 8444. FTE: Doctoral.** (1 cr. Prereq–Doctoral student, adviser approval, DGS approval)

**CI 8470. Special Topics on Literacy.** (1-6 cr [max 6 cr]. Prereq–CI PhD 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]. Prereq–#)

**CI 8495. Problems: Teaching English and Reading.** (1-6 cr [max 6 cr]; A-F only. Prereq–#)  
Individual research.

**CI 8511. Seminar: Research in Science Education.** (1 cr [max 6 cr]. Prereq–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 6 cr]; A-F only. Prereq–CI grad student or #)  
Examination and critique of current research topics, methods, and issues.

**CI 8594. Conducting Research in Science Education.** (3 cr. Prereq–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]. Prereq–CI grad student or #)  
Independent research.

**CI 8631. Research Seminar I: Second Languages and Cultures Education.** (3 cr; A-F only. Prereq–8133)  
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; A-F only. Prereq–8631)  
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 6 cr]. Prereq–CI grad student or #)  
Research topics vary.

**CI 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq–Doctoral student who has not passed prelim oral)

**CI 8691. Readings in Second Languages and Cultures Education.** (1-3 cr [max 3 cr]. Prereq–#)  
Independent reading.

**CI 8695. Problems: Second Languages and Cultures Education.** (1-6 cr [max 12 cr]. Prereq–#)  
Independent research.

**CI 8742. Seminar: Research in Social Studies Education.** (2 cr; A-F only. Prereq–CI grad student or #)  
Critical review and analysis of seminal research studies; criteria for appraising research findings; educational implications.

**CI 8777. Thesis Credits: Master's.** (1-18 cr [max 50 cr])

**CI 8795. Problems: Social Studies Education.** (1-6 cr [max 12 cr]. Prereq–CI grad student or #)  
Independent research.

**CI 8796. Research Internship in Social Studies Education.** (1-6 cr [max 6 cr]; A-F only. Prereq–CI grad student)  
Internship with social studies education faculty member; experience in collecting and analyzing data; drafting and presenting reports; writing for publication.

**CI 8888. Thesis Credits: Doctoral.** (1-24 cr [max 100 cr]. Prereq–Max 18 cr per semester or summer; 24 cr required)

## Dance (Dnce)

### Department of Theatre Arts and Dance

#### College of Liberal Arts

**Dnce 5010. Modern Dance Technique 7.** (2 cr [max 4 cr]. Prereq–A; 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]. Prereq–5010, A; 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]. Prereq–A; 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]. Prereq–5110, A; 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]. Prereq–A; 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]. Prereq–5210, A; audit registration not permitted)  
Continuation of 5210. Syncopation, performance projection. Specific styles: swing, bebop, lyrical, funk, latin.

**Dnce 5500. Topics in Dance.** (1-3 cr [max 10 cr])  
Topics specified in *Class Schedule*.

**Dnce 5601. Dance Composition 5.** (1 cr. Prereq–4601, 4602)  
Final part of six-semester sequence in dance composition. Exploration of movement through independently scheduled rehearsals. Choreographic concepts. Tools in dance creation, development/refinement of movement, structure of group choreography.

**Dnce 5700. Performance.** (1 cr [max 4 cr]. Prereq–[ ] technique course)  
Technique, improvisation, choreography, music, design, and technical production as they relate to dance performance.

**Dnce 5858. Teaching Dance.** (4 cr. Prereq–1020, #)  
Methods, principles, and techniques of teaching dance.

**Dnce 5970. Directed Studies.** (1-4 cr [max 10 cr]. Prereq–#, [ ])  
Guided individual study.

## Dentistry (Dent)

### School of Dentistry

**Dent 5101. Oral and Maxillofacial Radiology.** (3 cr; A-F only)  
General principles of radiology, radiation physics, dosimetry, biology, radiation protection, regulations and recent concepts of imaging.

**Dent 5102. Patient Management and Radiographic Interpretation.** (2 cr; A-F only. Prereq–Oral Rad I)  
Dental record keeping. Documentation/analysis of medical/clinical findings. Patient's rights, informed consent. Radiographic interpretation of deviations from normal.

**Dent 5103. Oral Radiology Preclinical Lab I.** (1 cr; S-N only)  
This course consists of preclinical demonstration-participation phases in radiographic technique using mounted human skulls.

**Dent 5104. Oral Radiology Preclinical Lab II.** (1 cr [max 2 cr]; S-N only)  
This course consists of preclinical demonstration-participation phases of radiographic technique using mounted human skulls.

**Dent 5121. Physical Evaluation I.** (3 cr; A-F only)  
General concepts of diagnosis and patient evaluation for use during examination of patients in various adult clinical programs in the School of Dentistry.

**Dent 5201. Pain and Anxiety Control.** (2 cr; A-F only)  
Didactic/clinical aspects of pain/anxiety control as pertains to dentistry. Emphasizes use of local anesthetics, conscious sedation (nitrous oxide inhalation). Acute/chronic pain mechanisms, neuropathic pain, issues pertaining to narcotic/other drug abuse.



- Dent 5301. Introduction to Oral Biology.** (2 cr; S-N only)  
Introduce the scientific foundation of dentistry. Oral microbiology, biochemistry, tissues, diseases, and pain will be related to clinical practice through lectures and discussions of current literature.
- Dent 5302. Topics in Dental Biochemistry.** (2 cr; A-F only)  
Biological, chemical, and biochemical phenomenon occurring in the oral cavity and the interrelationships between these phenomenon. Biological and chemical basis of dental caries and how saliva, dental plaque, and plaque fluid interact and impact on the caries process. Metabolic handling and anticaries mechanisms of fluoride.
- Dent 5303. Microbiology for Dental Students.** (6 cr; A-F only. Prereq—(Dental) Biochemistry/Histology)  
General microbiology, bacterial pathogenesis, virology with specific emphasis on oral microbial ecology, dental caries and periodontal diseases. Evaluation of current literature will be done by student essays. Discussions are based on assigned literature and focus on methodology.
- Dent 5315. Oral Histology and Embryology and Medical Genetics.** (3 cr; A-F only. §DH 2210)  
Embryologic development and histologic structure of tissues in the head, face, and mouth with emphasis on clinical correlations, principles of medical genetics, complex traits of the orofacial region, and genetic contributions to oral diseases.
- Dent 5321. Introduction to Dental Biomaterials.** (2 cr; A-F only)  
This introductory course includes ten laboratory sessions and ten lectures. In the laboratory class, students practice handling materials used in restorative dentistry and prosthodontics. Accompanying lectures provide a scientific foundation for selection and use of dentistry materials.
- Dent 5322. Applied Dental Biomaterials.** (2 cr; A-F only. Prereq—5321)  
Lectures on applications of dental materials, including areas of restorative dentistry, prosthodontics, orthodontics, and endodontics. Instruction in the scientific basis for selection and utilization of materials. Areas of current controversy, including replacement of traditional materials with new materials. Literature review seminars cover the evaluation principles for information sources on dental materials.
- Dent 5401. Dental Care Delivery and Oral Epidemiology.** (3 cr; A-F only. §DH 4131)  
Dental public health. Epidemiology, biostatistics, professional ethics, financing of dental care, health economics, health policy. Students participate in site visits and search, manage, and evaluate dental information from various resources.
- Dent 5402. Prevention and Oral Health Promotion.** (2 cr; A-F only)  
Aspects/principles of prevention. Risk assessment, screening, dietary analysis. Models of health education, health promotion. How dental profession influences public. Student groups research/present materials about oral health topic.
- Dent 5411. Professional Problem Solving.** (0 cr; A-F only)  
Critical thinking in ethical/professional problems in dentistry. How to organize, analyze, and reflect on issues, rights, responsibilities, codes of behavior/ethics, and consequences.
- Dent 5412. Professional Problem Solving.** (1 cr; A-F only)  
Critical thinking in ethical/professional problems in dentistry. How to organize, analyze, and reflect on issues, rights, responsibilities, codes of behavior/ethics, and consequences.
- Dent 5441. Patient Management II.** (3 cr; A-F only)  
Introduction to management of dental patients. Process/development of comprehensive treatment plans. Students are exposed to treatment planning in private-practice setting.
- Dent 5501. Pediatric Dentistry Pre-Clinic.** (2 cr; A-F only)  
Physical, emotional, dental, and language development; diagnosis, prevention, and management of oral diseases in children.
- Dent 5601. Introduction to Clinical Preventive Dentistry.** (2 cr; S-N only)  
Application of principles of prevention through case-based small group learning format and clinical experiences. Clinical observation of preventive protocols/techniques. Students prepare/deliver presentation on preventive topic.
- Dent 5611. Periodontology I Lecture.** (1 cr; A-F only. §DH 3131)  
Periodontal anatomy, physiology/etiology of periodontal diseases. Clinical, histopathological, and pathogenesis of gingivitis and periodontitis. Role of genetics, tobacco use, and systemic disorders.
- Dent 5612. Periodontology Technique.** (2 cr; A-F only)  
Presurgical procedures in periodontics. Development of clinical skills to examine, diagnose, prevent, and treat periodontal patients.
- Dent 5613. Periodontology Technique II.** (1 cr; S-N only. Prereq—5612)  
Extension of Dent 5612. Closely supervised, students treat at least three periodontal patients during the summer semester. Students develop clinical skills to examine, diagnose, prevent, and treat periodontal patients before assuming responsibility for their comprehensive care.
- Dent 5701. Introduction to Endodontics Lecture and Laboratory.** (4 cr; A-F only)  
Study of morphology, physiology, and pathology of the human dental pulp and periradicular tissues.
- Dent 5801. Operative Dentistry I.** (2 cr; A-F only. Prereq—Dental Anatomy, Biomaterials)  
Restoration of small caries lesions, cervical abrasion lesions, and attrition defects. Practical aspects of caries risk assessment, lesion identification, and comprehensive caries management. Emphasizes indications for surgical intervention, principles of restoration design, and rationale for various design features.
- Dent 5802. Operative Dentistry I Laboratory.** (3 cr; A-F only. Prereq—Dental Anatomy, Biomaterials)  
Restoration of small caries lesions, cervical abrasion lesions, and attrition defects in clinical simulation setting. Emphasizes designing/executing retentive/resistant restorations, conserving tooth structure, and operating in clinically relevant orientations. Self-evaluation techniques, discriminatory skills.
- Dent 5803. Operative Dentistry II Laboratory.** (2 cr; A-F only. Prereq—Operative Dentistry I)  
Diagnosis, treatment planning, and treatment of moderate to severe phase of dental caries. Use of dental amalgam, cast gold, composite resin, and cast porcelain. Aesthetic modification to teeth.
- Dent 5804. Operative Dentistry II Lab.** (3 cr; A-F only. Prereq—Operative Dentistry I Lab)  
Exercises in treatment of moderate to severe phase of dental caries utilizing dental amalgam, cast gold, composite resin, and cast porcelain. Aesthetic modifications to teeth.
- Dent 5805. Operative Dentistry III.** (3 cr; A-F only. Prereq—Operative Dentistry [I, II], Operative Dentistry [I, II] Lab)  
Integration/application of skills/knowledge in diagnosis, treatment planning, and treatment. Clinical setting.
- Dent 5901. Oral Anatomy I.** (2 cr; A-F only)  
Tooth morphology, nomenclature, classification, charting, calcification, and eruption sequences; mouth growth and development.
- Dent 5902. Oral Anatomy Laboratory I.** (2 cr; A-F only)  
Application of oral anatomy, fixed prosthodontic lab techniques, fundamentals of tooth preparation.
- Dent 5903. Preclinical Prosthodontics Lecture II.** (2 cr; A-F only. Prereq—5901, 5902)  
Prosthodontic procedures.
- Dent 5904. Preclinical Prosthodontic Technique Laboratory II.** (2 cr; A-F only. Prereq—5901, 5902)  
Lab techniques, fundamentals of tooth preparation.
- Dent 5905. Preclinical Prosthodontic Technique Lecture III.** (2 cr; A-F only. Prereq—5901, 5902, 5903, 5904)  
Fixed, removable, and occlusion topics.
- Dent 5906. Preclinical Prosthodontics Technique Laboratory III.** (2 cr; A-F only. Prereq—5901, 5902, 5903, 5904)  
Fixed, removable, and occlusion topics.
- Dent 5907. Preclinical Prosthodontics Technique Lecture IV.** (3 cr; A-F only. Prereq—5901, 5902, 5903, 5904, 5905, 5906)  
Fixed, removable, and occlusion topics.
- Dent 5908. Preclinical Prosthodontic Technique Laboratory IV.** (3 cr; A-F only. Prereq—5901, 5902, 5903, 5904, 5905, 5906)  
Fixed, removable, and occlusion topics.
- Dent 5909. Preclinical Prosthodontics Technique Lecture V.** (3 cr; A-F only. Prereq—5901, 5902, 5903, 5904, 5905, 5906, 5907, 5908)  
Fixed, removable, and occlusion topics.
- Dent 5910. Preclinical Prosthodontics Technique Laboratory V.** (3 cr; A-F only. Prereq—5901, 5902, 5903, 5904, 5905, 5906, 5907, 5908)  
Fixed, removable, and occlusion topics.
- Dent 5911. Preclinical Prosthodontics Technique Lecture VI.** (2 cr; A-F only. Prereq—5901 through 5910)  
Implanting fixed/removable protocols. Principles of restoring damaged teeth.
- Dent 5912. Preclinical Prosthodontics Techniques Laboratory VI.** (2 cr; A-F only. Prereq—5901 through 5910)  
Implanting fixed/removable protocols. Principles of restoring damaged teeth.
- Dent 8031. Topics and Problems in Dental Education.** (1-3 cr [max 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; A-F only. Prereq—Participation in TMJ and orofacial pain advanced education program)  
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 8123. Advanced Topics in Orofacial Pain.** (3 cr; A-F only. Prereq—Grad student in dentistry or other health sciences grad student or #)  
Review of cutting edge research and clinical findings regarding etiology/treatment of acute/chronic orofacial pain conditions and related disorders.

**Dent 8333. FTE: Master's.** (1 cr. Prereq—Master's student, adviser and DGS consent)

**Dent 8777. Thesis Credits: Master's.** (1-18 cr [max 50 cr]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

## Design Institute (DesI)

### College of Architecture and Landscape Architecture

**DesI 5100. Design Institute Directed Study.** (1-3 cr [max 6 cr]; A-F only)  
Guided independent study in design.

## Design, Housing, and Apparel (DHA)

### Department of Design, Housing, and Apparel

#### College of Human Ecology

**DHA 5111. History of Decorative Arts.** (4 cr; A-F only. Prereq—General art history survey course or #)  
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]; 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 [max 4 cr]; A-F only. Prereq—#)  
Independent study in design, housing, and apparel under tutorial guidance.

**DHA 5196. Field Study: National/International.** (1-10 cr [max 10 cr]; A-F only)  
Faculty-directed field study in a national or international setting.

**DHA 5215. Product Development: Softlines.** (4 cr; A-F only. Prereq—2213 or clothing design major or retail merchandising major or grad student or #)  
Product development for apparel and other sewn products. Developing products in a laboratory studio setting for effectiveness, reliability, and marketability. Team approach using merchandising and design principles to develop products for specific markets.

**DHA 5216. Retail Promotion and Consumer Decision Making.** (4 cr; A-F only. Prereq—[1201, 2213, [jr or sr or grad student], [DHA major or minor]] or Δ)  
Consumer behavior theories/concepts as related to apparel. Application to understanding/developing retail promotional strategies: advertising/promotion.

**DHA 5381. Digital Illustration.** (3 cr; A-F only. Prereq—4334, [DHA major or grad student])  
Integration of design with computer applications. Use of raster-/vector-based programs for illustration.

**DHA 5382. Digital Sound and Video.** (3 cr; A-F only. Prereq—[4334, [DHA major or grad student]] or #)  
Design solutions involving time-based media. Emphasizes sound/video. Electronic publishing via Internet.

**DHA 5383. Animation Design.** (3 cr; A-F only. Prereq—[4334, [DHA major or grad student]] or #)  
Animation in time-based electronic design. Introduction to three-dimensional modeling.

**DHA 5385. Internet-Based Media.** (3 cr; A-F only. Prereq—[4334, [DHA major or grad student]] or #)  
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; A-F only. Prereq—[4354, DHA major] or grad or #)  
Preliminary research, including theoretical, applied, and legal aspects. Planning/developmental models. Design prototyping, testing, and analysis.

**DHA 5399. Theory of Electronic Design.** (3 cr; A-F only. Prereq—[DHA major, sr] or grad student or #; offered alternate yrs)  
Theories, methodologies, histories of electronic design, its impact on visual communications. Digital artifacts, processes, paradigms.

**DHA 5463. Housing Policy.** (3 cr; A-F only. \$PA 5261. Prereq—2401, 2463 or #)  
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 5467. Housing and the Social Environment.** (4 cr; A-F only. Prereq—2401 or #)  
Housing choices in context of social environment. Emphasizes special needs of elderly, disabled, minorities, large families, female-headed households, and low-income households. Students conduct a post-occupancy evaluation of housing.

**DHA 5469. Understanding Housing: Assessment and Analysis.** (3 cr; A-F only. Prereq—[2401, 2463] or #)  
How to formulate housing research problems and analyze/present information about housing characteristics/conditions. Students develop housing-related research/grant proposals, use/design cartographic/graphic information about housing, and give a presentation on a research project.

**DHA 5471. Housing Studies Certificate Seminar.** (2 cr; A-F only. Prereq—Admitted to Housing Studies Certificate Prog)  
Integrative seminar and “capstone” to Certificate program. Students prepare an individual career plan that focuses on application of housing studies to community/workplace.

**DHA 5481. Housing for the Elderly and Special Populations.** (3 cr; A-F only. Prereq—2401 or #)  
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; A-F only. Prereq—2401, 2463 or #)  
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, Housing, and Apparel.** (4 cr; A-F only. Prereq—#)  
Educational processes/methods used in design studio/lecture courses. Learning styles, best practices for grading, alternative methods of critique, interacting with students, active learning strategies, teaching with technology. Lecture (3 cr), practicum (1 cr).

**DHA 8114. Design Studio.** (4 cr; A-F only. Prereq—#)  
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]; A-F only. Prereq—Varies with topic)  
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; S-N only. Prereq—Grad student)  
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]; A-F only. Prereq—#)  
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]; A-F only. Prereq—#)

**DHA 8222. Plan B Master's Project.** (3 cr; S-N only. Prereq—DHA master's student, #)  
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; A-F only. Prereq—8101 or #)  
Current conceptualizations and thematic areas in literature of textiles and apparel.

**DHA 8265. Dress: Race, Class, and Gender.** (3 cr; A-F only. Prereq—4212 or #)  
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; A-F only. Prereq—Grad DHA major or #)  
Aesthetics of dress; application of a framework for visual analysis and evaluation.

**DHA 8267. Dress and Culture.** (3 cr; A-F only. Prereq—4212 or #)  
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. Prereq—Master's student, adviser and DGS consent)

**DHA 8361. Color, Design, and Human Perception.** (3 cr; A-F only. Prereq—Basic color theory course or #) 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; A-F only. Prereq—Grad DHA major or #) 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. Prereq—Doctoral student, adviser and DGS consent)

**DHA 8463. Housing: Race and Class.** (3 cr; A-F only) Roles of difference (race, gender, class) in shaping distribution of housing, particularly in cities. Role of housing in patterns of social differentiation.

**DHA 8467. Theoretical Perspectives in Housing Studies.** (3 cr; A-F only. Prereq—5467 or #) 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]. Prereq—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]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**DHA 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—Max 18 cr per semester or summer; 24 cr required)

**DHA 8990. MFA Creative Thesis.** (6 cr [max 12 cr]; A-F only. Prereq—Completed coursework requirements for MFA in DHA w/multimedia emphasis, #) MFA project.

## Development Studies and Social Change (DSSC)

### College of Liberal Arts

**DSSC 8111. Approaches to Knowledge and Truth: Ways of Knowing in Development Studies and Social Change.** (3 cr; S-N only. Prereq—Grad DSSC minor or #)

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; S-N only. Prereq—Grad DSSC minor or #)

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; S-N only. Prereq—Grad DSSC minor or #)

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]. Prereq—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 5993. Directed Studies.** (1-4 cr [max 12 cr]. Prereq—#, □) 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]. Prereq—Grad or intr consent) Selected topics such as cultural, economic, intellectual, political, and social history.

**EAS 8333. FTE: Master's.** (1 cr. Prereq—Master's student, adviser and DGS consent)

**EAS 8777. Thesis Credits: Master's.** (1-18 cr [max 50 cr]. Prereq—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 5001. Spatiotemporal Dynamics of Plant Communities.** (3 cr. Prereq—[Biol 3407, 4014] or #)

Dynamic nature of plant communities in times of environmental changes. Emphasizes species invasion as key for structure/dynamics of plant assemblages. Observational, theoretical, and experimental studies on spatiotemporal dynamics of plant communities under various changes in biological/environmental conditions, including human-induced Global Warming.

**EEB 5008. Forest Response to Quaternary Climate Change.** (2 cr; A-F only. Prereq—Biol 3407, EEB 4631 or Geo 4631 concurrent registration EEB 5009)

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.** (3 cr. Prereq—[[4631 or Geo 4631], Biol 3407] or #)

History of vegetation/climate change in Quaternary period. Importance of mechanistic understanding on interpretation of historical events. Vegetation distribution/climate. Mechanisms of climate change and long-term vegetation dynamics. Vegetation and climate reconstructions. Modeling in paleoecology and paleoclimatology. Case studies in North America and other parts of globe. Human impacts on vegetation and climate.

**EEB 5011. Pollen Morphology.** (2 cr. Prereq—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. Prereq—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. Prereq—[[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. \$FW 5051. Prereq—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. Prereq—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 5122. Plant Interactions with Animals and Microbes.** (3 cr; A-F only. Prereq—Biol 2012 or 3002, 3407 or 3409) Ecological and environmental implications of mutualistic and antagonistic interactions between plants, animals and microbes at organismal, population, and community levels.

**EEB 5124. Plant Physiological Ecology/Plant Physiological Ecology.** (4 cr)

Plant function, its plasticity/diversity in an ecological context. Impact of environmental stresses on major physiological processes of plants, including photosynthesis, respiration, water uptake/transport, and nutrient uptake/assimilation. Lab, field trip to Cedar Creek.

**EEB 5146. Science and Policy of Global Environmental Change.** (3 cr; A-F only. \$FR 5146. Prereq—Biol 3407 Biol 5407 or equiv)

Critical issues underpinning global change and its biological implications. Current scientific literature in exploring evidence for human-induced global change and its potential effects on a wide range of biological processes. Emphasizes terrestrial ecosystems. Economic drivers, economic consequences. Local, national, and international laws and policies.

**EEB 5221. Molecular and Genomic Evolution.** (3 cr; A-F only. Prereq—[[Biol 4003 or GCD 3022], grad student] or #)

Molecular basis of evolutionary change. Current studies of selection and neutral evolutionary processes at molecular level. Evolution from gene to genome level: protein structure and function, multigene families, organelle genomes, genome organization. Lectures, discussions of current literature, and workshops where students practice analyses.

**EEB 5321. Evolution of Social Behavior.** (3 cr; A-F only. Prereq—Biol 3411 or #)

Introduction to theories and concepts relating to behavior evolution, mating systems, and cooperative behavior in animals.

**EEB 5322. Evolution and Animal Cognition.** (3 cr. Prereq—Biol 3411 or Psy 3061 or #)

Animal cognitive abilities. Learning, perception, memory, navigation, and communication from evolutionary/comparative perspective. Cognitive abilities as adaptations that solve specific environmental problems. Empirical methods for assessing cognitive abilities. Emphasizes parsimonious interpretations of data. Controversial topics such as animal intelligence, animal language and whether non-human animals have a “theory of mind.”

**EEB 5323. Neural and Endocrine Mechanisms Underlying Vertebrate Behavior.** (2 cr; A-F only. Prereq—Biol 3411 or Biol 3101 or NSc 3101 or Phsl 3101 or #)

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. Prereq—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. Prereq—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. Prereq—Grad student or #)

Theoretical/practical procedures of biological systematics. Phylogeny reconstruction. Computer-assisted analyses, morphological and molecular approaches, species concepts/speciation, comparative methods, classification, historical biogeography, nomenclature, use/value of museums.

**EEB 5609. Ecosystem Ecology.** (3 cr. Prereq—Biol 3407 or Biol 5407)

Regulation of energy and elements cycling through ecosystems. Dependence of cycles on kinds/numbers of species within ecosystems. Effects of human-induced global changes on functioning of ecosystems.

**EEB 5961. Decision Analysis and Modeling in Conservation Biology.** (3 cr; A-F only. Prereq—Grad student or #)

Decision analysis/modeling in conservation biology. Techniques, concepts, software.

**EEB 5963. Modeling Nature and the Nature of Modeling.** (3 cr. §EEB 3963. Prereq—[Math 1281, Math 1282] or equiv or #)

Hands-on modeling experiences in context of biological applications. Reviews calculus concepts. Students carry out modeling steps, from developing the model, to analytical analysis, to developing computer code, to running the models.

**EEB 8010. Seminar in Paleoecology.** (1 cr [max 4 cr]; S-N only. Prereq—#)

Reading and discussion of recent literature on Quaternary paleoecology.

**EEB 8020. Community Ecology Seminar.** (1 cr [max 5 cr]; S-N only. Prereq—#)

Research topics in selected areas.

**EEB 8050. Population Biology Seminar.** (1 cr [max 5 cr]; S-N only. Prereq—#)

Research topics in selected areas.

**EEB 8051. Empirical Ecology.** (4 cr. Prereq—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]; S-N only. Prereq—#)

Research topics in selected areas.

**EEB 8333. FTE: Master's.** (1 cr. Prereq—Master's student, adviser and DGS consent)

**EEB 8360. Behavioral Biology Seminar.** (1 cr [max 5 cr]; S-N only. Prereq—#)

Research topics in selected areas.

**EEB 8444. FTE: Doctoral.** (1 cr. Prereq—Doctoral student, adviser and DGS consent)

**EEB 8641. Spatial Ecology.** (3 cr. Prereq—[3407, 2 sem calculus] or #)

Introduction to spatial ecology. Role of space in population dynamics and 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.

**EEB 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq—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]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**EEB 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—Max 18 cr per semester or summer; 24 cr required)

**EEB 8980. Seminar on Current Topics.** (1-3 cr [max 6 cr]; S-N only. Prereq—[1st yr or 3rd sem] grad student, #)

Current research in ecology, evolution, and behavior.

**EEB 8990. Graduate Seminar.** (1 cr [max 5 cr]; S-N only. Prereq—#)

Research topics in selected areas.

**EEB 8991. Independent Study: Ecology, Evolution, and Behavior.** (1-10 cr [max 10 cr]; S-N only. Prereq—#)

Individual research on a specialized topic.

**EEB 8994. Directed Research.** (1-5 cr [max 10 cr]; S-N only. Prereq—#)

## Economics (Econ)

### Department of Economics

### College of Liberal Arts

**Econ 5109. Game Theory for Engineers.** (4 cr; A-F only. Prereq—[[Math 2283, Math 2373, Math 2374, Math 3283] or Math 4606], M.S./Ph.D. student in [engineerg or comp sci or info tech or operations mgmt]) or #; not for econ [undergrads or PhD students])

Introduction to game theory and its applications.

Utility theory, noncooperative/cooperative games, bargaining theory. Games in normal/extensive form, Nash equilibria/refinements.

**Econ 5151. Elements of Economic Analysis: Firm and Household.** (2 cr. Prereq—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. Prereq—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. Prereq—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 5890. Economics of the Health-Care System.** (3 cr; A-F only. §PubH 6832. Prereq—[3101, 3102] or #)

Economic analysis of U.S. health-care sector. Emphasizes problems of pricing, production, distribution. Health-care services as one factor contributing to nation's health.

**Econ 8001. Microeconomic Analysis.** (2 cr. Prereq—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. Prereq—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. Prereq—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. Prereq—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. Prereq—5151

or equiv, Math 2243 or equiv, ¶Math 5615 or concurrent registration in 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. Prereq—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. Prereq—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. Prereq—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. Prereq—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. Prereq—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. Prereq—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. Prereq–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. Prereq–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. Prereq–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. Prereq–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. Prereq–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. Prereq–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. Prereq–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. Prereq–8104, 8108 or #)  
Selected topics, emphasizing development of theoretical topics. Seven-week course.

**Econ 8125. History of Economic Thought.** (2 cr. Prereq–8124 or #)  
Selected topics, emphasizing development of theoretical topics. Seven-week course.

**Econ 8181. Advanced Topics in Microeconomics.** (2 cr [max 4 cr]. Prereq–8104 or #)  
Faculty and student presentations based on recent literature. Seven-week course.

**Econ 8182. Advanced Topics in Microeconomics.** (2 cr [max 4 cr]. Prereq–8104 or #)  
Faculty and student presentations based on recent literature. Seven-week course.

**Econ 8185. Advanced Topics in Macroeconomics.** (2 cr [max 4 cr]. Prereq–8108 or #)  
Faculty and student presentations based on recent literature. Seven-week course.

**Econ 8186. Advanced Topics in Macroeconomics.** (2 cr [max 4 cr]. Prereq–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]. Prereq–8104 or #)  
Students conduct research and present papers under faculty supervision.

**Econ 8192. Workshop in Mathematical Economics.** (1-3 cr [max 10 cr]. Prereq–8104 or #)  
Students work on research and present papers under faculty supervision.

**Econ 8201. Econometric Analysis.** (2 cr. Prereq–[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. Prereq–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. Prereq–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. Prereq–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. Prereq–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. Prereq–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. Prereq–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. Prereq–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. Prereq–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. Prereq–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. Prereq–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]. Prereq–8213 or #)  
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]. Prereq–8213 or #)  
Faculty and student presentations based on recent literature. Seven-week course.

**Econ 8291. Workshop in Econometrics.** (1-3 cr [max 10 cr]. Prereq–8213 or #)

**Econ 8292. Workshop in Econometrics.** (1-3 cr [max 10 cr]. Prereq–8213 or #)

**Econ 8311. Economic Growth and Development.** (2 cr. Prereq–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. Prereq–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. Prereq–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. Prereq–Master's student, adviser and DGS consent)

**Econ 8381. Advanced Topics in Economic Development.** (2 cr [max 4 cr]. Prereq–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]. Prereq–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]. Prereq–#)

**Econ 8392. Workshop in Economic Growth and Development.** (1-3 cr [max 10 cr]. Prereq–#)

**Econ 8401. International Trade and Payments Theory.** (2 cr. Prereq–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. Prereq–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. Prereq–8402 or #)  
International business cycles; exchange rates; capital movements; international liquidity. This is a 7-week course.

**Econ 8404. International Trade and Payments Theory.** (2 cr. Prereq–[8402, 8403] or #)  
Theoretical models of international trade. Trade data, empirical work on trade. Seven week course.

**Econ 8444. FTE: Doctoral.** (1 cr. Prereq–Doctoral student, adviser and DGS consent)

**Econ 8481. Advanced Topics in International Trade.** (2 cr [max 4 cr]. Prereq–8403 or #)  
Faculty and student presentations based on recent literature. Seven-week course.

**Econ 8482. Advanced Topics in International Trade.** (2 cr [max 4 cr]. Prereq–8403 or #)  
Faculty and student presentations based on recent literature. Seven-week course.

**Econ 8491. Workshop in Trade and Development.** (1-3 cr [max 10 cr]. Prereq–#)

**Econ 8492. Workshop in Trade and Development.** (1-3 cr [max 10 cr]. Prereq–#)

**Econ 8501. Wages and Employment.** (2 cr. Prereq–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. Prereq–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 8503. Wages and Employment.** (2 cr. Prereq–8502 or #)  
Economic analysis of labor markets and their operation under conditions of individual/collective bargaining. Implications of labor market operations for resource allocation, wage/price stability, income/employment growth. Wage structures and wage levels. Wage/employment theories/practices. Economic impacts of unions. Seven-week course.

**Econ 8581. Advanced Topics in Labor Economics.** (2 cr [max 4 cr]. Prereq–8502 or #)  
Faculty and student presentations based on recent literature. Seven-week course.

**Econ 8582. Advanced Topics in Labor Economics.** (2 cr [max 4 cr]. Prereq–8502 or #)  
Faculty and student presentations based on recent literature. Seven-week course.

**Econ 8601. Industrial Organization and Government Regulation.** (2 cr. Prereq–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. Prereq–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. Prereq–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]. Prereq–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]. Prereq–8603 or #)  
Faculty and student presentations based on recent literature. Seven-week course.

**Econ 8682. Advanced Topics in Industrial Organization.** (2 cr [max 4 cr]. Prereq–8603 or #)  
Faculty and student presentations based on recent literature. Seven-week course.

**Econ 8691. Workshop in Applied Microeconomics.** (1-3 cr [max 10 cr]. Prereq–#)

**Econ 8692. Workshop in Applied Microeconomics.** (1-3 cr [max 10 cr]. Prereq–#)

**Econ 8701. Monetary Economics.** (2 cr. Prereq–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. Prereq–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. Prereq–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. Prereq–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. Prereq–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. Prereq–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]. Prereq–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]. Prereq–8702 or #)  
Faculty and student presentations based on recent literature. Seven-week course.

**Econ 8782. Advanced Topics in Monetary Economics.** (2 cr [max 4 cr]. Prereq–8702 or #)  
Faculty and student presentations based on recent literature. Seven-week course.

**Econ 8791. Workshop in Macroeconomics.** (1-3 cr [max 10 cr]. Prereq–#)

**Econ 8792. Workshop in Macroeconomics.** (1-3 cr [max 10 cr]. Prereq–#)

**Econ 8801. Public Economics.** (2 cr. Prereq–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. Prereq–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. Prereq–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]. Prereq–8803 or #)  
Faculty and student presentations based on recent literature. Seven-week course.

**Econ 8882. Advanced Topics in Public Economics.** (2 cr [max 4 cr]. Prereq–8803 or #)  
Faculty and student presentations based on recent literature. Seven-week course.

**Econ 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq–Max 18 cr per semester or summer; 24 cr required)

**Econ 8891. Workshop in Public Economics and Policy.** (1-3 cr [max 10 cr]. Prereq–#)

**Econ 8892. Workshop in Public Economics and Policy.** (1-3 cr [max 10 cr]. Prereq–#)

**Econ 8990. Individual Graduate Research.** (1-7 cr [max 7 cr]. Prereq–#)

## Education (Educ)

### College of Education and Human Development

**Educ 8333. FTE: Master's.** (1 cr. Prereq–Master's student, adviser and DGS consent)

**Educ 8444. FTE: Doctoral.** (1 cr. Prereq–Doctoral student, adviser and DGS consent)

**Educ 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq–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]. Prereq–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**Educ 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq–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.** (3 cr. SEPSY 3119. Prereq–MED/initial licensure student or CLA music ed or preteaching major or #; psych course recommended)  
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; A-F only. Prereq–Post-bac or MED/initial licensure or CLA music ed or preteaching major or FOE or agriculture or kinesiology or #)  
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; A-F only. Prereq–MED/initial licensure student or CLA music ed major or preteaching major or instr approval)  
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; A-F only. Prereq-[MEd/initial licensure or CLA music ed major or preteaching major or #], basic computer skills)  
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; A-F only. Prereq-MEd/init lic or CLA music ed or preteaching or #)  
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. §EdPa 3021, Hum 3021, Hum 4021)  
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. §EdPa 3023, Hum 3023, Hum 4023)  
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. §Soc 5455)  
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 5070. Special Topics: School Leadership.** (1-5 cr [max 15 cr]. Prereq-BA or BS or other baccalaureate degree)  
Skills/knowledge necessary to respond to multiple challenges of reduced budgets, increased accountability requirements, and growing concerns about impact of technology investments in education.

**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 5104. Strategies for International Development of Education Systems.** (3 cr; A-F only. Prereq-Grad student)  
Strategies for improving quality/efficiency of schooling in developing countries. Introduction to current research on what policy/programmatic interventions have proven most successful in increasing access, raising quality, and improving efficiency of education in developing countries.

**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. §Anth 5128)  
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 5305. Leadership and Vision in School Technology.** (1 cr. Prereq-[Mac or PC] with 256 MB RAM, [Windows NT 2000 or XP or Mac OS 9 or 10], Pentium [2 or faster], internet connection, [Netscape or Internet Explorer], virus protection software, [School Technology Leadership] or #)  
How to create a shared vision for comprehensive integration of technology into educational environments. Ways to foster environment/culture conducive to realizing that vision.

**EdPA 5306. Staff Technology Development and Support.** (1 cr. §CI 5346. Prereq-[Mac or PC] with 256 MB RAM, [Windows NT 2000 or XP or Mac OS 9 or 10], Pentium [2 or faster], internet connection, [Netscape or Internet Explorer], virus protection software, [School Technology Leadership] or #)  
How to lead an organization in designing, implementing, evaluating, improving, and sharing approaches to staff development. Technology-related development. Facilitating staff development through use of technology.

**EdPA 5307. School Management and Technology.** (1 cr. Prereq—[[Mac or PC] with 256 MB RAM, [Windows NT 2000 or XP or Mac OS 9 or 10], Pentium [2 or faster], internet connection, [Netscape or Internet Explorer], virus protection software, School Technology Leadership] or #) Various organizational/management issues impacted by information technology. Focuses on hardware, software, and database technologies designed to facilitate management/operations of school organizations.

**EdPA 5308. Emerging Issues and School Technology.** (1 cr. Prereq—[[Mac or PC] with 256 MB RAM, [Windows NT 2000 or XP or Mac OS 9 or 10], Pentium [2 or faster], internet connection, [Netscape or Internet Explorer], virus protection software, School Technology Leadership] or #) Needs of schools/administrators to remain on forefront of information technologies. Focuses on anticipated technological trends years/decades ahead.

**EdPA 5309. Electronic Communication Tools and Environments for Schools.** (1 cr. Prereq—[[Mac or PC] with 256 MB RAM, [Windows NT 2000 or XP or Mac OS 9 or 10], Pentium [2 or faster], internet connection, [Netscape or Internet Explorer], virus protection software, School Technology Leadership] or #) Various electronic communication channels, information environments to facilitate educational organizations' operations/communication. Focuses on networked environments, integration with handheld computers, and outreach to internal/external stakeholders.

**EdPA 5310. Data-Driven Decision-Making I.** (1 cr. Prereq—[[Mac or PC] with 256 MB RAM, [Windows NT 2000 or XP or Mac OS 9 or 10], Pentium [2 or faster], internet connection, [Netscape or Internet Explorer], virus protection software, School Technology Leadership] or #) Data-driven decision-making needs of schools/administrators. Focuses on data collection/analysis needs of educational organizations and on use of appropriate software/databases to collect, manage, analyze, and report school information.

**EdPA 5311. Data-Driven Decision-Making II.** (1 cr. Prereq—[[Mac or PC] with 256 MB RAM, [Windows NT 2000 or XP or Mac OS 9 or 10], Pentium [2 or faster], internet connection, [Netscape or Internet Explorer], virus protection software, School Technology Leadership] or #) Continuation of 5310. Data-driven decision-making needs of schools/administrators. Hands-on training in students' own organizations in using technology to analyze data to make educational decisions.

**EdPA 5312. School Technology Policy Issues.** (1 cr. Prereq—[[Mac or PC] with 256 MB RAM, [Windows NT 2000 or XP or Mac OS 9 or 10], Pentium [2 or faster], internet connection, [Netscape or Internet Explorer], virus protection software, School Technology Leadership] or #) Various state/national policy issues related to educational technology. Focuses on "digital divide" in schools/communities, federal educational technology policy initiatives, and state/federal educational technology legislation.

**EdPA 5313. Legal and Ethical Issues in School Technology.** (1 cr. Prereq—[[Mac or PC] with 256 MB RAM, [Windows NT 2000 or XP or Mac OS 9 or 10], Pentium [2 or faster], internet connection, [Netscape or Internet Explorer], virus protection software, School Technology Leadership] or #) Social, legal, and ethical issues related to school technology. How to model responsible decision-making related to these issues.

**EdPA 5314. School Technology Safety and Security.** (1 cr. Prereq—[[Mac or PC] with 256 MB RAM, [Windows NT 2000 or XP or Mac OS 9 or 10], Pentium [2 or faster], internet connection, [Netscape or Internet Explorer], virus protection software, School Technology Leadership] or #) School safety/security issues impacted by information technology. Network/data security. Physical safety of students, employees, and facilities. Computer recycling/disposal. Appropriate ergonomic environments for students/employees.

**EdPA 5315. School Technology Leadership Multimedia Project.** (1 cr. Prereq—[[Mac or PC] with 256 MB RAM, [Windows NT 2000 or XP or Mac OS 9 or 10], Pentium [2 or faster], internet connection, [Netscape or Internet Explorer], virus protection software, School Technology Leadership] or #) Students focus on individualized school technology leadership topic of choice, deliver a multimedia presentation of project results. Regular consultation with faculty, peer mentors, and outside mentors.

**EdPA 5321. The Principalship.** (3 cr) Role of the principal: qualifications, duties, and problems.

**EdPA 5322. School Superintendency.** (3 cr) 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 5323. Women in Leadership.** (3 cr. Prereq—technology access) Women in leadership, in context of larger systems and their own lives. Supporting equity/equality across areas of difference.

**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 5325. Analytical Tools for Educational Leadership.** (1 cr. Prereq—#) Technological/analytical tools associated with data-driven decision-making processes in K-12 school environments.

**EdPA 5326. Data Analysis for Educational Leadership.** (2 cr. Prereq—[5325 or equiv], #) Advanced technological/analytical tools associated with data-driven decision-making processes in K-12 school environments.

**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. Legal Aspects of Elementary and Secondary Education.** (3 cr) Overview of legal foundations of elementary/secondary education. Statutory themes, relevant case law, emergent policy issues. Implications for educational organizations and for administrative practice.

**EdPA 5346. Politics of Education.** (3 cr; A-F only. Prereq—postbac, MEd, or grad student) 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. Administration of Human Resources in Education.** (2 cr. Prereq—Designed for students working on licensure for dir of community educ or superintendent or K-12 principal or dir of special educ) Effective personnel practices. Skills required for effective administrator/leader. Emphasizes human resources administration, including employee recruitment, selection, orientation/support, supervision, and performance appraisal of school district personnel.

**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 "futzurize the present."

**EdPA 5356. Disability Policy and Services.** (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, and local perspectives.

**EdPA 5361. Project in Teacher Leadership.** (3 cr [max 6 cr]; S-N only. \$CI 5178. Prereq—MEd student in Teacher Leadership Program) 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. Context and Practice of Educational Leadership.** (3 cr; A-F only) Current research/practice on educational leadership. Focuses 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. Prereq—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 5385. Licensure Seminar.** (1 cr [max 4 cr]; S-N only)

Preparation for licensure program. Program overview, preassessment, reflective practice, APA writing, exit panel review, administrative employment interview.

**EdPA 5386. Portfolio Seminar.** (1 cr [max 4 cr]; S-N only)

Development of electronic administrative licensure portfolio as part of process to earn endorsement for license as a school superintendent, K-12 principal, director of special education, or director of community education.

**EdPA 5387. Administration of Teaching and Learning.** (1 cr)

Administration of teaching/learning as a system in an inclusive school system. Multiple experts present components of system. Focuses on questions an administrator must address when functioning as leader of learning.

**EdPA 5388. Building the Master Schedule.** (2 cr)

Prereq—5387)

Scheduling models. Strategies for personalizing schools. Hands-on “infinite campus student system.” Master schedule is built online.

**EdPA 5389. Administration of Community and Alternative Education Programs.** (3 cr)

Competencies of leadership, community relations, communication, community assessment, program development, program evaluation. Philosophy/administration of community/alternative education programs.

**EdPA 5391. Special Education Law.** (1 cr. Prereq—Designed for students working on licensure in PK-12 administration)

Competencies of leadership, policy, and political influence. Legal/regulatory applications focusing on special education law.

**EdPA 5396. Field Experience in PK-12 Educational Administration.** (3 cr [max 6 cr]; S-N only. Prereq—#)

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. §EPsy 5243)

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)

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]; S-N only. §EPsy 5246. Prereq—5501 or EPsy 5243)

Informal seminar of faculty and advanced students. Issues/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. College Students Today.** (3 cr. §EPSY 5451)

Issues involving population of students in colleges/universities. College student development theory, students' expectations/interests. How college affects student outcomes. Role of curricular/extracurricular activities. Student-faculty interaction.

**EdPA 5721. Racial and Ethnic Diversity in Higher Education.** (2-3 cr [max 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.** (2-3 cr [max 3 cr]. §EPSY 5421)

Scope, administration, coordination, and evaluation of programs in college and university student affairs.

**EdPA 5727. Developmental Education Programs and Postsecondary Students.** (2-3 cr [max 3 cr]. Prereq—Bachelor's degree)

Focuses on populations served by developmental education programs in the United States and abroad. Defines developmental education. Historical perspective for need for developmental education, student development theories that guide practice in developmental education. Identifying student needs. Model programs, best practices for student retention. Current issues/trends in field.

**EdPA 5728. Two-Year Postsecondary Institutions.** (2-3 cr [max 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 5734. Institutional Research in Postsecondary Education.** (2-3 cr [max 3 cr]; A-F only. Prereq—[5701, (EPsy 5231 or EPsy 8261), grad student] or #)

Scope, role, administration, research strategies, and evaluation of institutional research in postsecondary institutions. Overview of research methodologies, disciplinary foundations of institutional research. Use of institutional, state, and national databases in addressing full range of institutional missions/functions.

**EdPA 5795. Plan B Research Design.** (3 cr [max 6 cr]; A-F only. Prereq—Grad student)

Foundation to design Plan B research project relevant to student's professional interests. Literature review strategies to establish conceptual framework for project. Relates research question to design alternatives and to associated qualitative/quantitative analysis techniques. Issues such as human subjects and APA guidelines for preparing research papers.

**EdPA 8002. Critical Issues in Contemporary Education.** (3 cr. Prereq—EdD or PhD 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; S-N only. Prereq—EdPA doctoral student)

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; S-N only. Prereq—EdPA doctoral student)

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; S-N only. Prereq—EdPA doctoral student)

Introduction to most important quantitative/qualitative approaches employed in educational policy research.

**EdPA 8014. Doctoral Research Seminar IV.** (1 cr; S-N only. Prereq—EdPA doctoral student)

Preparation of thesis prospectus.

**EdPA 8015. Research Design and Educational Policy.** (3 cr. Prereq—8011, EdPA PhD student)

Logic of research design, from research questions and audience considerations to selection of a suitable design for collecting/analyzing qualitative, quantitative, and mixed-method data.

**EdPA 8020. Leadership: From Theory to Reflective Practice.** (3 cr; A-F only. Prereq—[5001 or equiv], doctoral student) or #)

Leadership theory. Emphasizes seminal scholars' work from related social science disciplines. Implications of theory for practice of leadership. Knowledge, behaviors, values, and skills needed in educational and other public settings.

**EdPA 8087. Seminar: Educational Policy and Administration.** (1-3 cr [max 24 cr])

Seminar on issues of educational policy and administration.

**EdPA 8095. Problems: Educational Policy and Administration.** (1-3 cr [max 24 cr])

Independent study on issues of educational policy/administration. Arranged with instructor.

**EdPA 8096. Internship: Educational Policy and Administration.** (1-9 cr [max 24 cr])

Internship on issues of educational policy/administration. Arranged with instructor.

**EdPA 8104. Innovative Systems Thinking in Education and Culture.** (3 cr)

Critical aspects of historical/contemporary systems philosophy, thinking, and analysis. Development of concepts/skills applicable to coping with evolutionary/chaotic environments. Modeling/simulation of learning systems in rapidly changing national/international contexts.

**EdPA 8121. Doctoral Seminar: Comparative and International Development Education.** (1-6 cr [max 6 cr]; S-N only. Prereq—EdPA PhD candidate)

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 [max 4 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. Prereq—Master's student, adviser and DGS consent)**EdPA 8444. FTE: Doctoral.** (1 cr. Prereq—Doctoral student, adviser and DGS consent)**EdPA 8502. Program Evaluation Theory and Models: Qualitative and Quantitative Alternatives.** (3 cr. Prereq—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]. §EPsy 8295. Prereq—[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]. \$EPsy 8296. Prereq-[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]. Prereq-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. Prereq-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; A-F only. Prereq-5001, 5701)  
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.** (2-3 cr [max 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.** (2-3 cr [max 3 cr]. Prereq-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.** (2-3 cr [max 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. Prereq-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]. Prereq-Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**EdPA 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq-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]. Prereq-Grad student in psychological foundations of education or #)  
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 5118. Language: Psycholinguistic Research and Educational Application.** (3 cr; A-F only)  
Psychological study of language. Psychological processes involved in language use, mechanisms that guide these processes. Failures of these mechanisms. How language operates.

**EPsy 5135. Human Relations Workshop.** (4 cr)  
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 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 5158. Using Power and Influence to Effect Change.** (3 cr. Prereq-3xxx course in social sciences or #)  
How people can influence others and avoid manipulation. Factors that shape extent to which influence is successful. Indirect/direct influence processes, minority influence, motivation, behavior management, conformity, followership, group dynamics.

**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 and Human Development.** (3 cr; A-F only. Prereq-5261 or intro statistics course)  
Designing/conducting a research study. Reviewing literature, formulating research problem, using different approaches to gather data, managing/analyzing data, reporting results.

**EPsy 5221. Principles of Educational and Psychological Measurement.** (4 cr. Prereq-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 5222. Measurement and Analysis: K-12 Education Accountability.** (4 cr. Prereq-5231 or [5221, 5261] or [Psy 3305, Psy 5862] or #)  
Methods of educational accountability. Meaning of student/school accountability. Measurement of educational inputs, processes, and results. Data analysis, data use for school improvement.

**EPsy 5231. Introductory Statistics and Measurement in Education.** (4 cr. \$EPsy 3264, EPsy 5261)  
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. \$EdPA 5501)  
Introductory course in program evaluation; planning an evaluation study, collecting and analyzing information, reporting results; overview of the field of program evaluation.

**EPsy 5244. Survey Design, Sampling, and Implementation.** (3 cr. Prereq-[5221 or 5231 or 5261 or equiv], [CEHD grad student or MEd student])  
Survey methods, including mail, phone, and Web-based/e-mail surveys. Principles of measurement, constructing questions/forms, pilot testing, sampling, data analysis, reporting. Students develop a survey proposal and a draft survey, pilot the survey, and develop sampling/data analysis plans.

**EPsy 5246. Evaluation Colloquium: Psychological Foundations.** (1 cr [max 8 cr]; S-N only. \$EdPA 5524. Prereq-5243 or EdPA 5501)  
Informal seminar of faculty and advanced students interested in the issues and problems of program evaluation.

**EPsy 5247. Qualitative Methods in Educational Psychology.** (3 cr. Prereq-Grad student)  
Introduction to qualitative methods of inquiry. Contrasting different research traditions (e.g., case study, phenomenology, ethnography, social interactionism, critical theory). Practice with field notes, observations, and interviewing. Use of NVIVO to track/code data.

**EPsy 5261. Introductory Statistical Methods.** (3 cr. \$EPsy 3264, EPsy 5231)  
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. Prereq–3264 or 5261 or equiv)  
Application of statistical concepts/procedures. Analysis of variance, covariance, multiple regression. Experimental design: completely randomized, block, split plot/repeated measures.

**EPsy 5271. Becoming a Teacher of Statistics.** (3 cr. Prereq–5261 or equiv)  
Current methods of teaching first courses in statistics. Innovative teaching methods, materials, and technological tools. Types of first courses, reform recommendations, goals for student learning, recommended content, teaching methods, technology, student assessment.

**EPsy 5272. Statistics Teaching Internship.** (3 cr; S-N only. Prereq–Grad student, #)  
Supervised teaching experience.

**EPsy 5273. Methodology Teaching Internship.** (1 cr [max 2 cr]; S-N only. Prereq–Grad student, #)  
Supervised teaching experience as part of a course in statistics, measurement, or evaluation.

**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. Prereq–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. Prereq–#)  
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 5415. Child and Adolescent Development and Counseling.** (3 cr; A-F only. Prereq–Grad student or MEd student or K-12 [counseling endorsement or licensure] student)  
Development, issues, and needs of children, kindergarten through high school ages. Counseling/developmental theory/strategies, family/social environment. Cultural diversity, legal/ethical issues in counseling children/adolescents.

**EPsy 5421. Leadership and Administration of Student Affairs.** (3 cr. \$EdPA 5724)  
Theoretical approaches, administrative structure, and evaluation methods used in college/university student affairs.

**EPsy 5422. Principles of Group Work: Theory and Procedures.** (3 cr. Prereq–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. Prereq–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. Prereq–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. College Students Today.** (3 cr. \$EdPA 5704)  
Issues involving diverse populations of students in colleges/universities. Student development theory, students' expectations/interests, how college affects student outcomes. Role of curricular/extracurricular activities and of student-faculty interactions.

**EPsy 5461. Cross-Cultural Counseling.** (3 cr; A-F only)  
Effect of cross-cultural/cross-national psychological differences in human traits/characteristics. Framework for development/implementation of 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 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; A-F only. Prereq–Child development course, 5601 or equiv)  
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; A-F only. Prereq–5613)  
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; A-F only. Prereq–5612)  
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; A-F only. Prereq–5613, 5614)  
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. Prereq–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 [max 3 cr]; A-F only)  
Anatomy, physiology, and kinesthology. 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. Prereq–[5621, 5622] or #)  
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; A-F only. Prereq–5601 or #)  
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 [max 3 cr]. Prereq–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. Prereq—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. Prereq—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. Prereq—[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; A-F only. Prereq—5616, 5656)

Developing comprehensive behavioral programs for students with social and emotional disabilities. Instructing students with social and emotional disabilities.

**EPsy 5661. Introduction to Autism Spectrum Disorder.** (3 cr. Prereq—5616, Autism Spectrum Disorder certificate student, #)

Knowledge/skills needed to promote learning/success for school age children with Autism Spectrum Disorder. Definition, etiology, and characteristics of ASD. Current research/issues. Emphasizes collaborative problem solving approach that facilitates effective family-professional partnerships and educational programming for this population.

**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; A-F only.

Prereq—5671 or #)

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 5674. Techniques of Orientation, Mobility, and Independence for Students with Visual Disabilities.** (3 cr; A-F only. Prereq—5675 or #)

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 5676. Case Management for Children with Visual Disabilities.** (3 cr; A-F only. Prereq—5671, 5673, 5675)

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; A-F only. Prereq—5625)

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]; A-F only. Prereq—[5614, [FOE or SpEd grad or licensure student]] or #)

Observations and supervised support of teaching practice in schools or agencies serving children with disabilities in integrated programs.

**EPsy 5702. Practicum in Autism Spectrum Disorder.**

(3 cr. Prereq—5616, 5661, 5609, one of [5622 or 5644 or SLHS 5606], enrolled in Autism Spectrum Disorder certificate program, #)

Four hundred hours of supervised work in settings where individuals with Autism Spectrum Disorder are served. On-site supervision is provided by qualified professionals. A University supervisor conducts on-site observations. Bi-weekly seminars.

**EPsy 5703. Practicum in Applied Behavior Analysis.**

(3 cr. Prereq—5616, 5657, Psy 4011, Applied Behavior Analysis Certificate student, #)

Four hundred hours of supervised experience in applied behavior analytic intervention with individuals with significant challenging behavior and learning difficulties. On-site supervision is provided by qualified professionals. A University supervisor conducts on-site observations. Bi-weekly seminars.

**EPsy 5720. Special Topics: Special Education.** (1-4 cr [max 12 cr]. Prereq—#)

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]. Prereq—#)

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]. Prereq—#)

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]; S-N only. Prereq—#)

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]; S-N only. Prereq—#, completion of all course requirements for license in ECSE)

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]; A-F only. Prereq—Completion of licensure courses for social and emotional disorders, #)

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, Mild/Moderate.** (1-6 cr [max 6 cr]; A-F only. Prereq—Completion of all licensure coursework, #)

Supervised student teaching, or special practicum project, in schools or other agencies serving students at elementary/secondary levels who have mild to moderate developmental disabilities.

**EPsy 5756. Student Teaching: Developmental Disabilities, Moderate/Severe.** (1-6 cr [max 6 cr]; A-F only. Prereq—Completion of all licensure coursework, #)

Supervised student teaching, or special practicum projects, in schools or other agencies serving students at elementary/secondary levels who have moderate to severe developmental disabilities.

**EPsy 5757. Student Teaching: Physical and Health Related Disabilities.** (1-6 cr [max 8 cr]; A-F only. Prereq—#)

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]; A-F only. Prereq—#)

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 [max 4 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 [max 3 cr]. Prereq—Honors senior 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]; A-F only. Prereq-#)  
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: Human Expertise and Its Development.** (3 cr; A-F only. Prereq-Courses in [learning, cognition])  
Analysis of human expertise. Forms of human expertise. Novice-expert differences in various occupations/fields. How human expertise is developed. Deliberate practice. Educational/psychological applications.

**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 8116. Reading for Meaning: Cognitive Processes in the Comprehension of Texts.** (3 cr. Prereq-#)  
Students read primary articles on cognitive processes involved in reading comprehension. Focuses on inference making during reading and on construction of a coherent memory representation. Computational models, neurological processes, developmental/individual differences, effects of text genre (e.g., expository, narrative).

**EPsy 8117. Writing Empirical Paper and Research/Grant Proposals in Education and Psychology.** (3 cr. Prereq-#)  
Scientific writing skills. Focuses on logic/argumentation. Each student produces an empirical paper or research proposal. Breaks down the writing process into components: one component per week. Each week, students write a section of their paper/proposal and critique others'.

**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. Prereq-Personality or child psych course)  
Major research and theoretical work. Developmental and educational influences on personality.

**EPsy 8215. Advanced Research Methodologies in Education.** (3 cr. Prereq-5221, 5247, 8261, 8262, #)  
Quantitative research methods, including models of scientific inquiry, role of theories/research design, role of measurement error in quantitative data-based inference, and qualitative methods of inquiry. Focuses on advanced quantitative/qualitative methodologies used in methodologically-oriented studies in educational measurement, evaluation, and stats.

**EPsy 8216. Seminar: Research Processes in Psychological Foundations of Education.** (3 cr; A-F only. Prereq-[5216, admitted to doctoral program in psych foundations] or #)  
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. Prereq-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.** (4 cr. §Psy 5865. Prereq-[5221 or Psy 5862 or equiv], [8261 or 8262 or equiv])  
Generalizability theory, item response theory, factor models for test items, binomial model. Application to problems of designing, linking assessments. Includes a computer lab.

**EPsy 8261. Statistical Methods I: Probability and Inference.** (3 cr. Prereq-3264 or 5261 or equiv)  
Advanced theory, derivations of quantitative statistics. Descriptive statistics, probability, normal distribution. One-/two-sample hypothesis tests, confidence intervals. One-way analysis of variance, follow up tests.

**EPsy 8262. Statistical Methods II: Regression and the General Linear Model.** (3 cr. Prereq-[8260, 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. Prereq-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. Prereq-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 8266. Statistical Analysis Using Structural Equation Methods.** (3 cr. Prereq-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 8267. Applied Multivariate Analysis.** (3 cr. Prereq-[8261, 8262] or equiv), familiarity with matrix algebra, knowledge of a computerized statistics package)  
Use/interpretation of results from several multivariate statistical techniques. Matrix algebra, variance/covariance, Hotelling's T<sup>2</sup>, GLM, MANOVA, MANCOVA, discriminant analysis, canonical correlations, dimensionality, principal components, latent composites, distance, hierarchical clustering.

**EPsy 8269. Matrix Algebra for Statistical Modeling.** (2 cr. Prereq-8262 or equiv)  
Linear/matrix algebra, including vector operations, applications to multivariate statistics. Procedures for solving systems of linear equations. Geometry of vectors/matrices. Focuses on regression and regression diagnostics in a matrix framework. Uses SPSS MATRIX language.

**EPsy 8271. Statistics Education Research Seminar: Studies on Teaching and Learning Statistics.** (3 cr)  
Introduction to classic/current research related to teaching/learning of statistics. Research from psychology, education, and statistics. Students focus on a particular research question and review the literature related to that question.

**EPsy 8281. Advanced Statistical Computing and Data Analysis.** (3 cr. Prereq-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 8282. Statistical Analysis of Longitudinal Data.** (3 cr. Prereq-[8261, 8262] or equiv)  
Traditional/modern approaches to analyzing longitudinal data. Dependent t-test, repeated measures ANOVA and MANOVA. Linear mixed models, multilevel models, generalized models. Required labs using SAS computer program.

**EPsy 8290. Special Topics: Seminar in Psychological Foundations.** (1-6 cr [max 15 cr]. Prereq-#)  
Students formulate research designs. Learning and cognition, social psychology, measurement, and statistics.

**EPsy 8295. Evaluation Problems.** (1-6 cr [max 24 cr]. §EdPA 8595. Prereq-5243 or EdPA 5501, #)  
Individually directed study of an issue in the theory or practice of program evaluation.

**EPsy 8296. Evaluation Internship.** (1-9 cr [max 24 cr]. §EdPA 8596. Prereq-5243 or EdPA 5501, #)  
Hands-on experience in conducting a program evaluation in a real-world setting under supervision of an evaluation professional.

**EPsy 8300. Special Topics in Educational Psychology.** (1-4 cr [max 9 cr])  
Issues or related coursework in areas not normally available through regular curriculum offerings.

**EPsy 8333. FTE: Master's.** (1 cr. Prereq-Master's student, adviser and DGS consent)

**EPsy 8400. Topics: Counseling and Student Personnel Psychology.** (1-3 cr [max 9 cr])  
Current issues in counseling and student personnel psychology, or related coursework in areas not normally available through regular curriculum offerings.

**EPsy 8402. Individual Counseling: Theory and Applications.** (3 cr; A-F only. Prereq-Grad ed psy major with CSPP subprog or #)  
Traditional and contemporary theories of counseling and psychotherapy. Applications to various settings and populations.

**EPsy 8403. Social/Cultural Contexts: Counseling and Skills.** (3 cr; A-F only. Prereq-Grad ed psy major with CSPP subprog or #)  
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; A-F only. Prereq-Ed psy MA or PhD student with CSPP subprog or #)  
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; A-F only. Prereq-CSPP)  
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 8406. Professional Ethics for Counselors and Psychologists.** (3 cr)  
Theory, research, and practice in counseling ethics. Scope/impact of professional ethics. Ethical decision making. Ethics and the law. Ethical practice in special settings. Scholarship/research in counseling ethics. Lectures, discussions, case studies, individual/group examination of original research.

**EPsy 8411. Advanced Counseling Research.** (4 cr; A-F only. Prereq-Ed psy PhD student with CSPP subprog or #)  
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; A-F only. Prereq-Ed psy PhD student with CSPP subprog or #)  
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; A-F only. Prereq—[Psy 5604H or Psy 8111 or Psy 8112], doctoral student, #)  
Assessment interviews, MMPI-2, MMPI-A, DSM4, written assessment reports.

**EPsy 8431. Master's Research Seminar: CSPP.** (4 cr; A-F only. Prereq—5261 or equiv, 5221 or equiv, EPsy MA student with CSPP subprog or #)  
Survey of research methods, data-based decision making, basic research design skills, and research simulation.

**EPsy 8435. Organization of School Counseling Comprehensive Programs.** (3-6 cr [max 6 cr]; A-F only. Prereq—CSPP grad student in school counselor prog or #)  
Integrates learning from all courses in MA program with research in comprehensive guidance programming. Critiques of research, analyses of current trends/issues. Theories of management/organization in educational and other service settings. Literature review of comprehensive guidance programs. Students develop/demonstrate knowledge of comprehensive school counseling programming in K-12 school settings.

**EPsy 8436. Crisis Management and Consulting in School Counseling.** (3 cr; A-F only. Prereq—CSPP grad student in school counselor program or #)  
Issues, topics, problems. Diversity in school counseling. Review, discussion, and analysis of current literature. Students develop prevention, intervention, and guidance programs for K-12 schools.

**EPsy 8444. FTE: Doctoral.** (1 cr. Prereq—Doctoral student, adviser and DGS consent)

**EPsy 8452. Psychological Aspects of Counseling Supervision.** (3 cr. Prereq—Ed psy PhD 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; A-F only. Prereq—[CSPP or genetic counseling] grad student)  
Overview of basic helping skills through demonstration, in-class practice.

**EPsy 8502. Field Placement in Counseling and Student Personnel Psychology.** (2 cr; S-N only. Prereq—8501 or #)  
Students participate under supervision in practitioner activities within a counseling work environment.

**EPsy 8503. Counseling Practicum I.** (1-4 cr [max 4 cr]; A-F only. Prereq—8502 or #)  
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 [max 4 cr]; A-F only. Prereq—8503 or #)  
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. Prereq—[Ed psy PhD student with CSPP subprog] or #)  
Students involved in counseling supervision of beginning courses.

**EPsy 8512. Internship: CSPP.** (1-6 cr [max 12 cr]; A-F only. Prereq—EdPsy MA or PhD student with CSPP subprog)  
Supervised internship in counseling, counseling psychology, or student personnel psychology at sites approved by CSPP program.

**EPsy 8513. University Counseling Practicum I.** (4-6 cr; S-N only. \$Psy 8514. Prereq—EdPsy MA or PhD student with CSPP subprog, #)  
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.** (4-6 cr [max 6 cr]; S-N only. \$Psy 8515. Prereq—8513, #)  
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]; A-F only. Prereq—EdPsy MA or PhD student with CSPP subprog or #)  
Supervised practice in university and college student development offices.

**EPsy 8522. Counseling Practicum: Advanced.** (3 cr [max 9 cr]. Prereq—[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. Prereq—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]. Prereq—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]; A-F only. Prereq—EdPsy PhD student with spec ed subprog or #)  
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]; A-F only. Prereq—8701 or #)  
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]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**EPsy 8800. Special Topics in School Psychology.** (1-4 cr [max 9 cr])  
Issues or related coursework in areas not normally available through regular curriculum offerings.

**EPsy 8811. Assessment in School Psychology I: Foundations of Academic Assessment.** (3 cr; A-F only. Prereq—Grad ed psy major with school psy subprog or #)  
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; A-F only. Prereq—Grad ed psy major with school psy subprog or #)  
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]; A-F only. Prereq—8821, grad ed psy major with school psy subprog or #, ¶8811 or ¶8812)  
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]; A-F only. Prereq—Grad ed psy major with school psy subprog, ¶8815 or ¶8816)  
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. Issues in School Psychology.** (3 cr; A-F only. Prereq—EPsy grad student with SchPsy subprog)  
School psychology as professional field of specialization in psychology/education. Historical, theoretical, and research basis of school psychology. How school systems operate. Common roles/functions of school psychologists. In-class discussion, didactic/ field-based assignments.

**EPsy 8822. Research in School Psychology.** (3 cr [max 6 cr]. Prereq—[[[8860, 8861, 5616] or equiv], grad ed psy major with school psy subprog] or #)  
Integrative, developmental discussions/activities about research in school psychology. Consuming, synthesizing, distributing, and conducting research. Students formulate their own research agenda.

**EPsy 8823. Ethics and Professional Standards in School Psychology.** (2 cr [max 3 cr]; A-F only. Prereq-8821) Ethics, law, and current educational issues applied to study/practice of school psychology. Ethical principles, state/federal laws governing educational practices. How mandates are applied to work of school psychologists in general/special populations (e.g., special education, ESL, ethnic/racial minorities). Students apply learning as researchers and practicing school psychologists in schools.

**EPsy 8831. Practicum: School Psychological Services.** (1-3 cr [max 6 cr]. Prereq-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]. Prereq-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]; A-F only. Prereq-Grad ed psy major with school psy subprog or #) 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]; S-N only. Prereq-Grad ed psy major with school psy subprog, #) Advanced field placement. Full-time supervised experience for one year or part-time for no more than two years.

**EPsy 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq-Max 18 cr per semester or summer; 24 cr required)

**EPsy 8905. History and Systems of Psychology: Landmark Issues in Educational Psychology.** (3 cr. Prereq-Ed psy PhD 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]; A-F only. Prereq-#) Arranged independently with individual faculty members.

**EPsy 8994. Research Problems: Educational Psychology.** (1-6 cr [max 18 cr]; A-F only. Prereq-#) Research methodology, techniques, and literature. Students participate in formulating/executing research proposal.

## Electrical and Computer Engineering (EE)

*Department of Electrical and Computer Engineering*

*Institute of Technology*

**EE 5121. Transistor Device Modeling for Circuit Simulation.** (3 cr. Prereq-[3115, 3161] or #) Basics of MOS, bipolar theory. Evolution of popular device models from early SPICE models to current industry standards.

**EE 5141. Introduction to Microsystem Technology.** (4 cr. Prereq-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 5164. Semiconductor Properties and Devices II.** (3 cr. Prereq-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. Prereq-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. Prereq-5171 or ¶15171) 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. Prereq-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. Prereq-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. Prereq-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. Prereq-5301 or #) Basic algorithms, computational complexity. High-level synthesis. Test generation. Power estimation. Timing optimization. Current topics.

**EE 5323. VLSI Design I.** (3 cr. Prereq-[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. Prereq-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. Prereq-[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. Prereq-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. Prereq-[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 5364. Advanced Computer Architecture.** (3 cr. Prereq-4363 or CSci 4203) Instruction set architecture, processor microarchitecture. Memory and I/O systems. Interactions between computer software and hardware. Methodologies of computer design.

**EE 5371. Computer Systems Performance Measurement and Evaluation.** (3 cr. SEE 5863. Prereq-4364 or 5361 or CSci 4203 or 5201 or #) Tools/techniques for analyzing computer hardware, software, and system performance. Benchmark programs, measurement tools, performance metrics. Deterministic/probabilistic simulation techniques, random number generation/testing. Bottleneck analysis.

**EE 5381. Telecommunications Networks.** (3 cr. Prereq-[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. Prereq-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. Prereq-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. Prereq-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. Prereq-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. Prereq-[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. Digital Signal Processing Design.** (3 cr. Prereq-4541 or #)  
Real-time implementation of digital signal processing (DSP) algorithms, including filtering, sample-rate conversion, and FFT-based spectral analysis. Implementation on a modern DSP Platform. Processor architecture. Arithmetic operations. Real-time processing issues. Processor limitations. Integral laboratory.
- EE 5549. Digital Signal Processing Structures for VLSI.** (3 cr. Prereq-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. Prereq-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. Prereq-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. Prereq-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. Prereq-3601, [IT sr or grad student])  
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. Prereq-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 5607. Wireless Hardware System Design.** (3 cr. Prereq-3015, 3115, 3601)  
Review of random processes, noise, modulation, and error probabilities. Basis antenna operation, power transfer between antennas, rf propagation phenomena, transmitters/receivers, transmission lines, effect of antenna performance on system performance, rf/microwave device technologies, small-signal amplifiers, mixers, power amplifiers, rf oscillators.
- EE 5609. Digital Signal Integrity.** (3 cr. SEE 4609. Prereq-2011, Phys 1301, 1302, [EE or CompE grad student])  
Introduction to high speed interconnect design. Transmission line theory, coupled line theory, elements of microwave circuit theory, parasitic calculations/measurement, techniques for good interconnect design. Term paper.
- EE 5611. Plasma-Aided Manufacturing.** (4 cr; A-F only. \$ME 5361. Prereq-Upper div IT or grad, ME 3321, ME 3322 or equiv)  
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. Prereq-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. Prereq-5601 or ¶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. Prereq-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. Prereq-5621 or concurrent ¶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. Prereq-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. Prereq-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. Prereq-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 5653. Physical Principles of Magnetic Materials.** (3 cr. Prereq-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. Prereq-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. Prereq-IT 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. Prereq-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. Prereq-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. Prereq-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 [max 4 cr. Prereq-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. Prereq-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. Prereq-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. SEE 5371. Prereq-4363 or 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 [max 12 cr])  
Special topics in electrical and computer engineering. Topics vary.
- EE 5950. Special Topics in Electrical Engineering II.** (1-4 cr [max 12 cr])  
Special topics in electrical and computer engineering. Topics vary.
- EE 5960. Special Topics in Electrical Engineering III.** (1-4 cr [max 12 cr])  
Special topics in electrical and computer engineering. Topics vary.
- EE 5990. Curricular Practical Training.** (1-2 cr [max 6 cr]; S-N only. Prereq-#)  
Industrial work assignment involving advanced electrical engineering technology. Review by faculty member. Final report covering work assignment.
- EE 8100. Advanced Topics in Electronics.** (1-3 cr [max 12 cr]. Prereq-#)  
Topics vary according to needs and staff availability.
- EE 8141. Advanced Heterojunction Transistors.** (3 cr. Prereq-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. Prereq-#)  
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. Prereq–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; A-F only. Prereq–5632 or #)  
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]; S-N only. Prereq–#)  
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. Prereq–IT grad student, #)  
Generalized linear systems; applications, structural properties, computational approaches, classification, functional behavior, and synthesis.
- EE 8215. Nonlinear Systems.** (3 cr. Prereq–#)  
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. Prereq–#)  
Introduction to optimization in engineering; approximation theory. Least squares estimation, optimal control theory, and computational approaches.
- EE 8235. Advanced Control Topics.** (3 cr. Prereq–#)  
Adaptive and learning systems, optimal and robust control and stabilization, and stability of dynamic systems.
- EE 8300. Advanced Topics in Computers.** (1-3 cr [max 12 cr]. Prereq–#)  
Topics vary according to needs and staff availability.
- 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 8310. Advanced Topics in VLSI.** (1-3 cr [max 12 cr]. Prereq–#)  
Topics vary according to needs and staff availability.
- EE 8331. CMOS Data Converters: A/D and D/A.** (3 cr. Prereq–5333 or #)  
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. Prereq–Master's student, adviser and DGS consent)
- EE 8337. Analog Circuits for Wire/Wireless Communications.** (3 cr; A-F only. Prereq–5333)  
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 8367. Parallel Computer Organization.** (3 cr. §CSci 8205. Prereq–5364 or CSci 5204)  
Design/implementation of multiprocessor systems. Parallel machine organization, system design. Differences between parallel, uniprocessor machines. Programming models. Synchronization/communication. Topologies, message routing strategies. Performance optimization techniques. Compiler, system software issues.
- EE 8370. Computer Aided Design Seminar.** (1 cr [max 3 cr]; S-N only. Prereq–[EE or CompE or CSci] grad major, #)  
Current literature, individual assignments.
- EE 8444. FTE: Doctoral.** (1 cr. Prereq–Doctoral student, adviser and DGS consent)
- EE 8500. Seminar: Communications.** (1 cr [max 3 cr]; S-N only)  
Current literature, individual assignments.
- EE 8510. Advanced Topics in Communications.** (1-3 cr [max 12 cr]. Prereq–#)  
Topics vary according to needs and staff availability.
- EE 8520. Advanced Topics in Signal Processing.** (1-3 cr [max 12 cr]. Prereq–#)  
Topics vary according to needs and staff availability.
- EE 8541. Image Processing and Applications.** (3 cr. Prereq–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. Prereq–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. Prereq–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 8601. Advanced Electromagnetic Theory.** (3 cr; A-F only. Prereq–4601 or equiv)  
Aspects of electromagnetic theory. Review of introductory material. Scattering theory, geometric theory of diffraction, integral equation methods, Green's functions.
- EE 8610. Seminar: Electronics, Fields, and Photonics.** (1 cr [max 3 cr]; S-N only. Prereq–EE grad major or #)  
Students are assigned readings from current literature and make individual presentations to class. From time to time outside speakers present research papers.
- EE 8611. Plasma Physics.** (3 cr. Prereq–#)  
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 8630. Advanced Topics in Electromagnetics.** (1-3 cr [max 12 cr])  
Topics vary according to needs and staff availability.
- 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]. Prereq–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. Prereq–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. Prereq–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]. Prereq–Max 18 cr per semester or summer; 10 cr total required [Plan A only])
- EE 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq–Max 18 cr per semester or summer; 24 cr required)
- EE 8940. Special Investigations.** (1-3 cr [max 3 cr]. Prereq–1-3 cr [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 [max 12 cr]. Prereq–Cr ar [may be repeated for cr]; #)  
Topics vary according to needs and staff availability.
- EE 8961. Plan B Project I.** (3 cr. Prereq–Grad EE or CompE major)  
Project topic(s) arranged between student and adviser. Written report(s).
- EE 8963. Plan B Project II.** (1-2 cr [max 2 cr]. Prereq–EE grad student; may be taken to satisfy requirement for Plan B master's degree, may appear on master's program but may not be applied toward minimum)  
Project topic(s) arranged between student and adviser. Written report(s).
- EE 8970. Graduate Seminar I.** (1 cr [max 3 cr]; S-N only. Prereq–Grad student)  
Recent developments in electrical engineering, related disciplines.
- EE 8980. Graduate Seminar II.** (1 cr [max 3 cr]; S-N only)  
Recent developments in electrical engineering, related disciplines.
- EE 5163. Semiconductor Properties and Devices I.** (3 cr. Prereq–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.

## English: Composition (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. Prereq–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 5052. Graduate Research Presentations and Conference Writing for Non-Native Speakers of English.** (3 cr. Prereq–[Grad student, non-native speaker of English] or #)  
Practice in writing/presenting graduate-level research for conferences or professional seminars. Delivery of professional academic presentations to U.S. audiences. Conference abstract, paper, and poster presentation. Communication in research process. Students select topics from their own research/studies. Format, style, transitions, topic narrowing, non-verbal presentation skills.

## English: Creative Writing (EngW)

### Department of English Language and Literature College of Liberal Arts

**EngW 5102. Advanced Fiction Writing.** (4 cr [max 8 cr].) Advanced workshop for graduate students with considerable experience in writing fiction.

**EngW 5104. Advanced Poetry Writing.** (4 cr [max 8 cr].) 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].) 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].) Advanced workshop for graduate students with considerable experience in writing literary nonfiction.

**EngW 5110. Topics in Advanced Fiction Writing.** (4 cr [max 16 cr].) Special topics in fiction writing. Topics specified in *Class Schedule*.

**EngW 5120. Topics in Advanced Poetry.** (4 cr [max 16 cr].) Special topics in poetry writing. Topics specified in *Class Schedule*.

**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) 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]. Prereq—[Jr or sr], one EngW 3xxx course, permission number [available in creative writing office]) Advanced workshop. Contact creative writing program for specific description.

**EngW 5205. Screenwriting.** (4 cr. Prereq—[Jr or sr], one EngW 3xxx course, [permission number available in creative writing office]) Advanced workshop. Contact creative writing program for specific description.

**EngW 5207. Screenwriting II.** (4 cr. Prereq—5205, one [Eng W or EngL or EngC] 3xxx course, [Jr or sr]) Story structure, dialogue, description. Students turn story created in 5205 into a fully realized screenplay.

**EngW 5210. Topics in Advanced Literary Nonfiction.** (4 cr [max 16 cr]) 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]. Prereq—Grad student) Special topics in reading fiction, literary nonfiction, poetry. Topics specified in *Class Schedule*.

**EngW 5501. Minnesota Writing Project Selective Institute.** (1-3 cr [max 3 cr]. Prereq—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.** (1-2 cr [max 2 cr]. Prereq—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. Prereq—Participants must be members of the Minnesota Writing Project) Current theories of writing and writing pedagogy. Topics vary. Workshop.

**EngW 5606. Literary Aspects of Journalism.** (3 cr; A-F only. §Jour 5606W) 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]. Prereq—#, □) Projects in writing poetry, fiction, drama, and nonfiction, or study of ways to improve writing.

**EngW 8101. Reading Across Genres.** (4 cr; S-N only. Prereq—Creative writing MFA student) 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].) Focuses on full-length book (e.g., novel, short story collection). Assignments in common. Individual project.

**EngW 8130. Seminar: Writing of Literary Nonfiction.** (4 cr [max 8 cr].) Advanced workshop. Assignments in common and individual projects.

**EngW 8150. Poetry: Manuscript Preparation.** (4 cr [max 8 cr]. Prereq—Creative writing MFA student, #) Students work on creative project.

**EngW 8160. Manuscript Preparation: Fiction and Nonfiction.** (4 cr [max 8 cr]. Prereq—Creative writing MFA student, #) Students work on their creative project.

**EngW 8170. Mixed Genre: Manuscript Preparation.** (4 cr. Prereq—Creative Writing MFA student, #) Students work on their creative project.

**EngW 8310. Topics in Creative Writing.** (4 cr [max 8 cr]. Prereq—[English or creative writing] grad major) Special topics in fiction, literary nonfiction, poetry. Topics specified in *Class Schedule*.

**EngW 8333. FTE: Master's.** (1 cr. Prereq—Master's student, adviser and DGS consent)

**EngW 8990. MFA Creative Thesis.** (2-8 cr [max 48 cr]. Prereq—8140, 8150, 8160, creative writing MFA 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. Prereq—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. Prereq—Grad or #) Approaches to practical/theoretical problems of literary history/genre.

**EngL 5030. Readings in Drama.** (3 cr [max 9 cr]. Prereq—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 5090. Readings in Special Subjects.** (3-4 cr [max 9 cr]. §EngL 5100. Prereq—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 5110. Readings in Middle English Literature and Culture.** (3 cr [max 9 cr]. Prereq—Grad student or #) Wide reading in literature of period. Relevant scholarship/criticism. Topics vary. See *Class Schedule*.

**EngL 5121. Readings in Early Modern Literature and Culture.** (3 cr [max 9 cr]. Prereq—Grad student or #) Topical readings in early modern poetry, prose, fiction, and drama. Attention to relevant scholarship or criticism. Preparation for work in other courses or seminars.

**EngL 5140. Readings in 18th Century Literature and Culture.** (3 cr. §EngL 3141. Prereq—Grad student or #) Literature written in English, 1660-1798. Topics may include British literature of Reformation and 18th century, 18-century American literature, a genre (e.g., 18th-century novel).

**EngL 5150. Readings in 19th-Century Literature and Culture.** (3 cr [max 9 cr]. Prereq—Grad student or #) Topics may include British Romantic or Victorian literatures, American literature, important writers from a particular literary school, a genre (e.g., the novel). Readings.

**EngL 5170. Readings in 20th-Century Literature and Culture.** (3 cr [max 9 cr]. Prereq—Grad student or #) British, Irish, or American literatures, or topics involving literatures of two nations. Focuses either on a few important writers from a particular literary school or on a genre (e.g., drama). Topics specified in *Class Schedule*.

**EngL 5175. 20th-Century British Literatures and Cultures I.** (3 cr) Survey of principal writers, intellectual currents, conventions, genres and themes in Britain/Ireland, 1900-1945. Fiction/nonfiction by Conrad, Richardson, Forster, Joyce, Mansfield, Rhys, West, Woolf, Lawrence and Huxley. Poetry by Hardy, Hopkins, Loy, H.D., Yeats, Pound and Eliot. Drama by Synge and Shaw.

**EngL 5180. Readings in Contemporary Literature and Culture.** (3 cr. Prereq—Grad student or #) Multi-genre reading in contemporary American, British, Anglophone literature. Relevant scholarship/criticism. Topics vary. See *Class Schedule*.

**EngL 5200. Readings in American Literature.** (3 cr [max 9 cr]. Prereq—Grad student 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 5300. Readings in American Minority Literature.** (3 cr [max 9 cr]. Prereq—Grad or #) Contextual readings of 19th-/20th-century American minority writers. Topics specified in *Class Schedule*.

**EngL 5400. Readings in Post-Colonial Literature.** (3 cr [max 9 cr]. Prereq—Grad student or #) Selected readings in post-colonial literature. Topics specified in *Class Schedule*.

**EngL 5510. Readings in Criticism and Theory.** (3 cr [max 9 cr]. Prereq—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 5593. The Afro-American Novel.** (3 cr. §Afro 5593) Contextual readings of 19th-/20th-century black novelists, including Chesnut, Hurston, Wright, Baldwin, Petry, Morrison, and Reed.

**EngL 5597. Harlem Renaissance.** (3 cr. §Afro 5597) Multidisciplinary review of Jazz Age's Harlem Renaissance: literature, popular culture, visual arts, political journalism, major black/white figures.

**EngL 5602. Gender and the English Language.** (3 cr. Prereq–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. World Englishes.** (3 cr. Prereq–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. Prereq–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 5612. Old English I.** (3 cr. §EngL 3612. Prereq–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. §EngL 4613. Prereq–[[3612 or 5612], grad student] or #)  
Critical reading of texts, introduction to versification. Reading of *Beowulf*.

**EngL 5621. Modern Irish Language I.** (4 cr [max 5 cr]. Prereq–jr or sr or grad or #)  
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. Modern Irish Language II.** (5 cr. Prereq–5621 or #)  
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 Writing Instruction.** (3 cr. Prereq–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 5690. Minnesota Writing Project: Directed Studies.** (1-3 cr [max 30 cr]. Prereq–#)  
Workshops. Theories of writing and writing pedagogy. Writing for publication. Research topics in applied literacy.

**EngL 5711. 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 5712. Advanced Editing.** (4 cr. Prereq–5401 or 5711)  
Editing long text. Fiction, children’s literature, translations, indexes. Workshop/seminar.

**EngL 5743. History of Rhetoric and Writing.** (3 cr. Prereq–Grad student or #)  
Assumptions of classical/contemporary rhetorical theory, especially as they influence interdisciplinary field of composition studies.

**EngL 5790. Topics in Rhetoric, Composition, and Language.** (3 cr. Prereq–Grad student or #)  
Topics specified in *Class Schedule*.

**EngL 5800. Practicum in the Teaching of English.** (2 cr; S-N only. Prereq–Grad student or #)

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 5805. Writing for Publication.** (3 cr. Prereq–Grad student in Engl or #)  
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/readers. Electronic publication. Professional concerns.

**EngL 5880. General Topics.** (3 cr [max 9 cr])  
Topics specified in the *Class Schedule*.

**EngL 5992. Directed Readings, Study, or Research.** (1-15 cr [max 15 cr]. Prereq–#, □)

**EngL 8090. Seminar in Special Subjects.** (3 cr [max 12 cr]. Prereq–Engl grad student or #)  
Sample topics: literature of World War II, writings of the Holocaust, literature of English Civil War, advanced versification.

**EngL 8110. Seminar: Medieval Literature and Culture.** (3 cr [max 12 cr]. Prereq–Grad major or #)  
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. Seminar in Early Modern Literature and Culture.** (3 cr [max 12 cr]; A-F only. Prereq–Grad major or #)  
British writers/topics, from Reformation to French Revolution. In first half of period (which divides at 1640), a typical topic is Spenser and epic tradition; in second half, women historians before Wollstonecraft.

**EngL 8150. Seminar in Shakespeare.** (3 cr [max 9 cr]. Prereq–Engl grad student or #)  
Perspectives/works vary with offering and instructor. 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. Seminar in 19th-Century British Literature and Culture.** (3 cr [max 12 cr]. Prereq–Grad major or #)  
Advanced study in 19th-century British literature/culture. Sample topics: Romantic poetry, Victorian poetry, Englishness in Victorian novel, Victorian cultural criticism, text/image in 19th-century British culture. Topics specified in *Class Schedule*.

**EngL 8180. Seminar in 20th-Century British Literature and Culture.** (3 cr [max 12 cr]; A-F only. Prereq–Grad student or #)  
Sample topics: modernism, Bloomsbury Group, working-class/immigrant literature. Topics specified in *Class Schedule*.

**EngL 8190. Seminar in 20th-Century Anglophone Literatures and Cultures.** (3 cr [max 12 cr]. Prereq–Grad major or #)  
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]. Prereq–Grad major or #)  
American literary history. Sample 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]. Prereq–Grad major or #)  
Sample 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]. Prereq–Grad major or #)  
Sample topics: Harlem Renaissance, ethnic autobiographies, Black Arts movement. Topics specified in *Class Schedule*.

**EngL 8333. FTE: Master’s.** (1 cr. Prereq–Master’s student, adviser and DGS consent)

**EngL 8400. Seminar in Post-Colonial Literature, Culture, and Theory.** (3 cr [max 12 cr]. Prereq–Grad major or #)  
Sample topics: Marxism and nationalism; modern India; feminism and decolonization; “the Empire Writes Back”; Islam and the West. Topics specified in *Class Schedule*.

**EngL 8444. FTE: Doctoral.** (1 cr. Prereq–Doctoral student, adviser and DGS consent)

**EngL 8510. Studies in Criticism and Theory.** (3 cr [max 12 cr]. Prereq–Engl grad major or or #)  
Developments within critical theory that have affected literary criticism, by altering conceptions of its object (“literature”) or by challenging conceptions of critical practice. Topics specified in *Class Schedule*.

**EngL 8520. Seminar in Cultural Theory and Practice.** (3 cr [max 12 cr]. Prereq–Grad student in Engl or #)  
Sample topics: semiotics applied to perspective paintings, numbers, and money; analysis of a particular set of cultural practices by applying various theories to them. Topics specified in *Class Schedule*.

**EngL 8530. Seminar in Feminist Criticism.** (3 cr [max 12 cr]. Prereq–Grad student in Engl or #)  
Brief history of feminist criticism, in-depth treatment of contemporary perspectives/issues. Topics specified in *Class Schedule*.

**EngL 8600. Seminar in Language, Rhetoric, Literacy, and Composition.** (3 cr [max 9 cr]. Prereq–Grad student in Engl or #)  
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]. Prereq–Grad student in Engl or #)  
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 8625. Dissertation Seminar.** (3 cr. Prereq–[Engl PhD student, passed prelim exams] or #)  
Bridges gap between coursework for preliminary exam and writing the dissertation. Conceptualizing the dissertation (using model of Graduate School doctoral dissertation fellowship application). Producing a draft of a chapter. Students work with faculty mentors (e.g., advisers, members of their committees) and peer writing groups to develop research/writing strategies.

**EngL 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

**EngL 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq–Max 18 cr per semester or summer; 24 cr required)

**EngL 8992. Directed Reading in Language, Literature, Culture, Rhetoric, Composition, or Creative Writing.** (1-9 cr [max 15 cr]. Prereq–#)

## Entomology (Ent)

*Department of Entomology*

### *College of Agricultural, Food and Environmental Sciences*

**Ent 5011. Insect Structure and Function.** (4 cr; A-F only. Prereq–3005 or #)  
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)  
Identification of families of adult insects. Evolution/classification of insects. Techniques of collecting/curating insects. Principles of phylogeny reconstruction.

**Ent 5041. Insect Ecology.** (3 cr. Prereq–Biol 5041 or EBB 5122 or #)  
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 5045. Insect Population Dynamics.** (3 cr; A-F only. Prereq–3005 or #)  
Analytical/experimental approaches to study of insect abundance. Path/loop diagrams, time series analyses. Life tables and demography. Single-/multiple-species models for population growth/interactions with competitors. Predators/pathogens in time/space.

**Ent 5051. Scientific Illustration of Insects.** (3 cr)  
Traditional/computer-assisted techniques of scientific illustration. Emphasizes insects. Pencil, pen/ink, color (water color, acrylics, colored pencil). Vector/raster illustration using Adobe Illustrator and Adobe Photoshop. Digital photography, microscopy, photomontage, traditional/electronic publication.

**Ent 5081. Insects, Aquatic Habitats, and Pollution.** (3 cr; A-F only. Prereq–[3005, Biol 3407, FW 2001, EEB 4601] or #)  
Effects of pollutants on biology. Ecology and community structure of aquatic insects. Life-cycle, trophic guilds, community structure in lotic/lentic habitats. Organic pollution/eutrophication, heavy metal pollution, runoff/siltation, acidification, thermal pollution. Changes in aquatic insect community structure according to original literature sources for each class of pollutant. Biological monitoring networks.

**Ent 5121. Applied Experimental Design.** (4 cr. \$Agro 5121. Prereq–Stat 5021 or equiv or #)  
Principles of sampling methodologies, experimental design, and statistical analyses. Methods/procedures in generating scientific hypotheses. Organizing, initiating, conducting, and analyzing scientific experiments using experimental designs and statistical procedures. Offered with Agro 5121.

**Ent 5211. Insect Pest Management.** (3 cr. Prereq–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 5241. Ecological Risk Assessment.** (3 cr. Prereq–#)  
Evaluating current/potential impact of physical, chemical, biological agents on ecosystems. Identifying ecological stressors, assessing level of exposure, measuring ecological responses, communicating/managing risks. Class participation, two reaction papers, final exam, small-group project.

**Ent 5275. Medical Entomology.** (3 cr. Prereq–#)  
Biology of arthropod vectors of human disease. Emphasizes disease transmission and host, vector, and pathogen interactions.

**Ent 5321. Ecology of Agricultural Systems.** (3 cr; A-F only. \$Agro 5321. Prereq–[[3xxx or above] course in [Agro or AnSc or Hort], [3xxx or above] course in [Ent or PIPa or Soil]] or #)  
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 [max 4 cr]; A-F only. Prereq–3001, Biol 1009, EEB 3001 or grad)  
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. Prereq–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; A-F only. Prereq–#)  
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. Prereq–#; 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 5481. Invertebrate Neurobiology.** (2-3 cr [max 3 cr]. \$NSc 5481)  
Fundamental principles/concepts underlying cellular bases of behavior/systems neuroscience. Particular invertebrate preparations.

**Ent 5900. Basic Entomology.** (1-6 cr [max 6 cr]. Prereq–#)  
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]. Prereq–#)  
Individual field, lab, or library studies in various aspects of entomology.

**Ent 5920. Special Lectures in Entomology.** (1-3 cr [max 3 cr])  
Lectures or labs in special fields of entomological research. Given by visiting scholar or regular staff member.

**Ent 8006. Supervised Laboratory or Extension Teaching Experience.** (1-3 cr [max 3 cr]; A-F only. Prereq–3005 or equiv or #)  
Training/experience conducting lab or extension based educational activities in Entomology. Students select a faculty member to serve as their sponsor, and develop lecture outlines or instructional aids such as Web sites, Web-based training sites, print materials, demonstration aids, and demonstration projects. Students prepare/conduct lab or extension presentations. Overviews of Web-based instructional aids.

**Ent 8041. Advanced Insect Genetics.** (2 cr. Prereq–[5011, basic genetics course] or #; offered alt yrs)  
Molecular genetic techniques and their applications. Emphasizes insect species other than *Drosophila*. Application of genetic techniques to physiological processes.

**Ent 8051. Toxicology.** (2 cr. Prereq–[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 8061. Scientific Communication and Ethics.** (1 cr; S-N only)  
Students develop/use critical elements of scientific communication, within an ethical framework. Elements in writing scientific manuscripts and research proposals. Oral communication for scientific, outreach, and classroom presentations.

**Ent 8200. Colloquium in Social Insects.** (1-3 cr [max 3 cr]. Prereq–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 [max 3 cr]. Prereq–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 [max 2 cr]. Prereq–5041 or 5045 or #)  
Advanced topics.

**Ent 8300. Graduate Seminar.** (1 cr; S-N only. Prereq–#)  
Oral and written reports on and discussion by students of selected topics from current literature.

**Ent 8333. FTE: Master's.** (1 cr. Prereq–Master's student, adviser and DGS consent)

**Ent 8444. FTE: Doctoral.** (1 cr. Prereq–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]. Prereq–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]. Prereq–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**Ent 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq–Max 18 cr per semester or summer; 24 cr required)

## Environment and Natural Resources (ENR)

### College of Natural Resources

**ENR 5000. Colloquium: Environment and Natural Resources.** (1 cr [max 6 cr]; A-F only. \$ENR 3000)  
Lectures from experts, readings, discussions of current environmental topics/issues. Topics vary, see *Class Schedule*.

**ENR 5001. Treaty Rights and Natural Resources.** (3 cr; A-F only. \$ENR 3001. Prereq–Grad student or #)  
Readings, class discussion about treaty rights reserved by indigenous Americans with respect to use of natural resources. Emphasizes Midwest issues. Web-assisted course.

**ENR 5002. Colloquium: Restoration of Stream Ecosystems.** (1 cr)  
Key concepts/techniques. Overview of stream habitat restoration. Relationship of restoration to natural stream systems, planning, research, watershed groups, interagency coordination, and management decision process.

**ENR 5019. Business, Natural Environment, and Global Economy.** (2 cr)  
Business strategies that affect natural environment. Ways business strategies/practices can produce win-win outcomes for the environment and business.

**ENR 5021. Ecological Vegetation Management: a Consulting Approach.** (3 cr. \$ENR 3021. Prereq–Grad student or #)  
Application of ecological concepts such as succession/competition to ecosystems under management. Wetlands, riparian zones, urban interfaces, agriculture, agroforestry. Northern/boreal conifer, hardwood forests, grasslands (prairie). Management objectives, methods, impacts. Evaluating practices for sustainability. Social issues. Regional (Great Lakes area), national, global case studies.

**ENR 5031. Applied Global Positioning Systems for Geographic Information Systems.** (3 cr; A-F only. \$ENR 3031. Prereq–Grad student or #)  
GPS principles, operations, techniques to improve accuracy. Datum, projections, and coordinate systems. Differential correction, accuracy assessments discussed/applied in lab exercises. Code/carrier phase GPS used in exercises. GPS handheld units, PDA based ArcPad/GPS equipment. Transferring field data to/from desktop systems, integrating GPS data with GIS.

**ENR 5061. Water Quality and Natural Resources.** (3 cr. §ENR 4061W. Prereq—Grad student or #)  
Issues, parameters, and decision making for managing surface/groundwater resources in Minnesota and globally. Biophysical/human side of water management. Wetlands, exotic species, heavy metal deposition. Cultural, political, and societal dimensions. Case studies, discussions, problem-solving, debates, projects.

**ENR 5101. Conservation of Plant Biodiversity.** (3 cr; A-F only. §ENR 3101. Prereq—Grad student or #)  
Introduction to principles underlying assessment/conservation of plant biodiversity at individual, population, and community levels. Case studies in management of biodiversity to restore or maintain ecosystem function. Genetics, timber harvesting, invasive species, plant reproduction.

**ENR 5111. Hydrology and Water Quality Field Methods.** (3 cr; A-F only. §ENR 3111. Prereq—Grad student or #)  
Integrates water quality, surface/groundwater hydrology. Case studies, hands-on field data collection, calculations of hydrological/water quality parameters. Meteorological data, snow hydrology, stream gauging, well monitoring, automatic water samplers. Designing water quality sampling program. Geomorphology, interception, infiltration.

**ENR 5195. Problem Solving and Planning in Natural Resources.** (4 cr; A-F only. §ENR 4195W. Prereq—Grad student or #)  
Applying problem solving tools/skills in policy, planning, and managerial situations. Students work with ‘real world’ client to produce publishable technical report, present results in professional public forum.

**ENR 5202. Environmental Conflict Management, Leadership, and Planning.** (3 cr; A-F only. §ENR 3202W. Prereq—Grad or #)  
Negotiation of natural resource management issues. Use of collaborative planning. Case study approach to conflict management, strategic planning, and building leadership qualities. Emphasizes analytical concepts, techniques, and skills.

**ENR 5207. Emerging Issues in Tropical Agriculture and Forestry: Costa Rica.** (3 cr. §ENR 3207. Prereq—Grad student, #)  
Experiential learning through field trips. From conventional to organic bird-friendly coffee production/marketing. Sustainable management of high-/low-land tropical forests and of biodiversity. Lectures, seminars, labs field work, written project. Offered through CATIE/UoFM.

**ENR 5211. Survey, Measurement, and Modeling for Environmental Analysis.** (3 cr. §ENR 3211. Prereq—Grad student or #)  
Introduction to survey, measurement, and modeling concepts/methods for study of natural resources and environmental issues. Emphasizes survey design for data collection, estimation, and analysis for issues encompassing land, water, air, vegetation, animal, soil, and human/social variables.

**ENR 5241. Natural Resource and Environmental Policy: History, Creation, and Implementation.** (3 cr. §ENR 3241W. Prereq—Grad student or #)  
Basic concepts of political/administrative processes important to natural resource policy and program development. Case study approach to policy/legislative process, participants in policy development, and public programs. Federal/state laws/regulations, international issues.

**ENR 5245. Sustainable Land Use Planning and Policy.** (3 cr; A-F only. §ENR 3245. Prereq—Grad student or #)  
Overview of policies that affect recreation at local, state, and federal levels. Landscape-level planning. Collaborative relationships as means to implement sustainable natural/social policy. Class project involving all aspects of implementing recreation policy, from public meetings to hands-on evaluation of options.

**ENR 5251. Natural Resources in Sustainable International Development.** (3 cr; A-F only. §ENR 3251, LAS 3251. Prereq—Grad student or #)  
International perspectives on resource use in developing countries. Integration of natural resource issues with social, economic, and policy considerations. Agriculture, forestry, agroforestry, non-timber forest products, water resources, certification, development issues. Latin American case studies.

**ENR 5261. Economics and Natural Resources Management.** (4 cr; A-F only. §ENR 3261W. Prereq—Grad student or #)  
Microeconomic principles in natural resource management. Tools to address market failure, project analysis, and evaluation. Economic/financial considerations. Benefit/cost analysis methods/examples. Valuation/assessment methods for property/resources. Managing renewable natural resources.

**ENR 5295. GIS in Environmental Science and Management.** (4 cr; A-F only. §ENR 4295W. Prereq—Grad student or #)  
Application of spatial data inventory/analysis in complex environmental planning problems. Spatial data collection. Database development methods, including GPS, DLG, TIGER, NWI data, and spatial analysis. Topics identified by non-University partners.

**ENR 5480. Topics in Natural Resources.** (1-4 cr [max 6 cr]. Prereq—Sr or grad student)  
Lectures by visiting scholar or regular staff member. Topics specified in *Class Schedule*.

**ENR 5482. Biosafety Science and Policy.** (3 cr)  
Science/policy for governing environmental/health safety of genetic engineering through Minnesota, national, and international cases.

**ENR 5501. Biological Collections: Curation and Management.** (1 cr. Prereq—One [gen biology or intro to natural resources] course or #)  
Roles/value of biology collections in natural history museums. Conservation of biodiversity record. Students participate in various hands-on curatorial activities. Lectures, tours.

**ENR 5575. Wetlands Conservation.** (3 cr. §ENR 3575. Prereq—§: 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.

**ENR 5603. Environmental Life Cycle Analysis.** (3 cr. Prereq—[Math 1142 or [Math 1271, Math 1282]], [Econ 1101 or ApEc 1101])  
Concepts, major issues relating to inventory and subsequent analysis of production systems. Production system from holistic point of view, using term commonly used in industrial ecology: “the metabolic system.”

**ENR 5604. Environmental Management Systems.** (3 cr. §ENR 3604)  
Environmental problems such as climate change, ozone depletion, and loss of biodiversity.

**ENR 5605. Recycling: Extending Raw Materials Supplies.** (3 cr. §ENR 3605)  
Principles of recycling. Role of recycling in raw materials utilization, energy, and the environment. Recycling processes for number of commonly recycled materials/products. Properties, environmental implications of recycling.

**ENR 5606. Minimizing Industrial Emissions.** (3 cr. §ENR 3606. Prereq—Chem 1011 or #)  
Fundamental waste streams and pollution control technologies in natural resource conversion.

**ENR 5607. Industrial Biotechnology and the Environment.** (3 cr. §ENR 4607. Prereq—BioC 2011, grad student)  
Biotechnology pertaining to biobased products development and their environmental impact.

**ENR 5703. Agroforestry in Watershed Management.** (3 cr. §ENR 3703. Prereq—Grad student or #)  
Biological, physical, and environmental attributes of agroforestry as pertains to watershed management. Coupling production with watershed protection benefits. Implications for policy, economics, and human dimensions in sustainable development. Examples/case studies from North America and developing countries.

**ENR 5811. Environmental Interpretation.** (3 cr; A-F only. §ENR 4811. Prereq—Grad student or #)  
Theories of interpretation, nonformal teaching pedagogy. Interpretive talks, walks, and programs. Camp leadership. Oral presentation. Newsletter development. Web site design. Development of self-guided trail guides, brochures, and exhibits. Planning, evaluation. Interpretive work in private, state, or federal agencies. Hands-on experience.

## Environmental Science (ES)

*Department of Soil, Water, and Climate*

*College of Agricultural, Food and Environmental Sciences*

**ES 5211. Environmental Biophysics and Ecology.** (3 cr; A-F only. Prereq—[[Biol 1009 or equiv], Math 1271, Phys 1101, [upper div or grad student]] or #)  
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.

**ES 5212. Environmental Biophysics and Ecology Laboratory.** (1 cr; A-F only. Prereq—Biol 1009, Math 1271, Math 1282, Phys 1101)  
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.

**ES 5402. Biometeorology.** (3 cr. Prereq—Math 1271, Phys 1201, Stat 3011)  
Calculus-based introduction to atmospheric boundary layer (ABL), the interface between earth’s surface and the atmosphere. ABL development/turbulence, surface energy balance, ABL clouds, air quality, microclimate, observational/modeling methods.

**ES 5555. Wetland Soils.** (3 cr; A-F only. §SOIL 5555. Prereq—1125 or 2125 or equiv or #; ¶4511 recommended)  
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.

**ES 5601. Principles of Waste Management.** (3 cr; A-F only. Prereq—1125 or 2125, Biol 1002/1009 or Chem 1021, Stat 3011, ApEc 1101 or #)  
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.

## Experimental and Clinical Pharmacology (ECP)

*College of Pharmacy*

**ECP 5610. Pharmacoevidentiary.** (2 cr. Prereq—PubH 5320, PubH 5330 or #)  
Application of epidemiologic principles to study, use, and beneficial/adverse outcomes of drugs in human populations.

**ECP 5620. Drug Metabolism and Disposition.** (3 cr; A-F only. Prereq-Grad student or #)  
Oxidative/conjugative enzymes systems involved in human drug metabolism/disposition. Various in vitro models used to evaluate drug metabolism or chemical entity, pros/cons of each. Factors involved in conducting in vivo studies. Components used to predict in vivo drug disposition from in vivo studies.

**ECP 8100. Seminar.** (1 cr [max 8 cr]. Prereq-SACP grad major in ECP track or #)  
Selected topics in experimental and clinical pharmacology.

**ECP 8200. Research Problems.** (1-8 cr [max 16 cr]. Prereq-Grad SACP major (ECP Track) or #)  
Individually designed research experience directed at contemporary problems related to drug use.

**ECP 8210. Clinical Therapeutics.** (3 cr. Prereq-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. Prereq-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. Prereq-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. Prereq-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. Prereq-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]. Prereq-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 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 8900. Family Education Colloquium.** (1-4 cr [max 4 cr]; 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]; A-F only. Prereq-Family ed student doing Plan B research)

## Family Medicine and Community Health (FMCH)

### Medical School

**FMCH 5201. Clinical Family Medicine.** (12 cr [max 108 cr]; S-N only. Prereq-family 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.

**FMCH 5345. Curriculum Design and Teaching Strategies for Medical Education I.** (3 cr; A-F only. Prereq-#5346, #)  
Identifying/developing course goals. Developing course, teacher, learner evaluations. Students must also take 5346, which follows immediately after 5345.

**FMCH 5346. Curriculum Design and Teaching Strategies for Medical Education II.** (1 cr; A-F only. Prereq-#5345, #)  
Taken with 5345. Practicum of lecture, demonstration, small-group discussion, clinical teaching, and computer-assisted instruction. Academic ethics, policies, copyright issues, tenure, academic freedom, problem-based learning.

**FMCH 5564. Family Practice Seminar.** (1 cr [max 9 cr]. Prereq-MD or DO 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.

**FMCH 5650. Principles of Geriatrics I.** (1 cr [max 5 cr]. Prereq-Medical School or dental school or GNP School graduate)  
First in two-course sequence. Survey of major topics in geriatric medicine. Epidemiology, etiology, diagnosis, and treatment of major geriatric syndromes and illnesses.

**FMCH 5651. Principles of Geriatrics II.** (1 cr [max 5 cr]. Prereq-Medical School or dental school or GNP school graduate)  
Second in two-course sequence. Survey of major topics in geriatric medicine. Epidemiology, etiology, diagnosis, and treatment of major geriatric syndromes and illnesses.

**FMCH 5950. Clinical Issues in Human Sexuality.** (2 cr. Prereq-Enrollment in health sci grad programs in CSPP, Psy, PubH, SW or FSoS or #)  
Assessment and treatment techniques pertaining to common sexual problems.

**FMCH 5955. Directed Study.** (1-10 cr [max 10 cr]. Prereq-#; qualified students may arrange for work on a tutorial basis)  
Studies on special topics as arranged between student and faculty.

**FMCH 5960. Basic Research Methods in Family Practice.** (3 cr; A-F only. Prereq-Post-MD fellow, #)  
History and current status of research in family medicine, research resources available in the department. How to ask/define a research question, conduct a literature search, select a research methodology, meet federal requirements for protection of human subjects in research, critically read the medical literature and facilitate its discussion, and prepare a grant proposal.

**FMCH 5961. Family Medicine Fellows and Junior Faculty Integration Seminar.** (1-9 cr [max 9 cr]; A-F only. Prereq-[Family medicine faculty or fellow], #)  
Preparation for roles in academia. Achieving success as a clinical investigator. Funding opportunities, authorship, collaboration, publishing, grant preparation.

## Family Social Science (FSoS)

*Department of Family Social Science*

*College of Human Ecology*

**FSoS 5014. Quantitative Family Research Methods I.** (3 cr. Prereq-[[2105 or equiv], one statistics course] or #)  
Family research methods, issues associated with multiple levels of analysis. Conducting family-focused data analyses using basic/intermediate methods (through ANOVA and multiple regression), including power analysis. Ethical issues involved in family research such as IRB/HIPAA regulations.

**FSoS 5015. Family Research Laboratory.** (1 cr; S-N only. Prereq-One statistics course or #)  
Application of basic family research methods into experiential learning using statistical software. Analyses that correspond with problem situations in 5014 and that involve secondary data analyses. Using statistical software for basic family research. Preparation to work with quantitative family data sets.

**FSoS 5032. Family Systems Theories and Interventions.** (3 cr. Prereq-#)  
Systemic/cybernetic frameworks as they apply to diverse families. Thinking systemically about families across multiple ecological systems. How to identify crucial epistemological issues in theoretical/applied areas of family science. Theoretical frameworks. Experiential role-playing, guest presenters, videos, field work, research projects, reading clubs, class discussion.

**FSoS 5101. Family Systems.** (3 cr. §FSoS 3102. Prereq-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 5150. Special Topics in Family Social Science.** (1-4 cr [max 24 cr]. Prereq-#)  
Review of research/scholarly thought. Topics specified in *Class Schedule*.

**FSoS 5193. Directed Study in Family Social Science.** (1-6 cr [max 6 cr]. Prereq-FSoS or grad student in related field)

**FSoS 5426. Alcohol and Drugs: Families and Culture.** (3 cr. §FSoS 3426)  
Overview of psychology/sociology of drug use/abuse. Life-span, epidemiological, familial, cultural data regarding use. Fundamentals of licit/illicit drug use behavior. Gender, ethnicity, social class, sexuality, sexual orientation, disability.

**FSoS 5429. Counseling Skills Practicum I.** (3 cr. §FSoS 3429)  
Basic counseling skills. Counselor needs/motivations, non-verbal communication, basic/advanced empathy, identifying strengths, maintaining focus, challenging discrepancies, use of self. Emphasizes building from client strengths, learning through role-playing.

**FSoS 5431. Counseling Skills Practicum II.** (3 cr. §FSoS 3431. Prereq-[3429, 5429])  
Advanced therapeutic methods, processes of change. Identifying, reinforcing, challenging core beliefs. Reframing, paradox, trance, guided imagery. Cognitive-behavioral, solution-focused, narrative therapies. Emphasizes non-pathologizing models of therapy.

**FSoS 5432. Chemical Abuse and Families: An Overview.**

(3 cr)  
Relationships, family systems with particular application to families in which alcohol or drug use is a problem. Family types, family of origin, models of family therapy, family systems theory, alcoholism. Review of literature.

**FSoS 8001. Conceptual Frameworks in the Family.**

(3 cr. Prereq—Family course or #)  
Major theoretical models about families, emphasizing sociohistorical context.

**FSoS 8003. Current Issues in Family Science.**

(3 cr)  
Content, theories, and methodologies in family science. Emphasizes findings of recent/emerging areas of research. Readings covering a wide range of topics. Critical examination of research studies. Targeted class discussion.

**FSoS 8005. Multicultural Issues in Family Social Science.**

(3 cr)  
Impact of culture/ethnicity on family processes. Definitions/measurement of culture as a variable as it relates to family/individual development across life span. How culture/ethnicity influence dynamics, development, constellation, parenting, aging, and socialization. Cultural variations in relationships between families. Prevention/intervention outcomes. Ethnic socialization/identity. Ethnicity as related to family therapy practice/theory.

**FSoS 8007. Ethical Issues and Moral Dilemmas in Family Life.**

(3 cr)  
Multidisciplinary perspectives of ethics, social norms, family law, family policy, family economics, and family decision-making. Focuses on differing perspectives of individuals representing various ethnicities, socio-economic levels, religions, and sexual orientations.

**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 II.**

(3 cr. Prereq—[5014 or equiv], [8001 or equiv], two stat courses) or #)  
Quantitative research process, from developing a research question to putting findings to use. A major course project (development of a federally fundable research grant application) is basis for class discussion. Focuses on family research. Applying research knowledge to study of families.

**FSoS 8031. Family of Origin.**

(3 cr; S-N only. Prereq—Preference given to marriage and fam therapy students)  
In-depth study of each student's family of origin in a group of other students and a clinical faculty therapy supervisor.

**FSoS 8033. Problems in Families.**

(3 cr. Prereq—[8032 or equiv], #)  
Family therapy assessment/treatment approaches to problems such as depression, alcoholism, and sexual abuse, and to challenges of varying family structures, such as single-parent/remarried families.

**FSoS 8034. Marriage and Family Therapy Supervision.**

(3 cr. Prereq—5032 or 8032 or #)  
Theories of supervision, structures for supervision, methods of supervision, evaluation process, legal/ethical issues. Therapist-client-supervisor relationships, potential problems, contextual issues.

**FSoS 8035. Assessment of Couples and Families.**

(3 cr; A-F only. Prereq—8014 or equiv or #)  
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; A-F only. Prereq—8013, 8014)  
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]; A-F only. Prereq—[8032, practicum or internship exper] or [grad student in cooperating mental hilt practice prog who has completed 1 course on therapy with children])

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; A-F only. Prereq—8032 or equiv or #)  
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. Prereq—8001 or equiv or #, FSoS PhD 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. Prereq—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. Prereq—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. Prereq—Two grad family courses or #)  
Theory and research on gender roles in families. Gender issues in roles of mothers, fathers, marital partners, and same-sexpartners. Issues of race, ethnicity, and social class as they intersect with gender.

**FSoS 8103. Family Decision Making.**

(3 cr. Prereq—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 Seminar.**

(3 cr)  
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. Prereq—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. Seminar: Families From an Economic Perspective.**

(3 cr)  
Conceptual/methodological/economic perspectives of family social science. Family investments in human/socialcapital. Diversities in families. Interface of public policies and family economic well-being.

**FSoS 8107. Family Values Research: Theories and Critical Methods.**

(3 cr. Prereq—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]. Prereq—grad student or #)  
Special seminars on timely topics suited to the needs of students.

**FSoS 8160. Topics in Marriage and Family Therapy.**

(1-6 cr [max 6 cr]. Prereq—MFT grad student or #)  
Special seminars on timely topics.

**FSoS 8193. Directed Study in Family Social Science.**

(1-6 cr [max 12 cr]. Prereq—Doctoral student in FSoS or related field)  
Directed study.

**FSoS 8200. Orientation for Family Social Science.**

(1 cr; S-N only. Prereq—#)  
**FSoS 8201. Teaching Family Courses in Higher Education I.** (3 cr; S-N only. Prereq—12 FSoS grad cr; teaching assistant exper recommended)  
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; S-N only. Prereq—8201 or equiv)  
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; S-N only. Prereq—#; required for grad FSoS majors in marriage and family therapy prog)  
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]; S-N only. Prereq—Marriage and family therapy student)  
Clinical placement doing marriage and family therapy in a community setting.

**FSoS 8296. Family Therapy Internship.**

(1-21 cr [max 21 cr]; S-N only. Prereq—8295, marriage and family therapy student)  
Full-time clinical placement doing marriage and family therapy in a community setting.

**FSoS 8297. Supervision of Supervision.**

(1-3 cr [max 12 cr]; S-N only. Prereq—MFT student, #)  
Hands-on practicum to gain AAMFT-approved supervisor status.

**FSoS 8333. FTE: Masters.**

(1 cr. Prereq—Master s student, adviser and DGS consent)

**FSoS 8444. FTE: Doctoral.**

(1 cr. Prereq—Doctoral student, adviser and DGS consent)

**FSoS 8550. Advanced Topics in Family Social Science.**

(1-6 cr [max 6 cr]; A-F only. Prereq—FSoS PhD student)  
Special seminars on topics suited to student needs.

**FSoS 8560. Advanced Clinical Topics in Marriage and Family Therapy.**

(1-6 cr [max 36 cr]; A-F only. Prereq—FSoS PhD student or #)  
Special advanced topics or seminars.

**FSoS 8666. Doctoral Pre-Thesis Credits.**

(1-18 cr [max 60 cr]. Prereq—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]; S-N only. Prereq—FSoS MA student)  
Graduate faculty work with students on research for Plan B paper.

**FSoS 8777. Thesis Credits: Master's.**

(1-18 cr [max 50 cr]. Prereq—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 12 cr]. Prereq—Grad FSoS major)  
Directed research.

**FSoS 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—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. Prereq—Econ 8101, Econ 8102, business admin PhD 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. Prereq—Econ 8103, Econ 8104, business admin PhD 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. Prereq—8801, business admin PhD 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]. Prereq—Business admin PhD student or #)  
Problems or developments of special interest to the student.

**Fina 8894. Directed Research in Finance.** (1-8 cr [max 16 cr]. Prereq—Business admin PhD student specializing in finance or #)  
Individualized directed research on a project of interest to the student, approved and advised by faculty.

## Finnish (Fin)

*College of Liberal Arts*

**Fin 5670. Topics in Finnish Studies.** (3 cr [max 9 cr])  
Interdisciplinary social science topics on Finnish people, culture, and society. Taught in English.

## Fisheries and Wildlife (FW)

*Department of Fisheries, Wildlife, and Conservation Biology*

*College of Natural Resources*

**FW 5003. Human Dimensions of Biological Conservation.** (3 cr. Prereq—[Biol 1001 or Biol 1009], Biol 3407)  
Survey of social, psychological, economic, policy aspects of managing/conserving wildlife, fisheries, and related resources.

**FW 5051. Analysis of Populations.** (3 cr. §EEB 5051. Prereq—[[Biol 1001 or Biol 1009], [FW 4001 or Stat 3011 or Stat 5021]] or #)  
Factors involved in regulation, growth, general dynamics of populations. Data needed to describe populations, population growth, population models, regulatory mechanisms.

**FW 5136. Ichthyology.** (4 cr. §FW 3136. Prereq—Grad student)  
Fish biology, adaptations to different environments and modes of living, and environmental relationships. Lab emphasizes anatomy and identification of Minnesota fishes.

**FW 5411. Aquatic Toxicology.** (3 cr. Prereq—Intro chem, intro ecol, #)  
Pollution assessment approaches, biological effects, fate/flow of contaminants in aquatic systems, major types of pollutants.

**FW 5455. Sustainable Aquaculture.** (3 cr. Prereq—[Intro biology, intro chemistry] or #)  
How aquaculture affects the environment and human well-being in Minnesota and world-wide. Role of aquaculture as world's fastest growing food sector and in hatcheries to support fishing and rebuild endangered species. Organic aquaculture, other innovations.

**FW 5571. Avian Conservation and Management.** (3 cr. Prereq—EEB 4134 or grad or #)  
Current problems in avian conservation/management. Nongame, wetland, game birds.

**FW 5601. Fisheries Population Analysis.** (3 cr; A-F only. Prereq—[4001 or Stat 5021], Biol 3407, [Math 1142 or Math 1271])  
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 5603. Habitats and Regulation of Wildlife.** (3 cr; A-F only. Prereq—Biol 3407)  
Environmental interactions of wildlife at population/community levels. Environmental threats from human activities. Habitat management practices. Objectives, policies, regulations in population management.

**FW 5604. Fisheries Ecology and Management.** (3 cr. Prereq—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 5625. Wildlife Handling and Immobilization for Research and Management.** (2 cr; S-N only. Prereq—General biology, [grad student or vet med student or FW sr])  
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 [max 8 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. Prereq—Master's student, adviser and DGS consent)

**FW 8394. Research in Fisheries.** (1-4 cr [max 4 cr])  
Directed research.

**FW 8444. FTE: Doctoral.** (1 cr. Prereq—Doctoral student, adviser and DGS consent)

**FW 8448. Fishery Science.** (3 cr. Prereq—Grad student [in fisheries or wildlife conserv or conserv biol or ecology] or #)  
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 8450. Data Analysis.** (4 cr; A-F only. Prereq—5xxx statistics course)  
Advanced statistical methods are used to teach exploration/analysis of univariate/multivariate data. Descriptive statistics, estimation and inference, regression and smoothing, multivariate techniques, resampling.

**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. Prereq—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. Prereq—Vertebrate physiology course or #)  
Lectures, discussion, current literature. Complements 5459.

**FW 8462. Advanced Topics in Fish Behavior.** (1 cr. Prereq—5459 or behavior course or #)  
Current literature. Complements 5459.

**FW 8465. Fish Habitats and Restoration.** (3 cr. Prereq—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 [max 4 cr]. Prereq—#)  
Directed research.

**FW 8576. Biology and Management of Large Mammals.** (2 cr; A-F only. Prereq—[Ecology course, [wildlife, forestry, and ecology grad student]] or #)  
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]. Prereq—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]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**FW 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—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. Prereq—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. Prereq—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 5441. Introduction to New Product Development.** (2 cr. Prereq—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 5461. Food Packaging.** (2 cr. Prereq—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 5471. Advanced Food Chemistry.** (3 cr. Prereq–4111)  
Chemical reactions taking place in formation, stability, and degradation of important food constituents. Examples of reactions for major chemical changes occurring in food systems.

**FScN 5481. Sensory Evaluation of Food Quality.** (2 cr [max 3 cr]; A-F only. Prereq–3102, Stat 3011)  
Fundamentals of sensory perception. Test designs and methods used in studying sensory qualities of foods. Current issues in sensory evaluation. Group research project.

**FScN 5531. Grains: Introduction to Cereal Chemistry and Technology.** (2 cr. Prereq–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 5622. Vitamin and Mineral Biochemistry.** (3 cr. Prereq–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. Prereq–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 8310. General Seminar.** (1 cr [max 2 cr]; S-N only. Prereq–#)

Presentations by faculty, graduate students, and outside speakers.

**FScN 8318. Current Issues in Food Science.** (2 cr [max 4 cr]; A-F only. Prereq–4111, 4121, A)  
Current issues, how they impact food industry.

**FScN 8320. Advanced Topics in Food Science.** (1-3 cr [max 6 cr])  
Recent research or special topics.

**FScN 8330. Research Topics.** (1 cr [max 6 cr])  
Seminar in which faculty member or group of faculty/graduate students discuss research progress or review/discuss current research literature.

**FScN 8331. Food Proteins.** (3 cr. Prereq–4111, 4312)  
Basic protein biochemistry as applied to food systems and food processing. Emphasizes forces that determine protein structure. Techniques for isolation/characterization of food proteins. Protein structure function relationships in regard to handling/processing specific food protein systems (cereal, meat, dairy).

**FScN 8333. FTE: Master's.** (1 cr. Prereq–Master's student, adviser and DGS consent)

**FScN 8334. Reaction Kinetics of Food Deterioration.** (2 cr. Prereq–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. Prereq–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. Prereq–4111)  
Chemistry of food lipid oxidation and rancidification, and protective functions of antioxidants.

**FScN 8337. Flavor Chemistry.** (2 cr. Prereq–4111)  
Chemistry involved in formation, analysis, and release of flavoring materials in foods.

**FScN 8338. Antioxidants in Food: Practical Applications.** (2 cr. Prereq–4111, Bioc 3021, food chemistry, organic chemistry, biochemistry)  
Mechanisms of antioxidant activities in food systems. Free radical scavengers, hydroperoxide stabilizers, synergists, metal chelators, singlet oxygen quenchers, substance reducing hydroperoxides. Practical applications of antioxidants in various food systems, effect of antioxidants on health/diseases.

**FScN 8391. Independent Study: Food Science.** (1-4 cr [max 6 cr])  
Includes written reports.

**FScN 8444. FTE: Doctoral.** (1 cr. Prereq–Doctoral student, adviser and DGS consent)

**FScN 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq–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]. Prereq–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**FScN 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq–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; A-F only. \$FR 3104.  
Prereq–[Biol 1001 or 1009], grad student] or #; 1 semester college chemistry recommended)  
Form/function of forests as ecological systems. Characteristics/dynamics of species, populations, communities, landscapes, and ecosystem processes. Examples applying ecology to forest management. Weekly discussions on research topics, exercises, current issues in forest resource management. Required weekend field trip.

**FR 5114. Hydrology and Watershed Management.** (3 cr. \$FR 3114. Prereq–Grad student or #)  
Introduction to hydrologic cycle and water processes in upland/riparian systems. Applications of hydrological concepts to evaluate impacts of forest management and other land use patterns/activities on water yield, stormflow, erosion, sedimentation, and water quality. Concepts, principles, and applications of riparian/watershed management. Economic/social factors. National/global examples. Emphasizes forest ecosystems.

**FR 5118. Physiological Ecology of Woody Plants.** (3 cr; A-F only. \$FR 4118. Prereq–Grad student or #)  
Plant-water relations. Relations of biology to ecology and management. How physiological factors affect ecological processes and management decisions.

**FR 5131. Geographical Information Systems (GIS) for Natural Resources.** (4 cr; A-F only. \$FR 3131. Prereq–Grad student or #)  
Introduction to GIS. Focuses on natural resources. Data structures, sources, collection, and quality. Lab exercises introduce geodesy, map projections, spatial analyses, and cartographic modeling.

**FR 5142. Tropical Forest Ecology.** (3 cr [max 4 cr]. Prereq–3xxx ecology course)  
Ecological principles related to form, function, and development of wet/dry tropical forests at organismal, community, and ecosystem scales. Ecophysiology, succession, productivity, biodiversity, sustainability, agroforestry, social forestry, and management alternatives. Natural distribution of forest types. Causes, consequences, and extent of deforestation.

**FR 5146. Science and Policy of Global Environmental Change.** (3 cr [max 4 cr]. \$EEB 5146. Prereq–3104 or Biol 3407 or equiv)  
Intro to critical issues underpinning global change and its biological implications. Current scientific literature on evidence for global change and potential effects on a wide range of biological processes. Economic/political impact on global change.

**FR 5153. Forest and Wetland Hydrology.** (3 cr. Prereq–[Basic hydrology course, [upper div or grad student]] or #)  
Topics, methods, and models in forest/wetland hydrology. Hydrologic role of forests, wetlands, and riparian systems in snowfall and rainfall regimes. How human activities such as deforestation, wetland drainage, and stream channel alterations, impact hydrologic response of watersheds. Problem solving exercises to understand/quantify runoff and streamflow response from undisturbed/alterd forest/wetland watersheds.

**FR 5161. Northern Forest Field Course.** (2 cr; A-F only. Prereq–#)  
Field identification of common trees, shrubs, and nonwoody vascular plants. Plant communities, soil site relationships, wildlife values. Natural history of northern/boreal forests in terms of soils, ecological characteristics of trees, community-environment relationships, stand development, succession, and regeneration ecology. Land survey, tree/forest stand measurement, forest sampling techniques. Taught at Cloquet Forestry Center.

**FR 5203. Forest Fire and Disturbance Ecology.** (3 cr; A-F only. \$FR 3203. Prereq–[Grad student or #], course fee)  
Ecology, history, management, and control of fire, wind, insect infestation, browsing, and other disturbances in forests. Disturbance regimes of boreal, northern hardwood, and other major forest types of North America. Influence of disturbance on wildlife habitat, urban/wildland interfaces, forest management, and stand/landscape dynamics. Guest speakers on fire organization, training, and operations. Two-day field trip.

**FR 5204. Landscape Ecology and Management.** (3 cr; A-F only. \$FR 3204. Prereq–#)  
Introduction to landscape ecology at different scales in time/space. Development/implications of broad-scale patterns of ecological phenomena, role of disturbance in ecosystems. Characteristic spatial/temporal scales of ecological events. Principles of landscape ecology as framework for landscape research, analysis, conservation, and management.

**FR 5205. Productivity and Ecology of Forest Soils.** (3 cr. \$FR 3205. Prereq–Forest ecology, silviculture)  
Soil-site factors affecting plant/wildlife communities. Site quality estimation, site modification/enhancement. Effects of forest management and other human-related disturbances on forest site quality.

**FR 5218. Measuring and Modeling Forests.** (3 cr; A-F only. \$FR 3218. Prereq–Grad student or #)  
General sampling design and survey techniques to assess current resource conditions. Application of metrics/sampling methods to forest vegetation. Calculation of tree/stand volume, selection of modeling approaches. Case studies of modeling to project future growth. Landscape processes, characterization, and modeling.

**FR 5228. Advanced Assessment and Modeling.** (3 cr; A-F only. Prereq–3218, Math 1272, Stat 5021)  
Application of recently developed mathematics, computer science, and statistics methodologies to natural resource functioning, management, and use problems. Specific topics, software, and methodologies vary.

**FR 5262. Remote Sensing of Natural Resources and Environment.** (4 cr. \$FR 3262. Prereq–Grad student or #)  
Principles/techniques of remote sensing. Mapping/monitoring land/water resources from local to global scales. Forest and natural resource inventory. Forest cover and soil mapping. Landuse/global change analysis. Lab provides hands-on experience working with aerial photography and digital sensing imagery.

**FR 5264. Advanced Forest Management Planning.** (3 cr. Prereq–3471 or #)  
Applied models for forest planning to integrate forest resource conditions/uses. Stand-level management. Forest-wide/landscape-level planning. Regional timber supply analysis. Optimization models and heuristic techniques as tools. Integrating sustainable timber production with desirable future conditions and spatial structure for biodiversity. Problems, case studies involving recent large-scale applications.

**FR 5411. Managing Forest Ecosystems: Silviculture.** (3 cr. §FR 3411. Prereq–Grad student or #)  
Management of forest ecosystems for sustaining ecological integrity, soil productivity, water quality, wildlife habitat, biological diversity, commodity production in landscape context. Silvics, forest dynamics, disturbances, regeneration, restoration, silvicultural systems. Ramifications of management choices. Weekend field trip.

**FR 5412. Digital Remote Sensing.** (3 cr. Prereq–3262 or grad student or #)  
Physical basis and practical applications of digital remote sensing. Energy-matter interactions. Measurements and sensors. Digital image processing/analysis. Experience working with remote sensing data, image processing, and models.

**FR 5413. Managing Forest Ecosystems: Silviculture Lab.** (1 cr. Prereq–FR [major or minor] or grad student)  
Development of silvicultural prescriptions to achieve various landowner objectives. Timber cruise, growth/ yield simulations, stand density management diagrams, thinning schedules, use of forest vegetation simulator. Field trips, computer labs, lectures.

**FR 5431. Timber Harvesting and Road Planning.** (2 cr. §FR 3431. Prereq–Grad student or #)  
Forest operations. Terminology, engineering, equipment/harvesting system options, productivity/ costs. Relationship to forest management and silviculture. Road planning, forest management guidelines. Mitigating potential impacts to soil/water resources. Environmental implications of method/ equipment choices. Selling timber. Sale design, layout, and administration. Two all-day field trips.

**FR 5471. Forest Planning and Management.** (3 cr; A-F only. §FR 3471. Prereq–Grad student or #)  
Processes/techniques for scheduling forest management. Goals of landowners, industry, government, and society. Issues/policies/regulations that influence management. Predicting outcomes, financial analysis, regulation, mathematical models, linear programming, economic analysis. Landscape-level management, historical range of variability, wildlife management, carbon sequestration, resource monitoring, certification, adaptive management.

**FR 5480. Topics in Natural Resources.** (1-3 cr. §FR 3480. Prereq–#)  
Lectures in special fields of natural resources given by visiting scholar or regular staff member. Topics specified in *Class Schedule*.

**FR 5501. Urban Forest Management: Managing Greenspaces for People.** (3 cr. §FR 4501. Prereq–Grad student or #)  
Management concepts for green infrastructure of cities, towns, and communities. Urban forest as social/ biological resource. Emphasizes management of urban forest ecosystem to maximize benefits. Tree selection, risk assessment, cost-benefit analysis, landscape planning, values, perceptions. How urban forestry can be a tool to improve community infrastructure.

**FR 5611. Field Silviculture.** (2 cr. Prereq–3104, 3411, 3612)  
Collection of field data to prepare/write silvicultural prescriptions for regeneration, thinning, and harvesting in context of landscape, watershed, and wildlife habitat issues. Field exercises in forest entomology, pathology, tree improvement, and non-timber forest products. Tree planting. Marking stands for harvest. Taught at Cloquet Forestry Center. Field trips to forests managed by state/industry.

**FR 5612. Silviculture Practices in Minnesota.** (1 cr. §FR 3612. Prereq–Forest ecology, managing forest ecosystems: silviculture)  
Silviculture practices as driven by landowner objectives. Compares/contrasts silvicultural practices employed by county, state, federal, and industrial foresters in Minnesota.

**FR 5615. Field Remote Sensing and Resource Survey.** (2 cr; A-F only. Prereq–3218, 3262)  
Field applications of remote sensing, sampling/ measurement methods to inventory/mapping of forest and other natural resources. Offered at Cloquet Forestry Center.

**FR 5621. Field Timber Harvesting and Road Planning.** (2 cr. Prereq–[3411, 3431, 3612] or #)  
Design, layout, and administration of timber sales. Forest road planning and design. Protecting residual trees during harvesting operations. Dealing with protesters. Field trips and on-site evaluations of timber harvesting systems. Timber appraisal, forest management guidelines. Road location and profiling. Planning/layout considerations. Taught at Cloquet Forestry Center.

**FR 5700. Colloquium in Natural Resources.** (1-3 cr [max 3 cr]. Prereq–#)  
Colloquium in specialized topics in natural resources.

**FR 8101. Research Problems: Physiological Ecology.** (1-5 cr [max 10 cr]. Prereq–#)  
Independent research under faculty guidance.

**FR 8102. Research Problems: Forest-Tree Genetics.** (1-5 cr [max 5 cr])  
Independent research under faculty guidance.

**FR 8103. Research Problems: Forest Hydrology.** (1-5 cr [max 5 cr])  
Independent research under faculty guidance.

**FR 8104. Research Problems: Forest Ecology.** (1-5 cr [max 5 cr])  
Independent research under faculty guidance.

**FR 8105. Research Problems: Silviculture.** (1-5 cr [max 5 cr])  
Independent research under faculty guidance.

**FR 8106. Research Problems: Urban Forestry—Biology and Management.** (1-5 cr [max 5 cr])  
Independent research under faculty guidance.

**FR 8107. Seminar: Forest Resources.** (1 cr)  
Assigned topics, problem analyses, and research reports.

**FR 8201. Research Problems: Forest Economics.** (1-5 cr [max 5 cr])  
Independent research under faculty guidance.

**FR 8202. Research Problems: Forest Biometry and Measurements.** (1-5 cr [max 5 cr])  
Independent research under faculty guidance.

**FR 8203. Research Problems: Forest Recreation.** (1-5 cr [max 5 cr])  
Independent research under faculty guidance.

**FR 8204. Research Problems: Forest Policy.** (1-5 cr [max 10 cr])  
Independent research under faculty guidance.

**FR 8205. Research Problems: Spatial Data Analysis.** (1-5 cr [max 10 cr]. Prereq–#)  
Independent research under faculty guidance.

**FR 8206. Research Problems: Forest Management.** (1-5 cr [max 5 cr])  
Independent research under faculty guidance.

**FR 8207. Economic Analysis of Natural Resource Projects.** (2 cr; A-F only. Prereq–#)  
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 [max 5 cr]. Prereq–#)  
Independent research under faculty guidance.

## French (Fren)

*Department of French and Italian*

### *College of Liberal Arts*

**Fren 5250. Promenades Poétiques: The Subject in Motion.** (3 cr [max 9 cr]. Prereq–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 5260. The Returns of Tragedy.** (3 cr [max 9 cr]. Prereq–3111 or above)  
Tragedy as dramatic form in relation to social order, myth and history, and theatre.

**Fren 5270. “To Change or not to Change?”: Speculations on (Post) Modern French Texts.** (3 cr [max 9 cr]. Prereq–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. Prereq–Grad or #)  
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]. Prereq–3101 or equiv)  
Problem, period, author, or topic of interest. See *Class Schedule*.

**Fren 5470. Post/Colonial Francophone Literatures.** (3 cr [max 9 cr]. Prereq–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. §Fren 3501. Prereq–[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. §Fren 3502. Prereq–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. §Fren 3531. Prereq–§: 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 5541. Oral Discourse of French.** (3 cr. Prereq–3015, grad student; Ling 5001 recommended)  
Nature of contemporary spoken French discourse. Focuses on spontaneous, multi-speaker discourse. Readings include examples of various linguistic approaches to such discourse. Emphasizes syntactic analysis. Phonological/lexical particularities. ‘Macro’ level analyses such as discourse analysis and conversation analysis.

**Fren 5995. Directed Teaching.** (1-6 cr [max 24 cr]; S-N only. Prereq–#)  
Directed teaching.

**Fren 8110. Topics in Early Medieval French Literature.** (3 cr [max 9 cr]. Prereq–8111)  
Introduction to epic, romance, allegory, and theatre in Old French readings (12th-13th centuries). Specific topics/texts studied vary. Taught in French.

**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 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 8120. Topics in Later Medieval French Literature.** (3 cr [max 9 cr]. Prereq-8110 or #)  
Problems presented by texts written in France ca. 1300-1500. Evolution of Middle French language. Specific topics/texts vary. Taught in French.

**Fren 8210. Narrative, History, and Memory: Topics.** (3 cr [max 9 cr])  
Significance of narrative paradigm in literature, history, and cultural memory. Specific topics/texts treated vary. Taught in French.

**Fren 8220. Staging Modernity: Seminar in Problems of 20th-Century Theatre.** (3 cr [max 9 cr])  
Developments in 20th-century drama/performance in relation to French theatrical tradition. Post-1945 avant-garde innovation, interculturalism in contemporary theater. Specific topics/texts vary. Taught in French.

**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. Prereq-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 8410. Topics in Quebecois Literature.** (3 cr [max 9 cr])  
Quebecois in relation to other North American literatures and to Francophone literature produced elsewhere in the world. Specific topics/texts vary. Taught in French.

**Fren 8420. Critical Issues: Francophone Literature.** (3 cr [max 9 cr])  
Critical issues relating to literature of Francophone world. Specific topics/texts vary. Taught in French.

**Fren 8444. FTE: Doctoral.** (1 cr. Prereq-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]. Prereq-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]. Prereq-Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**Fren 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq-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]. Prereq-#)

**Fren 8994. Directed Research.** (1-5 cr [max 25 cr]. Prereq-#; 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. Prereq-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, Cell Biology and Development (GCD)

*Department of Genetics, Cell Biology, and Development*

*College of Biological Sciences*

**GCD 5036. Molecular Cell Biology.** (3 cr. Prereq-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 8008. Mammalian Gene Transfer and Expression.** (2 cr; A-F only. Prereq-#)

Current gene transfer technology. Applications of genetic modifications in animals, particularly transgenic animals and human gene therapy.

**GCD 8073. Advanced Human Genetics.** (3 cr. Prereq-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 8103. Human Histology.** (5 cr. \$GCD 6103. Prereq-Undergraduate biology, chemistry, math, and physics course; #)  
Light/electron microscopic anatomy of tissues and their organization into human organs. Emphasizes integrating structure, its relationship to function at levels from molecules to organs. Lecture, lab.

**GCD 8121. Advanced Molecular Genetics.** (3 cr. Prereq-Biol 4003, BioC 3021 or BioC 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. Prereq-3022 or Biol 4003, BioC 3021 or BioC 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. Prereq-#)

Theory and methodology of transmission and scanning electron microscopy.

**GCD 8151. Cell Biology and Signal Transduction.** (4 cr.

Prereq-[4034 or 8121 or BioC 8002], Biol 4004] or #)  
Structure, function, and biochemistry of cellular organelles. Cellular interactions in eukaryotes. Emphasizes membranes, secretion, trafficking, cytoskeleton, cell motility, nucleus, cell cycle, apoptosis, cell signaling, and signal transduction mechanisms.

**GCD 8161. Advanced Developmental Biology.** (3 cr. Prereq-[4034 or 8121 or BioC 8002], [8131 or Biol 4003], Biol 4004] 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; A-F only. Prereq-Grad MCDG major)

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. Prereq-[8121 or BioC 8002], 8151, [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. \$BioC 8213. Prereq-8121 or BioC 8002 or #)

Sample topics: DNA replication, recombination and gene conversion, regulation of gene expression in prokaryotes, regulation of gene expression in eukaryotes, chromatin structure and transcription, organellar gene expression. Lectures, readings, discussions.

**GCD 8900. Seminar.** (1 cr [max 4 cr]; S-N only. Prereq-Grad MCDG major or #)

Current scientific research.

**GCD 8910. Journal Club.** (1 cr [max 4 cr]; S-N only. Prereq-Grad MCDG major or #)

Critical evaluation of selected current literature.

**GCD 8912. Genetic Counseling in Practice.** (4 cr; A-F only. Prereq-MCDG MS student with genetic counseling specialization or #)

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; A-F only. Prereq-MCDG MS student with genetic counseling specialization or #)

Interviewing skills, supportive counseling, and case-study analysis specific to genetic counseling.

**GCD 8914. Ethical and Legal Issues in Genetic Counseling.** (3 cr; A-F only. Prereq-MCDG MS student with genetic counseling specialization or #)

Professional ethics; ethical and legal concerns with new genetic technologies.

**GCD 8920. Special Topics.** (1-4 cr [max 8 cr]. Prereq—Grad MCDG major or #)  
Special topics.

**GCD 8993. Directed Studies.** (1-5 cr [max 15 cr]. Prereq—#)  
Directed studies.

**GCD 8994. Research.** (1-5 or [max 20 cr]; S-N only. Prereq—#)  
Independent research determined by student's interests, in consultation with faculty mentor.

## Geographic Information Science (GIS)

*Department of Geography*

*College of Liberal Arts*

**GIS 5555. Basic Spatial Analysis.** (3 cr. Prereq—[Stat 3001 or equiv, MGIS student] or #)  
Analyses of data with spatial (locational) information. Exploratory data analysis. Descriptive statistics of point data. Descriptive statistics for line data. Descriptive statistics for polygon data. Spatial autocorrelation. Inferential statistical analysis of point data/polygons. Descriptive analysis of patches/landscapes. Spatial pattern recognition using empirical orthogonal functions and cluster analysis. Regression methods for spatially autocorrelated variables.

**GIS 5571. Introduction to Arc/Info.** (3 cr. Prereq—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. Prereq—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. Prereq—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. Prereq—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. Prereq—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 5577. Spatial Data Administration.** (3 cr. Prereq—#)  
Theory/application for administration of geographic databases. Quality assurance, development planning/management, maintenance, access/distribution, documentation.

**GIS 5578. GIS Programming.** (2 cr. Prereq—MGIS student or #)  
Opportunities/flexibility that computer programming offers to application of GIS technologies. Object-oriented programming techniques using Microsoft's Visual Basic programming language. Students apply GIS principles/concepts within Visual Basic programs using ESRI's MapObjects.

**GIS 5590. Special Topics in GIS.** (1-3 cr [max 6 cr]; A-F only. Prereq—#)  
Special topics in geographic information science (GIS). Topics vary according to student needs, technological developments in field.

**GIS 8333. FTE: Master's.** (1 cr. Prereq—Master's student, adviser and DGS consent)

**GIS 8501. Survey of Geographic Information Science: Past, Present, and Future Trends and Activities.** (3 cr. Prereq—MGIS student or #)  
Major trends and activities in geographic information science; university, local, state, and federal-level initiatives. History of GIS and its various disciplinary roots as well as major GIS-related resources (e.g., data sources, Web resources).

**GIS 8990. MGIS Capstone Project.** (2-6 cr [max 6 cr]; A-F only. Prereq—MGIS, #)  
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 5181. Russia and Environs.** (3 cr. \$Geog 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 5361. Geography and Real Estate.** (4 cr)  
Origins and evolution of land ownership in the United States.

**Geog 5371. American Cities I: Population and Housing.** (4 cr. \$PA 5201W. Prereq—Grad or #)  
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 5372. American Cities II: Land Use, Transportation, and the Urban Economy.** (4 cr. \$PA 5202W)  
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 5374. The City in Film.** (4 cr. \$Geog 3374V, Geog 3374W. Prereq—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 5377. Music in the City: Sounds and Bodies in Different Places.** (3 cr)  
Geographical conceptions of place, space, embodiment, and identity. Case studies of music.

**Geog 5385. Globalization and Development: Political Economy.** (4 cr. Prereq—Sr or grad or #)  
Nature/scope of modern world system (capitalism), its impact on regional development processes. Roles of state and of international financial institutions.

**Geog 5401. Geography of Environmental Systems and Global Change.** (4 cr. \$Geog 3401. Prereq—grad student or #)  
Processes that create/change the spatial patterns of climate, vegetation, and soils. Potential of humans to alter climate, vegetation, and soil processes. Possible impacts of human-altered environmental conditions.

**Geog 5411. Geography of Health and Health Care.** (4 cr. \$Geog 3411W)  
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. \$ES 5421. Prereq—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. Prereq—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. Prereq—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 5431. Plant and Animal Geography.** (3 cr. \$Geog 3431)  
Introduction to biogeography. Focuses on patterns of plant/animal distributions at different scales over time/space. Evolutionary, ecological, and applied biogeography. Paleobiogeography, vegetation-environment relationships, vegetation dynamics/disturbance ecology, human impact on plants/animals, nature conservation. Discussions, group/individual projects, local field trips.

**Geog 5441. Quaternary Landscape Evolution.** (3 cr. Prereq—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 5511. Advanced Cartography.** (3 cr)  
Topics on data sources for mapping. History of thematic cartography (focused on 19th-century European activity). Multivariate classification/symbolization. Models for cartographic generalization, spatial interpolation, and surface representation. Principles of animated/multimedia cartography.

**Geog 5512. Cartography: Topics.** (3 cr. Prereq—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]; S-N only. Prereq—#)  
Provides intensive hands-on experience in contemporary map production and design, ranging from GIS applications to digital prepress. Strong computer skills essential.

**Geog 5531. Numerical Spatial Analysis.** (4 cr. \$Geog 3531)  
Applied/theoretical aspects of geographical quantitative methods for spatial analysis. Emphasizes analysis of geographical data for spatial problem solving in human/physical areas.

**Geog 5561. Principles of Geographic Information Science.** (4 cr. Prereq–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. Prereq–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. Prereq–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. Prereq–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. Prereq–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 landuse systems.

**Geog 5588. Multimedia Cartography.** (3 cr. Prereq–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 5605. Honors: Geographical Perspectives on Planning.** (4 cr. §Geog 3605V, Geog 3605W, Geog 5605W, PA 5203W)

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 5605. Geographical Perspectives on Planning.** (4 cr. §Geog 3605V, Geog 3605W, Geog 5605V, PA 5203W. Prereq–Grad student or #)

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. Prereq–9 cr in geog, #)

Field investigation in physical, cultural, and economic geography; techniques of analysis and presentation; reconstruction of environments.

**Geog 5775. Geographic Education.** (3 cr. Prereq–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]. Prereq–sr or grad, #)

Special topics and regions. Course offered by visiting professors in their research fields.

**Geog 8001. Problems in Geographic Thought.** (3 cr; A-F only)

Currents of geographic thought in biophysical, GIS, human, cultural, and human-environment subfields. Focuses on concepts/paradigms through which geographers have attempted to unify/codify the discipline, around which debate has flourished, and about which interdisciplinary histories can be traced.

**Geog 8002. Research Methods in Geography.** (3 cr)

Seminar. Overview of research designs/methods in geography. Relationships between different research paradigms (modes of inquiry), research designs, and methods. Critical readings. Analyses of research projects.

**Geog 8005. Proseminar: Population Geography.** (3 cr. Prereq–#)

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. Prereq–#)

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. Prereq–#)

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 8020. Research Seminar: Economic Geography.** (3 cr. Prereq–#)

Contemporary research. Advanced topics, which vary with interests of faculty offering course.

**Geog 8101. Proseminar: Nature and Society.** (3 cr. Prereq–#)

Interconnectedness of environment and people, nature and society. Conceptual literature and empirical studies in human/cultural/political ecology.

**Geog 8102. Proseminar: The State, the Economy, and Spatial Development.** (3 cr. Prereq–#)

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 8103. Proseminar: Physical Geography.** (3 cr; S-N only. Prereq–#)

Historical development of research in physical geography, current research trends, and transfer of current research to undergraduate education.

**Geog 8105. Proseminar: Historical Geography.** (3 cr. Prereq–#)

Introduction to conceptual research and empirical studies.

**Geog 8106. Seminar: Social and Cultural Geography.** (3 cr. Prereq–#)

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 8107. Geographic Writing.** (3 cr; S-N only. Prereq–#)

Analysis of organization and presentation of geographic research. Critiques of selected examples of geographic writing.

**Geog 8200. Seminar: Urban Geography.** (3 cr; A-F only)

Contemporary research. Topics vary with the interests of faculty.

**Geog 8201. Explorations in the Geography of Minnesota.** (3 cr; S-N only. Prereq–#)

Physical environment, agriculture, forestry, mining, land survey, population, recreation, cities/towns, transportation. Sources of information about the state. Students make short oral/written reports. Might provide springboard for a Plan B paper, thesis, or dissertation. Two or three Saturday field trips.

**Geog 8211. Environmental Policy.** (3 cr. Prereq–#)

U.S. environmental policies at federal/state level. Policy formulation, implementation, and evaluation.

**Geog 8212. Africa.** (3 cr. Prereq–#)

Advanced topics. Topics vary with interests of faculty offering course.

**Geog 8213. East Asia and China.** (3 cr. Prereq–#)

Contemporary research, advanced topics. Topics vary with interests of faculty offering course.

**Geog 8214. South Asia.** (3 cr)

Advanced topics. Topics vary with interests of faculty offering course.

**Geog 8220. Agrarian Change and Rural Development.** (3 cr; A-F only)

Contours of agricultural/rural development in Third World. Theories of agrarian transformation and of rural development. Role of agriculture in economic development. Peasant economy. Nature/role of state intervention in rural sector.

**Geog 8230. Theoretical Geography.** (3 cr. Prereq–#)

Advanced topics. Topics vary with interests of faculty offering course. Contemporary theoretical/philosophical themes transcending subdisciplines of human/physical geography.

**Geog 8240. Medical Geography.** (3 cr. Prereq–5411 or #)

Geographic inquiry concerning selected problems of health and health care.

**Geog 8260. Seminar: Physical Geography.** (3 cr. Prereq–#)

Topics of contemporary research. Topics vary with interests of faculty offering course.

**Geog 8270. Seminar: Climatology.** (3 cr; A-F only. Prereq–#)

Sample topics: climate modeling; climatic variability; climate change and predictability; severe local storms; drought; energy balance; urban climate; statistical climatology.

**Geog 8280. Biogeography.** (3 cr [max 9 cr])

Sample topics: forest dynamics, dendrochronology, tree rings and climate, environmental disturbance, paleobiogeography, field/lab methods in biogeography.

**Geog 8290. Seminar in GIS and Cartography.** (3 cr. Prereq–#)

Selected concepts/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/animated cartography; incorporation of uncertainty.

**Geog 8291. Seminar in GIS, Technology, and Society.** (3 cr. Prereq–#)

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 8292. Seminar in GIS: Spatial Analysis and Modeling.** (3 cr; A-F only. Prereq–3511 [or equiv statistics course], [3561 or 5561 or equiv intro GIS course] or #)

Overview of Geographic Information Systems (GIS) and spatial analysis/modeling of human/environmental systems. Spatial statistics, modeling spatiotemporal processes, simulation techniques, visualization, complex systems/complexity. Guidance in thesis/dissertation research.

**Geog 8301. Advanced Qualitative Methods.** (3 cr; A-F only) Techniques available to scholars who use qualitative methods. Participant observation. Formal/informal interviews: life/oral histories, focus interviews. Documentary and material culture analysis. Practical experience, theoretical/ethical questions.

**Geog 8302. Research Development.** (3 cr; S-N only. Prereq-#) Students in geography and related social sciences are guided in key steps to effective research proposal writing.

**Geog 8333. FTE: Masters.** (1 cr. Prereq-Master's student, adviser and DGS consent)

**Geog 8336. The Developmental State.** (3 cr; A-F only) Why certain interventionist states in third world countries have been able to guide their economies to overcome legacy of underdevelopment while most have failed to induce development. Internal/external conditions that facilitated such departure from underdevelopment. Comparative national/provincial case studies: Taiwan, South Korea, Botswana, Brazil, India. Applying theoretical approaches to policy issues.

**Geog 8350. Seminar: World Population.** (3 cr. Prereq-#) Contemporary research in world population development and problems. Topics vary with interests of faculty offering course.

**Geog 8405. Seminar: Graduate Student Professional Development.** (1 cr [max 2 cr]; S-N only. Prereq-Geography grad student) Strategies for success in graduate program. Preparation for a career as a geographer. Completing/defending the dissertation. Publishing, job search, tenure process, oral presentations, non-academic career paths.

**Geog 8420. Teaching Practicum.** (1 cr [max 3 cr]; S-N only. Prereq-[Geog or MGIS] grad student or #) Teaching methodologies, learning objectives, course content, classroom techniques, student/course evaluation. Specific application to instruction in Geography.

**Geog 8444. FTE: Doctoral.** (1 cr. Prereq-Doctoral student, adviser and DGS consent)

**Geog 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq-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]. Prereq-Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**Geog 8800. Seminar: Development of Geographic Thought.** (3 cr. Prereq-#) Topics vary with interests of faculty offering course.

**Geog 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq-Max 18 cr per semester or summer; 24 cr required)

**Geog 8970. Directed Readings.** (1-5 cr [max 5 cr]. Prereq-Δ)

**Geog 8980. Topics in Geography.** (1-3 cr [max 15 cr]. Prereq-#) Seminar offered by visiting or regular faculty. Topics vary with interests of faculty.

**Geog 8990. Research Problems in Geography.** (1-5 cr [max 5 cr]. Prereq-Δ) Individual research projects.

## Geological Engineering (GeoE)

*Department of Civil Engineering  
Institute of Technology*

**GeoE 5311. Experimental Geomechanics.** (3 cr; A-F only. §CE 5311. Prereq-IT upper division or grad student, 4301, CE 4301, or #)

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; A-F only. §CE 5321. Prereq-IT upper division or grad student, 4301, CE 4301 or #) 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; A-F only. §CE 5331. Prereq-IT upper division or grad student, 4301 or CE 4301)

Soil and rock response in triaxial testing; drained and undrained behavior; elastic and plastic properties. Modeling stresses, strains, and failure in geomechanics problems.

**GeoE 5341. Wave Methods for Nondestructive Testing.** (4 cr; A-F only. Prereq-[AEM 2021, AEM 3031] or #)

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.** (1-3 cr [max 4 cr]; S-N only. §CE 8300) Presentations on various topics.

**GeoE 8301. Fracture of Geomaterials.** (3 cr; A-F only. §CE 8301. Prereq-5331, CE 5331 or #, IT grad student)

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; A-F only. §CE 8302. Prereq-CE 4300 or #, IT grad student) 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; A-F only. §CE 8311. Prereq-5331, CE 5331 or #, IT grad student) 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; A-F only. §CE 8321. Prereq-5321, CE 5321 or #, IT grad student) 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; A-F only. §CE 8322. Prereq-CE 4301 or #, IT grad student) 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; A-F only. §CE 8331. Prereq-5321 or CE 5321 or #, IT grad student) 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. Prereq-Master's student, adviser and DGS consent)

**GeoE 8336. Boundary Element Methods I.** (3 cr; A-F only. §CE 8336. Prereq-IT grad student or #) 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; A-F only. §CE 8337. Prereq-8336, CE 8336 or #) Transient and nonlinear problems.

**GeoE 8341. Dynamics of Soils and Foundations.** (4 cr; A-F only)

Vibration of single- and multi-degree-of-freedom systems. Dynamic Soil Properties. Wave propagation in continuous media. Foundation dynamics. Liquefaction. Introduction to seismology/earthquakes.

**GeoE 8351. Advanced Groundwater Mechanics I.** (3 cr; A-F only. §CE 8351. Prereq-CE 4351, IT grad student or #) 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; A-F only. §CE 8352. Prereq-4351 or CE 4351, IT grad student or #) 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; A-F only. §CE 8361. Prereq-IT grad student or #) 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. Prereq-Doctoral student, adviser and DGS consent)

**GeoE 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq-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]. Prereq-Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**GeoE 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq-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. §Geo 1005, Geo 1009, Geo 1101, Geo 2111H. Prereq—educ 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 5108. Principles of Environmental Geology.** (3 cr. Prereq—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; A-F only. Prereq—Math 2263 or #) 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 5203. Mineral and Rock Physics.** (3 cr. Prereq—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 5204. Geostatistics and Inverse Theory.** (3 cr. Prereq—Stat 3011 or #) Statistical treatment of geological and geophysical data. Statistical estimation. Stochastic processes/fields. Non-linear/non-assumptive error analysis. Cluster analysis. Eigenvalue-eigenvector methods. Regional variables. Correlograms and kriging. Theoretical framework of linear geostatistics and geophysical inverse theory.

**Geo 5302. Isotope Geology.** (3 cr; A-F only. Prereq—2303 or #) 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 [max 3 cr]. Prereq—[One yr chem, one yr physics] or #) Characterizing solid materials with electron beam instrumentation, including reduction of X-ray data to chemical compositions.

**Geo 5502. Advanced Structural Geology.** (3 cr. Prereq—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. Prereq—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. Prereq—4602, Math 2243 or #) Elementary mechanics of sediment transport applied to quantitative interpretation of sedimentary rocks.

**Geo 5701. General Hydrogeology.** (3 cr [max 4 cr]. Prereq—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. Prereq—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 5705. Limnogeology and Paleoenvironment.** (3 cr. Prereq—#) Within-lake, hydrogeologic, and landscape (geological/biological) processes that lead to formation of various proxy records of paleoenvironment. Systems approach to physical, geochemical, biogeochemical, and biotic proxies. Basic principles, case studies. Emphasizes how proxy records relate to paleoclimate.

**Geo 5713. Tracers and Karst Hydrogeology.** (3 cr. Prereq—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. Prereq—CSci 1107 or CSci 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 [max 3 cr]. Prereq—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. Prereq—Master's student, adviser and DGS consent)

**Geo 8351. Geochemical Modeling of Aqueous Systems.** (3 cr. Prereq—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. Prereq—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. Prereq—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. Prereq—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. Prereq—Doctoral student, adviser and DGS consent)

**Geo 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq—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 [max 4 cr]. Prereq—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; A-F only. Prereq—5701, CSci 1107 or #) 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]. Prereq—5701, cr per semester or summer; 10 cr total required [Plan A only])

**Geo 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—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]; A-F only. Prereq—#)

**Geo 8980. Seminar: Current Topics in Geology and Geophysics.** (1-4 cr [max 30 cr]; S-N only. Prereq—#)

**Geo 8994. Research in Geology and Geophysics.** (1-4 cr [max 30 cr]. Prereq—#) 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. Prereq—3011, [grad student or adv undergrad]) Achieving high proficiency in writing/speaking professional/academic German.

**Ger 5016. Advanced Translation: Theory and Practice.** (3 cr. Prereq—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. Prereq—1004, Ling 3001 or Ling 5001 or #) Phonology, morphology, and syntax of standard German.

**Ger 5410. Topics in German Literature.** (3 cr [max 9 cr]. Prereq—3011) 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]. Prereq—3011) A topic of contemporary German culture explored in depth.

**Ger 5610. German Literature in Translation.** (3 cr [max 9 cr]. Prereq—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]. Prereq=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. Prereq=3011)  
Historical development of German, from beginnings to 1450.

**Ger 5712. History of the German Language II.** (3 cr. Prereq=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. Prereq=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. Prereq=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 5993. Directed Studies.** (1-4 cr [max 12 cr]. Prereq=#, □)  
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]. Prereq=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 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. Prereq=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 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]. Prereq=#; 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. Prereq=Master's student, adviser and DGS consent)

**GSD 8444. FTE: Doctoral.** (1 cr. Prereq=Doctoral student, adviser and DGS consent)

**GSD 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq=Doctoral student who has not passed prelim oral)

**GSD 8801. Dissertation Seminar.** (3 cr; S-N only)  
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; S-N only. Prereq=8801, completion of doctoral preliminary examinations)  
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 Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq=Max 18 cr per semester or summer; 24 cr required)

## Gerontology (Gero)

*School of Public Health*

**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)  
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 5111. Studying Aging and Chronic Illness.** (2 cr. Prereq=Introductory course in epidemiology or #)  
Methodological issues unique to studies of older populations. Focuses on measurement of epidemiological characteristics. Health conditions/disorders of older Americans.

**Gero 8020. Seminar in Gerontology.** (2 cr. Prereq=#)  
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. Empire and Modernity.** (3 cr; A-F only. Prereq=[3101, 3144] or #)  
How modern world has been constituted by colonial encounter. Role of colonialism in construction of 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. Prereq=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 & Empire.** (3 cr; A-F only. Prereq=[3101, 3144] or #)  
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 5410. Interactive Global and Local Studies.** (3 cr; A-F only. Prereq=#)  
Global studies topics, locally in the Twin Cities and Minnesota, and internationally through linked communication with classes at cooperating universities in other countries. Students communicate with counterparts abroad through e-mail to develop comparative/interactive elements. Possible topics: role of river in local history, grain storage/processing, manufacturing/trade, growth of metropolitan area.

**GloS 5602. Other Worlds: Globality and Culture.** (3 cr; A-F only. Prereq=[3101, 3144, grad student] or #)  
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. \$HIST 5251)  
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 5643. Colonialism and Culture.** (3 cr; A-F only. \$Anth 5043)  
Making of culture as colonial/anthropological object of knowledge. Relationship between colonial knowledge/formation of academic disciplines (especially anthropology). Colonial/postcolonial transformations of colony, nation, and metropole.



**GloS 5801. International Development: Critical Perspectives on Theory and Practice.** (3 cr; A-F only. Prereq—Admission to MSID prog, grad student)

Interdisciplinary approaches to development. Assumptions, competing paradigms, analysis of policies, projects, problems. Globalization, societal crisis, indigenous alternatives to dominant paradigm. Partially taught in separate sections to deepen understanding of particular topic (e.g., environment, health, education).

**GloS 5802. Cross-Cultural Perspectives on Work.** (3 cr; A-F only. Prereq—Admission to MSID prog, grad student) Intercultural communication concepts/skills. U.S. cultural/value system. Stages of adjustment. Coping strategies for crossing cultural boundaries. Host-country cultural characteristics. Emphasizes work, family, community, views of development.

**GloS 5803. MSID Country Analysis.** (3 cr; A-F only. Prereq—Admission to MSID prog, grad student) Multidisciplinary study of host country. Emphasizes social sciences and history, especially concepts/information regarding development issues.

**GloS 5805. Grassroots Development Internship.** (3 cr; A-F only. Prereq—Admission to MSID prog, grad student) Grassroots internship with a host-country development agency or project through Minnesota Studies in International Development. Community characteristics, development strategies/problems, organizational structure/culture, cross-cultural communication issues.

**GloS 5806. Topics: Case Studies in International Development.** (3 cr; A-F only. Prereq—Admission to MSID prog, grad student) Development issues illustrated in students. local-level projects through MSID. Focuses on a particular sector as it relates to development of country. Sample topics: environment and development; health and development; education, literacy, and development; women and development.

**GloS 5807. Applied Field Methods.** (3 cr; A-F only. Prereq—Admission to MSID program) Application of selected field research methods in rural/urban settings in Asia, Africa, and Latin America. Analysis of practical, ethical, and theoretical issues raised through small field assignments and individual research projects.

**GloS 5808. MSID Directed Research.** (3 cr; A-F only. Prereq—Admission to MSID prog, grad student) Research project based on field work in Ecuador, India, Kenya, or Senegal through Minnesota Studies in International Development (MSID).

**GloS 5900. Topics in Global Studies.** (1-4 cr [max 4 cr]) Proseminar. Selected issues in global studies. Topics specified in *Class Schedule*.

**GloS 5910. Topics in East Asian Studies.** (1-3 cr [max 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 [max 4 cr]) Description varies with topic title.

**GloS 5993. Directed Studies.** (1-4 cr [max 12 cr]. Prereq—#, □) Guided individual reading or study. Open to qualified students for one or more semesters.

**GloS 5994. Directed Research.** (1-4 cr [max 12 cr]. Prereq—#, □) Qualified students work on a tutorial basis.

## Graduate School (Grad)

### Graduate School

**Grad 5102. Preparation for University Teaching for Nonnative English Speakers.** (2 cr; S-N only. Prereq—Grad student, [SPEAK score of 40-45 or successful completion of “Foundations in English”], [current or anticipated] TA assignment, #)

Theory/practice of teaching in higher education in the United States. Emphasizes awareness of cross-cultural communication issues. Students practice in a simulated instructional setting.

**Grad 5105. Practicum in University Teaching for Nonnative English Speakers.** (2 cr; S-N only. Prereq—[SPEAK score of 50 or successful completion of 5102], [current or anticipated] TA assignment)

Theory, advanced practice in teaching in higher education for nonnative speakers of English. Emphasizes interactive teaching strategies, oral presentation skills, legal/policy issues.

**Grad 8101. Teaching in Higher Education.** (3 cr)

Teaching methods/techniques. Focuses on active learning, critical thinking, practice teaching, and preparing a portfolio to document/reflect upon teaching. Readings, discussion, peer teaching, e-mail dialog, reflective writing, co-facilitation of course.

**Grad 8102. Practicum for Future Faculty.** (3 cr; S-N only. Prereq—8101 or equiv, #)

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.

**Grad 8200. Teaching and Learning Topics in Higher Education.** (1 cr [max 4 cr]; A-F only. Prereq—8101 or PFF prog director consent)

Teaching/learning topics in higher education. Applications to specific contexts/topics. Students create course materials for a context/discipline and assess an action plan in terms of student learning. Students write an action plan. Different sections cover topics such as active learning in the sciences, teaching with technology, multicultural education, teaching in clinical settings, learning-community course design.

## Greek (Grk)

### Department of Classical and Near Eastern Studies

#### College of Liberal Arts

**Grk 5012. Prose Composition.** (3 cr. Prereq—Grad student or #) 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. Prereq—Grad student or #) English-to-Greek verse composition or writing styles of individual Greek authors.

**Grk 5032. Text Criticism.** (3 cr. Prereq—Grad student or #) Theory/practice. Elements of paleography and manuscript study. Tools for analyzing textual apparatus; constructing a critical edition of a literary text.

**Grk 5121. Biblical and Patristic Greek.** (3 cr. Prereq—Grad student or #) Septuagint, Philo, Josephus, New Testament, Apostolic Fathers, and other patristic literature to 5th century CE. Reading/discussion of selected texts in major genres.

**Grk 5310. Greek Literature: Oratory.** (3 cr [max 9 cr]. Prereq—Grad student or #) One or more authors.

**Grk 5320. Greek Literature: Tragedy.** (3 cr [max 9 cr]. Prereq—Grad student or #) Reading of Greek tragedy.

**Grk 5330. Greek Literature: Comedy.** (3 cr [max 9 cr]. Prereq—Graduate student status or instructor consent) Readings in Greek comedy.

**Grk 5340. Greek Literature: History.** (3 cr [max 9 cr]. Prereq—Grad student or #) Readings from Greek historians. Traditions of Greek historiography.

**Grk 5350. Greek Literature: Philosophy.** (3 cr. Prereq—Grad student or #) Readings from one or more works of Plato or Aristotle in original Greek. Selections vary.

**Grk 5360. Literature: Religious Texts.** (3 cr [max 9 cr]. Prereq—Grad student or #) Reading/discussion of religious texts from Greek antiquity, such as Homeric Hymns, cultic verse, antalogy, sacred tales, oracle texts.

**Grk 5370. Greek Literature: Epic.** (3 cr [max 9 cr]. Prereq—Grad student or #) Reading classical Greek epic.

**Grk 5380. Greek Literature: Lyric.** (3 cr [max 9 cr]. Prereq—Grad student or #) Selections from Greek lyric poets.

**Grk 5390. Greek Literature: Romance.** (3 cr [max 9 cr]. Prereq—Grad student or #) Selections from Hellenistic Romances of, e.g., Chariton, Longus.

**Grk 5440. Greek Literature: Later Authors.** (3 cr [max 9 cr]. Prereq—Grad student or #) Selected topics in later Greek literature, especially Byzantine prose.

**Grk 5450. Greek Literature: Classical Authors.** (3 cr [max 9 cr]. Prereq—Grad student or #) Selected topics in classical Greek literature. Topics specified in *Class Schedule*.

**Grk 5621. Grk Paleography.** (3 cr. Prereq—Grad student or #) Analysis of various hands used in Greek manuscripts with attention to date/provenance. History of transmission of Greek literature.

**Grk 5715. Introduction to the Historical-Comparative Grammar of Greek and Latin.** (3 cr. \$Lat 5715. Prereq—Grad student or #) Historical/comparative grammar of Greek/Latin, from their Proto-Indo-European origins to classical norms.

**Grk 5716. History of Greek.** (3 cr. Prereq—Grad student or #) Reading and formal analysis of documents illustrating evolution of Greek language from Mycenaean to modern times.

**Grk 5993. Directed Studies.** (1-4 cr [max 18 cr]. Prereq—Grad student or #) Guided individual reading or study.

**Grk 5994. Directed Research.** (1-12 cr [max 18 cr]. Prereq—Grad student or #) Supervised original research on topic chosen by student.

**Grk 5996. Directed Instruction.** (1-12 cr [max 20 cr]. Prereq—Grad student or #) Supervised teaching internship.

**Grk 8120. Greek Text Course.** (3 cr [max 15 cr]. Prereq—3111; not for students in dept of Classical and Near East Studies) 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 concurrent scholarship and original student research.

## Health Informatics (HInf)

*Department of Laboratory Medicine and Pathology*

### Medical School

#### HInf 5430. Health Informatics I. (4 cr; A-F only)

History/challenges of health informatics. Structure of healthcare delivery system. Electronic medical records. Clinical information systems. Basics of information, computation, communication. Data management in health settings. Added value of information systems in health care, Ethical and legal considerations.

#### HInf 5431. Health Informatics II. (4 cr; A-F only)

Topics related to health care information systems. System integration and communications. System selection/deployment. Current technologies/architectures. Security. Special topics such as telemedicine.

#### 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 [max 6 cr]. Prereq-#)

Individual or group studies in health informatics.

#### HInf 5496. Internship in Health Informatics. (1 cr [max 3 cr]; S-N only. Prereq-5430, 5431, #)

Practical industrial experience not directly related to student's normal academic experience.

#### HInf 5499. Capstone Project for the Masters of Health Informatics. (3 cr; A-F only. Prereq-[[5430, 5431] or #], MHI student)

Students apply related knowledge/skills to a practical problem in health informatics. Proper design of projects, past exemplar projects. Students work with adviser to design/complete a project in a practical setting. Students submit a written project report in lieu of a final examination.

#### HInf 8333. FTE: Master's. (1 cr. Prereq-Master's student, adviser and DGS consent)

#### HInf 8405. Advanced Topics in Health Computer Sciences I. (3 cr. Prereq-#)

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. Prereq-#)

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; A-F only. Prereq-5432 or #)

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. Prereq-Doctoral student, adviser and DGS consent)

#### HInf 8446. Professional Studies in Health Informatics. (1-2 cr [max 2 cr]; A-F only. Prereq-5431, PubH 5452 or #, grad hlth inf major)

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 [max 6 cr]; A-F only. Prereq-#)

Directed readings in topics of current or theoretical interest in medical informatics.

#### HInf 8494. Research in Health Informatics. (1-6 cr [max 6 cr]; A-F only. Prereq-#)

Directed research under faculty guidance.

#### HInf 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]. Prereq-Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

#### HInf 8770. Plan B Project. (4 cr; A-F only. Prereq-Plan B MS student, #, no credit toward PhD)

Research project. Topic arranged between student and instructor. Written report required.

#### HInf 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]. Prereq-Max 18 cr per semester or summer; 10 cr total required [Plan A only])

#### HInf 8888. Thesis Credit: Doctoral. (1-24 cr [max 100 cr]. Prereq-Max 18 cr per semester or summer; 24 cr required)

## Hebrew (Hebr)

*Department of Classical and Near Eastern Studies*

### College of Liberal Arts

#### Hebr 5015. Advanced Modern Hebrew I. (3 cr. Prereq-3012)

Advanced studies in a variety of genres and media including fiction, poetry, drama, film, and journal. Emphasis on expanded oral and written self expression. Materials from several periods are used to prepare for future specialized study. Taught in Hebrew.

#### Hebr 5016. Advanced Modern Hebrew II. (3 cr. \$HEBR 3016. Prereq-3015 or 5015 or qualified fr or #)

A continuation of 3015. Emphasis on expanded oral and written self expression. Samples a variety of Hebrew periods to prepare for specialized study. Studies utilize a variety of genres and media including fiction, poetry, drama, film, and journal. Taught in Hebrew.

#### Hebr 5200. Advanced Classical Hebrew. (3 cr [max 18 cr]. \$HEBR 3200. Prereq-3012 or 3102 or #)

In-depth reading, analysis, and discussion of classical Hebrew texts. Grammar, syntax. Introduction to text-criticism, history of scholarship, and scholarly tools. Format varies between survey of themes (e.g., law, wisdom, poetry) and extended concentration upon specific classical texts.

#### Hebr 5300. Post-Biblical Hebrew: Second Temple Period. (3 cr [max 18 cr]. Prereq-Grad student or #)

Readings in late-/post-biblical Hebrew literature of Persian, Hellenistic, and early Roman periods (e.g., Chronicles, Ezra-Nehemiah, Ecclesiastes, Daniel, Dead Sea Scrolls, apocrypha, pseudepigrapha). Focuses on historical development of Hebrew language and literature in relation to earlier biblical sources.

#### Hebr 5400. Rabbinic Texts. (3 cr [max 18 cr]. Prereq-Grad student or #)

Language, idiom, and literary forms of classical Rabbinic sources in Hebrew. Selections drawn from legal, homiletical, and narrative texts (Mishnah, Tosefta, Talmud, Midrash). Original socio-historical/cultural background of Rabbinic literature, its enduring religious significance.

#### Hebr 5990. Topics in Hebrew Studies. (1-4 cr [max 12 cr]. Prereq-Grad student or #)

Historical, linguistic, literary, religious, or humanistic study of Hebrew society/culture. Approach/method of study varies with topic.

#### Hebr 5992. Directed Readings. (1-4 cr [max 12 cr]. Prereq-3012 or #)

Guided individual reading or study.

## Hindi (Hndi)

*Department of Asian Languages and Literatures  
College of Liberal Arts*

#### Hndi 5040. Readings in Hindi Texts. (2-4 cr [max 12 cr]; A-F only. Prereq-4162 or equiv or #)

Students read authentic materials of various types to improve reading/speaking ability. Topics specified in *Class Schedule*.

#### Hndi 5710. Topics in Hindi Language, Literature, and Culture. (4-5 cr [max 5 cr])

Topics in Hindi literature or the linguistic structure of Hindi.

#### Hndi 5990. Directed Research. (3-5 cr [max 5 cr]. Prereq-#, Δ, □)

#### Hndi 5993. Directed Readings. (1-4 cr [max 12 cr]. Prereq-#, Δ, □)

Guided individual reading or study of modern Hindi texts.

#### Hndi 8790. Research. (1-5 cr [max 5 cr]. Prereq-#)

## History (Hist)

*Department of History*

### College of Liberal Arts

#### Hist 5011. Quantitative Methods for Historical Research. (4 cr. Prereq-#)

Basics of quantitative historical data collection, measurement, and analysis.

#### Hist 5051. Before Herodotus: History and Historiography of Mesopotamia and the Ancient Near East. (3 cr; A-F only. \$CNES 5051. Prereq-Prev coursework in ancient Near Eastern history recommended)

Historical method/sources for ancient Near Eastern history. Historical traditions. Historiographic texts of Mesopotamia and neighboring regions of the ancient Near East, secondary emphasis on their relationship to works of classical historians such as Herodotus. Use of these sources in modern historiography of ancient Near East.

#### Hist 5111. Proseminar in the History of Medieval Europe. (3 cr; A-F only. Prereq-Advanced undergrads of exceptional ability or grads, #)

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. Prereq-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. \$GloS 5603)

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 cr [max 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 5271. The Viking World: Story, History, and Archaeology.** (3 cr; A-F only. §Hist 3271) Viking society and expansion of Viking influence abroad. Viking impact on Western Europe, interactions with Slavic lands, settlement of North Atlantic islands, Western Europe's impact on Scandinavian lands. Analyzes archaeological, historical, linguistic, and numismatic evidence.
- Hist 5285. Problems in Historiography and Representation of the Holocaust.** (3 cr. Prereq—JwSt 3521 or ReIS 3521 or #) Issues connected with the Holocaust. Inclusiveness of other groups. Holocaust vs. "Shoah," historiographical conflicts about perpetrators, problems of representation in literature/art, problems of narrative theology after Auschwitz.
- 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]. Prereq—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. Prereq—Grad or #) 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 5437. History of East Africa.** (3 cr. §Afro 3437, Afro 5437, Hist 3437) Major themes in history of East Africa, from era of early human cultural development to present. Methods that historians use to reconstruct history. Varying interpretations/constructions of history over time.
- Hist 5439. Environment and Society in Africa.** (3 cr. Prereq—#) Major historiographical, theoretical, and methodological debates concerning people-environment relations in Africa, from rise of human societies to present. Environment and the rise of civilizations. Demography, colonial environmental policies, conservation, disease, indigenous knowledge, water management, food.
- Hist 5441. Transformations in Pre-Colonial African History.** (3 cr; A-F only. Prereq—#) African internal/external processes before 1600. Framework by which early African history is understood, tools for reconstructing it, themes/debates that have shaped it, new directions in which it is moving.
- Hist 5446. Problems in West African History.** (3 cr. Prereq—Grad or #) 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. §EAS 3464, Hist 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. §EAS 3465W, Hist 3465W) 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. §EAS 3467W, Hist 3467W) 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. §EAS 3468, Hist 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 5469. Historiographies of China, 1000-1700.** (3 cr; A-F only. Prereq—Grad student or #) Important recent English-language work on Chinese culture during the Song, Yuan, and Ming dynasties. Topics include religion, gender, family structures, ethnic identity, commerce/economics, and political structures/events.
- Hist 5473. Japan's Modernities: Historiographies.** (3 cr; A-F only. §EAS 3473. Prereq—[Advanced undergrad, #] or grad student) Historiography on modern Japan in English language scholarship. Major trends since 1950s, latest scholarship. Issues concerning Japan's modernity. Definitions of modernity, modernization, and modernism. Relationship between knowledge-making and nation building. Japan's place in world.
- Hist 5474. Sex and the Politics of Desire: Japan and Beyond.** (3 cr; A-F only. Prereq—Grad student or #) History of gender/sexuality in modern Japan and Korea. Geography of Japan. Theoretical/methodological literature not specific to Japan. Sexology, eugenics, feminism, nationalism, colonialism, cyber sexuality.
- Hist 5479. History of Chinese Cities and Urban Life.** (3 cr; A-F only. §Hist 3479) Introduction to traditional Chinese cities, 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. Prereq—#) Place of medieval Europe in the world. Relations of Europe with Asia, Africa, and the Americas. European knowledge of the world's other great cultures. European travelers/explorers. Assessment of other cultures' knowledge of Europe in the period.
- Hist 5505. Survey of the Middle East.** (3 cr. Prereq—Grad or #) Peoples, lands, cultures of the Middle East, from earliest civilizations to present.
- Hist 5520. Topics in Chinese History.** (3 cr [max 12 cr]) Selected topics not covered in regular courses. Taught as staffing permits.
- Hist 5541. Islam in the Catholic Age.** (3 cr. Prereq—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. Prereq—Grad student or #) Founding 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; A-F only. Prereq—Grad student or #) Basic scholarly bibliography for medieval Western European history during early Middle Ages. Foundation for teaching courses in medieval history, preparing for general doctoral exam.
- Hist 5612. Proseminar in Medieval History.** (3 cr; A-F only. Prereq—[5611, grad student] or #) Basic scholarly bibliography for medieval Western European history during central/late Middle Ages. Foundation for teaching courses in medieval history, preparing for general doctoral exam.
- Hist 5614. The Medieval Church.** (3 cr. Prereq—Grad student or #) Introduction to history of western church in Middle Ages. Emphasizes church teachings and institutional structures, beliefs/practices of lay people, medieval Christian encounter with non-Christian world.
- Hist 5616. Proseminar in Medieval Spain.** (3 cr; A-F only. Prereq—#) 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.** (3 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; A-F only. Prereq—Grad student or [advanced undergrad, #]) 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; A-F only. Prereq—Hist grad or #) Critical reading of historical literature dealing with integration of the globe during the early modern period, ca. 1350-1750; book reports, class discussion.
- Hist 5632. World History Proseminar.** (3 cr; A-F only. Prereq—#) Theoretical approaches to world/global history. Review of major theories, controversies, chronologies, pedagogical approaches.
- Hist 5633. Socio-Economic History of China.** (3 cr; A-F only. Prereq—Grad student or [adv undergrad, #]) Nature of Chinese socio-political formations and economic development in Qing and Republican eras, 1644-1937. Establishment/methods of state rule, merchants, agrarian social structure, domestic industry, demographic regimes, capitalism, and imperialism. Comparisons using theoretical and case studies of economic development.

**Hist 5649. Ideas in Context: Making Early Modern Knowledge, 1500-1800.** (3 cr; A-F only. Prereq—Grad student or #)

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; A-F only. Prereq—Hist grad or #)

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; A-F only. Prereq—#)

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; A-F only. Prereq—#)

Critical study of principal writings about English history.

**Hist 5671. Proseminar: Modern Britain.** (3 cr; A-F only. Prereq—#)

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/Politics:Modern Europe.** (3 cr [max 6 cr]; A-F only. Prereq—Grad or #)

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. §Hist 3721. Prereq—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 [max 4 cr]. Prereq—#)

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]; A-F only. Prereq—#)

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 5761. Proseminar - Imperial Russia.** (3 cr. Prereq—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. Prereq—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. Prereq—#)

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. Prereq—#)

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. Focuses 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 5811. Nineteenth-Century U.S. History.** (3 cr; A-F only. Prereq—[Grad or honors] history major, #)

Proseminar. Central themes/debates in historiography of 19th-century United States. Market revolution, antebellum party politics. Slavery, the Civil War, Reconstruction. Immigration and nationalism. Transformations in ideologies/experiences of race/gender. Industrialization, labor, and urbanization. Western expansion. Emergence of populism/progressivism.

**Hist 5821. American History in the Twentieth Century.** (3 cr [max 4 cr]; A-F only. Prereq—Grad student, #)

Intensive readings seminar.

**Hist 5841. Proseminar in American Economic History.** (3 cr; A-F only. Prereq—#)

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 5845. History of American Capitalism.** (3 cr; A-F only. Prereq—Grad student or #)

Historiography/history of American capitalism. Crucial events (e.g., market "revolution," development of industrial cities) focus weekly discussions of new literature. Students analyze theoretical models of capitalism and new work in social, political, and economic history.

**Hist 5857. Proseminar: Readings in the History of American Women.** (3 cr. Prereq—#)

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; A-F only. Prereq—#)

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; A-F only. Prereq—#)

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 5871. Readings in U.S. Intellectual History: 19th-20th Centuries.** (3 cr. Prereq—#)

Definitions of American national identity from 1789 to the present as expressed in politics, religion, literature, painting, music, architecture, and history.

**Hist 5877. Asian American History.** (3 cr; A-F only)

Introduction to key issues, theoretical frameworks, research, and methodologies of Asian American history. Seminal texts that defined the field. Recent scholarship in history and in related disciplines. Emphasis field's comparative/transnational linkages to ethnic studies, Asian studies, and the Americas.

**Hist 5881. American Foreign Relations to 1895.** (3 cr. Prereq—#)

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. Prereq—#)

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. §Amln 5890. Prereq—#)

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]. Prereq—Grad or [advanced undergrad 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. Prereq—#)

Introduces beginning graduate and advanced undergraduate students to major historical writings on various Latin American themes.

**Hist 5902. Latin America Proseminar: Modern.** (3 cr. Prereq—#)

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]. Prereq—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 15 cr]. Prereq—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]; A-F only. Prereq—Grad or #)

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]; A-F only. Prereq—Grad student or #)

Topics specified in *Class Schedule*.

**Hist 5932. African Historiography and the Production of Knowledge.** (3 cr; A-F only. Prereq—Major in African history or [grad student, #])

Recent scholarship on social history of Africa. Focuses on new literature on daily lives of ordinary people in their workplaces, communities, households.

- Hist 5933. Seminar in Ancient History.** (3 cr; A-F only. Prereq—Previous coursework in Greek or Roman history, #) Seminar on a selected topic in ancient history.
- Hist 5934. Comparative History and Social Theory.** (3 cr; A-F only. Prereq—Grad student or [upper-div undergrad, #]) Works of history/sociology that are broadly comparative/theoretical. Issues of state formation, social movements, social structure, and economic development.
- Hist 5935. Methods and Pedagogy in African History.** (3 cr; A-F only. Prereq—Grad student or #) Current historical methods/sources of African history. Pedagogical issues. Students design their own courses.
- Hist 5940. Topics in Modern Chinese History.** (1-4 cr [max 16 cr]). Prereq—Grad student or [advanced undergrad, #]) Possible topics include cultural, economic, intellectual, political, and social history.
- Hist 5941. Readings in Chinese Documents.** (3 cr. Prereq—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: History of Medicine.** (3-4 cr [max 16 cr]). Prereq—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]). Prereq—Grad or advanced undergrad with #) 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]). Prereq—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. Prereq—Grad student, #) Research proseminar on actions of Europeans in wider world, 1350-1790. Based on documents in James Ford Bell Library.
- Hist 5964. Comparative Economic History.** (3 cr. Prereq—#) 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 [max 15 cr]). Prereq—Grad student or [advanced undergrad, #]) 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 5990. Readings in Comparative History.** (3 cr [max 15 cr]). Prereq—#) Students read/discuss historical works that focus on common theme or employ similar methods in different geographic areas. Issues of cross-area comparison. Topics vary (e.g., peasant societies, race/ethnicity, states/nationalism).
- Hist 5993. Directed Study.** (1-16 cr [max 16 cr]). Prereq—[Grad student or sr], #, A, □) Guided individual reading or study.
- Hist 5994. Directed Research.** (1-16 cr [max 16 cr]). Prereq—[Grad student or sr], #, A, □) Work on a tutorial basis.
- Hist 8015. Scope and Methods of Historical Studies.** (3 cr; A-F only. Prereq—#) 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 8021. Seminar: Advanced Historical Writing.** (3 cr; A-F only. Prereq—Grad student, #) Formal writing group. Writing practices for historians. Readings/discussions about historical analysis. Practical application of writing historical narratives. Students complete a major writing project based on their program needs and progress.
- Hist 8110. Medieval History: Research Seminar.** (3 cr; A-F only. Prereq—#, good reading knowledge of Latin, French, one other European language) 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; A-F only. Prereq—#) Dynamics of gender, racial, class, and ethnic relations in U.S. history; intersections of these forces.
- Hist 8240. Topics in Research in Gender, Race, Class, or Ethnicity in the United States.** (3 cr [max 6 cr]; A-F only. Prereq—#) Dynamics of gender, racial, class, and ethnic relations in U.S. history. Intersections of these forces. Topics vary by instructor.
- Hist 8245. Race, Nation, and Genocides.** (3 cr; A-F only) Theoretical literature on genocides and human rights. Historical case studies of genocides. Readings/discussions on meaning of “genocide” and its codification in international law. Theoretical literature on race/nation. Historical cases, primarily in 20th century (e.g., Armenian genocide, the Holocaust, Rwanda, former Yugoslavia). Students choose specific case to research.
- Hist 8333. FTE: Master's.** (1 cr. Prereq—Master's student, adviser and DGS consent)
- Hist 8390. Research in American Indian History.** (3 cr; A-F only. Prereq—5890 or Amln 5890 or #) 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. Prereq—Doctoral student, adviser and DGS consent)
- Hist 8464. Research in Yuan, Ming, and Qing History.** (3 cr; A-F only. Prereq—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. Bibliographic exercises; reading and translating primary documents.
- Hist 8465. Research in Yuan, Ming, and Qing History.** (3 cr. Prereq—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; A-F only. Prereq—#) 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]). Prereq—Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)
- Hist 8709. Seminar: History of Sexuality.** (3 cr; A-F only) Theories of sexuality (by, e.g., Foucault, Butler, deLauretis), their application in history. Topics may include: feminist critique of Foucault and the classics, psychoanalytic approaches to religious transformations such as the Reformation, varying forms of gender transgression, sexuality in colonial encounters, operation of sexual metaphors in political conflict, and AIDS and the writing of history.
- Hist 8715. Research on European Women's History, 1450-1750.** (3 cr. Prereq—5715) Research techniques for completing a major research paper based on primary sources.
- Hist 8720. Research Seminar on Central European History.** (1-4 cr [max 16 cr]; A-F only) Broad research theme/problem: in most cases preparation for dissertation. Students identify primary/secondary sources, conduct research, write paper, and read/comment upon each other's drafts. Geographic focus varies with instructor, may include Germany or lands of former Habsburg Austrian empire.
- Hist 8777. Thesis Credits: Master's.** (1-18 cr [max 50 cr]). Prereq—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; A-F only. Prereq—5857, #) 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; A-F only. Prereq—5801 or #) 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 Credit: Doctoral.** (1-24 cr [max 100 cr]). Prereq—Max 18 cr per semester or summer; 24 cr required)
- Hist 8900. Topics in European/Medieval History.** (1-4 cr [max 16 cr]; A-F only) Topics not covered in regular courses.
- Hist 8910. Topics in U.S. History.** (1-4 cr [max 16 cr]; A-F only) Topics not covered in regular courses.
- Hist 8920. Topics in African History.** (1-4 cr [max 16 cr]; A-F only) Topics not covered in regular courses.
- Hist 8930. Topics in Ancient History.** (1-4 cr [max 16 cr]; A-F only) Topics not covered in regular courses.
- Hist 8940. Topics in Asian History.** (1-4 cr [max 16 cr]; A-F only) Topics not covered in regular courses.
- Hist 8944. Research Seminar: New Directions in African Social History I.** (3 cr; A-F only. Prereq—#) First of two-part course. 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 II.** (3 cr; S-N only. Prereq—8944, #) Second of two-part course. Students conceptualize and write major research paper.
- Hist 8950. Topics in Latin American History.** (1-4 cr [max 16 cr]; A-F only) Topics not covered in regular courses.
- Hist 8960. Topics in History.** (1-4 cr [max 16 cr]; A-F only) Topics not covered in regular courses.

**Hist 8961. Research Seminar: Intellectual History.** (3 cr; A-F only)  
Approaches/methods. Readings on or exemplifying intellectual history. Intellectual history as something broader than history of philosophical thought: a set of approaches of broad cross-disciplinary applicability. Each student prepares a research paper on a topic of intellectual history and present it to class for critique.

**Hist 8990. Topics in Comparative History-Research.** (3 cr [max 15 cr]. Prereq-#)  
Topics vary. Students read/discuss historical works from different geographic areas, develop proposals for comparative research, or pursue comparative research projects.

**Hist 8993. Directed Study.** (1-16 cr [max 16 cr]; A-F only. Prereq-Grad student, #)  
Students work on tutorial basis. Guided individual reading or study.

**Hist 8994. Directed Research.** (1-16 cr [max 16 cr]; A-F only. Prereq-#)  
Work on a tutorial basis.

## 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. Prereq-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. Prereq-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; A-F only. Prereq-5210)  
Use of archives, primary sources. Supervised research project.

**HMed 5940. Topics in the History of Medicine.** (3-4 cr [max 16 cr])  
Seminar on the historical relations between medicine and the State from the 18th to 20th centuries.

**HMed 8220. Seminar: Current Topics in the History of Medicine.** (3 cr [max 9 cr]; A-F only. Prereq-#)  
Topics vary.

**HMed 8333. FTE: Master's.** (1 cr. Prereq-Master's student, adviser and DGS consent)

**HMed 8444. FTE: Doctoral.** (1 cr. Prereq-Doctoral student, adviser and DGS consent)

**HMed 8631. Directed Study.** (1-6 cr [max 12 cr]; A-F only. Prereq-#)

**HMed 8632. Directed Study.** (1-6 cr [max 12 cr]; A-F only. Prereq-#)

**HMed 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq-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]. Prereq-Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**HMed 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq-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. §HSci 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. §HSci 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. §HSci 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. §HSci 3331)  
Development of American technology in its cultural/intellectual context from 1790 to present. Transfer of technology to America. Establishment of an infrastructure promoting economic growth. Social response to technological developments.

**HSci 5332. Science and American Culture.** (3 cr. §HSci 3332)  
Development of American science since 1600, including transfer of science to America. Development of indigenous traditions for pursuit of science. Establishment of infrastructure for education/research. Response of public to scientific development.

**HSci 5401. Ethics in Science and Technology.** (3 cr. §HSci 3401)  
Historical issues involving ethics in science. Ethical problems posed by modern science/technology, including nuclear energy, chemical industry, and information technologies.

**HSci 5411. Art and Science in Early Modern Europe.** (3 cr)  
Interaction of art and science, from Renaissance to 19th century. Development of linear perspective, color theory, artistic practice, and scientific illustration/representation.

**HSci 5993. Directed Studies.** (1-15 cr [max 15 cr]. Prereq-#)  
Guided individual reading or study.

**HSci 5994. Directed Research.** (1-15 cr [max 15 cr]. Prereq-#)

**HSci 8111. Historiography of Science and Technology.** (3 cr; S-N only. Prereq-Grad HSci major or #)  
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; A-F only. Prereq-Grad HSci major or minor or #)  
Development of natural/mathematical science in ancient Near East and Classical Greece.

**HSci 8125. Foundations for Research in the Scientific Revolution.** (3 cr; A-F only. Prereq-Grad HSci major or minor or #)  
Development of sciences/natural philosophy, 1500-1725.

**HSci 8333. FTE: Master's.** (1 cr. Prereq-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. Prereq-#)  
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. Prereq-Doctoral student, adviser and DGS consent)

**HSci 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq-Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

**HSci 8777. Thesis Credits: Master's.** (1-18 cr [max 50 cr]. Prereq-Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**HSci 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq-Max 18 cr per semester or summer; 24 cr required)

**HSci 8900. Seminar: History of Early Physical Science.** (3 cr. Prereq-#)  
For advanced graduate students; topics in development of natural and mathematical science before 1800.

**HSci 8910. Seminar: History of Modern Physical Sciences.** (3 cr [max 6 cr]. Prereq-#)  
For advanced graduate students; topics in development of physical sciences since 1800.

**HSci 8920. Seminar: History of Biological Sciences.** (3 cr. Prereq-#)  
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. Prereq-#)  
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. Prereq-#)  
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. Prereq-#)  
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]. Prereq-#)

**HSci 8994. Directed Research.** (1-5 cr [max 15 cr])

## Hmong (Hmng)

### College of Liberal Arts

**Hmng 5040. Readings in Hmong Texts.** (2-4 cr [max 12 cr]. Prereq-1016 or 3022 with grade of at least B or #) Comprehensive, multidimensional overview of Hmong oral forms/traditions. Hmong legends, mythology, folksongs, birth, marriage/funeral rites. History, social/cultural anthropology. Values, life ways of traditional village society. Societal changes resulting from emigration to U.S.

## Horticultural Science (Hort)

### Department of Horticultural Science

#### College of Agricultural, Food and Environmental Sciences

**Hort 5009. Pesticides in Horticulture: Their Use and Abuse.** (3 cr; A-F only. Prereq-[4251 or ¶4251 or Ent 4015 or ¶Ent 4015], [PIPa 2001 or ¶PIPa 2001]) History of and practical information about pesticides used by horticulture industry. Pesticide modes of action. Use, application methods, environmental effects. Final three weeks devoted to labs on practical mixing and delivery systems.

**Hort 5018. Landscape Operations and Management.** (3 cr. Prereq-1001 or #) Business, managerial, and technical aspects of landscape management relative to environmental horticulture and green industry. Tasks associated with maintaining turf and woody/herbaceous plants in landscape. Relationship of those tasks to preparation/justification of labor, equipment, and supply budgets. Labs, demonstrations, hands-on experiences associated with science and technically-based landscape maintenance/operations.

**Hort 5021. Landscape Design and Implementation II.** (4 cr. Prereq-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 5023. Public Garden Management.** (2 cr) Overview of knowledge/skills necessary to manage a public garden. History of public gardens. Development of mission and vision. Planning and design. Operations. Education and research. Fund raising, business management, personnel, marketing, conservation.

**Hort 5031. Sustainable Fruit Production Systems.** (2 cr; A-F only. Prereq-1001, 3005) 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; A-F only. Prereq-[3005, Ent 3005, PIPa 2001, Soils 2125] or #) 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 Management.** (4 cr; A-F only. Prereq-[1001, 1012] or #) Production, maintenance, and marketing of woody ornamental plants. Establishment/management of nursery or garden centers. Lab, field trips.

**Hort 5051. Floriculture Crop Production.** (4 cr; A-F only. Prereq-1001, 1011, 3002) 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. Specialty Greenhouse Crop Production.** (3 cr; A-F only. Prereq-1001, 1011, 3002) 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/dyeing procedures. Consumer surveys at Minneapolis and St. Paul farmers' markets.

**Hort 5061. Turfgrass Science.** (3 cr. Prereq-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. Prereq-Biol 2022 or Biol 3002, Biol 1001 or Biol 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]. Prereq-8 cr upper div Hort courses, #) In-depth exploration of concepts, technology, materials, or programs in specific area to expand professional competency/self-confidence. Planning, organizing, implementing, and evaluating knowledge obtained from formal education and from experience.

**Hort 8005. Supervised Classroom or Extension Teaching Experience.** (2 cr; S-N only. \$Agro 8005, BAE 8005, PIPa 8005, Soil 8005. Prereq-#) 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 [max 5 cr]. Prereq-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; A-F only. Prereq-9 grad cr in ag or bio sciences) 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]. Prereq-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. Prereq-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. Prereq-BioC 3021 or BioC 4331, PBio 5412) Examined from molecular to organismal levels.

**Hort 8090. Graduate Horticultural Research.** (1-12 cr [max 18 cr]. Prereq-#) Conduct literature, lab, and/or field research with horticultural plants and cropping systems.

**Hort 8201. Plant Breeding Principles I.** (3 cr; A-F only. \$Agro 8201. Prereq-Stat 5301 or equiv) 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; A-F only. \$Agro 8270. Prereq-Grad major in [hort or applied plant sciences or ent or agro or plnt brdg or plnt path or soil] or #) Reports/discussions on problems, investigation work.

**Hort 8280. Current Topics in Applied Plant Sciences.** (1 cr; S-N only. Prereq-Grad major in [hort or applied plnt sciences or ent or agro or plnt brdg or plnt path or soil] or #) Topics presented by faculty or visiting scientists.

**Hort 8305. Physiological Ecology of Plants in Natural and Managed Ecosystems.** (4 cr; A-F only. \$Agro 8305. Prereq-Biol 1009, Biol 1201-1202, BioC 3000) 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 [max 12 cr]; S-N only. \$Agro 8900. Prereq-#) Special workshops or courses in applied plant sciences.

## Human Factors (HumF)

### School of Kinesiology

#### College of Education and Human Development

**HumF 5001. Foundations of Human Factors/Ergonomics.** (3 cr; A-F only. \$Kin 5001. Prereq-Enrollment in good standing, grad HumF minor) 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 5505. Human-Centered Design - Principles and Applications.** (3 cr. \$HumF 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.

**HumF 5722. Human Factors Psychology.** (3 cr; A-F only. Prereq-Grad student or #) 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.

**HumF 8001. Special Topics: Human Factors/Ergonomics.** (2-3 cr [max 3 cr]. Prereq-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]; A-F only. Prereq-Enrollment in good standing, grad HumF minor) 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 5001. Survey: Human Resource Development and Adult Education.** (3 cr. \$AdEd 5001)

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. Prereq-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. Prereq-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. Prereq-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; A-F only. Prereq-5001 or 5101, 5102, 5103, 5104)

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]; S-N only. Prereq-5001, 5201 or 5301)

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. Training and Development of Human Resources.** (3 cr; A-F only)

Training/development of human resources in organizations. Process phases 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/change.

**HRD 5302. Managing Work Teams in Business and Industry.** (3 cr; A-F only. Prereq-2 core courses in HRD)

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 5401. Distance Learning in Adult Education and Training.** (3 cr; A-F only. \$AdEd 5401)

Distance learning concepts, theory, history, present practice, delivery systems, course design, major issues, future directions.

**HRD 5405. Quality Improvement Through Human Resources.** (3 cr; A-F only. Prereq-[5201, 5301] or #)

Quality management, productivity improvement theory/practice from a human resource perspective. Organization development/training as integral components of quality improvement. HR role within quality standards. History of quality improvement, contributions of major 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 5410. Survey of Research Methods and Emerging Research in Human Resource Development.** (3 cr; A-F only. Prereq-[Registered, in attendance] at conference of Academy of HRD)

Role of research in HRD. Standards/criteria for evaluating research, critique of conference research papers, identification of emerging research themes. Offered in conjunction with the annual conference of Academy of HRD.

**HRD 5496. International Field Study in Human Resource Development.** (3 cr. Prereq-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. \$WCCE 5601)

Developing learning progress reporting systems and tests of knowledge, affect, and processes for programs focused on instruction of skills associated with business/industry. Evaluating instructional effectiveness. Applying tests and other evaluation instruments to assess/report learning in business/industry and career/technical education fields. Students develop each type of test and an overall evaluation plan for a course.

**HRD 5612. Managing and Consulting in Human Resource Development and Adult Education.** (3 cr. \$AdEd 5612. Prereq-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. \$BIE 5624)

Strategies and techniques for developing effective sales people.

**HRD 5625. Technical Skills Training.** (3 cr. \$BIE 5625)

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. \$BIE 5626)

Overview of customer service strategies used by successful organizations and training practices used to develop customer-oriented personnel.

**HRD 5627. Management and Supervisory Development.** (3 cr. \$BIE 5627)

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. \$BIE 5628)

Designing, creating, and presenting information using multimedia resources in business settings.

**HRD 5629. Course Development in Business and Industry.** (2 cr; A-F only. \$WCCE 5629)

Designing instructional programs/courses that help learners develop desired competence. Designing instruction for performance-based training and vocational/technical education. Developing course syllabus components that clarify course expectations. Developing academic/community-based elements that complement course goals. Students reflect on and compare performance-based instruction with other curriculum models for the field.

**HRD 5661. Instructional Methods in Business and Industry.** (2 cr. \$WCCE 5661)

Theory/practice in instructional methods for career/technical education (CTE) instructors and human resources/development (HRD) professionals. How to select various teaching methods and plan for their delivery. Preparing an instructional methods plan to clarify course content, teaching methods selected, rationale for their selection, and how a student organization might facilitate student learning.

**HRD 5662. Comptr Trng in Sch & Ind.** (3 cr. \$BIE 5662. Prereq-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 5802. Education and Human Resource Development Through Tourism.** (3 cr; A-F only)

Policies/practices of education and human resource development in tourism industry.

**HRD 5821. Diversity Issues and Practices in Work, Community, and Family Settings.** (3 cr. \$WCCE 5821)

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 Work, Community, and Family.** (3 cr. \$WCCE 5822)

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; A-F only. \$AdEd 8001. Prereq-5001 or AdEd 5001)

Theoretical understanding of individuals and organizations as adaptive entities; roles of human resource development and adult education in mediating complex demands.

**HRD 8201. Advanced Training and Development of Human Resources.** (3 cr; A-F only. Prereq-5201)

Personnel training/development research. Critical review of selected/innovative practices.

**HRD 8301. Advanced Organization Development.** (3 cr; A-F only. Prereq-5301)

Organization development research. Critical review of selected, innovative practices.



## Human Resources and Industrial Relations (HRIR)

*Industrial Relations Center*

*Curtis L. Carlson School of Management*

### **HRIR 5000. Topics in Human Resources and Industrial Relations: Managing Teams.** (2 cr [max 8 cr])

Concept of team effectiveness in traditional organizations. Extrinsic/intrinsic factors/conditions that affect team performance. Models to manage teams. Teams that meet through the technological infrastructure of company and operate across time/space.

### **HRIR 5021. Systems of Conflict and Dispute Resolution.** (4 cr. Prereq—CSOM upper div undergrad major grad)

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. Prereq—CSOM upper div undergrad major grad)

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. Employment and Labor Law for the HRIR Professional.** (2 cr. Prereq—[[At least 60 sem cr or 75 qtr cr], 2.00 GPA] or grad student or #)

Application of statutes and case law to work settings. Civil rights and equal opportunity. Discrimination and harassment. Compensation and benefits. Employee protection and privacy, labor relations. Emphasizes application and ability to recognize legal aspects of HRIR issues.

### **HRIR 5024. Employee Performance: Appraisal and Management.** (2 cr. Prereq—CSOM upper div undergrad major grad)

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. Prereq—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 5026. Innovative HR Leadership in the Context of Change and Uncertainty.** (2 cr. Prereq—[[At least 60 cr], 2.00 GPA] or grad student or Δ; grad majors must register A-F)

Overview of leadership in managing human resources. Historical evolution. Major theories/models. Principles of effective HR leadership in practice. Effects of uncertainty/change on leadership style/practice. HR leadership as powerful management tool.

### **HRIR 5054. Public Policies on Employee Benefits: Social Safety Nets.** (2 cr. Prereq—Undergrad in micro economics; HRIR grad majors must register A-F)

Analysis of social safety nets through government-mandated employee benefits: workers' compensation, unemployment insurance, social security, health insurance. Rationale for social safety nets. Administration/evaluation of existing programs. Effects on worker well-being and on behavior of employers/workers. Need for reform.

### **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 5062. Personnel Economics.** (2 cr. Prereq—Econ 1101, [[At least 60 sem cr, 2.00 GPA] or grad student]; grad majors must enroll A-F only)

Application of economic tools to problems in human resources and industrial relations. Human capital and training. Incentives and information. Hiring and turnover.

### **HRIR 5991. Independent Study in Human Resources and Industrial Relations.** (1-8 cr [max 8 cr]. Prereq—#)

Individual readings or research topics.

### **HRIR 8000. Graduate Topics in Human Resources and Industrial Relations.** (1-8 cr [max 8 cr]. Prereq—HRIR MA student or Sch Mgmt approval; grad majors must enroll A-F only)

Selected graduate topics of current relevance to human resource management and industrial relations.

### **HRIR 8011. Quantitative Methods in Human Resources and Industrial Relations.** (4 cr. Prereq—Grad HRIR major; grad majors must enroll A-F only)

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. Prereq—[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; A-F only. SPA 8386. Prereq—8011, grad HRIR major; grad majors must enroll A-F only)

Application of social science research methods to public policy issues.

### **HRIR 8014. Human Resource Information Systems.** (2 cr. Prereq—Grad HRIR major; grad majors must enroll A-F only)

Hardware and database fundamentals, software applications, security issues, vendor evaluation, system and software development and design issues, and strategies for gaining user acceptance.

### **HRIR 8021. Introduction to Human Resources and Industrial Relations.** (3 cr. \$HRIR 3021. Prereq—\$: 3021; Econ 1101, Econ 1102, Psy 1001; grad HRIR majors must enroll A-F only)

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. Prereq—[8011, 8031, 8041, 8051, 8061, 8071, grad HRIR major]; 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. Prereq—MBA 6215 or grad HRIR major; grad majors must enroll A-F only)

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. Prereq—Psy 1001, grad HRIR major; grad majors must enroll A-F only)

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. Prereq—[8031, HRIR grad student]; 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. Prereq—[8031, HRIR grad student]; 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. Prereq—8031 or #, grad HRIR major; grad majors must enroll A-F only)

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. Prereq—Econ 1101, Econ 1102, Psy 1001 or #, grad HRIR major; grad majors must enroll A-F only)

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. Prereq—8041 or #, grad HRIR major; 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. Prereq—8041 or #, grad HRIR major; 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. Prereq—8041 or #, grad HRIR major; grad majors must enroll A-F only)

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. Prereq—Econ 1101, Econ 1102, Psy 1001 or #, grad HRIR major; grad majors must enroll A-F only)

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. Prereq—8051 or #, grad HRIR major; grad majors must enroll A-F only)

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. Prereq–8011, 8051 or #, grad HRIR major; grad majors must enroll A-F only)

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. Prereq–Econ 1101, Econ 1102 or #, grad HRIR major; grad majors must enroll A-F only)

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. Prereq–8061 or #, grad HRIR major; grad majors must enroll A-F only)

Case studies used to diagnose strategy.

**HRIR 8063. Human Resources and Organizational Performance.** (2 cr. SPA 8105. Prereq–8061 or #, grad HRIR major or A; grad majors must enroll A-F only)

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 [max 3 cr]. Prereq–8061 or #, HRIR PhD student; grad majors must enroll A-F only)

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 [max 3 cr]. Prereq–8061 or #, HRIR PhD student; grad majors must enroll A-F only)

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. Prereq–Econ 1101, Econ 1102 or #, grad HRIR major; grad majors must enroll A-F only)

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. Prereq–8071 or #, grad HRIR major; grad majors must enroll A-F only)

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. Prereq–8071 or #, grad HRIR major; grad majors must enroll A-F only)

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. Prereq–8071 or #, grad HRIR major; grad majors must enroll A-F only)

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. Prereq–Master's student, adviser and DGS consent)

**HRIR 8444. FTE: Doctoral.** (1 cr. Prereq–Doctoral student, adviser and DGS consent)

**HRIR 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq–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]. Prereq–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 [max 3 cr]. Prereq–HRIR core or #, HRIR PhD student; grad majors must enroll A-F only)

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]. Prereq–HRIR PhD student; grad majors must enroll A-F only) Application in research projects.

**HRIR 8821. Seminar: Human Resources and Industrial Relations Systems.** (1-4 cr [max 3 cr]. Prereq–HRIR core or #, HRIR PhD student; grad majors must enroll A-F only)

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]. Prereq–8031 or #, HRIR PhD student; grad majors must enroll A-F only)

Concepts, problems, and research.

**HRIR 8840. Seminar: Organization Theory and Behavior.** (1-4 cr [max 8 cr]. Prereq–8041 or #, HRIR PhD student; grad majors must enroll A-F only)

Application in human resources and industrial relations research/practice.

**HRIR 8850. Seminar: Compensation and Reward.** (1-4 cr [max 8 cr]. Prereq–8051 or #, HRIR PhD student; grad majors must enroll A-F only)

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]. Prereq–8061 or #, HRIR PhD student; grad majors must enroll A-F only)

Functions and operations of labor markets, theory, and research.

**HRIR 8870. Seminar: Labor Relations and Collective Bargaining.** (1-4 cr [max 8 cr]. Prereq–8071 or #, HRIR PhD student; grad majors must enroll A-F only)

Analysis of contemporary theoretical and empirical research.

**HRIR 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq–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]; A-F only. Prereq–#) Individual readings and/or research projects.

**IE 5441. Engineering Cost Accounting and Cost Control.** (4 cr; A-F only)

Financial accounting, managerial accounting, engineering economics. Preparing financial statements, handling accounts payable/receivable, inventories, depreciation. Financing sources, capital cost/structure. Time value of money and of risk in managerial decision making. Design of cost accounting system and activity-based accounting.

**IE 5511. Human Factors and Work Analysis.** (4 cr; A-F only. Prereq–Upper div IT or grad student)

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; A-F only. Prereq–Upper div IT or grad student, 5511)

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; A-F only. Prereq–Upper div IT or grad student)

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. Prereq–[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. Prereq–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. Prereq–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 5545. Decision Analysis.** (4 cr. Prereq–4521 or equiv) Normative theories of decision making. Emphasizes structuring of hard decision problems arising in business and public policy contexts. Decision trees, expected utility theory, screening prospects by dominance, assessment of subjective probability, multiple attribute utility, analytic hierarchy process, benchmarking with data envelopment analysis, basics of game theory.

**IE 5551. Production Planning and Inventory Control.** (4 cr. Prereq–CNR or upper div or grad student)

Inventory control, supply chain management, demand forecasting, capacity planning, aggregate production and material requirement planning, operations scheduling, and shop floor control. Quantitative models used to support decisions. Implications of emerging information technologies and of electronic commerce for supply chain management and factory operation.

## Industrial Engineering (IE)

*Department of Mechanical Engineering*

*Institute of Technology*

**IE 5080. Topics in Industrial Engineering.** (4 cr. Prereq–Upper div or grad student)

Topics vary each semester.

**IE 5552. Design and Analysis of Manufacturing Systems.** (4 cr. Prereq–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.** (4 cr. Prereq–CNR or upper div or grad student)

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 8333. FTE: Master's.** (1 cr. Prereq–Master's student, adviser and DGS consent)**IE 8444. FTE: Doctoral.** (1 cr. Prereq–Doctoral student, adviser and DGS consent)**IE 8531. Engineering Optimization II.** (4 cr)

Topics in integer programming and combinatorial optimization. Formulation of models, branch-and-bound. Cutting plane and branch-and-cut algorithms. Polyhedral combinatorics. Heuristic approaches. Introduction to computational complexity.

**IE 8532. Stochastic Processes and Queuing Systems.** (4 cr. Prereq–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. Prereq–8532 or #)

Renewal/generative processes, Markov/semi-Markov processes, martingales, queuing theory, queuing networks, computational methods, fluid models, Brownian motion.

**IE 8534. Advanced Topics in Operations Research.** (4 cr [max 8 cr]. Prereq–5531, 8532)

Special topics determined by instructor. Examples include Markov decision processes, stochastic programming, integer/combinatorial optimization, and queueing networks.

**IE 8538. Advanced Topics in Information Systems.** (4 cr; A-F only. Prereq–8541, college-level computer programming course)

Decision support methods. Case studies of specific systems. Methods for testing usability/performance. Trust/over-reliance, their impact on system performance. System-level issues, general planning, design, information analysis, problem paradigms. How to frame problems. Techniques to combine engineering and information technology.

**IE 8541. Decision Support Systems.** (4 cr; A-F only. Prereq–College-level computer programming course)

Intelligent computer tools to aid designers, process planners, and analysts in making decisions better or faster.

**IE 8552. Advanced Topics in Production, Inventory, and Distribution Systems.** (4 cr [max 8 cr]. Prereq–5551)

Cutting edge research issues in production, inventory, and distribution systems. Topics vary: stochastic models of manufacturing systems, stochastic inventory theory, multi-echelon inventory systems and supply chains, supplier-retailer and supplier-manufacturer coordination, supplier and warehouse networks, business logistics, transportation.

**IE 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq–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; S-N only. Prereq–8773)

Recent developments.

**IE 8777. Thesis Credits: Master's.** (1-18 cr [max 50 cr]. Prereq–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]. Prereq–#)

Directed research.

**IE 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq–Max 18 cr per semester or summer; 24 cr required)**IE 8951. Plan B Course.** (1 cr; S-N only)

Structured environment in which students can complete M.S. Plan B project.

**IE 8953. Plan B.** (2 cr; A-F only. Prereq–8951)

Structured environment in which students can complete M.S. Plan B project.

## 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. Prereq–Business admin PhD 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. Prereq–Business admin PhD student or #)

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. Prereq–Business admin PhD student or #)

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 [max 4 cr]. Prereq–Business admin PhD 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. Prereq–Business Admin PhD 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]. Prereq–Business admin PhD 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 cr [max 20 cr]. Prereq–Business Admin PhD student or #)

New areas of research, research methods, issues.

**IDSc 8892. Readings in Information and Decision Sciences.** (1-8 cr [max 16 cr]. Prereq–Business admin PhD 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]. Prereq–Business admin PhD 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 5101. Project Management.** (3 cr; A-F only. Prereq–ISE student)

Broad areas in project management and leadership. Emphasizes practical understanding of business/engineering project management. Project planning, scheduling, controlling. Budgeting, staffing, task/cost control. Communicating with, motivating, leading, and managing conflict among team members. Lectures, discussions, experiential exercises.

**ISE 5104. Construction Estimating.** (2 cr; A-F only. Prereq–ISE grad student)

Methods for quantity take-offs. Identification of resources for price/availability information.

**ISE 5105. Computer Applications II.** (1 cr; A-F only. Prereq–ISE grad student)

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; A-F only. Prereq–ISE grad student)

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; A-F only. Prereq–ISE grad student)

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; A-F only. Prereq–ISE grad student)

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.** (2 cr; A-F only. Prereq–ISE grad student)

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; A-F only. Prereq–ISE student)

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; A-F only. Prereq–ISE grad student)

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 5302. Critical Infrastructure Security and Protection.** (2 cr. Prereq—ISE grad student or #)  
Security challenges of protecting critical infrastructure, facilities, and built environment. Security, agility, and robustness/survivability of large-scale critical infrastructure that face new threats and unanticipated conditions. Systems risk analysis, engineering, economics, and public policy approaches to infrastructure security. Design/management of complex civil infrastructure systems.

**ISE 5401. Water Distribution Systems.** (1 cr; A-F only. Prereq—ISE grad student)  
Components/design of water distribution systems. Methods of evaluation/management. Maintenance/rehabilitation techniques.

**ISE 5402. Storm Water Management.** (2 cr [max 10 cr]; A-F only. Prereq—ISE grad student)  
Components/design of storm water collection systems. Methods of evaluation/management. Maintenance/rehabilitation techniques.

**ISE 5403. Water Treatment Systems.** (2 cr; A-F only. Prereq—ISE student)  
Components/design of water treatment systems. Evaluation/management methods. Maintenance/rehabilitation techniques.

**ISE 5500. Public Interactions.** (1 cr [max 2 cr]; A-F only. Prereq—ISE student)  
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.** (2 cr; A-F only. Prereq—ISE student)  
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; A-F only. Prereq—ISE student)  
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 5504. Construction Law and Ethics.** (2 cr; A-F only. Prereq—ISE student)  
Ethical framework for responsible management of public works projects. Moral leadership, trust in public/private organizations, quality control.

**ISE 8105. Capstone Project.** (1-2 cr [max 3 cr]; A-F only. Prereq—ISE student)  
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. Prereq—Master's student, adviser approval, DGS approval)

## Insurance and Risk Management (Ins)

*Industrial Relations Center*

*Curtis L. Carlson School of Management*

**Ins 5000. Personal Financial Planning 2: Tax and Estate Planning Techniques.** (2 cr. Prereq—5201)  
In-depth treatment of estate planning and tax management techniques introduced in 5201. Charitable giving, probate process, use of health care directives, durable powers of attorney, revocable/irrevocable trusts, wills, asset distribution.

**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. Prereq—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. SCEBS 11)  
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.

**Ins 5202. Personal Financial Planning 2: Tax and Estate Planning Techniques.** (2 cr. Prereq—5201)  
In-depth treatment of estate planning and tax management techniques introduced in 5201. Charitable giving, probate process, use of health care directives, durable powers of attorney, revocable/irrevocable trusts, wills, asset distribution.

## Interdisciplinary Archaeological Studies (InAr)

*College of Liberal Arts*

**InAr 5100. Topics in Interdisciplinary Archaeological Studies.** (3 cr; A-F only. Prereq—InAr grad major or #)  
Topics specified in the *Class Schedule*.

**InAr 8004. Method and Theory in Archaeology.** (3 cr; A-F only. Prereq—InAr grad major or #)  
Survey and evaluation of archaeological approaches to non-literary, material evidence for past human activities and societies.

**InAr 8100. Interdisciplinary Seminar.** (3 cr; A-F only. Prereq—InAr grad major or #)  
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 [max 7 cr]. Prereq—InAr grad major or #)

**InAr 8300. Directed Research.** (1-7 cr [max 7 cr]. Prereq—InAr grad major or #)

**InAr 8333. FTE: Master's.** (1 cr. Prereq—Master's student, adviser and DGS consent)

**InAr 8444. FTE: Doctoral.** (1 cr. Prereq—Doctoral student, adviser and DGS consent)

**InAr 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq—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]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**InAr 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—Max 18 cr per semester or summer; 24 cr required)

## Interpersonal Relationships Research (IRel)

*College of Education and Human Development*

**IRel 8001. Proseminar in Interpersonal Relationships Research.** (1 cr [max 2 cr]; S-N only. Prereq—Grad IRel minor)  
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; S-N only. Prereq—Grad IRel minor, #)  
Survey of topics in design and analysis of research on behavior in two-person interactions.

**IRel 8360. Seminar: Topics in Interpersonal Relationships Research.** (1-3 cr [max 6 cr]. Prereq—Grad IRel minor or #)  
Intensive study of topics.

## Italian (Ital)

*Department of French and Italian*

*College of Liberal Arts*

**Ital 5201. Reading Italian Texts: Poetics, Rhetoric, Theory.** (3 cr [max 12 cr]. \$Ital 3201. Prereq—Grad student or #)  
Rhetorical/poetic aspects of language and literature. Interpretive methods, theoretical concepts.

**Ital 5203. Italian Travelers: From the Enlightenment to the Present.** (3 cr [max 12 cr]. \$Ital 3203. Prereq—Grad student or #)  
Literary representations of travel, migration, immigration, exile, and tourism in Italy, from Enlightenment to present.

**Ital 5209. Trecento Literature: Ruling the Canon.** (4 cr [max 16 cr]. Prereq—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 [max 16 cr]. Prereq—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 5305. Staging the Self: Theater and Drama in Modern Italy.** (4 cr [max 16 cr]. \$Ital 3305. Prereq—Grad student or #)  
Theatrical representations of the self in modern Italy. Focuses on issues of identity, gender, and class in theatrical works ranging from Alfieri's *Mirra*, Pirandello's *Enrico IV* to Dacia Maraini's *Clytemnestra*.

**Ital 5321. Italian Renaissance Epic.** (4 cr [max 16 cr]. Prereq—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 [max 16 cr]. Prereq—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, Sereno, and Deledda studied in the context of a range of sociopolitical and cultural issues.

**Ital 5401. Mondo di Dante.** (4 cr [max 16 cr]. Prereq—3015, 3201 or #)  
Intensive reading of Dante's *Inferno*, *Purgatorio*, and *Vita Nuova* with emphasis on Dante's linguistic and cultural contributions.

**Ital 5502. Making of Modern Italy: From the Enlightenment to the Present.** (3 cr [max 12 cr]. \$Ital 3502. Prereq—Grad student or #)  
Italian literary, cultural, and symbolic practices, from Enlightenment to present.

**Ital 5550. Topics in 19th Century Italy.** (3 cr [max 12 cr].

Prereq-Ital 3015 or #)

Explores the literature and culture of Italy in the 19th century. Content will vary depending on the instructor. Topics and readings may include literary, critical, cultural, historical, and/or social issues, a specific author, a genre, or other topics of interest for the period. Specific content will be posted in the department and listed in the Course Guide.

**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 5640. Topics in Italian Studies.** (3 cr [max 12 cr].

Prereq-Ital 3015)

Topics of interest in studies of Italian and/or Italian American culture of the 20th century. Topics and readings may include literary, critical, cultural, historical, and/or social issues, a specific author, a genre, or other topics. Content varies by instructor. Specific content posted in the department and in the Course Guide.

**Ital 5806. Negotiating the Terms: Italian Film and Literature.**

(3 cr [max 12 cr]. Ital 3806. Prereq-Grad student or #)

Cinematic representations of Italian literary texts. Basic tools of literary/film analysis. How both media impact Italian culture. Taught in English.

**Ital 5970. Directed Readings.** (1-4 cr [max 16 cr]. Prereq-#)

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: Masters.** (1 cr. Prereq-Master's student, adviser and DGS consent)**Ital 8777. Thesis Credits: Master's.** (1-18 cr [max 50 cr]. Prereq-Max 18 cr per semester or summer; 10 cr total required [Plan A only])**Ital 8992. Directed Readings.** (1-4 cr [max 16 cr]. Prereq-#)

Requirements decided on by faculty member and student: contact hours, number of credits, written/other work.

## Japanese (Jpn)

### Department of Asian Languages and Literatures

#### College of Liberal Arts

**Jpn 5040. Readings in Japanese Texts.** (2-4 cr [max 12 cr];

A-F only. Prereq-4041 or equiv or #)

Students read authentic materials of various types to increase reading/speaking ability. Topics specified in *Class Schedule*.

**Jpn 5071. Communicative Competence for Japan-Oriented Careers.** (4 cr. Prereq-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. Prereq-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 16 cr])

Literary, historical, or cultural study of selected Japanese literature.

**Jpn 5161. Women's Writing in Premodern Japan.** (4 cr; A-F only. Prereq-3162, 4061 or # when readings are in Japanese; 3162 or # when in translation)

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; A-F

only. Prereq-3162, course from classical Japanese language sequence or #)

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; A-F only. Prereq-3162, course from classical Japanese language sequence or #)

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; A-F only. Prereq-3032 when readings are in Japanese or #)

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; A-F only. Prereq-3032 when offered in Japanese or #)

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. Prereq-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 5251. History of the Japanese Language.** (4 cr.

Prereq-3032, 5451 or #)

Development of Japanese grammar from classical to the modern language.

**Jpn 5451. Structure of Japanese: Syntax/Semantics.** (4 cr.

Prereq-3032, Ling 3001 or #)

Analysis of structure and meaning of Japanese sentence patterns.

**Jpn 5452. Structure of Japanese: Phonology/Morphology.**

(4 cr. Prereq-3032, Ling 3001 or #)

Generative and nongenerative approaches to Japanese sound and word structure.

**Jpn 5453. Structure of Japanese: Discourse/Conversation Analysis.** (4 cr. Prereq-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]. Prereq-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]. Prereq-#, □)

Individual study with guidance of a faculty member.

**Jpn 8333. FTE: Master's.** (1 cr. Prereq-Master's student, adviser and DGS consent)**Jpn 8444. FTE: Doctoral.** (1 cr. Prereq-Doctoral student, adviser and DGS consent)**Jpn 8630. Seminar in Premodern Japanese Literature.** (4 cr [max 12 cr]; A-F only. Prereq-#)

Selected topic in Japanese literature from 8th century to 1860s; theoretical tools used to analyze modern Japanese literature.

**Jpn 8631. Premodern Poetry.** (4 cr; A-F only. Prereq-3162,

course from classical Japanese language sequence or #)

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; A-F only. Prereq-3162, course from classical Japanese language sequence [preferably both courses] or #)

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; A-F only.

Prereq-course from classical Japanese language sequence [preferably both courses] or #)

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]. Prereq-#)

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].

Prereq-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].

Prereq-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]. Prereq-Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**Jpn 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr].

Prereq-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. §JwSt 3013W, ReIA 3013W, ReIA 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. §ReIS 5111. Prereq-JwSt 3521 or ReIS 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 5112. Jewish Mysticism, Magic, and Kabbalah.** (3 cr;

A-F only. §JwSt 3112, ReIA 3112, ReIA 5112)

Mystical traditions from early rabbinic traditions to Zohar (Book of Splendor) in 13th century. Literature of heavenly ascent (Hekhalot, Merkavah), Book of Creation (Sefer Yetzirah), precursors of Zohar. the Bahir. Schools of Provence, Gerona, and Zohar. Tension between legal/mystical aspects, magical theurgic techniques, evolution of doctrine of Sefirot, mystical interpretation of Scripture, erotic dimension.

**JwSt 5115. Mishnah and Midrash in Translation.** (3 cr. \$JwSt 3115, ReIA 3115, ReIA 5115)  
Jewish law studies as mirror of society and as way to actualize its value. Original socioreligious contexts, current applications. Biblical interpretations addressing moral, theological, legal, and literary problems.

**JwSt 5513. Scripture and Interpretation.** (3 cr; A-F only. \$ReIA 5513)  
Idea of divine revelation, its impact upon religion/literature. How history of Bible's creation, transmission, and interpretation help us think critically about role of idea of revelation in religious traditions. What is revelation? How does belief that a text is revealed affect the way it is read within the community for which it constitutes revelation?

**JwSt 5900. Topics in Jewish Studies.** (3-4 cr [max 8 cr])  
Topics specified in *Class Schedule*.

**JwSt 5992. Directed Readings.** (1-12 cr [max 12 cr]. Prereq=#)  
Guided individual reading or study.

## Journalism and Mass Communication (Jour)

### *School of Journalism and Mass Communications College of Liberal Arts*

**Jour 5004. Advanced Information for Mass Communication.** (3 cr; A-F only. Prereq=Enrollment in M.A. in health journalism)  
Messages, information, audiences, and storytelling. Search strategy and question analysis. Informal information sources. Libraries, electronic information, and data tools. Institutional sources. Interviews, polls, surveys, and evaluating information. Ethics and information for messages.

**Jour 5101. Advanced News Writing and Reporting.** (3 cr; A-F only. Prereq=Enrollment in MA in Health Journalism or #)  
Techniques of newspaper reporting and writing. Hands-on approach. What makes news. Basics of AP style. Thinking critically. Generating story ideas. Interviewing sources. Writing news stories and features. Exercises, discussion.

**Jour 5131. Capstone: In-Depth Reporting.** (3 cr; A-F only. Prereq=[3004W, 3101, [3121 or 3173W or 3451], [jour major or approved IDIM major or ICP major or BIS major]] or grad student)  
Techniques/issues of special project stories. Explanatory, investigative, civic, and literary or ethnographic journalism. Topics (e.g., civil rights, governmental malfeasance, health care problems) typically involved in these stories.

**Jour 5155. Capstone: Advanced Reporting Methods.** (3 cr; A-F only. Prereq=[3004W, 3101, [3121 or 3173W or 3451], [jour major or approved IDIM major or ICP major or BIS major]] or grad student)  
Investigative techniques for mass media, computer-assisted reporting, use of records/documents, advanced interviewing, methods for adverse conditions, or field-based practicum.

**Jour 5174. Capstone: Magazine Editing and Production.** (4 cr; A-F only. Prereq=[3004W, 3101, [3155 or 3173W or 3321 or 4302], [jour major or approved IDIM major or ICP major or BIS major]] or grad student)  
Writing, editing, illustration, design, layout, and photocomposition of print or Web magazine. Emphasizes reporting, telling substantive stories. Students work in groups with varying specializations.

**Jour 5251. Psychology of Advertising.** (3 cr; A-F only. Prereq=jour maj or min or design comm or graphic pre-design or design comm or graph design or IDIM/ICP/BIS or #)  
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; A-F only. Prereq=[3006, [jour major or jour minor or approved IDIM major or approved ICP major or approved BIS major]] or grad student or #)  
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; A-F only. Prereq=Non-jour major or jour major with course appr on prog plan or prejour with adviser approval)  
Theories of communication, persuasion, attitude change. Functions of interpersonal/mediated communication in diffusion of information and in opinion formation.

**Jour 5541. Mass Communication and Public Health.** (3 cr. Prereq=Jour major or jour minor or grad major or IDIM major or ICP major or BIS major)  
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 5552. Law of Internet Communications.** (3 cr; A-F only. Prereq=Non-jour major or jour major with course appr on prog plan or [pre-jour with adviser approval])  
Whether/how/which traditional media laws/regulations apply to the Internet. Developing law of communication on Internet, global/ethical issues.

**Jour 5601. History of Journalism.** (3 cr; A-F only. Prereq=Jour major or jour minor or approved IDIM major or ICP major or BIS major; IDL sections are open to non-majors; prereqs do not apply to IDL sections)  
Development of American media, from beginnings in Europe to present day. Rise of film/radio/television/Internet. Relation of communications development to political, economic, social trends.

**Jour 5606. Literary Aspects of Journalism.** (3 cr; A-F only. \$EngW 5606. Prereq=Jour major or jour minor or approved IDIM major or ICP major or BIS major; IDL sections are open to non-majors; prereqs do not apply to IDL sections)  
Literary aspects of journalism as exemplified in, and influenced by, works of American/British writers, past/present. Lectures, discussions, weekly papers, critiques.

**Jour 5615. History of the Documentary.** (3 cr; A-F only. Prereq=Non-jour major or jour major with course appr on prog plan or pre-jour with adviser approval)  
Social history of photography, film, video. Informational, documentary, propaganda, and entertainment functions of visual communication. Rise/influence of visual media industries and of public-image making.

**Jour 5725. Management of Media Organizations.** (3 cr; A-F only. Prereq=Non-jour major or jour major with course appr on prog plan or prejour with adviser approval)  
Introduction to concepts/principles of media management. Strategic planning, leadership, organizational strategies, ethical/legal issues. Working in teams. Balance sheets, income statements. Motivating/promoting people.

**Jour 5771. Media Ethics: Principles and Practice.** (3 cr; A-F only. Prereq=Non-jour major or [jour major, course appr on prog plan] or [pre-jour, adviser approval])  
Connecting theoretical approaches to media ethics with real-life case studies. History of ethical standards in print, broadcast, photojournalism, public relations, and advertising. Making ethical judgments in complex situations.

**Jour 5777. Contemporary Problems in Freedom of Speech and Press.** (3 cr; A-F only. Prereq=Jour major or jour minor or approved IDIM major or ICP major or BIS major)  
Legal/constitutional derivation of freedom of press/speech. Emphasizes case law, statutes, judicial theories. Leading cases in privacy torts, prior restraints, news gathering/dissemination. Access to courts/government, including via the Internet. Legal-research techniques.

**Jour 5825. World Communication Systems.** (3 cr; A-F only. Prereq=Non-jour major or jour major with course appr on prog plan or prejour with adviser approval)  
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.** (3 cr [max 9 cr]; A-F only. Prereq=Jour major or approved IDIM major or ICP major or BIS major)  
Topics specified in *Class Schedule*.

**Jour 5993. Directed Study.** (1-3 cr [max 6 cr]; A-F only. Prereq=[Jour major or jour minor or approved IDIM major or ICP major or BIS major], GPA of at least 3.00, □, #)  
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; A-F only. Prereq=8001)  
Literature on history of the field, cultural and humanistic approaches to its study, and legal and ethical issues.

**Jour 8003. The Changing Media Environment.** (3 cr; A-F only. Prereq=Journalism graduate students)  
Nonprofessional skills course. Prepares entering graduate students to work in the changing media environment, emphasizing its political, social, economic, legal, ethical and technological implications nationally and globally; students produce scholarly research about changing media.

**Jour 8191. Proseminar in Health Journalism.** (4 cr; A-F only. Prereq=Enrolled in MA in health journalism)  
Skills/tools necessary to report on health/medical news for various media. Working in multiple media. Working with quantitative/technical information.

**Jour 8192. Proseminar in Advanced Health Journalism.** (4 cr; A-F only. Prereq=Enrolled in MA in health journalism)  
Skills/tools necessary to report on health/medical news for various media. Ethics, investigative skills. Reporting for specialized audiences. Second of two-course sequence.

**Jour 8193. Directed Study: Health Journalism Capstone.** (1-4 cr [max 4 cr]; A-F only. Prereq=8191, 8195, health journalism MA prog)  
Individual directed study, capstone course. Students prepare/present a final project that could be a publishable article on an important health topic, an original research paper on a dimension of health/communications, or a multimedia production on a health issue/problem aimed at a particular audience.

**Jour 8195. Information Technology and Health.** (2 cr; A-F only. Prereq=Grad student; enrollment in MA in health journalism preferred)  
Trends in use/application of selected technologies.

**Jour 8200. Communication Strategy Research in Rapidly Changing and Complex Media Environments.** (3 cr. Prereq=Strat Comm MA grad major)  
Concepts, analytical techniques, and methods to analyze audiences, target markets, and social trends affecting communication strategy in context of complex and rapidly changing media environments.

**Jour 8201. Factors Affecting Communication Strategy.** (3 cr. Prereq=Strat Comm MA grad major)  
Literature/research concerning identification/analysis of the media and environmental, regulatory, competitive, and economic factors that affect the development of communication strategy.

**Jour 8202. Generation and Selection of Communication Strategies.** (3 cr. Prereq=Strat Comm MA grad major)  
Concepts/methods to support analytic/creative processes that lead to development of breakthrough communication strategies. Criteria for selecting among strategic alternatives.

**Jour 8203. Integration of Communication Strategies Across Media.** (3 cr. Prereq–8200, 8201, 8202, strat comm MA grad major)

Concepts, analytical techniques, and methodologies used to plan communication strategies and implement communication campaigns utilizing a diverse range of media.

**Jour 8204. Measuring the Effectiveness of Strategic Communication Campaigns.** (3 cr. Prereq–8203, Strat Comm MA grad major)

Examination, evaluation, and application of concepts/methods to evaluate effectiveness of strategic communication campaigns and their components.

**Jour 8205. Cases in Strategic Communication.** (3 cr. Prereq–8203, strat comm MA grad major)

Case study analysis concerning development, implementation, and evaluation of communication strategies. Cases cover broad range of organizations, focus on such issues as brand introduction, brand reinforcement, revitalizations, crisis communication, issues management, and legal/ethical considerations.

**Jour 8206. Directed Study: Development of an Integrated Strategic Communication Campaign.** (3 cr [max 6 cr]. Prereq–8205, strat comm MA grad major)

Project to develop a case study analysis concerning development, implementation, and evaluation of a strategic communication campaign.

**Jour 8317. Seminar: Visual Communication Research.** (3 cr; A-F only. Prereq–5316, [(8001, 8002) or #])

Theoretical approaches, analysis of research methods, development of research designs/projects.

**Jour 8333. FTE: Master's.** (1 cr. Prereq–Master's student, adviser and DGS consent)

**Jour 8442. Seminar: Broadcast News.** (3 cr; A-F only. Prereq–4442 or #)

Major issues. Confrontations between federal government and network news departments. Historical studies.

**Jour 8444. FTE: Doctoral.** (1 cr. Prereq–Doctoral student, adviser and DGS consent)

**Jour 8501. Seminar: The Process of Quantitative Mass Communication Research.** (3 cr; A-F only. Prereq–9 cr soc sci, EPsy 5260 or equiv or ¶EPsy 5260)

Logic of social sciences research. Relationship between theory and research, concept explication, measurement, instrumentation, and design issues.

**Jour 8502. Seminar: Multi-method research in Mass Communication.** (3 cr; A-F only. Prereq–8501, [EPsy 5260 or equiv or ¶EPsy 5260])

Quantitative/qualitative research principles/techniques applied to mass communication and kindred questions. Reliability, generalizability, and validity in their classic/contemporary senses. Survey methods, focus groups, interviews, other methods. Emphasizes “triangulation” of diverse methods.

**Jour 8513. Seminar: Ethnographic Methods in Mass Communication Research.** (3 cr; A-F only. Prereq–[8001, 8002] or #)

Theoretical foundations in anthropology/sociology. Field projects.

**Jour 8514. Seminar: Mass Communication Theory.** (3 cr; A-F only. Prereq–8001, 8002)

Research paradigms, concepts, and findings for developing a general theory of mass communication.

**Jour 8601. Seminar: Methods in Mass Communication History Research.** (3 cr; A-F only. Prereq–5601, #)

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; A-F only. Prereq–5601)

Research in history/development of U.S. mass media.

**Jour 8603. Seminar: Theories and Models in Mass Communication History Research.** (3 cr; A-F only. Prereq–5601, #)

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; A-F only. Prereq–5251 or #)

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; A-F only. Prereq–8001 or 8002 or equiv)

Interplay between social theories and media studies. Pragmatism, structural-functionalism, Marxism, political economy, cultural studies, globalization.

**Jour 8662. Seminar: Literary Aspects of Journalism.** (3 cr; A-F only. Prereq–5606)

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]. Prereq–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; A-F only. Prereq–5725 recommended)

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; 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; A-F only. §Law 6059. Prereq–5777 or #)

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: Media and Globalization.** (3 cr; A-F only. Prereq–4801 or 5825 or #)

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; A-F only. Prereq–4721 or equiv or #)

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]. Prereq–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; A-F only. Prereq–4801 or 5825)

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 Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq–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 [max 6 cr]; A-F only. Prereq–Grad mass comm major or minor, #)

Directed study.

## Kinesiology (Kin)

### School of Kinesiology

#### College of Education and Human Development

**Kin 5001. Foundations of Human Factors/Ergonomics.** (3 cr; A-F only. \$HUMF 5001)

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 5111. Sports Facilities.** (3 cr; A-F only. §Rec 5111. Prereq–Kin or Rec grad student or MED student)

Steps in planning/building facilities for athletics, physical education, and sport for college, professional, and public use.

**Kin 5115. Event Management in Sport.** (3 cr; A-F only. Prereq–Grad student, #)

Techniques/principles of planning, funding, and managing sport events. Collegiate championships, non-profit events, benefits, professional events.

**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; A-F only. Prereq–4385 or equiv or #)

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 5126. Sport Psychology.** (3 cr. Prereq–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 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; A-F only. Prereq—FScN 1112 or equiv)  
Requirements and physiologic roles of nutrients and physical activity in promotion of health/performance. Assessment of energy requirements, RDAs, food composition/safety, weight management. Prevention of chronic diseases; emphasizes coronary heart disease.

**Kin 5152. Curriculum Development in Physical Education.** (2 cr; A-F only. Prereq—initial licensure/MEd phys ed student)  
Trends, issues, and challenges in early childhood/K-12 physical education. Potential effect on curriculum.

**Kin 5171. Foundations of Kinesiology.** (3 cr; A-F only. Prereq—Kin major or #)  
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]; S-N only. Prereq—5103 or 5104 or ¶5104 or #; KIN undergraduate pre-teaching with sr status are limited to 2 practicum hrs)  
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; A-F only. Prereq—[3112 or equiv], PMed 5135, undergrad college physics, intro calculus)  
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 5371. Sport and Society.** (3 cr; A-F only. §Rec 5371. Prereq—[3126, grad student] or #)  
Sport, sporting processes, social influences, systems. Structures that have effected and exist within/among societies, nations, and cultures. Contemporary issues such as social differentiation, 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; A-F only. Prereq—undergrad physiology or biology)  
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 5421. Sport Finance.** (3 cr; A-F only. §Rec 5421. Prereq—Grad student or #)  
Introduction to financial analysis in sport. Cash flow statements, budgeting issues, traditional/innovative revenue producing strategies available to sport organizations. Discussion, practical analysis of current market.

**Kin 5435. Advanced Theory and Techniques of Exercise Science.** (3 cr; A-F only. Prereq—[3385, 4385, Kin major] or #)  
Theoretical constructs, in-depth description of procedures used in exercise science research and clinical settings. Laboratory exercises, lectures.

**Kin 5461. Foundations of Sport Management.** (3 cr; A-F only. Prereq—[Kin or Rec] student or #)  
Theories/techniques in administration/management of sport enterprises. Organizational theory/policy, practical examples of sport management skills/strategies.

**Kin 5485. Advanced Electrocardiogram, Graded Exercise Testing, and Prescription.** (3 cr; A-F only. Prereq—[3385, 4385] or #)  
Introduction to electrocardiogram. Placement/interpretation, use in clinical exercise testing and exercise prescription. Hands-on experience in electrocardiogram for exercise testing.

**Kin 5511. Women in Sport and Leisure.** (3 cr; A-F only. §Rec 5511)  
Critically examines women's involvement in/ contributions to sport, physical activity, and leisure.

**Kin 5601. Sport Management Ethics and Policy.** (3 cr; A-F only. §Rec 5601. Prereq—MEd or grad student or #)  
How to critically analyze ethical concepts that underpin or inform sport policies and evaluate sport policies from a normative point of view. Selected sport policy issues are used to illustrate relevance of ethical considerations in policy development and to explore the ethical implications of sport policy.

**Kin 5631. Programming and Promotion in Sport.** (3 cr; A-F only. §REC 5631. Prereq—Kin or Rec grad student or #)  
Introduction to marketing concepts as they apply to sport industry. Consumer behavior, market research, marketing mix, corporate sponsorship, licensing. Discussion, practical application.

**Kin 5696. Practicum in Kinesiology.** (1-6 cr [max 6 cr]; S-N only. Prereq—Grad student in KIN, #)  
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]; S-N only. Prereq—admission to coaching program, #)  
Student coaching experience under supervision of a mentor coach.

**Kin 5720. Special Topics in Kinesiology.** (1-8 cr [max 8 cr]. Prereq—Kin upper div undergrad or grad student or #)  
Current issues in the broad field and subfields in kinesiology, or related coursework in areas not normally available through regular offerings.

**Kin 5723. Psychology of Sport Injury.** (3 cr. Prereq—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; A-F only. Prereq—Grad/initial licensure or #)  
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; A-F only. Prereq—Kin major, MEd student, or #)  
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; A-F only. Prereq—Kin major, MEd student, or #)  
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]; 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; A-F only. Prereq—Kin or rec major)  
Legal issues related to recreation, park, and sport programs/facilities in public/private sectors.

**Kin 5941. Neural Basis of Movement.** (3 cr; A-F only. Prereq—[3111, CBN 1027] or equiv, [Phsl 3051 or equiv])  
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, Recreation, and Sport.** (3 cr; A-F only. §Rec 5981. Prereq—3151 or equiv)  
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 5987. Professional Skills and Grant Writing for Health Sciences.** (2 cr. Prereq—Grad student)  
Introduction to structure/function of different organizations (e.g., NIH, AHA). Writing/reviewing grants/manuscripts. Preparing for a job in academia.

**Kin 5992. Readings in Kinesiology.** (1-9 cr [max 9 cr]; A-F only. Prereq—CEHD student, grad, #)  
Independent study under tutorial guidance.

**Kin 5995. Research Problems in Applied Kinesiology.** (1-6 cr [max 6 cr]; A-F only. Prereq—[Grad or MEd student in Kin], #)  
Selected topics in physical activity/human performance.

**Kin 8122. Seminar: Exercise Physiology.** (2-6 cr [max 6 cr]; A-F only. Prereq—5122 or equiv or #)  
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; A-F only. Prereq—5126 or instr approval)  
Literature, theoretical constructs, research methodology, design. Focuses on student-selected topics/problems.

**Kin 8132. Seminar: Motor Development.** (3 cr; A-F only. Prereq—4132 or equiv or #)  
Contemporary research literature focusing on motor skill development from before birth to senescence. Emphasizes interaction between physical, environmental, and performer constraints, and coordination/control of movement.

**Kin 8135. Seminar: Motor Control and Learning.** (3 cr [max 6 cr]; A-F only. Prereq—4135 or equiv or #)  
Advanced reading and discussion of research on motor control, motor learning, and human performance.

**Kin 8211. Perception and Action.** (3 cr. Prereq—[CEHD or Psy] grad student or #)  
Survey of theory/research on use of perceptual information for control of action. Focuses on behavioral research on perceptual guidance of daily activities (e.g., standing, walking, driving). Perceptual control in context of expertise (e.g., sports). Perceptual-motor development.

**Kin 8333. FTE: Master's.** (1 cr. Prereq—Master's student, adviser and DGS consent)  
**Kin 8444. FTE: Doctoral.** (1 cr. Prereq—Doctoral student, adviser and DGS consent)

**Kin 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq—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]; S-N only. Prereq—5126, 8126, Kin PhD student, #)  
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]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**Kin 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—Max 18 cr per semester or summer; 24 cr required)

**Kin 8980. Graduate Research Seminar in Kinesiology.** (1 cr [max 9 cr]; S-N only. Prereq—Grad Kin major, #)  
Reporting and discussion of student and faculty research activity.

**Kin 8995. Research Problems in Kinesiology.** (1-9 cr [max 9 cr]; S-N only. Prereq—Kin PhD student or #)



## Laboratory Medicine and Pathology (LaMP)

*Department of Laboratory Medicine and Pathology*

### Medical School

**LaMP 5100. General and Systemic Pathology for Dental Students.** (4 cr; A-F only. Prereq—Regis dental student) Causes, courses, mechanisms and outcomes of disease. Required as preparation for clinical dental practice and oral pathology.

**LaMP 5125. Chronobiology.** (2-6 cr [max 6 cr]) 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; A-F only. Prereq—B.E.D. accelerated status or LA grad or #) 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; A-F only. Prereq—LA major or #; recommended for both BED and Grad students) Design studio experience drawing on ecological, cultural, aesthetic influences to explore development of design ideas responsive to ecological issues and human experience.

**LA 5204. Landscape Ecology.** (3 cr. Prereq—B.E.D. accelerated status or LA grad student or #) Relationships among spatial patterns, temporal patterns, ecological processes in landscape. Factors affecting landscape patterns, measurement of landscape pattern, material transport through landscape, effects of landscape pattern on population dynamics, landscape planning.

**LA 5301. Introduction to Drawing in Architecture and Landscape Architecture.** (3 cr. §Arch 1301, LA 1301. Prereq—LA grad student, accelerated B.E.D. student) Perceiving/representing material environment. Sketching/drawing conventions, visual phenomena/forms.

**LA 5351. AutoCAD I.** (3 cr. Prereq—B.E.D. major or LA grad or #; may not be taken for graduate credit) 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. §Arch 5352. Prereq—Arch 5351 or LA 5351, B.E.D. major or LA grad or #; may not be taken for graduate credit) 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; S-N only. §Arch 5371. Prereq—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; S-N only. §Arch 5372. Prereq—Arch/LA 5371, LA grad or #) Current techniques and computer programs, and their application to landscape architecture computing.

**LA 5373. Computer Methods III.** (3 cr. §Arch 5373. Prereq—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]; A-F only. Prereq—B.E.D. accelerated status or LA grad or #) Current topics in landscape architecture. Taught by regular or visiting faculty in their areas of specialization.

**LA 5401. M-Term drawing class.** (1-3 cr [max 12 cr]; A-F only. Prereq—#) Independent studies under direction of landscape architecture faculty.

**LA 5402. Directed Studies in Landscape Architecture History and Theory.** (1-6 cr [max 12 cr]; A-F only. Prereq—#) Independent studies under the direction of landscape architecture faculty.

**LA 5403. Directed Studies in Landscape Architecture Technology.** (1-6 cr [max 12 cr]; A-F only. Prereq—#) Independent studies under the direction of landscape architecture faculty.

**LA 5404. Directed Studies in Landscape Architecture Design.** (1-6 cr [max 12 cr]; A-F only. Prereq—#) Independent studies under the direction of landscape architecture faculty.

**LA 5405. Interdisciplinary Studies in Landscape Architecture.** (1-6 cr [max 12 cr]; A-F only. Prereq—#) Research, planning, or design projects. Topics vary.

**LA 5406. Urban Design Journal.** (3-4 cr [max 4 cr]; A-F only. Prereq—Admitted to Denmark International Study Program co-sponsored by the University; given in Denmark) Methods and theories in urban design and human behavior. Students develop journal as tool for experiencing, analyzing, and recording the urban landscape, its fabric, spatial elements, and individual components, and for analyzing design solutions.

**LA 5407. Landscape Architecture Studio.** (3-4 cr [max 4 cr]; A-F only. Prereq—Admitted to Denmark International Study Program co-sponsored by the University; given in Denmark) Individual and small-group projects focusing on urban issues; design process in Danish conditions; solutions based on knowledge of Danish problems in landscape and urban design and an understanding of how these problems are solved within Danish and European contexts.

**LA 5408. Landscape Architecture, Architecture, and Planning.** (3-4 cr [max 4 cr]; A-F only. Prereq—Admitted to Denmark International Study Program co-sponsored by the University; given in Denmark) Methods and theories in urban design and human behavior. Students develop urban design journal as tool for experiencing, analyzing, and recording the urban landscape, its fabric, spatial elements, and individual components, and for analyzing design solutions.

**LA 5413. Introduction to Landscape Architectural History.** (3 cr; A-F only. Prereq—One course in history at 1xxx or higher) 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; A-F only. Prereq—Accelerated BED student or LA grad student) Theory and professional applications of landform systems for design. Landform typology, representation methods, manipulation techniques, use of land survey data, earthwork construction issues. Spatial accommodation of vehicles in landscape architecture, including road design.

**LA 5572. Plants in Design.** (3 cr; A-F only. Prereq—[5201, 5203, plant identification course] or #) 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; A-F only. Prereq—jr or sr B.E.D. major or LA grad or #) 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 5574. Identification of Minnesota Flora.** (3 cr; A-F only. Prereq—BED accelerated status or LA grad student or #) Introduction to identification of approximately 500 plants commonly used by landscape architects and environmental designers in Minnesota. Students develop a working knowledge of over 250 plants. Focuses on plant selection techniques, plant landscape associations, and issues of plants for use in standard landscape architectural settings. Regular field sessions.

**LA 5712. Infrastructure, Natural Systems and the Space of Inhabited Landscapes.** (3 cr; A-F only) Relationship between natural/infrastructural systems for human dwelling. Land-embedded systems for hybrid agricultural/post-ag landscapes. Relationships between natural systems/resources and engineered systems. Appropriateness/fit versus flexible generalizability. Resolution of economic/ecological forces. Role of landscape architects in creating morphologies of settlement.

**LA 5721. Proseminar in Metropolitan Design.** (3 cr; A-F only. §Arch 5721. Prereq—[Arch 5711 or equiv], enrollment in CMD prog) or #) Reading seminar. Evolution of the contemporary city. Dynamics that created contemporary urban spatial patterns. Planning/design theories that have guided public interventions in the built environment. Thematic texts, classroom discussions.

**LA 5790. Special Topics in Metropolitan Design.** (3 cr [max 6 cr]; A-F only. §Arch 5790. Prereq—Enrollment in CMD prog or #)

**LA 8201. Designing Landscapes for Dwelling and Settlement.** (6 cr; A-F only. Prereq—5203, 5571, grad LA major, ¶8202 or #) 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 [max 3 cr]. Prereq—Grad LA 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; A-F only. Prereq–8202, grad LA major, concurrent enrollment 8204 or #) 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; A-F only. Prereq–Grad LA major or #) 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 [max 8 cr]. Prereq–2 yrs of studio, grad LA 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; A-F only. Prereq–8201 or #8201, grad LA major or #) Alternative methodological approaches to landscape architectural research and consideration of their appropriateness for contemporary research topics.

**LA 8302. Professional Practice.** (3 cr; A-F only. Prereq–8205, grad LA major or #) Office and project management case studies. Organizational behavior, marketing, sales, strategic planning, financial and cost accounting, insurance, legal issues and contracts.

**LA 8333. FTE: Masters.** (1 cr. Prereq–Master’s student, adviser and DGS consent)

**LA 8400. Topics in Landscape Architecture.** (1-3 cr [max 12 cr]. Prereq–Grad LA 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]; A-F only. Prereq–#) Current topics in landscape architecture. Seminar offered by regular or visiting faculty in their area of specialization. Subject matter varies with instructor.

**LA 8402. Directed Studies in Landscape Architecture History and Theory.** (1-6 cr [max 12 cr]; A-F only. Prereq–Grad LA major or #) Advanced independent studies under direction of landscape architecture faculty.

**LA 8403. Directed Studies in Landscape Architecture Technology.** (1-6 cr [max 12 cr]; A-F only. Prereq–Grad LA major or #) Advanced independent studies under direction of landscape architecture faculty.

**LA 8404. Directed Studies in Landscape Architecture Design.** (1-6 cr [max 6 cr]; A-F only. Prereq–Grad LA major or #) Advanced independent studies under direction of landscape architecture faculty.

**LA 8405. Interdisciplinary Studies in Landscape Architecture.** (1-6 cr [max 12 cr]; A-F only. Prereq–Grad LA major or #) 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; A-F only. Prereq–Grad land arch major or #) 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. Prereq–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; A-F only. Prereq–Grad land arch or arch major or #) 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; A-F only. Prereq–Land arch or arch grad student with 1 yr grad design or #) Exercises and projects in site manipulation to adjust structures and attendant uses and circulation to specific land parcels.

**LA 8554. Project Programming.** (1 cr [max 3 cr]; A-F only. Prereq–8203, grad land arch major or #) Individual research in preparation for final studio.

**LA 8555. Advanced Landscape Planning and Design.** (6 cr; A-F only. Prereq–8205, grad land arch major or #) Advanced studies in area of student’s choice.

**LA 8574. Landscape Storm Water Management.** (3 cr. Prereq–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. The Art and Ecology of Landscape Detail.** (3 cr. Prereq–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 8741. Metropolitan Design Workshop and Optional Seminar.** (3-6 cr [max 6 cr]; A-F only. Prereq–Enrollment in CMD prog or #) Introduction to discipline/methodologies of urban design. Contributing fields/issues, including government/community goals, land use, housing, economic development, natural resources, services, and transportation. Implementation program.

**LA 8777. Thesis Credits: Master’s.** (1-18 cr [max 50 cr]. Prereq–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. \$LgTT 5611) Examine, evaluate, and use technology in language teaching. Theoretical background, demonstration, hands-on exploration.

**LgTT 5611. Technology in Second Language Instruction.** (3 cr. \$LgTT 5110) 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. Prereq–Grad student or #) Latin grammar, syntax, diction, and prose style. Graduated exercises in prose composition.

**Lat 5032. Text Criticism.** (3 cr. Prereq–Grad student or #) Theory/practice. Elements of paleography and manuscript study. Tools for analyzing a textual apparatus. Constructing a critical edition of a literary text.

**Lat 5033. Epigraphy.** (3 cr. Prereq–Grad student or #) Practical/theoretical introduction to Latin epigraphy (study/interpretation of inscriptions). Readings/discuss of epigraphic texts. Focuses on their value as historical documents, as evidence for development of Latin language, and as literary texts.

**Lat 5310. Latin Literature: History.** (3 cr [max 12 cr]. Prereq–Grad student or #) One or more authors.

**Lat 5320. Latin Literature: Epistles and Essays.** (3 cr [max 12 cr]. Prereq–Grad student or #) One or more authors.

**Lat 5330. Latin Literature: Oratory.** (3 cr [max 12 cr]. Prereq–Grad student or #) One or more authors.

**Lat 5340. Latin Literature: Epic and Pastoral.** (3 cr [max 12 cr]. Prereq–Grad student or #) One or more authors.

**Lat 5350. Latin Literature: Lyric and Elegiac Poetry.** (3 cr [max 12 cr]. Prereq–Grad student or #) One or more authors.

**Lat 5360. Latin Literature: Latin Dramatists.** (3 cr [max 12 cr]. Prereq–Grad student or #) One or more authors.

**Lat 5370. Latin Literature: Satire.** (3 cr [max 12 cr]. Prereq–Grad student or #) One or more authors.

**Lat 5380. Latin Literature: Legal Texts.** (3 cr [max 12 cr]. Prereq–Grad student or #) One or more authors.

**Lat 5390. Literature: Religious Texts.** (3 cr [max 12 cr]. Prereq–Grad student or #) Reading/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]. Prereq–Grad student or #) Pagan/Christian Latin literature selected from authors of 3rd to 6th centuries AD. Topics specified in *Class Schedule*.

**Lat 5420. Medieval Latin.** (3 cr [max 12 cr]. Prereq–Grad student or #) Literature from 6th to 15th centuries. Authors/genres vary. Topics specified in *Class Schedule*.

**Lat 5621. Latin Paleography.** (3 cr. Prereq—Grad student or #)  
Analysis of various hands used in manuscripts of Latin authors, with attention to date/provenance. Transmission of ancient Latin literature.

**Lat 5715. Introduction to the Historical-Comparative Grammar of Greek and Latin.** (3 cr. §Grk 5715. Prereq—# 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. Prereq—Grad student or #)  
Reading/analysis of documents illustrating stylistic registers/evolution of Latin language, from its earliest attestations through Middle Ages.

**Lat 5993. Directed Studies.** (1-4 cr [max 18 cr]. Prereq—#, Δ)  
Guided individual reading or study.

**Lat 5994. Directed Research.** (1-12 cr [max 20 cr]. Prereq—Grad student or #)  
Guided research on original topic chosen by student.

**Lat 5996. Directed Instruction.** (1-12 cr [max 20 cr]. Prereq—Grad student or #)  
Supervised teaching internship.

**Lat 8120. Latin Text Course.** (3 cr [max 15 cr]. Prereq—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. Prereq—#)  
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.

## Liberal Studies (LS)

### College of Continuing Education

**LS 5100. Liberal Studies Seminar.** (1-4 cr [max 24 cr]; A-F only)  
Interdisciplinary topics.

**LS 5125. Field Experience.** (1-8 cr; A-F only. Prereq—MLS student or #)  
Off-campus observation, experience, and evaluation in interdisciplinary field of study.

**LS 5950. Special Topics.** (1-4 cr [max 12 cr]; A-F only. Prereq—MLS student or #)  
Special interdisciplinary topics.

**LS 5993. Directed Studies.** (1-4 cr [max 15 cr]. Prereq—Grad student)  
Guided individual reading or study.

**LS 5994. Directed Research.** (1-4 cr [max 15 cr]. Prereq—#)  
Tutorial for qualified graduate students.

**LS 8001. Introduction to Interdisciplinary Inquiry.** (3 cr; A-F only. Prereq—MLS student)  
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; A-F only. Prereq—MLS; all MLS coursework must be completed by end of sem)  
Students synthesize/complete final project.

**LS 8100. Advanced Interdisciplinary Inquiry.** (1-3 cr [max 5 cr]; A-F only. Prereq—MLS student)  
Readings/discussion to shape/focus final project. Workshop format. Key ideas of various disciplines, influential thinkers. Emphasizes developing critical themes.

**LS 8333. FTE: Master's.** (1 cr. Prereq—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. §LING 3001, LING 3001H. Prereq—grad or #)  
Phonetics, phonology, morphology, syntax, semantics, and historical-comparative linguistics; language learning and psychology of language; linguistic universals; language in society.

**Ling 5005. Applications of Linguistics.** (3 cr. Prereq—3001 or 3011 or 5001 or #)  
Relationships between linguistics and neighboring disciplines. Applications to practical fields such as lexicography, orthography, translation/interpreting, language planning, reading, language teaching, bilingual education, education of the deaf, and correction of language disorders. Computer applications, forensic applications. Topics vary with each offering.

**Ling 5101. Language Types and Linguistic Universals.** (3 cr. Prereq—[3001 or 3001H or 5001], 5201, 5302 or #)  
Comparison of languages and language types. Cross-linguistic similarities/universals of language, their explanation.

**Ling 5105. Field Methods in Linguistics I.** (4 cr. Prereq—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. Prereq—5105)  
Techniques for obtaining and analyzing linguistic data from unfamiliar languages through direct interaction with a native speaker.

**Ling 5201. Syntax I.** (3 cr. Prereq—3001 or 3001H or 5001 or #)  
Syntactic phenomena/constructions in various languages. Principles of grammar construction/evaluation. Syntactic theories as instruments of grammatical analysis.

**Ling 5202. Syntax II.** (3 cr. Prereq—5201)  
Foundation in modern syntactic theory. Syntactic phenomena in various languages. Emphasizes syntactic argumentation, development of constraints on grammar formalisms.

**Ling 5205. Semantics.** (3 cr. Prereq—5201 or #)  
Analysis of sentence meaning. Semantic properties. 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. Prereq—5201 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. Phonetics.** (4 cr. §Ling 3301. Prereq—3001 or 3001H or 5001 or 15001 or #)  
Phonetic analysis/transcription of speech. Articulatory/acoustic correlates of speech sounds. Extensive practice transcribing. Emphasizes narrow transcription of human speech. One section focuses on universal phonetics, another focuses on English.

**Ling 5302. Phonology I.** (3 cr. Prereq—5301)  
Concepts/types of information needed for describing patterns in sounds of words, for all speakers of all human languages, including current theoretical frameworks. Extensive practice identifying/analyzing phonological patterns in words of a language.

**Ling 5303. Phonology II.** (3 cr. Prereq—5302 or #)  
Phonology of human languages. Preparation for reading papers in the literature and for doing research in phonology.

**Ling 5461. Conversation Analysis.** (3 cr. §Comm 5461. Prereq—3001 or 3001H or 5001 or #)  
Discourse processes. Application of concepts through conversation analysis.

**Ling 5462. Field Research in Spoken Language.** (3 cr. §COMM 5462. Prereq—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. Prereq—3001 or 3001H or 5001 or #)  
First/second language acquisition.

**Ling 5505. Introduction to Second Language Acquisition.** (3 cr. Prereq—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. Historical Linguistics.** (3 cr. §LING 3601. Prereq—3001 or 3011H or 5001)  
Historical change in phonology, syntax, semantics, and lexicon. Linguistic reconstruction. Genetic relationship among languages.

**Ling 5701. Sociolinguistics.** (3 cr. Prereq—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. Prereq—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. Prereq—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. Prereq—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 [max 12 cr])  
Topics vary. See *Class Schedule*.

**Ling 5931. Morphology and Syntax of Contemporary English.** (3 cr. Prereq—3001 or 3001H or 5001 or #)  
Linguistic analysis of word/sentence structure of contemporary English. Focuses on data from recorded/written texts.

**Ling 5932. Topics in the Structure of Modern English.** (3 cr [max 12 cr]. Prereq—[3001 or 3001H or 5001], [5201 or 5931] or #)  
Aspects of the morphology, syntax, or semantics/pragmatics of modern English. Emphasizes analysis of written or recorded texts. Topics vary.

**Ling 5993. Directed Study.** (1-3 cr [max 10 cr]. Prereq—#, □)  
Directed study for Linguistics.

**Ling 8005. Research Paper Workshop.** (3 cr [max 12 cr]; S-N only. Prereq-[5105, 5202, 5205, 5302] or [#, grad ling major]) Workshop on research methodology/writing in Linguistics.

**Ling 8200. Topics in Syntax and Semantics.** (3 cr [max 9 cr]. Prereq-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. Prereq-5202, 5205 or #)  
Current issues in syntactic theory. Topics vary.

**Ling 8220. Seminar in Semantics.** (3 cr [max 9 cr]. Prereq-5202, 5205, 5206 or #)  
Current issues in semantics. Topics vary.

**Ling 8221. Formal Semantics of Natural Language.** (3 cr; A-F only. \$Phil 8182. Prereq-Phil 5201 or #)  
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]. Prereq-5303 or #)

**Ling 8320. Seminar in Phonology.** (3 cr [max 9 cr]. Prereq-5303 or #)  
Current issues in phonological theory. Topics vary.

**Ling 8333. FTE: Master's.** (1 cr. Prereq-Master's student, adviser and DGS consent)

**Ling 8444. FTE: Doctoral.** (1 cr. Prereq-Doctoral student, adviser and DGS consent)

**Ling 8500. Topics in Second Language Acquisition.** (3 cr [max 9 cr]. Prereq-5001, 5505)

**Ling 8531. Research Methods in Language Acquisition.** (3 cr. Prereq-[5001, 5505] or #)  
Based on review of published research, students design and carry out their own studies, writing/presenting research reports at end of term. Focuses on first or second language acquisition, or both, depending on instructor.

**Ling 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq-Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

**Ling 8777. Thesis Credits: Master's.** (1-18 cr [max 50 cr]. Prereq-Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**Ling 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq-Max 18 cr per semester or summer; 24 cr required)

**Ling 8900. Seminar: Topics in Linguistics.** (3 cr [max 9 cr]. Prereq-#)

**Ling 8920. Topics in Language and Cognition.** (3 cr [max 6 cr]. Prereq-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]. Prereq-#)

## 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]. Prereq-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]. Prereq-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 5019. Business, Natural Environment, and Global Economy.** (2 cr. Prereq-MBA student)  
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; A-F only. Prereq-3001, CSOM upper div)  
Applying theories/research on how new organizational programs, products, and technologies are developed/implemented. Diagnostic skills. How innovation unfolds.

**Mgmt 5177. The Business Plan.** (2 cr. Prereq-4008, CSOM upper div)  
Structure of business plans. Critically analyzing business plans. Formulating an original business plan.

**Mgmt 8101. Theory Building and Research Design.** (4 cr. Prereq-Business admin PhD 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. Prereq-Business admin PhD student or #)  
Considers works in political and legal philosophy, ethics, and economics.

**Mgmt 8202. Seminar in International Management.** (4 cr. Prereq-Business admin PhD student or #)  
Overview of the field of international management research.

**Mgmt 8204. Topics in BGS - I.** (2 cr; A-F only. Prereq-PhD student or #)  
Topics vary.

**Mgmt 8205. Topics in Business, Government, and Society II.** (2 cr; A-F only. Prereq-PhD student or #)  
Topics vary.

**Mgmt 8301. Seminar in Organizational Behavior.** (4 cr. Prereq-Business admin PhD student or #)  
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. Prereq-Business admin PhD student or #)  
Major theories and current research on organizational and interorganizational topics from a macro perspective.

**Mgmt 8304. Topics in Organizations I.** (2 cr; A-F only. Prereq-PhD student or #)  
Topics vary.

**Mgmt 8305. Topics in Organizations II.** (2 cr; A-F only. Prereq-PhD student or #)  
Topics vary.

**Mgmt 8401. Seminar in Strategy Content.** (4 cr. Prereq-Business admin PhD student or #)  
Review of research in strategy formulation.

**Mgmt 8402. Seminar in Strategy Process.** (4 cr. Prereq-Business admin PhD student or #)  
Examines research on process by which strategy is formulated and implemented in firms.

**Mgmt 8403. Strategy Seminar.** (4 cr. Prereq-Business admin PhD student or #)  
Strategic management. Topics vary.

**Mgmt 8404. Topics in Strategy I.** (2 cr; A-F only. Prereq-PhD student or #)  
Topics vary.

**Mgmt 8405. Topics in Strategy II.** (2 cr; A-F only. Prereq-PhD student or #)  
Topics vary.

**Mgmt 8892. Readings in Management Theory and Administration.** (1-8 cr [max 16 cr]. Prereq-Business admin PhD 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]. Prereq-Business admin PhD 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 5991. MOT Independent Study.** (1-3 cr; S-N only. Prereq-MOT grad student)  
Independent study in MOT-related topic.

**MOT 8111. Marketing Management in Technology-Based Organizations.** (2 cr; A-F only. Prereq-Grad MOT major)  
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; A-F only. Prereq-Grad MOT major)  
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; A-F only. Prereq-Grad MOT major)  
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. Technology, Fundamental Structure.** (1 cr. Prereq-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; A-F only. Prereq-Grad MOT major)  
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.** (2.5 cr; A-F only. Prereq-Grad MOT major)  
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. Communication in a Technological Environment.** (2 cr; A-F only. Prereq-Grad MOT major)  
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. New Product Development.** (2 cr; A-F only. Prereq-Grad MOT major)  
Need for and problems of organizational integration in development of product policy. Execution of development process for new product. Necessary organizational interactions among marketing, research/development, and operations in design/delivery of products.

**MOT 8213. Business, Government, and Macroeconomics.** (2 cr; A-F only. Prereq–Grad MOT major)  
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. Understanding and Forecasting Technology Development.** (2 cr; A-F only. Prereq–Grad MOT major)  
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; A-F only. Prereq–Grad MOT major)  
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 in the New Millennium.** (2 cr [max 2.5 cr]; A-F only. Prereq–MOT grad major)  
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; A-F only. Prereq–Grad MOT major)  
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; A-F only. Prereq–Grad MOT major)  
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]; A-F only. Prereq–Completion of two semesters, grad MOT major)  
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. Prereq–Master’s student, adviser and DGS consent)

**MOT 8900. Conflict Management.** (.5 cr. Prereq–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; A-F only. Prereq–Grad MOT major)  
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; A-F only. Prereq–MOT grad student)  
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.** (.5 cr; S-N only. Prereq–MOT grad student)  
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.** (.5 cr; S-N only. Prereq–MOT grad student)  
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; A-F only. Prereq–MOT grad student)  
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.

## Managerial Communications (MCom)

*Business Career Center*

*Curtis L. Carlson School of Management*

**MCom 5400. Managerial Communications for the HR Professional.** (2 cr. Prereq–HRIR student)  
Memo writing, oral presentations, and team communication required of HR professional. Emphasizes hands-on, experiential learning, including videotaping.

## Manufacturing Systems (MS)

*Institute of Technology*

**MS 5101. Manufacturing Strategy and Operations Management.** (3 cr; A-F only. Prereq–Grad MS major)  
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; A-F only. Prereq–Grad MS major)  
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; A-F only. Prereq–Grad MS major)  
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; A-F only. Prereq–Grad MS major)  
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 [max 3 cr]; A-F only. Prereq–Grad MS major)  
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; A-F only. Prereq–Grad MS major)  
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; A-F only. Prereq–MS grad student, #)  
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.

**MS 5199. Topics in Manufacturing Systems.** (1 cr [max 7 cr]; A-F only. Prereq–MS grad student)  
See *Class Schedule*.

**MS 5201. Project Management.** (1 cr; A-F only. Prereq–Grad MS major)  
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; A-F only. Prereq–Grad MS major)  
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; A-F only. Prereq–Grad MS major)  
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; A-F only. Prereq–Grad MS major)  
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; A-F only. Prereq–Grad MS major)  
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; A-F only. Prereq—Grad MS major)  
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; A-F only. Prereq—Grad MS major)  
Machine design practice plans for assembly of components into systems. Basic design principles.

**MS 5208. Plasma Processing.** (1 cr; A-F only. Prereq—Grad MS major)  
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; A-F only. Prereq—Grad MS major)  
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; A-F only. Prereq—Grad MS major)

**MS 5211. Fabrication of Plastics and Composite Materials.** (1 cr; A-F only. Prereq—Grad MS major)  
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]; A-F only. Prereq—ISE grad student)  
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. Prereq—Master's student, adviser and DGS consent)

**MS 8760. Computer-assisted Product Realization: Capstone Project.** (4 cr; A-F only. Prereq—Grad manufacturing systems major)  
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]. Prereq—#, □)  
Individualized guided reading or study of modern Marathi texts.

**Mar 5994. Directed Research.** (3-5 cr [max 12 cr]. Prereq—#, □)  
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. Prereq—MBA 6210 or equiv, business admin PhD student or #)  
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. Prereq—MBA 6210 or equiv, business admin PhD student or #)  
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. Prereq—MBA 6210 or equiv, business admin PhD student or #)  
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. Prereq—MBA 6210 or equiv, business admin PhD student or #)  
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]. Prereq—MBA 6210 or equiv, business admin PhD student or #)  
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]. Prereq—MBA 6210 or equiv, business admin PhD 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]. Prereq—MBA 6210 or equiv, business admin PhD 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 5150. Current Financial Accounting Issues.** (2 cr; A-F only. Prereq—2050, MBT student)  
Accounting principles and practices underlying preparation of financial statements and additional disclosures. Includes recent pronouncement on financial accounting.

**MBT 5200. Tax Accounting Methods and Periods.** (4 cr; A-F only. Prereq—Acct 5135, MBT student)  
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.

**MBT 5220. Tax Research, Communication, and Practice.** (4 cr; A-F only. Prereq—Acct 5135, MBT student)  
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.

**MBT 5223. Tax-exempt Organizations.** (2 cr; A-F only)  
Tax law and issues concerning Section 501(c)(3) and other tax-exempt organizations, including qualification and procedures. Unrelated business income, private foundations (including intermediate sanctions), joint ventures.

**MBT 5226. Negotiation Techniques in Taxation.** (2 cr; A-F only)  
Hands-on approach. Applications from facilitating business sales, mergers, and acquisitions, to representing a client's position before IRS, to controlling TV remote. Negotiation process: planning, pre-negotiation preparation, strategy development.

**MBT 5230. Corporate Taxation I.** (2 cr; A-F only. Prereq—5135, MBT student)  
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.

**MBT 5236. Introduction to Taxation of Business.** (2 cr; A-F only. Prereq—5135 or Acct 5135)  
Introduction to income tax laws governing taxation of corporations, partnerships, limited liability companies, limited liability partnerships, and S corporations. Students write research memorandums.

**MBT 5323. Mergers and Acquisitions I.** (2 cr; A-F only)  
Different types of acquisitions, dispositions, reorganizations, and spin-offs involving C corporations. Tax consequences of acquisition to corporations/shareholders involved. Use of 338 elections, limitations on acquired net operating losses/credits, use of covenants not to compete, consulting agreements, deferred payment terms, treatment of transaction costs.

**MBT 5326. Mergers and Acquisitions II.** (2 cr; A-F only)  
Current corporate transactions serve as case studies for analyzing tax consequences of various transaction structures. Participants prepare present value models of related tax consequences to corporations/shareholders involved. Use of Section 338(h)(10) for acquisitions of S corporations, international acquisitions.

**MBT 5333. Tax Aspects of Consolidated Returns.** (2 cr; A-F only. Prereq—5230, MBT student)  
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.

**MBT 5335. Taxation of the Small Business Corporation.** (2 cr; A-F only. Prereq—5230, MBT student)  
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.

**MBT 5340. Taxation of Partners and Partnerships.** (2 cr; A-F only. Prereq—Acct 5135, MBT student)  
Reviews tax consequences associated with formation, operation, and dissolution of a partnership.

**MBT 5341. Taxation of Partners and Partnerships II.** (2 cr; A-F only)  
Advanced partnership allocation issues (special allocation arrangements, substantial economic effect regulations. Allocations of gains, losses, and depreciation under Code Section 704(c)), advanced partnership disguised sales issues, allocation of partnership liabilities, mergers/divisions. Interaction of section 197 and partnership rules (including antichurning provisions). Issues relating to choice of entity, issues encountered when converting to/from partnership form.

**MBT 5346. FAS 109 Computations and Analysis.** (2 cr; A-F only)

Financial accounting/reporting standards for effects of income taxes that result from corporate activities. Computation of current/deferred tax expense or benefit, temporary differences, carryforwards, computation of deferred tax assets/liabilities, valuation allowances, business combinations. Investments in subsidiaries and equity method investments. Foreign operations, tax allocations, interim period tax calculations.

**MBT 5350. Taxation of Estates and Gifts.** (2 cr; A-F only. Prereq—Acct 5135, MBT student)

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.

**MBT 5351. Estate Planning.** (2 cr; A-F only. Prereq—Acct 5135, MBT student)

Addresses various topics related to planning the transfer of property during lifetime and at death.

**MBT 5353. Income Taxation of Fiduciaries.** (2 cr; A-F only. Prereq—Acct 5135, MBT student)

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.

**MBT 5356. Taxation of Compensation Arrangements.** (2 cr; A-F only. Prereq—Acct 5135, MBT student)

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.

**MBT 5360. State and Local Taxation.** (2 cr; A-F only. Prereq—Acct 5135, MBT student)

Examines state levying of individual income, corporate income, property, sales, and excise taxes. Tax problems of businesses with multistate operations.

**MBT 5361. State and Local Taxation II.** (2 cr; A-F only)

Income/sales tax consequences of mergers/acquisitions, corporate reorganizations. Practical application of tax concepts. Planning ideas in drop shipments, investment holding companies, e-commerce, leasing companies, and like tax alternatives. Real property taxation, individual income taxation, state administrative tax procedures, state payroll considerations.

**MBT 5363. Taxation of Executive Compensation.** (2 cr; A-F only)

Federal income taxation of executive compensation, relevant fringe benefit programs. Benefit programs other than qualified retirement plans. Salary continuation, stock options, non-profit organization plans, health/welfare plans.

**MBT 5370. Taxation of Property Transactions.** (2 cr; A-F only. Prereq—Acct 5135, MBT student)

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.

**MBT 5373. Taxation of Inventories.** (2 cr; A-F only)

Basic inventory requirements: valuation, charitable contributions of inventory, acquisition of going-business valuation, uniform capitalization requirements, retail inventory method, and accounting method changes. As related to LIFO: background, economic considerations, election, conformity, costing, pooling, methods, and Inventory Price Index Computations (IPIC).

**MBT 5376. Taxation of Financial Instruments.** (2 cr; A-F only)

How financial products/derivatives are used and the tax consequences that result. Trends/developments.

**MBT 5380. Tax Aspects of International Business I.** (2 cr; A-F only. Prereq—Acct 5135, MBT student)

Multinational business operations and transactions involving foreign income. Tax consequences of transactions with foreign organizations and by related foreign companies.

**MBT 5381. Tax Aspects of International Business II.** (2 cr; A-F only. Prereq—Acct 5135, MBT student)

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.

**MBT 5390. Topics in Taxation.** (1-4 cr [max 160 cr]; A-F only. Prereq—MBT student)

Current tax legislation and problems. Topics may vary. S-N grading allowed with MBT program approval.

**MBT 5420. Current Topics in Taxation.** (1-4 cr [max 4 cr]; A-F only)

Tax research/compliance, other tasks. Students submit summary paper.

**MBT 5500. Business, Government, and Economic Tax Policy.** (4 cr. Prereq—Acct 5135, MBT 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.

**MBT 8333. FTE: Master's.** (1 cr. Prereq—Master's student, adviser and DGS consent)

## Master of Healthcare Administration (MHA)

### Curtis L. Carlson School of Management

**MHA 8762. Contemporary Problems in Healthcare.** (2 cr; A-F only. Prereq—PhD student)

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; A-F only. Prereq—PhD student)

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 8782. Research Practicum.** (2 cr; A-F only. Prereq—PhD student)

Field experience in healthcare research. Supervised independent and team research on selected topics and problems.

## Materials Science (MatS)

### Department of Chemical Engineering and Materials Science

#### Institute of Technology

**MatS 5221. Introduction to Polymer Chemistry.** (3 cr [max 4 cr]; A-F only. §Chem 5221, Chem 8221, ChEn 5221, MatS 8221. Prereq—[3501, Chem 2302] or #)

Condensation, radical, ionic, emulsion, ring-opening, metal-catalyzed polymerizations. Chain conformation, solution thermodynamics, molecular weight characterization, physical properties.

**MatS 5223. Polymer Laboratory.** (2 cr. §Chem 5223W.

Prereq—4214 or 5221 or ChEn 4214 or Chem 5221 or 8221 or #)

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 5518. Imaging and Diffraction in the Scanning Electron Microscope.** (1 cr; A-F only. Prereq—#)

Theory/practice of scanning electron microscopy. Classroom sessions cover how instrument works, best-use practices. Practical sessions allow students to hone skills.

**MatS 5519. Basic Transmission Electron Microscopy.** (1 cr; A-F only. Prereq—#)

Theory/practice of transmission electron microscope. Classroom sessions cover how instrument works, best-use practices. Practical sessions allow students to hone skills.

**MatS 5520. Basic Analytical Electron Microscopy.** (1 cr; A-F only. Prereq—5518, 5119)

Theory/practice of analytical electron microscopy. Classroom sessions cover techniques, best-use practices. Practical sessions allow students to hone skills.

**MatS 5521. Thin Films and Interfaces.** (3 cr. Prereq—IT upper div or grad, 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. §ChEn 5531. Prereq—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; A-F only. Prereq—#)

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 8114. Structure and Symmetry in Soft Materials.** (2 cr; A-F only. Prereq–8001 or equiv or #)  
Molecular interactions, packing, symmetry operations/structure. X-ray/neutron scattering in soft materials, including organic/liquid crystals, amphiphiles, and polymers.

**MatS 8115. Electron Microscopy of Soft Matter.** (2 cr; A-F only. Prereq–Materials science/engineering or chemical engineering grad major or #)  
Operation principles of transmission electron microscope (TEM) and scanning electron microscope (SEM). How these instruments are applied in study of soft materials (e.g., liquid, semi-liquid material systems). Unique specimen preparation techniques, low image contrast, electron-beam radiation-damage, limited signal-to-noise ratio. TEM /SEM digital imaging.

**MatS 8204. Computational Methods and Applications to Problems in Materials Science and Engineering.** (2 cr; A-F only. Prereq–Grad student, knowledge of programming languages such as Fortran)  
Implementation of computational methods/applications to numerical problems in materials science and engineering. Emphasizes implementation to applications.

**MatS 8211. Physical Chemistry of Polymers.** (3 cr. §Chem 8211. Prereq–Undergrad physical chem or #)  
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. Prereq–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; A-F only. Prereq–#)  
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; A-F only. Prereq–#)  
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; A-F only. Prereq–#)  
Electronic properties of ceramics; electronic and ionic conduction; dielectric behavior; ferroelectric, piezoelectric, pyroelectric, and electrooptic 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 8217. Advanced Electron Microscopy.** (3 cr; A-F only. Prereq–5517)  
Theory/application of scanning/transmission electron microscopy.

**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; A-F only. §ChEn 5103, ChEn 8103)  
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 8221. Introduction to Polymer Chemistry.** (4 cr; A-F only. §Chem 5221, Chem 8221, ChEn 5221, MatS 5221. Prereq–[3502, Chem 2302] or #)  
Condensation, radical, ionic, emulsion, ring-opening, metal-catalyzed polymerizations. Chain conformation, solution thermodynamics, molecular weight characterization, physical properties.

**MatS 8333. FTE: Master's.** (1 cr. Prereq–Master's student, adviser and DGS consent)

**MatS 8444. FTE: Doctoral.** (1 cr. Prereq–Doctoral student, adviser and DGS consent)

**MatS 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 6 cr]). Prereq–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]). Prereq–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**MatS 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]). Prereq–Max 18 cr per semester or summer; 24 cr required)

**MatS 8993. Directed Study.** (1-12 cr [max 12 cr])

**MatS 8994. Directed Research.** (1-12 cr [max 12 cr])

**MatS 8995. Special Topics.** (1-4 cr [max 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. Prereq–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. Prereq–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. Prereq–Two yrs calculus, basic computer skills)  
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; A-F only. Prereq–5075)  
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. §Math 4152. Prereq–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. Prereq–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. Prereq–2 sems soph math)  
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. Probabilistic algorithms: pseudoprimes, prime factorization. Pseudo-random numbers. Elliptic curves.

**Math 5251. Error-Correcting Codes, Finite Fields, Algebraic Curves.** (4 cr. Prereq–2 sems soph math)  
Information theory: channel models, transmission errors. Hamming weight/distance. Linear codes/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 5285. Honors: Fundamental Structures of Algebra I.** (4 cr. Prereq–[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 5286. Honors: Fundamental Structures of Algebra II.** (4 cr. Prereq–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. Prereq–[2243 or 2373 or 2573], [¶12263 or ¶12374 or ¶12574])  
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. Prereq–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. Prereq—[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. Prereq—[2263 or 2374 or 2573], [2243 or 2373 or 2574]; [2283 or 3283] recommended)  
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. Prereq—[2263 or 2374 or 2573], [2243 or 2373 or 2574])  
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.** (4 cr. Prereq—[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. Prereq—[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. Prereq—[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. Prereq—[2243 or 2373 or 2573], familiarity with some programming language)  
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. Prereq—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. Prereq—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. Prereq—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. Prereq—[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. Prereq—[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. Prereq—2 sems soph math [including [2263 or 2374 or 2573], [2283 or 3283]] recommended)  
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. Prereq—[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 [max 400 cr]; A-F only. Prereq—[[2243 or 2373 or 2573], [2263 or 2374 or 2574], 5587] or #)  
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 5594. Honors Mathematics - Topics.** (4 cr [max 12 cr]; A-F only. Prereq—[3593H with grade of at least B, experience in writing proofs]; intended for mathematically-talented students with proven achievement in theoretical mathematics courses)  
Topics vary depending on interests of instructor. Theoretical treatment of chosen topic.

**Math 5615. Honors: Introduction to Analysis I.** (4 cr. Prereq—[[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 5616. Honors: Introduction to Analysis II.** (4 cr. Prereq—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. §Math 4653, Stat 4101, Stat 5101. Prereq—[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. Prereq—5651 or Stat 5101)  
Random walks, Markov chains, branching processes, martingales, queuing theory, Brownian motion.

**Math 5654. Prediction and Filtering.** (4 cr. Prereq—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. Prereq—[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. Prereq—[2243 or 2373 or 2573], [2263 or 2374 or 2574]; [2283 or 3283] orexperience 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. Prereq—2 sems soph math [including 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 [max 3 cr]; S-N only. Prereq—1 math grad student in good standing or #)  
New approaches to teaching/learning, issues in mathematics education, components/expectations of a college mathematics professor.

**Math 8141. Applied Logic.** (3 cr; A-F only. Prereq—#)  
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; A-F only. Prereq—#)  
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; A-F only. Prereq—5166 or #)  
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; A-F only. Prereq—8151 or #)  
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; A-F only. Prereq—Math grad student or #)  
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; A-F only. Prereq—8166, #)  
Sample topics: complexity theory, recursive analysis, generalized recursion theory, analytical hierarchy, constructive ordinals.

**Math 8172. Model Theory.** (3 cr; A-F only. Prereq—Math grad student or #)  
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; A-F only. Prereq—8172 or #)  
Types of elements. Prime models, homogeneity, saturation, categoricity in power. Forking.

**Math 8190. Topics in Logic.** (1-3 cr [max 12 cr]; A-F only. Prereq—#; offered for one year or one semester as circumstances warrant)

**Math 8201. General Algebra.** (3 cr; A-F only. Prereq—4xxx algebra or equiv or #)  
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; A-F only. Prereq—8201 or #)  
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; A-F only. Prereq—8202 or #)  
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; A-F only. Prereq—8207 or #)  
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; A-F only. Prereq—8202 or #)  
Selected topics.

**Math 8212. Commutative and Homological Algebra.** (3 cr; A-F only. Prereq—8211 or #)  
Selected topics.

**Math 8245. Group Theory.** (3 cr; A-F only. Prereq—8202 or #)  
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; A-F only. Prereq—8245 or #)  
Representation and character theory, simple groups, free groups and products, presentations, extensions, Schur multipliers.

**Math 8251. Algebraic Number Theory.** (3 cr; A-F only. Prereq—8202 or #)  
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; A-F only. Prereq—8251 or #)  
Zeta and L-functions of global fields. Artin L-functions. Hasse-Weil L-functions. Tehebotarev density. Local and global class field theory. Reciprocity laws. Finer theory of cyclotomic fields.

**Math 8253. Algebraic Geometry.** (3 cr; A-F only. Prereq—8202 or #)  
Curves, surfaces, projective space, affine and projective varieties. Rational maps. Blowing-up points. Zariski topology. Irreducible varieties, divisors.

**Math 8254. Algebraic Geometry.** (3 cr; A-F only. Prereq—8253 or #)  
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]; A-F only. Prereq—Math 8201, Math 8202; offered for one year or one semester as circumstances warrant)

**Math 8271. Lie Groups and Lie Algebras.** (3 cr; A-F only. Prereq—8302 or #)  
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; A-F only. Prereq—8271 or #)  
Solvable and nilpotent Lie algebras and Lie groups; Lie's and Engel'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]; A-F only. Prereq—#; offered for one year or one semester as circumstances warrant)

**Math 8300. Topics in Algebra.** (1-3 cr [max 12 cr]; A-F only. Prereq—Grad math major or #; offered as one yr or one sem crse as circumstances warrant)  
Selected topics.

**Math 8301. Manifolds and Topology.** (3 cr; A-F only. Prereq—[Some point-set topology, algebra] or #)  
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; A-F only. Prereq—8301 or #)  
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; A-F only. Prereq—8301 or #)  
Singular homology, cohomology theory with coefficients. Eilenberg-Stenrod axioms, Mayer-Vietoris theorem.

**Math 8307. Algebraic Topology.** (3 cr; A-F only. Prereq—8306 or #)  
Basic homotopy theory, cohomology rings with applications. Time permitting: fibre spaces, cohomology operations, extra-ordinary cohomology theories.

**Math 8333. FTE: Master's.** (1 cr. Prereq—Master's student, adviser and DGS consent)

**Math 8360. Topics in Topology.** (1-3 cr [max 12 cr]; A-F only. Prereq—8301 or #; offered as one yr or one sem crse as circumstances warrant)  
Selected topics.

**Math 8365. Riemannian Geometry.** (3 cr; A-F only. Prereq—8301 or basic point-set topology or #)  
Riemannian metrics, curvature, Bianchi identities, Gauss-Bonnet theorem, Meyers's theorem, Cartan-Hadamard theorem.

**Math 8366. Riemannian Geometry.** (3 cr; A-F only. Prereq—8365 or #)  
Gauss, Codazzi equations. Tensor calculus, Hodge theory, spinors, global differential geometry, applications.

**Math 8370. Topics in Differential Geometry.** (1-3 cr [max 12 cr]; A-F only. Prereq—8301 or 8365; offered for one yr or one sem as circumstances warrant)  
Current research in Differential Geometry.

**Math 8380. Topics in Advanced Geometry.** (1-3 cr [max 12 cr]; A-F only. Prereq—8301, 8365, #, offered for one year or one semester as circumstances warrant)

**Math 8385. Calculus of Variations and Minimal Surfaces.** (3 cr; A-F only. Prereq—4xxx partial differential equations or #)  
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; A-F only. Prereq—8595 or #)  
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; A-F only. Prereq—[5xxx numerical analysis, some computer experience] or #)  
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; A-F only. Prereq—8597 or #)  
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]; A-F only. Prereq—8601; offered for one yr or one sem as circumstances warrant)  
Current research.

**Math 8401. Mathematical Modeling and Methods of Applied Mathematics.** (3 cr; A-F only. Prereq—4xxx numerical analysis and applied linear algebra or #)  
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; A-F only. Prereq—8401 or #)  
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; A-F only. Prereq—5xxx numerical analysis of partial differential equations or #)  
Equations of continuity/motion. Kinematics. Bernoulli's theorem, stream function, velocity potential. Applications of conformal mapping.

**Math 8432. Mathematical Fluid Mechanics.** (3 cr. Prereq—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. Prereq—[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. Prereq–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. Prereq–Doctoral student, adviser and DGS consent)

**Math 8445. Numerical Analysis of Differential Equations.** (3 cr; A-F only. Prereq–4xxx numerical analysis, 4xxx partial differential equations or #)

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; A-F only. Prereq–8445 or #)

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]; A-F only. Prereq–Grad math major or #; offered as one yr or one sem crse as circumstances warrant)  
Selected topics.

**Math 8470. Topics in Mathematical Theory of Continuum Mechanics.** (1-3 cr [max 12 cr]; A-F only. Prereq–#; offered for one year or one semester as circumstances warrant)

**Math 8501. Theory of Ordinary Differential Equations.** (3 cr; A-F only. Prereq–4xxx ODE or #)

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; A-F only. Prereq–8501 or #)

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; A-F only. Prereq–8501 or #)

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; A-F only. Prereq–5525 or 8502 or #)

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; A-F only. Prereq–5587 or #)

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]; A-F only. Prereq–8502, #; offered for one yr or one sem as circumstances warrant)  
Current research.

**Math 8530. Topics in Ordinary Differential Equations.** (1-3 cr [max 3 cr]; A-F only. Prereq–8502, #; offered for one year or one semester as circumstances warrant)

**Math 8540. Topics in Mathematical Biology.** (1-3 cr [max 12 cr]; A-F only)  
Offered for one year or one semester as circumstances warrant.

**Math 8571. Theory of Evolutionary Equations.** (3 cr; A-F only. Prereq–8502 or #)

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; A-F only. Prereq–8571 or #)

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]; A-F only. Prereq–8572 or #; offered for one yr or one semester as circumstances warrant)

**Math 8581. Applications of Linear Operator Theory.** (3 cr; A-F only. Prereq–4xxx applied mathematics or #)  
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; A-F only. Prereq–8581 or #)

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; A-F only. Prereq–[Some 5xxx PDE, 8601] or #)

Classification of partial differential equations/characteristics. Laplace, wave, heat equations. Some mixed problems.

**Math 8584. Theory of Partial Differential Equations.** (3 cr; A-F only. Prereq–8583 or #)

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 [max 3 cr]; A-F only. Prereq–8602; offered for one yr or one sem as circumstances warrant)  
Research topics.

**Math 8600. Topics in Advanced Applied Mathematics.** (1-3 cr [max 12 cr]; S-N only)

Offered for one yr or one semester as circumstances warrant. Topics vary. For details, contact instructor.

**Math 8601. Real Analysis.** (3 cr; A-F only. Prereq–5616 or #)

Set theory/fundamentals. Axiom of choice, measures, measure spaces, Borel/Lebesgue measure, integration, fundamental convergence theorems, Riesz representation.

**Math 8602. Real Analysis.** (3 cr; A-F only. Prereq–8601 or #)

Radon-Nikodym, Fubini theorems.  $C(X)$ .  $L_p$  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]; A-F only. Prereq–8602 or #; offered for one yr or one sem as circumstances warrant)

Current research.

**Math 8641. Spatial Ecology.** (3 cr; S-N only. Prereq–Two semesters calculus, theoretical population ecology or four semesters more robust calculus, course in statistics or probability or #)

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. Prereq–5616 or #)

Probability spaces. Distributions/expectations of random variables. Basic theorems of Lebesgue 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. Prereq–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. Prereq–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. Prereq–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. Prereq–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])

Offered for one year or one semester as circumstances warrant.

**Math 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq–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; A-F only. Prereq–8668 or #)

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]; A-F only. Prereq–Grad math major or #; offered as one yr or one sem crse as circumstances warrant)

Selected topics.

**Math 8701. Complex Analysis.** (3 cr; A-F only. Prereq–5616 or #)

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; A-F only. Prereq–8701 or #)

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]. Prereq—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]; A-F only. Prereq—8702 or #; offered for one yr or one sem as circumstances warrant)  
Current research.

**Math 8801. Functional Analysis.** (3 cr; A-F only. Prereq—8602 or #)  
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; A-F only. Prereq—8801 or #)  
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 Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—Max 18 cr per semester or summer; 24 cr required)

**Math 8990. Topics in Mathematics.** (1-6 cr [max 24 cr]; S-N only. Prereq—#)  
Readings, research.

**Math 8991. Independent Study.** (1-6 cr [max 24 cr]; S-N only. Prereq—#)  
Individually directed study.

**Math 8992. Directed Reading.** (1-6 cr [max 24 cr]; S-N only. Prereq—#)  
Individually directed reading.

**Math 8993. Directed Study.** (1-6 cr [max 24 cr]; S-N only. Prereq—#)  
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. Prereq—Enrollment in math initial licensure 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. Prereq—Tchg exper or isnr consent)  
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. Prereq—Enrollment in math initial licensure 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 12 cr]. Prereq—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. Prereq—Tchg license or student elem ed MEd or special ed or #)  
Modern trends, methods, and materials used to convey mathematical ideas.

**MthE 5155. Rational Number Concepts and Proportionality.** (3 cr. Prereq—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. Prereq—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 [max 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 5305. Middle School Mathematics Methods.** (2 cr. Prereq—Elem ed licensure student)  
The unique needs of middle school students in the mathematics classroom. Mathematics content and pedagogical skills. Adolescent development/psychology. Field placement in a middle school mathematics classroom.

**MthE 5313. Teaching and Learning Mathematics in the Middle School.** (3 cr. Prereq—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. Prereq—Math Ed or MEd or CI MEd or grad student or #)  
Methods, materials, and curriculum development. Principles of learning. Review of research. Preparation/evaluation of tests, units, and materials of instruction. Recent developments in mathematics curriculum and in instructional alternatives. Issues in teaching/learning. Program planning/evaluation.

**MthE 5345. Teaching and Learning in Developmental Mathematics.** (3 cr. Prereq—Certificate in Postsecondary Developmental Education student or Mathematics Education student or grad student or #)  
Research related to developmental education and mathematics education. Principles of learning. Students' mathematical development. Assessment/evaluation of teaching/learning. Instructional technology. Strategies for students.

**MthE 5355. Mathematics for Diverse Learners.** (3 cr. Prereq—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]. Prereq—MEd/initial licensure student or #)  
Student teaching in secondary school mathematics classes.

**MthE 5993. Directed Studies in Mathematics Education.** (2 cr [max 3 cr]; S-N only. Prereq—Math ed MEd student, #)  
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. Prereq—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. Prereq—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 [max 3 cr]. Prereq—Math educ PhD 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.** (1-6 cr [max 12 cr]. Prereq—MA or PhD 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. Prereq—IT upper div or grad student, submission of permission form, #)  
Topics vary each semester.

**ME 5090. Advanced Engineering Problems.** (1-4 cr [max 4 cr]. Prereq—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; A-F only. Prereq—IT upper div or grad student)  
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; A-F only. Prereq—IT upper div or grad, 3322 or 3323)  
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; A-F only. Prereq—5103, [IT upper div or grad student])  
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; A-F only. Prereq—IT upper div or grad student)  
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; A-F only. Prereq—IT upper div or grad student)  
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; A-F only. Prereq—IT upper div or grad student)  
Fundamentals of cleanroom 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; cleanroom design and operation; high purity systems; particle detection in processing equipment.
- ME 5133. Aerosol Measurement Laboratory.** (4 cr; A-F only. Prereq—IT upper div or graduate student)  
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; A-F only. Prereq—3221, AEM 3031, CSci 1113, MatS 2001)  
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. Prereq—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; A-F only. Prereq—IT upper div or grad, 3221, AEM 3031, CSci 1113, MatS 2001)  
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; A-F only. Prereq—ME or AEM upper div or grad student, 5281 or equiv)  
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; A-F only. Prereq—IT upper div or grad, 3222, CSci 1113 or equiv)  
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; A-F only. Prereq—IT upper div or grad, 3222 or equiv, basic kinematics and dynamics of machines; knowledge of CAD packages such as Pro-E recommended)  
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; A-F only. Prereq—AEM 3031, MatS 2001)  
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. Prereq—IT upper div 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. Prereq—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; A-F only. Prereq—[3281 or equiv], [upper div ME or AEM or CSci or grad student])  
Manipulator forward/inverse kinematics, homogeneous transformations, coordinate frames, Jacobian/velocity control, task primitives/programming, computational issues. Determining path trajectories. Reaction forces, manipulator dynamics/control. Vehicle kinematics, dynamics, and guidance. Lab project demonstrates concepts.
- ME 5341. Case Studies in Thermal Engineering and Design.** (4 cr; A-F only. Prereq—IT upper div or grad student, 3321, 3322)  
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; A-F only. Prereq—IT upper div or grad student, 3321, 3322)  
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. Prereq—IT upper div 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; A-F only. Prereq—IT upper div or grad student, 3322)  
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; A-F only. SEE 5611. Prereq—Grad or IT upper div, ME 3321, ME 3322 or equiv)  
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; A-F only. SBME 5311, ChEn 5753. Prereq—IT upper div or grad student, transport class, [3322 or ChEn 5103] or #)  
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; A-F only. Prereq—IT upper div or grad student, 3321, 3322)  
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; A-F only. Prereq—IT upper div or grad student, C or better in 3322 or 3324)  
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; A-F only. Prereq—IT upper div or grad student, 3321, 3322)  
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.** (3 cr [max 4 cr]; A-F only. Prereq—IT grad student or #)  
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; A-F only. SBME 8401, Entr 6041, Entr 6087, OMS 6061. Prereq—IT grad student, some design experience)  
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; A-F only. SBME 8402. Prereq—8221)  
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; A-F only. Prereq—3222, 5341, AEM 3031, CSci 1113)  
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; A-F only. Prereq-5228 or equiv, 5341, AEM 3031, CSci 1113) 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. Topics in Design.** (4 cr [max 12 cr]; A-F only. Prereq-5243) Topics vary with each offering.

**ME 8262. Topics in Modeling and Analysis of Manufacturing Processes.** (4 cr [max 12 cr]; A-F only. Prereq-3221, AEM 3016) Advanced topics in Manufacturing. Analytical/numerical modeling of manufacturing processes. Use of computer-based modeling tools and computer controlled manufacturing machines. Comparison of predictions/measurements of process variables and part characteristics. Part production/testing. Processes, technologies, and topics vary with each offering.

**ME 8281. Advanced Control System Design.** (4 cr; A-F only. Prereq-5281) Loop Shaping. Review of controllability/observability. LQR/LQG/LTR. Repetitive control. Input shaping. Tracking control (feedforward, precompensation). Lyapunov stability. System identification.

**ME 8282. Control of Nonlinear Systems.** (4 cr; A-F only. Prereq-5281) Introduction to nonlinear systems, bifurcations, chaos, Lyapunov stability. Input-output stability (circle theorem, passivity, Lure'). Input-output and input-state feedback linearization. Lyapunov-based design. Sliding surface control, dynamic surface control. Parameter identification (least squares, gradient, etc). Lyapunov-based adaptive control, integrator backstepping, singular perturbations.

**ME 8287. Topics in Dynamics and Control.** (4 cr [max 12 cr]; A-F only. Prereq-5281) Topics vary with each offering.

**ME 8333. FTE: Master's.** (1 cr. Prereq-Master's student, adviser and DGS consent)

**ME 8337. Experimental Methods in the Thermal Sciences.** (3 cr; A-F only) Planning experiments. Uncertainty, qualification, visualization, analogies. Temperature, pressure, heat flux, and flow measurements. Signal processing and analysis. Introduction to optical diagnostics.

**ME 8341. Advanced Heat Transfer I.** (3 cr. Prereq-3322, IT grad student) Fundamentals of heat conduction and thermal radiation. Analytical treatment of heat conduction in steady/unsteady problems. Solution of governing equations by separation of variables and by other methods. Basic concepts of radiation, blackbody radiation, and radiative properties. Radiation heat transfer in enclosures and in radiatively participating media such as flames, plasmas, and aerosols.

**ME 8342. Advanced Heat Transfer II.** (3 cr; A-F only. Prereq-8341) Heat transfer in fluids flowing around bodies and in tubes/ducts. Forced/natural convection. Laminar/turbulent flow regimes. Turbulent transport and modeling. High-speed flows, viscous dissipation, variable property effects. Application to heat exchange devices. Convective mass transfer.

**ME 8345. Computational Heat Transfer and Fluid Flow.** (3 cr. Prereq-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 8361. Molecular Gas Dynamics.** (3 cr; A-F only. SAEM 8231. Prereq-IT grad student) Kinetic theory of gases, Boltzmann equation, Maxwell-Boltzmann distribution, collisions, transport properties. Introduction to quantum mechanics. Statistical thermodynamics, classical/quantum statistics. partition functions and thermodynamic properties. Irreversible thermodynamics.

**ME 8362. Introduction to Plasma Technology.** (3 cr; A-F only. Prereq-8361) Fundamentals of gaseous plasmas. Thermal/nonequilibrium plasmas. Types of plasma generation. Electron energy distribution function. Sheaths, glow discharges, electric arcs, RF plasmas. Steady/unsteady plasmas. Plasma heat transfer. Plasma diagnostics.

**ME 8381. Bioheat and Mass Transfer.** (3 cr. Prereq-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 8390. Advanced Topics in the Thermal Sciences.** (1 cr [max 6 cr]; A-F only) Topics vary according to instructor.

**ME 8444. FTE: Doctoral.** (1 cr. Prereq-Doctoral student, adviser and DGS consent)

**ME 8462. Turbomachinery.** (3 cr; A-F only. Prereq-IT grad student, 3321, 3322 or equiv or #) 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 8646. Reacting Flows.** (3 cr; A-F only. Prereq-8361) Introduction to simple methods for thermophysical data estimation. Principles/application of chemical kinetics. Simulation of homogeneous/heterogeneous kinetics, including transport. Principles 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]. Prereq-Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

**ME 8772. Advanced Transportation Technologies Seminar.** (1 cr; S-N only. SCE 8213) Advanced technologies specifically related to transportation. Topics draw from core science/technology areas of human factors, intelligent vehicles, traffic modeling/management, sensing, communications, and controls.

**ME 8773. Graduate Seminar.** (1 cr; S-N only. Prereq-IT grad student) Recent developments.

**ME 8774. Graduate Seminar.** (1 cr; S-N only. Prereq-8773) 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]. Prereq-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]. Prereq-#) Directed research.

**ME 8800. Modern Developments in Mechanical Engineering.** (1 cr [max 2 cr]; S-N only. Prereq-IT grad student) 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 Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq-Max 18 cr per semester or summer; 24 cr required)

**ME 8951. Plan B.** (1 cr; S-N only) Structured environment in which students can complete a M.S. Plan B project.

**ME 8953. Plan B.** (2 cr; A-F only. Prereq-8951) Structured environment in which students can complete a M.S. Plan B project.

## Medicinal Chemistry (MedC)

### Department of Medicinal Chemistry College of Pharmacy

**MedC 5185. Principles of Biomolecular Simulation.** (3 cr. Prereq-Chem 3502 or #) Molecular simulation for students in medicinal chemistry, pharmaceuticals, biochemistry, and chemical physics

**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; A-F only. SChem 5245, Phar 6245. Prereq-Chem) 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; A-F only. Prereq-#) 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 5700. General Principles of Medicinal Chemistry.** (2 cr; A-F only. Prereq-MedC grad student or #) Fundamental principles of molecular recognition, physicochemical properties of drugs, drug metabolism and disposition, interaction of molecules with DNA/RNA.

**MedC 5710. General Principles of Medicinal Chemistry.** (2 cr; A-F only. Prereq-MedC grad student or #) Fundamental principles of enzyme inhibitors, combinatorial chemistry and library design, drug receptor interactions and signal transduction mechanisms, and molecular modeling.

**MedC 8100. Medicinal Chemistry Seminar.** (1 cr [max 6 cr]. Prereq-Grad major or #) Current topics.

**MedC 8333. FTE: Master's.** (1 cr. Prereq-Master's student, adviser and DGS consent)

**MedC 8444. FTE: Doctoral.** (1 cr. Prereq-Doctoral student, adviser and DGS consent)

**MedC 8500. Design of Chemotherapeutic Agents.** (2 cr; A-F only. Prereq-5600 or #) 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; A-F only. Prereq-5600 or #) 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]. Prereq-Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

**MedC 8700. Advanced Concepts in Drug Design.** (2 cr; A-F only. SChem 8700, Phar 6247H. Prereq-5600 or #) Current approaches to rational design of drugs.

**MedC 8760. Design of Peptidomimetics.** (2 cr; A-F only. Prereq–5600 or #)  
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]. Prereq–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]; S-N only. Prereq–Grad med chem major or #)  
Experiential rotations in medicinal chemistry research laboratories.

**MedC 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq–Max 18 cr per semester or summer; 24 cr required)

**MedC 8900. Research in Medicinal Chemistry.** (1-4 cr [max 8 cr]; A-F only. Prereq–Grad med chem major or #)  
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]. Prereq–One yr work in some area of Middle Ages, reading knowledge of appropriate language, #)  
From late antiquity through end of Middle Ages (circa 300-1500 A.D.). Current topics specified in *Class Schedule*.

**MeSt 5993. Directed Studies in Medieval Studies.** (1-3 cr [max 6 cr]. Prereq–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]; S-N only. Prereq–#)  
Lectures by and discussions with faculty and visiting speakers.

**MeSt 8110. Seminar in Medieval Studies.** (3-4 cr [max 48 cr]; A-F only. Prereq–Appropriate languages, #)  
Offered when feasible.

## Microbial Engineering (MicE)

*BioTechnology Institute*  
*College of Biological Sciences*

**MicE 5309. Biocatalysis and Biodegradation.** (3 cr. \$BioC 5309. Prereq–chemistry through organic chemistry; knowledge of word processing, e-mail, access to World Wide Web, access to college-level science 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; A-F only. Prereq–[Biol 3301 or MicB 3301], [grad student in microbial engineering or upper-div major in [microbiology or chem engineering or biochemistry]], #)  
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. Prereq–Master's student, adviser and DGS consent)

**MicE 8777. Thesis Credits: Master's.** (1-18 cr [max 50 cr]. Prereq–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**MicE 8920. Teaching Practicum.** (1 cr [max 4 cr]. Prereq–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]. Prereq–First-yr students enroll S-N, as they do not make a presentation; second-yr students enroll 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 [max 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.

## Microbiology, Immunology, and Cancer Biology (MICa)

*Department of Microbiology*  
*Medical School*

**MICa 5000. Practicum: Teaching.** (1 cr [max 4 cr]; A-F only. Prereq–[MIMP or MICaB] grad major or #)  
Supervised experience in lab instruction. Use of instructional materials, tests/measurement.

**MICa 8001. Integrated Topics in Microbiology, Immunology, and Cancer Biology.** (3 cr; A-F only. Prereq–MICa grad student or #)  
Molecular, structural, and biochemical complexity of microbes. Molecular mechanisms of disease. Cell death/injury. Adaptive immune responses, immunological tolerance.

**MICa 8002. Structure, Function, and Genetics of Bacteria and Viruses.** (4 cr; A-F only. Prereq–8001 or #)  
Structure, function, and metabolism of microorganisms; microbial genetics; molecular virology.

**MICa 8003. Immunity and Immunopathology.** (4 cr. Prereq–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 Cancer Biology.** (4 cr; A-F only. Prereq–8001 or GCB 8132 or #)  
Fundamental concepts in cellular, molecular, and genetic basis of disease. Molecular basis of inflammation and cancer metastasis. Genetic basis for inherited disorders and gene therapy. Molecular mechanisms of pathogenesis.

**MICa 8005. Topics in Microbiology, Immunology, and Cancer Biology.** (1-4 cr [max 4 cr]. Prereq–8001, two of [8002 or 8003 or 8004])  
Colloquium format. Readings/discussion on specialized topic.

**MICa 8006. Protein Sequence Analysis.** (3 cr. Prereq–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; A-F only. \$BioC 8007. Prereq–8002 or 8004 or #)  
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 8009. Biochemical Aspects of Normal and Abnormal Cell Growth and Cell Death.** (2 cr. Prereq–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 8010. Microbial Pathogenesis.** (3 cr; A-F only. Prereq–MICa grad student or instr)  
Molecular mechanisms of bacterial/viral pathogenesis. Strategies of disease causation/interaction with host, regulation of virulence factors, mechanism of virulence factor transmission to other microbes.

**MICa 8011. Current Topics in Immunology.** (3 cr; A-F only. Prereq–MICa 8003 or #)  
Colloquium format. In-depth reading, discussion

**MICa 8094. Research in Microbiology, Immunology, and Cancer Biology.** (1 cr [max 5 cr]; S-N only. Prereq–1st yr MICa grad student)  
One-on-one research training from faculty adviser during laboratory rotation.

**MICa 8333. FTE: Master's.** (1 cr. Prereq–Master's student, adviser and DGS consent)

**MICa 8371. Mucosal Immunobiology.** (3 cr; A-F only. \$CMB 8371, \$Bio 8371. Prereq–8001 or #)  
Host immune processes at body surfaces. Innate/adaptive immunity at mucosal surfaces, interactions/responses of various mucosal tissues to pathogens, current approaches being used to target protective vaccination to mucosal tissues. Lectures, journal club format.

**MICa 8444. FTE: Doctoral.** (1 cr. Prereq–Doctoral student, adviser and DGS consent)

**MICa 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq–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]. Prereq–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**MICa 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq–Max 18 cr per semester or summer; 24 cr required)

**MICa 8910. Seminar: Faculty Research Topics.** (1 cr [max 10 cr]; S-N only. Prereq–[MIMP or MICa] grad student or #)  
State-of-the-art information presented by scientific experts within/outside the University.

**MICa 8920. Seminar: Student Research Topics.** (1 cr [max 10 cr]; S-N only. Prereq–[MIMP or MICa] grad student or #)  
Current thesis topics and other aspects of microbiology, immunology, and cancer biology.

## 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. §CAS 5311. Prereq—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. §CAS 3526, CAS 5526, MELC 3526)

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. §CAS 3532, CAS 5532, MELC 3532)

Rise and fall of the Mongol Empire, formation of the Chagatai 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. Persian Fiction in Translation.** (3 cr. §CAS 3601, CAS 5601, MELC 3601)

Impact of westernization on Iran, from 1920s to present. Materials produced by Iranian writers, film makers, and intellectuals. Internal/external forces that bind contemporary Iranian society to world civilization. Works of Hedayat (especially *Blind Owl*), Chubak, Al-i Ahmad, Daneshvar, and Behrangi are analyzed/interpreted.

**MELC 5602. Persian Poetry in Translation.** (3 cr. §CAS 3602, CAS 5602, MELC 3602)

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 [max 10 cr]. Prereq—#, □)

**MELC 5994. Directed Research.** (1-10 cr [max 10 cr]. Prereq—#, □)

## Molecular Cellular Developmental Biology and Genetics (MCDG)

*College of Biological Sciences*

**MCDG 8333. FTE: Master's.** (1 cr. Prereq—Master's student, adviser and DGS consent)

**MCDG 8444. FTE: Doctoral.** (1 cr. Prereq—Doctoral student, adviser and DGS consent)

**MCDG 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq—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]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**MCDG 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—Max 18 cr per semester or summer; 24 cr required)

**MCDG 8900. Student Research Seminar.** (1 cr [max 10 cr]; S-N only. Prereq—Grad MCDG major)  
Presentation and discussion of student thesis research.

**MCDG 8910. Journal Presentations.** (1 cr [max 2 cr]; S-N only. Prereq—Grad MCDG major)  
Discussion of original scientific literature; for first-year graduate students.

**MCDG 8920. Special Topics.** (1-4 cr [max 8 cr]. Prereq—Grad MCDG major or Δ)

**MCDG 8950. Teaching Practicum.** (1 cr [max 2 cr]; S-N only. Prereq—Grad MCDG major or Δ)  
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]. Prereq—MCDG grad student or #)  
Directed Studies.

**MCDG 8994. Research.** (1-5 cr [max 10 cr]; S-N only. Prereq—MCDG grad student or Δ)  
Independent research determined by student's interests, in consultation with faculty mentor.

## Museum Studies (MSt)

*Bell Museum of Natural History*

**MSt 5011. Museum History and Philosophy.** (3 cr; A-F only. Prereq—#)

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; A-F only. Prereq—5011 or #)

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]; S-N only. Prereq—5011, 5012)

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]; A-F only. Prereq—[5012 or ¶5012], #)  
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. Prereq—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 5102. Piano Pedagogy II.** (2 cr. Prereq—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; A-F only. Prereq—5102 or grad piano major or #)

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; A-F only. Prereq—5101 or grad piano major or #)

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]; A-F only. Prereq—5101-5102 or 5111-5112 or #)

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 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; A-F only. Prereq—3502, 3603, sr or grad or #)

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; A-F only. Prereq—3502, 3603, sr or grad or #)

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]; A-F only. Prereq—Accomp major)

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]; A-F only. Prereq—French, German and Italian diction, accomp or grad vocal major)

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; A-F only. Prereq—Grad piano major or #)

Literature for piano from late Baroque period to mid-20th century.

**Mus 5182. Advanced Piano Literature II.** (2 cr; A-F only. Prereq—Grad piano major or #)

Literature for piano from late Baroque period to mid-20th century.

**Mus 5230. Chorus.** (1 cr [max 8 cr]. Prereq—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]; A-F only. Prereq—Audition, #)

Mixed chorus of about 24 voices. Performances each semester of works for small choirs.

**Mus 5241. Vocal Literature I.** (3 cr; A-F only. Prereq—[12 cr in MusA 1304, grad music student] or #)

Vocal literature of major/minor composers from 17th century to present. Structure, style, performance practice.

**Mus 5242. Vocal Literature II.** (3 cr; A-F only. Prereq—12 cr in MusA 1104 or MusA 1304, grad music major or #)

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]; A-F only. Prereq—audition, #)

Preparation and performance of operatic arias, choruses, and scenes. Participation in fully staged or workshop productions of music theatre repertoire.



- Mus 5270. Voice Practicum.** (1 cr [max 2 cr]. Prereq—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; A-F only. Prereq—12 cr MusA 1304 or grad music major or #)  
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; A-F only. Prereq—12 cr MusA 1304 or grad music major or #)  
Principles and techniques of singing in English, Italian, Spanish, German, and French. International Phonetic Association alphabet used.
- Mus 5275. Vocal Pedagogy I.** (3 cr. Prereq—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 5277. Vocal Workshop.** (1-2 cr [max 8 cr]; A-F only. Prereq—Music major or #)  
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; A-F only. Prereq—Performance only track: 2 cr per sem; performance/pedagogy track: 3 cr per sem; [upper div student or grad student], #)  
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]; A-F only. Prereq—Audition, #)  
Preparation and performance of fully-staged operatic production. Major involvement in singing, acting, and technical aspects of opera.
- Mus 5340. Jazz Ensemble.** (1 cr [max 6 cr]; A-F only. Prereq—Audition, #)  
A 20-member performing organization covering significant jazz compositions and arrangements written specifically for this medium.
- Mus 5341. Jazz Pedagogy.** (2 cr; A-F only. Prereq—#)  
Teaching methods of vocal and instrumental jazz improvisation, basic arranging techniques, and jazz history; bibliographies and materials.
- Mus 5380. Gospel Choir.** (1 cr [max 4 cr]; A-F only)  
Performance ensemble. Students explore history of gospel music through experiential/participatory songs. Field songs, songs of struggle. Southern, traditional, and contemporary songs.
- Mus 5410. University Wind Bands.** (1 cr [max 14 cr]; A-F only. Prereq—Audition, #)  
Wind ensemble and symphony bands perform standard and contemporary literature; concerts and tour appearances. Players from all colleges may participate.
- Mus 5420. Orchestra.** (1 cr [max 8 cr]; A-F only. Prereq—Audition, #)  
Symphony orchestra performs standard repertoire and major works with chorus; concerts and tour appearances. Players from all colleges may participate.
- Mus 5421. Suzuki Violin Pedagogy I.** (2 cr; A-F only. Prereq—Violin major or #)  
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; A-F only. Prereq—5421 or #)  
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; A-F only. Prereq—[(#5424 or #5425), grad music student] or #, grad consent)  
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; A-F only. Prereq—5422 or #)  
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; A-F only. Prereq—5424 or #)  
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 5427. Violin Pedagogy I.** (2 cr; A-F only. Prereq—Violin or viola major or #)  
Private teaching of violin students at beginning, intermediate, and advanced levels. Discussion and demonstrations of pedagogical techniques.
- Mus 5428. Violin Pedagogy II.** (2 cr; A-F only. Prereq—Violin or viola major or #)  
Private teaching of violin students at beginning, intermediate, and advanced levels. Discussion and demonstrations of pedagogical techniques.
- Mus 5430. New Music Ensemble.** (1 cr [max 8 cr]; A-F only. Prereq—#)  
Study/performance of contemporary ensemble (including small chamber orchestra) literature. Historical/theoretical analysis of works performed.
- Mus 5440. Chamber Ensemble.** (1 cr [max 8 cr]; A-F only. Prereq—Audition, #)  
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]; A-F only. Prereq—#)  
Investigation of practical and performance problems in standard orchestral repertoire with regard to style and interpretation.
- Mus 5460. Ensemble for the Performance of Early Music, c900-1750.** (1 cr [max 8 cr])  
Performance of medieval, renaissance, and baroque music (sacred and secular) according to traditions established from c900 to 1750. Ensemble consists of a chamber chorus and consorts of period instruments. Repertoire includes Gregorian chant, masses, motets, chansons, madrigals, and choral/instrumental movements from cantatas, oratorios, passions, all in original languages.
- 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; A-F only. Prereq—Guitar principal or major or #)  
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]; A-F only. Prereq—Audition, #)  
Chamber music performance using homogeneous or mixed combinations of woodwind instruments.
- Mus 5471. Woodwind Literature and Pedagogy I.** (3 cr; A-F only. Prereq—Music major or #)  
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; A-F only. Prereq—Music major or #)  
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; A-F only. Prereq—Music major or #)  
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]. Prereq—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. Prereq—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. Prereq—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]; A-F only. Prereq—#)  
Practice and performance of standard and contemporary compositions for percussion instruments in various combinations.
- Mus 5491. Percussion Literature I.** (2 cr; A-F only. Prereq—Jr or sr or grad or #)  
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; A-F only. Prereq—Jr or sr or grad or #)  
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 5550. Class Composition.** (2 cr [max 8 cr]; A-F only. Prereq—3502 or #)  
Original works in various forms. Development of individual compositional style in a post-tonal idiom. Various forms, performing forces, techniques.
- Mus 5561. Orchestration I.** (3 cr; A-F only. Prereq—3502)  
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; A-F only. Prereq—5561)  
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; A-F only. Prereq—3502)  
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. Prereq–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 5573. Analysis of Late-Romantic Orchestral Literature.** (3 cr; A-F only. Prereq–3502 or Theory IV Exam or # 3504 or equiv recommended)

Introduction to advanced tonal analysis. Corpus of dramatic orchestral music by Wagner, Strauss, Tchaikovsky, Rimsky-Korsakov, Moussorgsky, and Rachmaninoff as focus for projects and classroom discussions related to chromatic harmony, form, and orchestration.

**Mus 5591. Electronic Music: History, Literature, Principles.** (3 cr; A-F only. Prereq–#, at least jr)

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; A-F only. Prereq–5591 or #)

Study of specific dsp topics such as filtering, formant synthesis, reverbification techniques, and additive synthesis. Work with interactive MIDI applications.

**Mus 5597. Music and Text.** (3 cr; A-F only. Prereq–3502)

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; A-F only. Prereq–3603)

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]; A-F only. Prereq–Grad music major or #)

Study of specific operas. Development of opera in context of other artistic, social, cultural, and political events, movements, and changes. Periods/countries vary each semester.

**Mus 5644. Music in 20th-Century American Culture.** (3 cr; A-F only. Prereq–3603, 5501 or #)

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. Prereq–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; A-F only. Prereq–3603, 5501 or #)

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; A-F only. Prereq–5502, 12 cr music history)

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; A-F only. Prereq–3603, #)

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; A-F only. Prereq–1801 or 1804 or music grad or #)

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]. Prereq–#, Δ, □)

Guided individual reading or study.

**Mus 8110. Sonata Seminar.** (2 cr [max 8 cr]; A-F only. Prereq–Accompanying emphasis, strings and winds by audition, #)

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; A-F only. Prereq–Grad student in accompanying/conducting)

Reducing orchestra scores, representing orchestral reductions at piano, working with conductors. Conductors join course in mid-semester.

**Mus 8131. Advanced Keyboard Skills.** (2 cr; A-F only. Prereq–Grad student in music or #)

Diatonic/chromatic tonal harmony applied to keyboard. Emphasizes harmonization, transposition, and improvisation. Open score and clef reading using alto, tenor, and soprano clefs.

**Mus 8133. Seminar in Basso Continuo.** (3 cr; A-F only. Prereq–Grad student in Music or #)

Realization of figured basses (bass lines annotated with Arabic numerals indicating harmony) and performance of continuo parts in European concerted music from 17th/18th centuries at keyboard. Emphasizes developing stylistic accompaniment skills at harpsichord/organ.

**Mus 8151. Seminar in Organ Repertoire.** (3 cr; A-F only. Prereq–Grad student in music or #)

Repertoire for pipe organ. Readings/presentations on selected areas of repertoire of 15th through 20th centuries. Organ design/construction of various European and American schools, as well as relevant performance practices.

**Mus 8170. Advanced Vocal Accompanying Skills and Repertoire.** (2 cr [max 8 cr]; A-F only. Prereq–[French, German, Italian diction], accompanying or DMA voice emphasis or MM voice emphasis by audition)

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; A-F only. Prereq–[Grad student with major in vocal performance or in accompanying or in piano], #)

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; A-F only. Prereq–[Grad student with major in vocal performance or in accompanying or in piano], #)

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; A-F only. Prereq–[Grad student with major in vocal performance or in accompanying or in piano], #)

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; A-F only. Prereq–[Grad student with major in vocal performance or in accompanying or in piano], #)

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; A-F only. Prereq–[Grad student with major in vocal performance or in accompanying or in piano], #)

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; A-F only. Prereq–Grad student with major in accompanying or in conducting)

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; A-F only. Prereq–#)

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; A-F only. Prereq–#)

Survey of sacred and secular choral works.

**Mus 8299. Performance in Choral Conducting.** (3 cr; A-F only. Prereq–#)

Preparation and performance of choral conducting recital, with supporting paper.

**Mus 8333. FTE: Master's.** (1 cr. Prereq–Master's student, adviser and DGS consent)

**Mus 8444. FTE: Doctoral.** (1 cr. Prereq–Doctoral student, adviser and DGS consent)

**Mus 8450. Graduate Seminar in Conducting.** (3-4 cr [max 32 cr]; A-F only. Prereq–Grad student in conducting or #)

Development of musicianship, conducting, rehearsal, and analytical skills. Repertoire, gesture, score study, interpretation, pedagogy, and performance presentation in wind band, orchestral, and choral conducting. Students meet twice weekly in group seminar, and prepare and participate in weekly conducting labs scheduled with all major University ensembles.

**Mus 8470. Wind Ensemble/Band Conducting (Wind Conducting).** (4 cr [max 12 cr]; A-F only. Prereq–#)

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; A-F only. Prereq–Wind conducting emphasis or #)

Seminar in wind band repertoire 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; A-F only. Prereq–Wind conducting emphasis or #)

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; A-F only. Prereq–8472, #)

Preparing and performing full wind ensemble or band conducting program with supporting document.

**Mus 8480. Orchestral Conducting.** (4 cr [max 16 cr]; A-F only. Prereq–#)

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; A-F only. Prereq-#)

Preparing and performing full orchestral conducting program with supporting document.

**Mus 8490. Choral Conducting.** (4-12 cr [max 12 cr]; A-F only. Prereq-#)

Prepare students for careers in conducting. Students study musical scores and conducting/rehearsal techniques.

**Mus 8501. Music Theory Pedagogy.** (3 cr; A-F only. Prereq-Grad student in music or #)

Comparison of pedagogical philosophies/methods in music theory. Pedagogical literature, practice teaching, curriculum design.

**Mus 8550. Composition.** (3 cr [max 12 cr]; A-F only. Prereq-#)

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]; A-F only. Prereq-#)

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; A-F only. Prereq-Emphasis in composition or choral conducting or voice or accompanying or music education, #)

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]; A-F only. Prereq-Composition emphasis or #)

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]; A-F only. Prereq-8570)

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; A-F only. Prereq-#)

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]; A-F only. Prereq-Grad music major who has completed all undergrad requirements in tonal theory and analysis)

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; A-F only. Prereq-#)

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; A-F only. Prereq-8581 or #)

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; A-F only. Prereq-8581 or #)

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]; A-F only. Prereq-Grad music major, #)

Seminar explores literatures of 20th-century art music.

**Mus 8631. Seminar: Music in Medieval Europe.** (3 cr; A-F only. Prereq-Undergrad music degree)

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; A-F only. Prereq-Undergrad music degree)

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]; A-F only. Prereq-Musicology or theory emphasis or #)

Topics vary; readings, research, strategies, and methods.

**Mus 8644. Seminar: Advanced Research in Historical Musicology.** (3 cr; A-F only. Prereq-Undergrad music degree)

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; A-F only. Prereq-Musicology or theory emphasis or #)

Readings and topics in recent scholarly and analytical work.

**Mus 8647. Seminar: The Critical Editing of Early Music—Method and Practice.** (3 cr; A-F only. Prereq-Undergrad music degree)

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; A-F only. Prereq-#)

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]. Prereq-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]. Prereq-Max 18 cr per semester or summer; 10 cr total required [Plan A only])
**Mus 8864. Current Issues in Ethnomusicology.** (3 cr; A-F only. Prereq-#)

Ethnomusicological methods, theorizing, and research practice. Current issues in monographs, journals, and anthologies. Fieldwork practicum.

**Mus 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq-Max 18 cr per semester or summer; 24 cr required)
**Mus 8994. Directed Research.** (1-3 cr [max 12 cr]; A-F only. Prereq-#)

Directed research.

**Mus 8999. Recital Credits: Doctoral.** (4 cr [max 20 cr]; A-F only. Prereq-DMA student, #)

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]; A-F only. Prereq-Audition, Δ)

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]; A-F only. Prereq-Audition, Δ)

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]; A-F only. Prereq-Audition, Δ)

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.

## Courses

- 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]; A-F only. Prereq=Audition)

- 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. Prereq—Mus 1001, elem ed grad student) Fundamentals of music, methods, and materials for incorporating singing, rhythmic activities, classroom instruments, movement, listening, appreciation, and creation into context of classroom curriculum.
- MuEd 5112. Research in Music Education: Techniques.** (3 cr; A-F only. Prereq—Grad music ed major or #) 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 5118. Research in Arts Education: Qualitative.** (3 cr; A-F only. Prereq—Grad student in arts or #) Practical/systematic introduction to qualitative research procedures in arts education. Prepares students to develop research proposals. Students participate in a joint field exploration. Those who have established research interests may also work in another setting relevant to their long-term research goals.
- 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; A-F only. Prereq—Music or music ed major or #) 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; A-F only. Prereq—Music or music ed major or #) 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; A-F only. Prereq—Music or music ed major or #) 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 5669. Psychology of Music.** (3 cr; A-F only. Prereq—Psy 1001 or Psy 3604 or #) Basic study of the psychology and psychoacoustics of music including hearing, music perception and cognition, values and preferences, musical abilities, musical systems, media music effects, the influence of music on human behavior, and psycho-socio-physiological processes involved in musical behavior.

- MuEd 5750. Topics in Music Education.** (1-4 cr [max 16 cr]; A-F only. Prereq—Grad student in music education/therapy or education or special education or grad minor in gerontology or spirituality/healing or nursing student or psychology student) Focuses on single topic, specified in *Class Schedule*.

- MuEd 5991. Independent Study.** (1-4 cr [max 8 cr]; A-F only. Prereq—Music ed or music therapy major or grad, #) Independent study project organized by the student in consultation with the appropriate instructor.

- MuEd 8281. Seminar: Philosophical Issues.** (3 cr; A-F only. Prereq—Doctoral student in [music or music education] or #) Issues in philosophical foundations of music education.

- MuEd 8282. Seminar: Historical Issues.** (3 cr; A-F only. Prereq—Doctoral student in music or music education or #) Issues in historical foundations of music education.

- MuEd 8283. Seminar: Psychological Issues.** (3 cr; A-F only. Prereq—Doctoral student in music or music education or #) Issues in psychological foundations of music education.

- MuEd 8284. Seminar: Research and Scholarly Issues.** (3 cr; A-F only. Prereq—Doctoral student in music or music education or #) Scholarly/professional expectations of music educators and music therapists in academia and other positions of leadership. Writing for a variety of professional purposes/publications.

- MuEd 8333. FTE: Master's.** (1 cr. Prereq—Master's student, adviser and DGS consent)

- MuEd 8880. Master's Research Project.** (1-5 cr [max 5 cr]; A-F only. Prereq—Grad music ed major, #) Individual Plan B projects.

- MuEd 8994. Directed Research.** (1-8 cr [max 8 cr]; A-F only. Prereq—#)

## Nanoparticle Science and Engineering (NPSE)

### Institute of Technology

- NPSE 8001. Introduction to Nanoparticle Science and Engineering.** (3 cr; A-F only)

A broad, interdisciplinary overview of the emerging field of nanoparticle science and engineering. This introductory course, designed for students with diverse backgrounds in science and engineering, covers a wide spectrum of topics—from the synthesis of nanoparticles, to nanoparticle growth and transport, to characterization methods for nanoparticles, to novel nanoparticle-based materials and devices.

- NPSE 8002. Nanoparticle Science and Engineering Laboratory.** (3 cr; A-F only. Prereq—8001, [IT grad student or #]) Practical exposure to computational and experimental techniques in nanoparticle research. Required for Ph.D. students minoring in nanoparticle science and engineering.

- NPSE 8101. Nanoparticle Science and Engineering Seminar.** (1 cr; S-N only. Prereq—IT grad student or) Broad overview of current research in nanoparticle science and engineering. Topics include areas of nanoparticle synthesis, nanoparticles characterization, nanoparticle-based materials and devices, environmental impact of nanoparticles, and instrumentation for nanoparticle research. Speakers from the University of Minnesota as well as external experts.

## Natural Resources Science and Management (NR)

### Department of Forest Resources

### College of Natural Resources

- NR 8333. FTE: Master's.** (1 cr. Prereq—Master's student, adviser and DGS consent)

- NR 8444. FTE: Doctoral.** (1 cr. Prereq—Doctoral student, adviser and DGS consent)

- NR 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq—Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

- NR 8777. Thesis Credits: Master's.** (1-18 cr [max 50 cr]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

- NR 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—Max 18 cr per semester or summer; 24 cr required)

## Neuroscience (NSc)

### College of Biological Sciences

**NSc 5031. Perception.** (3 cr. \$Psy 5031W. Prereq–Psy 3031 or Psy 3051 or #)

Cognitive, computational, and neuroscience perspectives on visual perception. Color vision, pattern vision, image formation in eye, object recognition, reading, impaired vision. Course is biennial: offered fall of odd years.

**NSc 5037. Psychology of Hearing.** (3 cr. \$Psy 5037. Prereq–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. \$NSc 5201, \$Phl 5201. Prereq–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. Theoretical Neuroscience: Systems and Information Processing.** (3 cr. Prereq–[3101, 3102W] recommended)

Concepts of computational/theoretical neuroscience. Distributed representations and information theory. Methods for single-cell modeling, including compartmental/integrate-and-fire models. Learning rules, including supervised, unsupervised, and reinforcement learning models. Specific systems models from current theoretical neuroscience literature. Lecture/discussion. Readings from current scientific literature.

**NSc 5461. Cellular and Molecular Neuroscience.** (4 cr; A-F only. Prereq–NSc grad student or #)

Lectures by team of faculty, problem sets in important physiological concepts, discussion of original research papers.

**NSc 5462. Neuroscience Principles of Drug Abuse.** (2 cr. \$PHCL 5462. Prereq–#)

Current research on drugs of abuse, their mechanisms of action, characteristics shared by various agents, and neural systems affected by them. Offered biennially, spring semester of even-numbered years.

**NSc 5481. Invertebrate Neurobiology.** (3 cr; A-F only. \$Ent 5481)

Fundamental principles/concepts underlying cellular bases of behavior and “systems” neuroscience. Particular invertebrate preparations. Offered annually the last 10 weeks of spring semester.

**NSc 5540. Advanced Survey of Biomedical Neuroscience.** (2 cr. Prereq–#; intended for members of biomedical community or students with advanced scientific backgrounds)

Current topics in biomedical neuroscience, accompanied by supporting fundamental concepts. Intensive, one week course.

**NSc 5551. Itasca Cell and Molecular Neurobiology Laboratory.** (4 cr; S-N only. Prereq–Neuroscience grad or #)

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; A-F only. Prereq–NSc grad student or #)

Principles of organization of neural systems forming the basis for sensation/movement. Sensory-motor/neural-endocrine integration. Relationships between structure and function in nervous system. Team taught. Lecture, laboratory.

**NSc 5661. Behavioral Neuroscience.** (3 cr; A-F only.

Prereq–Grad NSc major or grad NSc minor or #) Neural coding/representation of movement parameters. Neural mechanisms underlying higher order processes such as memorization, memory scanning, and mental rotation. Emphasizes 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. \$CMB 8361, PSY 8026. Prereq–5561, MicB 4131)

Regulatory systems (neuroendocrine, cytokine, and autonomic nervous systems) linking brain and immune systems in brain-immune axis. Functional effects of bidirectional brain-immune regulation. Course is offered fall of even-numbered years.

**NSc 8207. Seminar: Psychopharmacology.** (1-3 cr [max 12 cr]. \$PHCL 8207, PSY 8070. Prereq–#)

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; A-F only. Prereq–Neuroscience grad student or #)

How neuronal types develop. Emphasizes general mechanisms. Experimental data demonstrating mechanisms.

**NSc 8216. Selected Topics in Autonomic and Neuroendocrine Regulation.** (1 cr; S-N only. \$Phl 8216. Prereq–#)

Advanced seminar. Course is offered fall and spring semesters.

**NSc 8217. Systems and Computational Neuroscience.** (2 cr; S-N only. Prereq–5561 or #)

Advanced seminar.

**NSc 8221. Neurobiology of Pain and Analgesia.** (2 cr. Prereq–#)

Pain and analgesia. Course is triennial.

**NSc 8222. Central Regulation of Autonomic Function.** (3 cr; A-F only. \$Phl 8222. Prereq–5561)

Neural/hormonal sensory pathways affecting central autonomic nuclei involved in maintenance of homeostasis. Current research on physiological control systems at cellular, organ, and integrative levels. Course is offered fall of odd-numbered years.

**NSc 8247. Anatomy and Physiology of Hearing and Balance.** (3 cr. \$Otol 8247)

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 [max 2 cr]. \$Otol 8248)

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]) Topics in neurobiology and neurophysiology.

**NSc 8321. Career Skills and Understanding Responsibilities as a Neuroscientist.** (.5 cr [max 2 cr]; S-N only. Prereq–Neuroscience grad major or #)

Information that falls outside of core neuroscience academic curriculum. Areas of practical value for graduate school and career development. Career skills, writing skills, responsible conduct in research.

**NSc 8333. FTE: Master's.** (1 cr. Prereq–Master's student, adviser approval)

**NSc 8334. Laboratory Neuroscience.** (1-3 cr [max 10 cr]; S-N only. Prereq–Grad NSc major) Guided research.

**NSc 8411. Teaching in Neuroscience.** (1 cr [max 4 cr]; S-N only. Prereq–Instr approval)

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. Prereq–Doctoral student, adviser and DGS consent)

**NSc 8481. Advanced Neuropharmacetics: Principles and Applications.** (3 cr; A-F only. \$CMB 8481, Phm 8481. Prereq–Survey courses in [biochemistry, cell biology] or #) Delivery of compounds to central nervous system (CNS) to activate proteins in specific brain regions for therapeutic benefit. Pharmaceutical/pharmacological issues specific to direct drug delivery to CNS.

**NSc 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq–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 Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq–Max 18 cr per semester or summer; 24 cr required)

## Neuroscience Department (Nsci)

### Department of Neuroscience

#### Medical School

**Nsci 5101. Introduction to Neuroscience for Graduate Students.** (3 cr; A-F only. Prereq–[BioC 3021 or BioC 4331]; intended for grad students outside neuroscience program who require comprehensive intro)

Basic principles of cellular/molecular neurobiology and nervous system. A term paper supplements lectures. Multiple-choice exams.

**Nsci 5110. Dental Neuroscience for Graduate Students.** (2 cr; A-F only. Prereq–\$: 6110; BioC 3021, Biol 4004, #; intended for grad students who require a comprehensive grad-level neuroscience course)

Structure/function of human nervous system. Lectures and reading assignments emphasize topics pertinent to dentistry.

**Nsci 5111. Medical Neuroscience for Graduate Students.** (5 cr; A-F only. Prereq–\$: 6111; BioC 3021, Biol 4004, #; intended for grad students who require a comprehensive medically-oriented neuroscience course)

Survey of molecular, cellular, and systems neuroscience as related to medicine. Lecture/lab.

**Nsci 5540. Advanced Survey of Biomedical Neuroscience.** (2 cr. Prereq–#; intended for members of biomedical community or students with advanced scientific backgrounds)

Current topics in biomedical neuroscience. Supporting, fundamental concepts. Intensive, one week course.

**Nsci 5913. BrainU 101: Neuroscience in the Classroom.** (3 cr; A-F only. Prereq–[Elementary or middle school or high school or preservice] teacher, #, application)

Two-week summer workshop. Week one focuses on training teachers in neuroscience through lectures, activities, and discussion sessions. Week two focuses on designing inquiry-based classroom investigations based on neuroscience education given during week one. Follow-up activities held during the academic year include BrainU staff/faculty classroom presentations and use of training materials.

**Nsci 5914. BrainU 202: Neuroscience in the Classroom.** (3 cr; A-F only. Prereq–[5913 or Biol 5190], #, application)

One-week summer workshop. Focuses on critiquing previously implemented neuroscience class activities, developing assessment tools, learning peer mentoring, and expanding neuroscience content knowledge. Follow-up activities held during academic year include BrainU staff/faculty classroom presentations, use of training materials, and peer mentoring sessions.

**Nsci 5915. BrainU 303: Neuroscience in the Classroom.** (2 cr; A-F only. Prereq—[5913 or Biol 5190], 5914, #, application) One-week summer workshop. Focuses on critiquing previously implemented neuroscience class activities and assessment tools, and expanding neuroscience content knowledge. Follow-up activities held during academic year include BrainU 303 participants. use of training materials and implementation of neuroscience investigations.

## Neurosurgery (NSu)

### Department of Neurosurgery Medical School

**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 [max 15 cr]. Prereq—8104, □)

## Nursing (Nurs)

### School of Nursing

**Nurs 5016. Critical Reading of Scientific Literature in Adolescent Health.** (1 cr. Prereq—[Grad-level research methods course, inferential statistics course] or #)

Application of skills, from research methods and statistics courses to critical reading of empirical literature on adolescent health. Relevance of research findings to adolescent health practice.

**Nurs 5030. Clinical Foundations.** (7 cr [max 21 cr]; A-F only. Prereq—Admission to postbaccalaureate certificate nursing program)

Foundation for culturally appropriate, ethical, evidence-based nursing practice across the life span. Emphasizes research/theory that underlie art/science of professional nursing. Concepts of person, environment, health, and nursing. Didactic, clinical, and laboratory experiences.

**Nurs 5031. Human Response to Health and Illness: Adults and Elders.** (6 cr; A-F only. Prereq—Postbaccalaureate certificate prog, #)

Individual responses to health/illness, in context of families/environments. Clinical component emphasizes application of nursing process in adult/elderly populations.

**Nurs 5032. Human Response to Health and Illness: Children and Childbearing Families.** (6 cr; A-F only. Prereq—Postbaccalaureate certificate prog, #)

Family responses to health/illness. Emphasizes application of nursing process in children and childbearing families. Seminar and community-based project focus on family as unit of care.

**Nurs 5033. Population Response to Health and Mental Illness.** (5 cr; A-F only. Prereq—Nursing Postbaccalaureate Certificate Prog, #)

Population-based nursing practice. Emphasizes application of nursing process in promoting mental health and public health, and in preventing illness across life span. Clinical experiences include interactions with individuals, families, communities, and systems.

**Nurs 5034. Clinical Seminar: Nursing Care of Clients With Complex Health Conditions.** (2 cr; A-F only. Prereq—5033, 8100, Nursing Postbaccalaureate Certificate Prog)

Exemplar cases from students. clinical settings used as basis for development of clinical decision-making. Critical analysis of current/emergent nursing care issues associated with caring for complex/diverse populations.

**Nurs 5035. Prac NursCareComplexHealthCond.** (5 cr; A-F only. Prereq—Nursing Post Baccalaureate Certificate Program student, #)

Clinical decision-making, comprehensive nursing care of clients with complex health problems. In collaboration with a clinical preceptor and a faculty adviser, students develop an individualized learning contract to meet course objectives.

**Nurs 5040. Seeking Solutions to Global Health Issues.** (2-3 cr [max 3 cr]. Prereq—Grad student or sr nursing honors student or CLA upper div honors or #)

Global health issues from interdisciplinary perspective. Emphasizes ethical/cultural sensitivity/complexities. Students propose realistic actions that could be taken to resolve these issues.

**Nurs 5111. Learning Theories for Nursing Education.** (1 cr) Overview of selected learning theories used in academic, patient, and staff education in nursing.

**Nurs 5113. Web-based Teaching/Learning Strategies.** (2 cr; S-N only. Prereq—#)

Skills necessary to design, produce, implement, and evaluate effective technology enhanced learning environments. Pedagogical/technological issues surrounding teaching with technology.

**Nurs 5141. Ethical Issues in Health Care of Elders.** (3 cr. Prereq—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]. \$PubH 6170)

Exploration of research topic to meet individual student needs.

**Nurs 5171. SPSS Programming and Data Analysis.** (2 cr. Prereq—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. Prereq—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. Prereq—#)

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. Prereq—Grad nursing major, #)

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. Prereq—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. Prereq—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.

Prereq—Nursing grad student in advanced practice in primary care, physiology course, #)

Foundation in pharmacotherapeutics across life span. 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. Prereq—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 5228. Acute Care Pharmacotherapeutics.** (3 cr; A-F only. Prereq—Grad student)

Analysis of pharmacodynamics, physiological bases, therapeutic effects, and non-intended effects (common errors, adverse effects, side effects) for selected pharmacologic agents within drug categories commonly used in acute care.

**Nurs 5300. Health Behavior Intervention: Theory and Application.** (3 cr. Prereq—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. Prereq—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 [max 2 cr]; S-N only. Prereq—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. Prereq—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 5522. Sociopolitical Context of Women's Health.**

(1-2 cr [max 3 cr]; S-N only. Prereq—Grad student) Women's health issues from multidisciplinary perspective. Sexual/reproductive health issues across life span. Sociocultural issues affecting health, such as poverty/violence.

**Nurs 5601. School Nursing in the Educational System and the Community.** (1-3 cr [max 3 cr]; A-F only. Prereq—3 yrs of college level courses, #)

School health problems, assessment/intervention strategies. Integration of research findings. Applications with individuals, families, communities.

**Nurs 5604. Advanced Health Assessment and Interventions with Adolescents.** (2 cr. Prereq–CPsy 5303 or equiv or #) Integrates knowledge from nursing, public health, health behavior, and adolescent development as framework for developing health assessment/intervention strategies for clinical practice with adolescents.

**Nurs 5800. Nursing Topics.** (1-4 cr [max 8 cr]. Prereq–#) 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)

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.

Prereq–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. Prereq–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; S-N only. Prereq–[Upper div or grad] student in [health sciences or health care])

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; S-N only. Prereq–Undergrad nursing student or grad student in health sciences or health professional)

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 5806. Theoretical Foundations and Experiential Learning in Complementary/Alternative Therapies.** (2-3 cr. Prereq–#)

Overview of complementary therapies. Demonstration of selected therapies. Theoretical/scientific knowledge supporting use of therapies.

**Nurs 5807. Stories of Illness.** (3 cr)

Subjective experiences of various physical/mental illnesses. Social context of illness, society's responses to illness. Ethical implications for patients/practitioners. Uses fiction, art, film, music, first-person accounts of illness, and anthropological, sociological, and historical literature.

**Nurs 5808. American Indian Health and Health Care.** (2 cr. Prereq–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 5810. Health Activism.** (3 cr)

Interdisciplinary skill-building workshops. Sessions taught by community leaders/activists. Community project focuses on issues of health disparities, environmental justice, and access to care.

**Nurs 5830. Advanced Clinical Nursing.** (1-6 cr [max 2 cr]. Prereq–Graduate nursing major or #)

Independent study or faculty seminar on special clinical topic.

**Nurs 5900. Introduction to Principles and Practice of Anesthesia.** (3 cr; A-F only. Prereq–Grad student in nurse anesthesia)

Safe/effective administration of anesthesia for nurse anesthetists. Application in operating room setting under one-to-one guidance of a certified registered nurse anesthetist (CRNA).

**Nurs 5901. Basic Principles and Practice of Nurse Anesthesia.** (2 cr; A-F only. Prereq–5900)

Students apply principles of anesthesia to formulate nurse anesthesia care plans for care of adults undergoing anesthesia.

**Nurs 5910. Nurse Anesthesia Care: Patients With Cardiothoracic Problems.** (2 cr. Prereq–5222, 5224, 5228, 5901, Phsl 5115)

First in series of three courses. Delivering anesthesia to complex patients. Focuses on anesthesia for patients undergoing cardiothoracic procedures.

**Nurs 5920. Nurse Anesthesia Care: Pediatric Patients and Patients With Trauma.** (3 cr; A-F only. Prereq–5910)

Second in a series of three courses. Theory/application of principles used to deliver anesthesia by nurse anesthetists to pediatric patients and to trauma patients.

**Nurs 5930. Nurse Anesthesia Care: Obstetric and Gynecology Patients.** (3 cr; A-F only. Prereq–5920)

Third of three courses. Theory/application of principles used to deliver anesthesia by nurse anesthetists for complex patients with obstetric or gynecologic conditions and for effective management of pain. Increasing autonomy in decision-making processes and clinical experiences.

**Nurs 5995. Research Dissemination.** (2 cr. Prereq–Doctoral student or #)

Knowledge dissemination skills for advancement of health/nursing science/practice. Emphasizes interpretation/diffusion of research findings to health professional and scientific audiences in various venues and communication modalities.

**Nurs 8100. The Discipline of Nursing.** (3 cr. Prereq–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 8112. Theoretical Foundations of the Discipline.** (3 cr. Prereq–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; S-N only. Prereq–8100 or equiv, 8112 or #)

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. Prereq–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. Health Behaviors and Illness Responses.** (3 cr; A-F only. Prereq–Doctoral student or #)

Theories of health behaviors and responses to illness are analyzed/critiqued. Multivariate research designs. Specification of testable, descriptive, dynamic models for health/illness that incorporate culture, biology, environment, and health systems for diverse individuals, families, communities, and populations.

**Nurs 8122. Stress, Coping, and Health.** (2 cr. Prereq–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. Prereq–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.** (2-3 cr [max 3 cr]. Prereq–8100 or #)

Emerging theory in family nursing science. Related theories. Research on family systems for structuring a systemic framework to examine clinical problems related to family health care. Applications to selected phenomena of interest to health care.

**Nurs 8134. Nursing Interventions and Outcomes.** (3 cr; A-F only. Prereq–[8121, PhD student] or #)

Design/evaluation of intervention/outcomes research. Analysis of classification systems for nursing interventions/outcomes. Use of advanced experimental design and multivariate statistical approaches to specify/test multi-level, theory-based interventions with various populations.

**Nurs 8140. Moral and Ethical Positions in Nursing.** (3 cr. Prereq–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. Prereq–Grad nurs major, 8140 or #)

Interactions among research and theory in moral judgment and behavior, applied ethics, and nursing.

**Nurs 8152. Scholarship in Health Care Ethics.** (2 cr. Prereq–Doctoral student)

Analysis/evaluation of philosophical/empirical research in health care ethics with consideration of human diversity.

**Nurs 8170. Research in Nursing.** (3 cr. Prereq–[8170 or inferential stat course taken within two yrs])

Research process/methods appropriate for problems relevant to nursing. Critique of research studies, proposal development.

**Nurs 8171. Qualitative Research Design and Methods.** (3-4 cr [max 4 cr]. Prereq–8170 or equiv)

Overview and comparative analysis of selected qualitative research methods and analytic strategies. Focuses on developing rigorous qualitative designs that contribute to development of nursing and health care knowledge for diverse populations.

**Nurs 8172. Theory and Theory Development for Research.** (3 cr. Prereq–Doctoral student)

Paradigms in nursing/health, associated methods of scientific/scholarly inquiry. Inductive/deductive techniques for theory development. Theory-testing using data obtained under controlled conditions.

**Nurs 8173. Principles and Methods of Implementing Research.** (3 cr. SSAPH 8173. Prereq–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. Quantitative Research Design and Methods.** (3 cr; A-F only. Prereq-[8170 or equiv], 8xxx applied statistics) Designs for quantitative description and quasi-experimental/experimental evaluation of scientific problems across domain of nursing. Emphasizes evaluation of logic of design/attribution of causality from health and social science perspectives.

**Nurs 8176. Research on Decision Making in Health Care.** (3 cr. Prereq—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.** (2 cr; S-N only. Prereq-[8181 or ¶8181], PhD nursing student, #, adviser consent) Students collaborate with research team under supervision of faculty mentor in designing/conducting a health-related research project.

**Nurs 8178. Methods for the Study of Family Health Phenomena.** (3 cr. Prereq—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 8180. Doctoral Proseminar I: Scholarly Development.** (1 cr; S-N only. Prereq—Doctoral nursing student) Transition to doctoral study. Begins socialization process to role of nursing scholar/scientist. Career trajectories of nursing scholars who have pursued various roles.

**Nurs 8181. Protection of Research Subjects.** (1 cr. Prereq—[PhD student or #], [(Responsible Conduct of Research I, RCR II) or NIH Web-based course equiv or concurrent]) Ethical research conduct from design to dissemination. Application of Code of Federal Regulations for protecting human subjects, role of and relationship with Institutional Review Boards, risk management. Safety monitoring and reporting of adverse events. Data management. Misconduct policies.

**Nurs 8190. Critical Review in Nursing Research.** (2 cr; A-F only. Prereq—Advanced statistics course or #) Skills needed to critique a body of scientific literature in focused areas of nursing research and related fields. Construction of literature reviews for planning research projects and for research utilization.

**Nurs 8193. Special Topics in Nursing Research.** (1-6 cr [max 6 cr]. Prereq—#) Seminar and/or individual study of research design, methodologies, or instruments.

**Nurs 8194. Problems in Nursing - Plan B.** (1-6 cr [max 6 cr]; S-N only. Prereq-[8100 or ¶8100], [8170 or ¶8170], #) Using a scholarly process to address a specific issue relevant to science/practice of nursing

**Nurs 8240. Advanced Practice Nursing: Roles and Issues.** (2 cr. Prereq—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 [max 3 cr]. Prereq—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. Prereq—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. Prereq—Grad nurs major, Minnesota RN licensure) 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. Prereq—¶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. Prereq—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. Prereq—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. Prereq—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. Prereq—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. Prereq—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. Prereq—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. Prereq—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. Prereq—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 8314. Intervention Models for Adults/Elders with Chronic Health Conditions.** (3-4 cr [max 4 cr]; A-F only. Prereq—5222, 5800, 8100, 8140, 8170, #) Development of theory-/research-based nursing intervention models for adults/elders with chronic health conditions. Students implement/evaluate intervention models in an advanced practice role with chronically ill adults/elders.

**Nurs 8315. Advanced Practice Nursing for Adults.** (4-5 cr [max 5 cr]; A-F only. Prereq—5222, 5800, 8100, 8140, 8170, #) Development of clinical expertise in provision of advanced nursing care to adults with acute health problems needing restorative care. Students utilize theory/research to manage/evaluate acute health problems in a selected adult specialty area.

**Nurs 8316. Implementing Advanced Practice Roles in Adult Nursing.** (4 cr; A-F only. Prereq—5222, 5800, 8100, 8140, 8170, 8314, 8315) Clinical nurse specialist roles of case management, teaching, consultation, and collaboration. Students use theory/research to provide advanced nursing care to adults within context of selected specialty area.

**Nurs 8320. Multidisciplinary Seminar on Social Perspectives of Aging.** (3 cr) 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.** (4-6 cr [max 6 cr]; A-F only. Prereq—Grad student in nursing, #) Functional patterns of health. 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 elderly.

**Nurs 8322. Primary Health Care for Elders.** (3-6 cr [max 6 cr]; A-F only. Prereq—8321, #) Data-based primary care management of common acute/chronic conditions of elderly. Physiological, psychosocial, and pharmacological interventions. Age-related, cultural, family, and community variations. Implementation, evaluation of interventions.

**Nurs 8323. Advanced Nursing Care of the Elderly (II): For Nurse Practitioners.** (5-6 cr [max 6 cr]; A-F only. Prereq—8322, 8xxx advanced gerontological nurs course, grad nurs major, #) 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; A-F only. Prereq—Grad nurs major, #) 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. Prereq—Master's student, adviser and DGS consent)

**Nurs 8340. Advanced Practice Psychiatric/Mental Health Nursing with Individuals and Their Families.** (7 cr. Prereq—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. Prereq–5340, 8340, ¶18240, ¶18242)

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 [max 6 cr]. Prereq–Grad nurs major, #)

Independent study or faculty seminar on special clinical topic when interest exists.

**Nurs 8361. Special Topics in Nursing.** (1-4 cr [max 4 cr]. Prereq–Grad nurs major, #)

Students select and study a topic of interest.

**Nurs 8402. Primary Care: Assessment and Management of Health for Advanced Practice Nurses.** (2-4 cr [max 4 cr]; A-F only. Prereq–5200, 5222, 5224, 8242)

Data-based assessment/management of preventive health services and common acute/chronic conditions of primary care populations. Emphasizes clinical reasoning and independent/collaborative practice health care plans.

**Nurs 8403. Primary Care Practice for Family Nurse Practitioners: Assessment and Management of Health.** (4 cr; S-N only. Prereq–5200, 5222, 8402)

Application of advanced practice comprehensive health histories and physical assessments in formulating client centered databases. Development/implementation of care plans. Follow-up evaluation of primary care delivered to families across life span.

**Nurs 8404. Family Practice Practicum I.** (2 cr; A-F only. Prereq–5200, 5222, 5224, 8402, 8601)

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 [max 4 cr]; A-F only. Prereq–5200, 5222, 5224, 8402, 8601)

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; A-F only. Prereq–#)

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; A-F only. Prereq–5200, 5222, 5224, 8242, 8402)

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. Prereq–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. Prereq–Doctoral student, adviser and DGS consent)

**Nurs 8450. Primary Care: Health Assessment and Care of Well Children.** (3 cr. Prereq–5200, 5222, ¶18451)

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.** (2-3 cr [max 3 cr]; A-F only. Prereq–5200, ¶18450, #)

Focus on age-specific, family-centered nursing assessments/interventions to promote wellness of children, infants through adolescence. Emphasizes compiling/evaluating interventions for children/families. Practicum includes exposure to models of primary prevention.

**Nurs 8452. Primary Care: Common Acute Health Conditions Affecting Children.** (2 cr. Prereq–8501, 8451, ¶18453, #)

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. Prereq–8411, 8442, ¶18452, #)

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. Prereq–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. Prereq–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. Prereq–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. Prereq–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 8459. Advanced Nursing Care of Children With Acute Illness for Pediatric Clinical Nurse Specialists.**

(2 cr. Prereq–Nursing grad student admitted to pediatric clinical nurse specialist area of study or #)

Synthesis/application of theory/research to effectively implement pediatric clinical nurse specialist role. Focuses on comprehensive care management across settings, evaluation of care, role implementation, and contextual factors affecting health care for children with special health needs and families.

**Nurs 8500. Reproductive Health Care for Women Practicum for the Family Nurse Practitioner.** (2 cr; S-N only. Prereq–Concurrent registration with Nurs 8501, 8405)

Synthesis/utilization of nursing knowledge/research in clinical decision making process related to women's reproductive/sexual health throughout life cycle. Evaluation of patient outcomes using nursing standards/criteria.

**Nurs 8501. Reproductive Health Care for Women.** (3-8 cr [max 8 cr]. Prereq–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 [max 6 cr]. Prereq–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 [max 10 cr]; A-F only. Prereq–8501, #)

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 8504. Nurse Midwifery and Women's Health Care Nurse Practitioner Primary Care Practicum.** (2-3 cr; S-N only. Prereq–5200, 5222, 8402)

Application of advanced practice comprehensive health histories and physical assessments in formulating client centered databases. Development/implementation of care plans. Follow-up evaluation of primary care delivered to adult populations. Focuses on women.

**Nurs 8520. Advanced Concepts in Women's Health for the Nurse Practitioner.** (3-8 cr [max 8 cr]; A-F only. Prereq–8501, #)

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. Prereq–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. Prereq–8040)

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; S-N only. Prereq–8242, 8601)

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; S-N only. Prereq—8100, 8170, 8241, 8242, 8600) 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]. Prereq—Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

**Nurs 8701. Nursing and Health-Care Systems Administration I.** (4 cr; A-F only. Prereq—#) 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; A-F only. Prereq—8701, #) 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 Learning Process in Nursing.** (3 cr. Prereq—[5204, 8100, 8140, a course in learning theory] or #) Critiquing theories of teaching/learning. Developing a theoretical/conceptual model for teaching. Testing models/methods in simulated situations.

**Nurs 8721. The Nurse Educator in Higher Education.** (4 cr. Prereq—[8241, 8242, 8720, educational measurement course, grad nursing major] or #) Teaching practicum: comprehensive implementation/evaluation of effectiveness of personal teaching models in classroom/clinical settings in an academic environment. Roles/responsibilities of faculty. Issues affecting curriculum design/development.

**Nurs 8777. Thesis Credits: Master's.** (1-18 cr [max 50 cr]. Prereq—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. Prereq—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 Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—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 5621. Nutrition and Metabolism.** (4 cr. Prereq—BioC 3021, Phsl 3051, FSCN 4612) Carbohydrate, lipid, and protein metabolism. Uses “systems” or “holistic” approach to emphasize how metabolic pathways interrelate.

**Nutr 8333. FTE: Master's.** (1 cr. Prereq—Master's student, adviser and DGS consent)

**Nutr 8444. FTE: Doctoral.** (1 cr. Prereq—Doctoral student, adviser and DGS consent)

**Nutr 8610. Nutrition Graduate Seminar.** (1 cr; S-N only. Prereq—Nutr grad student, #) Presentation of thesis (M.S. or Ph.D.) or plan B project work in public seminar.

**Nutr 8613. Advances in Nutrition: Lipoproteins, Cholesterol, and Atherosclerosis.** (2 cr. Prereq—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. Prereq—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. Prereq—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. Prereq—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; A-F only. \$PubH 8162. Prereq—[[BioC 3001, BioC 3021, BioC 4331] or equiv], [Chem 2302 or equiv]) Fundamental background in chemical carcinogenesis, carcinogen activation/detoxification, carcinogen-DNA adduct formation, cellular oncogenesis, cancer chemoprevention, nutrition/cancer. Topics integrated/interrelated.

**Nutr 8618. Neuroregulation of Energy Metabolism.** (2 cr; A-F only. Prereq—[FScN 5621, FScN 5623] or #) Advanced topics on neural regulation of food intake and energy expenditure. Neurotransmitters, including NPY, opioids, urocortin, melanocortins, oxytocin, and vasopressin. Genetics of obesity. Behavioral aspects of feeding. Energy balance. Macronutrient specific appetite. Energy expenditure. Uncoupling proteins. Vagal feeding regulation. Drug therapy for obesity. Eating disorders. Students read/discuss key research papers.

**Nutr 8620. Advances in Nutrition.** (2-3 cr [max 6 cr]. Prereq—#) Recent research or special topics (e.g., obesity, vitamin biochemistry, nutrition education).

**Nutr 8621. Presentation Skills.** (1 cr; 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]. Prereq—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]. Prereq—#) Written report for master's plan B project.

**Nutr 8777. Thesis Credits: Master's.** (1-18 cr [max 50 cr]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**Nutr 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—Max 18 cr per semester or summer; 24 cr required)

**Nutr 8900. Advances in Nutrition: Advanced Lifestyle Nutrition.** (2 cr. Prereq—\$: PubH 8900; Nutr grad major or Pub hith 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. Prereq—Master's student, adviser and DGS consent)

**OT 8777. Thesis Credits: Master's.** (1-18 cr [max 50 cr]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

## Operations and Management Sciences (OMS)

*Department of Operations and Management  
Curtis L. Carlson School of Management*

**OMS 5170. Simulation Modeling and Analysis.** (4 cr; A-F only. Prereq—MBA 6120 or BA 1550 or #) 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 [max 4 cr]; A-F only. Prereq—MBA 6120 or equiv or business admin PhD student or #; offered alt yrs) 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 [max 4 cr]; A-F only. Prereq—MBA 6120 or equiv, business admin PhD student or #; offered alt yrs) Regression and correlation models, inferences in simple and multiple regression, multicollinearity, indicator variables, variable selection techniques, treatment of assumption violations, applications to management problems, basic concepts of experimental design.

**OMS 8661. Linear Programming.** (3 cr [max 4 cr]; A-F only. Prereq—Business admin PhD student or #) Revised simplex, primal-dual, and large-scale methods, including decomposition and partitioning and methods for bounded variables.

**OMS 8671. Simulation Analysis.** (3 cr [max 4 cr]; A-F only. Prereq—\$: SCIC 8031; Business admin PhD student or #; offered alt yrs) 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 [max 4 cr]; A-F only. Prereq—Business admin PhD student or #; offered alt yrs) 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 [max 4 cr]; A-F only. Prereq—8672, business admin PhD student or #) 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 [max 4 cr]; A-F only. Prereq—Business admin PhD student or #; offered alt yrs) 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 [max 4 cr]; A-F only. Prereq—Business admin PhD student or #; offered alt yrs)

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 [max 4 cr]; A-F only. Prereq—Business admin PhD student or #; offered alt yrs)

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 [max 4 cr]; A-F only. Prereq—Business admin PhD student or #; offered alt yrs)

Research literature, methods, and results. Research on quality strategy, economics of quality, statistical process control, vendor management, off-line quality, and quality practice.

**OMS 8800. Research Topics in Operations and Management Science.** (2-4 cr [max 16 cr]; A-F only. Prereq—Business admin Ph.D. student or #)

Topics selected from new areas of research. Research methods, issues in operations/management science.

**OMS 8892. Readings in Operations and Management Science.** (1-8 cr [max 16 cr]. Prereq—Business admin PhD 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]. Prereq—Business admin PhD 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 8021. Oral Microbiology.** (2 cr. Prereq—Dental specialist or oral research trainee or #)

Role of indigenous human oral microflora in health/disease. Colonization of oral cavity. Role of specific pathogens in development of dental caries and periodontal diseases. Infections of dental pulp and periapical tissues. Oral manifestations of viral/fungal infections. Microbial considerations in specialty areas of dental practice.

**OBio 8022. Oral Neuroscience.** (2 cr. Prereq—Dental specialist or oral research trainee or #)

Background lectures and student presentations on current research topics to evaluate questions in general motor/sensory function related to oral/nasal structures. Taste, smell, and other chemical senses as they relate to those structures.

**OBio 8023. Physical Biology of the Oral Cavity.** (2 cr; A-F only. Prereq—Dental specialist or oral research trainee or #)

Structure/function of load-bearing components of human masticatory system from biophysical point of view. Mandibular form/movement. Infrastructure of hard tissues as related to occlusal wear and masticatory efficiency. Role of saliva and salivary pellicle in reduction of interocclusal friction. Computer simulation of jaw mechanics.

**OBio 8024. Genetics and Human Disease.** (1 cr. Prereq—Dental specialist or oral research trainee or #)

Principles of medical genetics. Emphasizes 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; A-F only. Prereq—Dental specialist or oral research trainee or #)

Lectures, assigned readings, and discussions of basic epidemiological, biological, and chemical aspects of dental caries. Etiology, epidemiology, and pathogenesis of dental caries. Influence of dietary, salivary, plaque, and microbial factors on caries process.

**OBio 8026. Salivary Glands and Secretions.** (2 cr; A-F only. Prereq—Dental specialist or oral research trainee or #)

Salivary gland structure/development. Mechanisms/control of macromolecule/electrolyte secretion. Salivary protein structure/function, interactions with bacteria. Salivary pellicle, salivary gland disease. Clinical studies, readings, student presentations. Each student develops a research proposal.

**OBio 8027. Structural and Biological Aspects of Dental Biomaterials.** (1 cr. Prereq—Dental specialist or oral research trainee or #)

Relates composition/structure of dental biomaterials to their behavior in a biological environment. Cause/mechanism of such effects. Materials that have beneficial effects. Dental implantology, guided tissue regeneration.

**OBio 8028. Molecular Basis of Cellular and Microbial Adhesion.** (2 cr; A-F only. Prereq—Dental specialist or oral research trainee or #)

Biochemical basis of adhesion phenomena. Cells of immune system, development of organs, tissue formation, bacterial colonization of the human.

**OBio 8030. Oral Biology Seminar.** (1 cr [max 10 cr]; S-N only. Prereq—Dental specialist or oral research trainee or #)

Faculty and student discussion of current topics in oral biology.

**OBio 8093. Tutorial in Oral Biology.** (1-2 cr [max 2 cr]. Prereq—#)

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 [max 10 cr]; S-N only. Prereq—#)

**OBio 8333. FTE: Master's.** (1 cr. Prereq—Master's student, adviser and DGS consent)

**OBio 8371. Mucosal Immunobiology.** (3 cr; A-F only. §CMB 8371, MICa 8371. Prereq—MICa 8001 or equiv or #)

Host immune processes at body surfaces. Innate/adaptive immunity at mucosal surfaces. Interactions/responses of various mucosal tissues to pathogens. Approaches to target protective vaccination to mucosal tissues. Lectures, journal.

**OBio 8444. FTE: Doctoral.** (1 cr. Prereq—Doctoral student, adviser and DGS consent)

**OBio 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq—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]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**OBio 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—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; A-F only. Prereq—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; A-F only. Prereq—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 24 cr]; A-F only. Prereq—#)

Directed readings and preparation of reports on selected topics.

**Otol 8230. Clinical Otorhinolaryngology.** (4 cr; A-F only. Prereq—Grad otol major)

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 practice and weekly special group conferences.

**Otol 8231. Surgery of the Ear, Nose, and Throat.** (3 cr; A-F only. Prereq—Grad otol major)

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 practice and weekly special group conferences.

**Otol 8232. Maxillofacial Surgery.** (1 cr; A-F only. Prereq—Grad otol major)

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; A-F only. Prereq—Otol major)

Otolaryngologic cosmetic surgery emphasizing rhinoplasty and otoplasty.

**Otol 8234. Anatomy of the Head and Neck and Temporal Bone Dissection.** (2 cr. Prereq—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 [max 12 cr]; A-F only. Prereq—Grad otol major)

Principles and procedures in roentgenology for otolaryngologic and head and neck problems.

**Otol 8236. Pharmacology in Otolaryngology.** (1 cr [max 12 cr]; A-F only. Prereq—Grad otol major)

Principles of pharmacology as they relate to otolaryngology.

**Otol 8237. Endoscopy.** (1 cr [max 12 cr]; A-F only. Prereq—Grad otol major)

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 [max 12 cr]; A-F only. Prereq—Grad otol major)  
Gross pathology and histopathology of diseases of the ear, nose, throat, and related regions.

**Otol 8239. Otoneurology.** (1-2 cr [max 12 cr]. Prereq—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 [max 12 cr]; A-F only. Prereq—Grad otol major)

Concepts and management of otolaryngologic allergy.

**Otol 8241. Cancer of the Head and Neck.** (1 cr [max 12 cr]; A-F only. Prereq—Grad otol major)

Clinical head and neck oncology; etiology, treatment (both surgical and nonsurgical), and other principles of management.

**Otol 8242. Audiology and Speech Pathology.** (2 cr. Prereq—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; laryngeal speech; and speech disorders related to head and neck cancer.

**Otol 8243. Introduction to Research Methodology.** (1 cr. Prereq—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. Prereq—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. §NSc 8247. Prereq—#)

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 [max 2 cr]. §NSc 8248. Prereq—#)

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. Prereq—#)

Review of current research papers concerning cochlear anatomy and pathology.

**Otol 8250. Advanced Biochemistry of the Auditory System.** (1 cr. Prereq—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. Prereq—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. Prereq—Master's student, adviser and DGS consent)

**Otol 8444. FTE: Doctoral.** (1 cr. Prereq—Doctoral student, adviser and DGS consent)

**Otol 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq—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]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**Otol 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—Max 18 cr per semester or summer; 24 cr required)

## Pharmaceutics (Phm)

### Department of Pharmaceutics

#### College of Pharmacy

**Phm 500. New-Drug Development Process.** (1 cr)

New-drug development process in the U.S. pharmaceutical industry.

**Phm 8100. Seminar: Pharmaceutics.** (1 cr [max 4 cr]; S-N only. Prereq—Grad Phm major)

**Phm 8110. Readings in Pharmaceutics.** (1 cr [max 4 cr]; S-N only. Prereq—Grad Phm major)  
Current literature.

**Phm 8150. Pharmacokinetics Research Seminar.** (1 cr [max 12 cr]; S-N only. §Phar 6223. Prereq—Grad Phm major)  
Current concepts and literature review.

**Phm 8295. Research Problems in Pharmaceutics.** (1 cr [max 20 cr]; S-N only. Prereq—#)  
Experimental investigation of problems in pharmaceutics.

**Phm 8333. FTE: Master's.** (1 cr. Prereq—Master's student, adviser and DGS consent)

**Phm 8411. Stabilization of Pharmaceuticals.** (3 cr. Prereq—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; A-F only)  
Topics in kinetics of drug absorption, distribution, metabolism, and excretion.

**Phm 8441. Solid-State Properties of Drugs.** (2 cr; A-F only. Prereq—Physical chem survey course or #)  
Physical and physicochemical properties of drugs in solid state as related to drug delivery.

**Phm 8444. FTE: Doctoral.** (1 cr. Prereq—Doctoral student, adviser and DGS consent)

**Phm 8451. Industrial Pharmacy.** (2 cr)  
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; A-F only. Prereq—Physical chem survey course or #)

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; A-F only. Prereq—Survey courses in biochem, physical chem, cell biol, differential equations)

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 8481. Advanced Neuropharmaceutics.** (3 cr; A-F only. §CMB 8481, NSc 8481. Prereq—Survey courses in [biochemistry, cell biology] or #)  
Delivery of compounds to the central nervous system (CNS) to activate proteins in specific brain regions for therapeutic benefit. Pharmaceutical/pharmacological issues specific to direct drug delivery to CNS.

**Phm 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq—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]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**Phm 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—Max 18 cr per semester or summer; 24 cr required)

**Phm 8900. Spec Topics in Pharmaceutics.** (1-4 cr; A-F only)

## Pharmacology (Phcl)

### Department of Pharmacology

#### Medical School

**Phcl 5101. Pharmacology for Pharmacy Students.** (3 cr; A-F only. Prereq—2nd yr pharmacy student or #)  
Action/fate of drugs. Lectures, lab.

**Phcl 5102. Pharmacology for Pharmacy Students.** (2 cr; A-F only. Prereq—5101 or #)  
Action/fate of drugs.

**Phcl 5103. Pharmacology for Dental Students.** (3 cr. Prereq—enrolled dental student or #)  
Pharmacological principles/actions of drugs.

**Phcl 5109. Problems in Pharmacology.** (1-18 cr [max 18 cr]. Prereq—Upper div or grad student or #)  
Research projects and special problems by arrangement.

**Phcl 5110. Introduction to Pharmacology.** (2 cr; A-F only. Prereq—Grad student or #)  
Basic principles of Pharmacology. Focuses on molecular mechanisms of drug action.

**Phcl 5111. Pharmacogenomics.** (3 cr; A-F only. Prereq—Grad student or #)  
Human genetic variation, its implications. Functional genomics, pharmacogenomics, toxicogenomics, proteomics. Interactive, discussion-based course.

**Phcl 5210. Pharmacology.** (1 cr; A-F only. Prereq—Grad student or #)  
Principles of pharmacology. Meets with 6110.

**Phcl 5211. Pharmacology.** (2 cr; A-F only. Prereq—5210 or #)  
Continuation of 5210. Meets with 6111. Lectures on the major classes of drugs.

**Phcl 5212. Pharmacology.** (3 cr; A-F only. Prereq—5211 or #)  
Continuation of 5211. Meets with 6112

**Phcl 5462. Neuroscience Principles of Drug Abuse.** (2 cr. §NSc 5462. Prereq—#)  
Current research on drugs of abuse, their mechanisms of action, characteristics shared by various agents, and neural systems affected by them. Offered biennially, spring semester of even-numbered years.

**Phcl 8110. Advanced Pharmacology I.** (3 cr; A-F only. Prereq—Biochem and physiology background, 6110 or ¶6111 or #)  
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; A-F only. Prereq—Biochem and physiology background, 6111 or ¶6112 or #)  
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]. Prereq—6112 or #)  
Student-presented seminars.

**Phcl 8207. Seminar: Psychopharmacology.** (1 cr. §NSc 8207, PSY 8070. Prereq—#)

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 8208. Neuropsychopharmacology.** (3 cr; A-F only. Prereq—[5212, 6112, Psy 5021, Psy 5061] or #)

Methodologies to study relationships between drugs and biochemical, behavioral, and neurophysiological consequences. Functional biogenic amine, peptidergic, other pathways. How manipulations alter neuronal function or behavior. Feedback mechanisms, induction, inhibition. Reinforcement of, tolerance to, or dependence on drugs of abuse: stimulants, hallucinogens, depressants, opiates. Student presentations. Offered alternate years.

**Phcl 8217. Problems in Investigative Pharmacology.** (1 cr; 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 8221. Neurobiology of Pain and Analgesia.** (2 cr. Prereq—#)

Course offered triennially.

**Phcl 8333. FTE: Master's.** (1 cr. Prereq—Master's student, adviser and DGS consent)

**Phcl 8444. FTE: Doctoral.** (1 cr. Prereq—Doctoral student, adviser and DGS consent)

**Phcl 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq—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]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**Phcl 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—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. Prereq—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. Prereq—5201 or #)  
Elements of set theory, including the concepts of enumerability and nonenumerability. Turing machines and recursive functions; the results of Church, Gödel, and Tarski and the philosophical significance of those results.

**Phil 5211. Modal Logic.** (3 cr. Prereq—5201 or #)  
Axiomatic and semantic treatment of propositional and predicate modal logics; problems of interpreting modal languages.

**Phil 5221. Philosophy of Logic.** (3 cr. Prereq—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. Prereq—College level logic or mathematics course or #)

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, Gödel, Quine.

**Phil 5323. Education and Social Change.** (4 cr; A-F only. §Phil 4325)

Connections between education, social change. Theories of democratic/popular education, their application through in-depth practicum in community education setting.

**Phil 5324. Ethics and Education.** (3 cr. §Phil 4324. Prereq—6 cr in [philosophy or education] or #)

What constitutes good education in terms of educational outcomes and of processes that promote learning. Connections between concepts of good education and of good society.

**Phil 5325. Biomedical Ethics.** (3 cr. Prereq—Grad or #)

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 5326. Lives Worth Living: Questions of Self, Vocation, and Community.** (4 cr. §Phil 4326. Prereq—#)

Immersion experience. Students live together as a residential community of learners. Works of philosophy, history, and literature form backdrop for exploring such questions as How is identity constructed? What is vocation? What experiences of community are desirable in a life? Each student creates a life-hypothesis for a life worth living.

**Phil 5415. Philosophy of Law.** (3 cr. Prereq—1003 or 1004 or 3302 or social science major or #)

Analytical accounts of law and legal obligation.

**Phil 5601. History of the Philosophy of Science.** (3 cr. Prereq—#)

History 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 5602. Scientific Representation and Explanation.** (3 cr. Prereq—#)

Contemporary issues concerning representation and explanation of scientific facts.

**Phil 5603. Scientific Inquiry.** (3 cr. Prereq—#)

Philosophical theories of methods for evaluating scientific hypotheses, of role of experimentation in science, and of how hypotheses come to be accepted within a scientific community.

**Phil 5605. Space and Time.** (3 cr. §Phil 4605. Prereq—Courses in [philosophy or physics] or #)

Philosophical problems concerning nature/structure of space, time, and space-time.

**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 5611. Philosophy of the Social Sciences.** (3 cr. §Phil 4611. Prereq—[9 cr of [philosophy or social science], grad student] or #)

Criteria for describing/explaining human actions. Problems of objectivity, reduction, freedom.

**Phil 5622. Philosophy and Feminist Theory.** (3 cr. §Phil 4622, WoSt 4122, WoSt 5122. Prereq—8 crs in [philosophy or women's studies] or #)

Encounters between philosophy/feminism. Gender's influence in traditional philosophical problems/methods. Social role of the theorist/theorizing as they relate to politics of feminism.

**Phil 5760. Selected Topics in Philosophy.** (3 cr [max 9 cr].

Prereq—3xxx-5xxx course in phil or #)  
Philosophical problems of contemporary interest. Topics specified in *Class Schedule*.

**Phil 5993. Directed Studies.** (1-3 cr [max 6 cr]. Prereq—#, □)  
Guided individual reading or study.

**Phil 8010. Workshop in History of Philosophy.** (1 cr [max 4 cr]. Prereq—[4xxx hist of phil course, #])

Topics vary by offering.

**Phil 8080. Seminar: History of Ancient and Medieval Philosophy.** (3 cr [max 6 cr]. Prereq—#)

Topics vary by offering.

**Phil 8081. Seminar: History of Philosophy—Ancient Philosophers.** (3 cr)

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. Prereq—#)

Major developments in modern philosophic thought; methods and role of history of philosophy in discipline of philosophy.

**Phil 8090. Seminar: History of Modern Philosophy.** (3 cr [max 6 cr]. Prereq—#)

Topics vary by offering.

**Phil 8100. Workshop in Epistemology and Metaphysics.**

(1 cr [max 4 cr]. Prereq—[4xxx [epistemology or metaphysics] course, #])

Topics vary by offering.

**Phil 8110. Seminar: Metaphysics.** (3 cr [max 6 cr]. Prereq—4101 or #)

Topics vary by offering.

**Phil 8130. Seminar: Epistemology.** (3 cr [max 6 cr]. Prereq—4105 or #)

Problems in the theory of knowledge. Topics specified in *Class Schedule*.

**Phil 8131. Epistemology Survey.** (3 cr)

Survey, against background of traditional issues, of contemporary developments in theory of knowledge.

**Phil 8133. Feminist Theories of Knowledge.** (3 cr. §WoSt 8103)

Interdisciplinary seminar; feminist approaches to knowledge and 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.

**Phil 8180. Seminar: Philosophy of Language.** (3 cr [max 6 cr]. Prereq—4231 or #)

Topics vary by offering.

**Phil 8182. Formal Semantics of Natural Language.** (3 cr; A-F only. §Ling 8221. Prereq—Phil 5201 or #)

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 [max 4 cr]. Prereq—[4xxx logic or 4xxx phil of math], #)

Topics vary by offering.

**Phil 8210. Seminar: Logical Theory.** (3 cr [max 6 cr]. Prereq—[5201, 5205] or #)

Topics vary by offering.

**Phil 8220. Seminar: Philosophy of Mathematics.** (3 cr [max 6 cr]. Prereq—5202 or [4xxx or 5xxx] math course or #)

Topics such as significance of limitative metatheorems (Goedel, et al), assessment of major foundational programs (set theoretic, modern Hilbertian, constructivist), modal/structuralist alternatives to standard platonism.

**Phil 8300. Workshop in Moral and Political Philosophy.** (1 cr [max 4 cr]. Prereq—[4xxx moral phil or 4xxx pol phil] #)

Topics vary by offering.

**Phil 8310. Seminar: Moral Philosophy.** (3 cr [max 9 cr]. Prereq–4310 or 4320 or 4330 or #)  
Concepts/problems relating to ethical discourse.

**Phil 8320. Seminar on Medical Ethics.** (3 cr [max 6 cr]. Prereq–[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.

**Phil 8333. FTE: Master's.** (1 cr. Prereq–Master's student, adviser and DGS consent)

**Phil 8410. Seminar: Philosophy of Law.** (3 cr [max 6 cr]. Prereq–5415 or #)  
Primarily for law students and advanced political science, history, or sociology majors or minors.

**Phil 8420. Seminar: Political Philosophy.** (3 cr [max 6 cr]. Prereq–4321 or 4414 or #)  
Topics vary by offering.

**Phil 8444. FTE: Doctoral.** (1 cr. Prereq–Doctoral student, adviser and DGS consent)

**Phil 8500. Workshop in Aesthetics.** (1 cr [max 4 cr]. Prereq–[14xxx aesthetics course, #])  
Topics vary by offering.

**Phil 8510. Seminar: Aesthetics Studies.** (3 cr [max 6 cr])  
Topics vary by offering.

**Phil 8550. Seminar: Philosophy of Religion.** (3 cr [max 6 cr]. Prereq–4521 or #)  
Topics vary by offering.

**Phil 8600. Workshop in the Philosophy of Science.** (1 cr [max 4 cr]. Prereq–[14xxx phil of sci course, #])  
Topics vary by offering.

**Phil 8606. Seminar: Philosophy of Medicine and the Biomedical Sciences.** (3 cr)  
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: History of Modern Physical Sciences.** (3 cr [max 6 cr]. Prereq–#)  
Topics specified in *Class Schedule*.

**Phil 8620. Seminar: Philosophy of the Biological Sciences.** (3 cr [max 6 cr])  
Topics vary by offering.

**Phil 8640. Seminar: Philosophy of the Cognitive Sciences.** (3 cr [max 6 cr]. §CGSC 8000. Prereq–#)  
Philosophical framework for analyzing cognitive sciences. Recent developments in metaphysics/epistemology. Nature of scientific theories, methodologies of cognitive sciences, relations among cognitive sciences. Relation of cognitive science to epistemology and to various philosophical problems. Topics vary by offering.

**Phil 8660. Seminar: Social and Cultural Studies of Science.** (3 cr [max 6 cr]. §SST 8420)  
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]. Prereq–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

**Phil 8670. Seminar: Philosophy of Science.** (3 cr [max 6 cr]. Prereq–#)  
Topics vary by offering.

**Phil 8710. Seminar: Feminist Philosophy.** (3 cr [max 6 cr]. Prereq–4622 or 5622 or WoSt 4122 or WoSt 5122 or #)  
Topics vary by offering.

**Phil 8777. Thesis Credits: Master's.** (1–18 cr [max 50 cr]. Prereq–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**Phil 8888. Thesis Credit: Doctoral.** (1–24 cr [max 100 cr]. Prereq–Max 18 cr per semester or summer; 24 cr required)

**Phil 8993. Directed Study.** (1–3 cr [max 6 cr]. Prereq–#)

**Phil 8994. Directed Research.** (1–3 cr [max 6 cr]. Prereq–#)

## Physical Medicine and Rehabilitation (PMed)

### Department of Physical Medicine and Rehabilitation Medical School

**PMed 5121. Issues in Mental Health.** (1 cr; S-N only. Prereq–One course gen psych, one course abnorm psych)  
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.** (2 cr; A-F only. Prereq–OT student or #)  
Relates neuroanatomical/neurophysiological principles to neurological conditions commonly seen in occupational/physical therapy practice.

**PMed 5161. Theory of Physical Medicine and Rehabilitation Applied to Medical Sciences.** (2 cr; A-F only. Prereq–OT student or #)  
Diagnostic procedures. Medical, surgical, and rehabilitation management of patient problems in orthopedics, surgery, pediatrics, dermatology, medicine, cancer, and speech. Correlation to current practice. Presentation of patients.

**PMed 5182. Functional Neuroanatomy and Neurophysiology.** (4 cr; A-F only. Prereq–Registered occupational therapy student or #)  
Neuroanatomic structures as functional systems, basic neurophysiologic concepts. Emphasizes applications for understanding/treating physical dysfunctions.

**PMed 5214. Clinical Practice of Physical Therapy.** (1 cr; S-N only. Prereq–Registered PT student)  
Clinical visitation.

**PMed 5215. Clinical Practice of Physical Therapy I.** (1 cr [max 2 cr]; S-N only. Prereq–Regis PT student)  
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 5217. Clinical Practice of Physical Therapy III.** (1 cr; S-N only. Prereq–Registered 2nd-year PT student)  
Third of three-course sequence. Sensitivity to needs of patients, families, and health-care coworkers. Patient handling techniques, communication skills, awareness of cultural differences, psychological aspects of disability, use of community resources. Offered summer session.

**PMed 5223. Electrotherapy and Electrophysiological Testing.** (2 cr; A-F only. Prereq–Enrolled PT student)  
Theory and technique of movement analysis and treatment using electrophysiological testing and therapeutic devices.

**PMed 5231. Clinical Biomechanics.** (5 cr; A-F only. §PT 6231. Prereq–Registered PT student, intro calculus, intro physics)  
Forces/structures internal/external to body responsible for normal/abnormal human movement. Analysis techniques, independent assignments. Muscle function, palpation, posture. Gait of normal individuals, analysis to detect deviation from norm.

**PMed 5260. Professional Issues in Physical Therapy.** (3 cr; A-F only. Prereq–Enrolled PT student)  
Current professional issues, dilemmas, and trends in health care. Evaluation and treatment skills in physical therapy specialty areas.

**PMed 5284. Musculoskeletal II.** (4 cr; A-F only. Prereq–Enrolled PT student)  
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; A-F only. Prereq–Enrolled PT student)  
Assessment and rehabilitation of patients with neurological conditions (e.g., cerebral vascular disease traumatic brain injury, multiple sclerosis, Parkinson's disease, amyotrophic lateral sclerosis), and behavioral conditions. Preparation for adult assessment/treatment with neurological, general medical, and vascular disease. Students use etiologic knowledge to assess patients in clinic and establish treatment plans and goals.

**PMed 5288. Neurorehabilitation II.** (4 cr; A-F only. Prereq–Registered PT student)  
Pediatric assessment/rehabilitation for neurological, orthopedic, cardiac, prematurity, transplant, and behavioral conditions. Preparation for adult assessment/treatment with neurological, general medical, and vascular disease. Students use etiologic knowledge to assess patients in clinic and establish treatment plans and goals.

**PMed 5300. Concepts for Occupational Therapy Practice.** (4 cr; A-F only. Prereq–Enrolled OT student or #)  
Critical thinking, ethics, professional resources/organizations, patient-therapist relationship. Level I fieldwork experience.

**PMed 5313. Therapeutic Occupation.** (4 cr; A-F only. Prereq–Enrolled OT student or #)  
Occupational therapy philosophy, history, and frames of reference. Activity analysis applied to purposeful, therapeutic activities for individuals and groups.

**PMed 5341. Introduction: Evaluation and Intervention I.** (4 cr; A-F only. Prereq–5393 or #)  
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; A-F only. Prereq–5300, 5313 or #)  
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; A-F only. Prereq–5342 or #)  
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; A-F only. Prereq–5343 or #)  
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; A-F only. Prereq–5313 or #)  
Application of group/team dynamics in diverse professional settings.

**PMed 5370. Theory of Occupation.** (1 cr [max 2 cr]; A-F only. Prereq–Enrolled OT student or #)  
Occupational therapy frames of reference, role of activity, and historical development of profession.

**PMed 5375. Community Resources and Health-Care Issues.** (2 cr; A-F only. Prereq–[5300, 5342] or #)  
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; A-F only. Prereq–5313 or #)  
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; A-F only. Prereq–[5360, 5375, 5376] or #)  
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; A-F only. Prereq–[5375, 5376] or #)  
The well elderly, school therapy, work-related injuries/industrial rehabilitation. Fieldwork.

**PMed 5392. Research in Occupational Therapy.** (3 cr; A-F only. Prereq–5313 or #)  
Analysis of scientific literature, development of research proposals.

**PMed 5393. Functional Anatomy and Kinesiology.** (4 cr; A-F only. Prereq–Enrolled OT student or #)  
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; A-F only. Prereq–5341 or #)  
Analysis, design, and construction of orthotic devices.

**PMed 5395. Independent Study in Occupational Therapy.** (1-4 cr [max 16 cr]. Prereq–Enrolled OT student or #)

**PMed 8103. Physical Therapy Clinic.** (1-4 cr [max 4 cr]; A-F only. Prereq–Physical therapist)  
Adult and pediatric rehabilitation.

**PMed 8200. Physical Medicine and Rehabilitation Service.** (1-15 cr [max 15 cr]. Prereq–Enrolled in PMed residency training program)

**PMed 8207. Basic and Applied Psychiatry.** (1 cr. Prereq–Enrolled in PMed residency training program)

**PMed 8210. Research in Physical Medicine.** (1-15 cr [max 15 cr]. Prereq–Enrolled in PMed residency training program)

**PMed 8212. Electromyography.** (1-15 cr [max 15 cr]. Prereq–Enrolled in PMed residency training program)

**PMed 8214. Readings in Electromyography.** (1-3 cr [max 3 cr]. Prereq–Enrolled in PMed residency training program)

**PMed 8220. Seminar: Physical Medicine and Rehabilitation.** (1-15 cr [max 15 cr]. Prereq–Enrolled in PMed residency training program)

**PMed 8300. Research Seminar in Occupational Therapy.** (1 cr; S-N only. Prereq–5392 or #)  
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.** (1-6 cr [max 6 cr]; S-N only. Prereq–[5392, Plan B OT student] or #)  
Individual, concentrated study of a problem in occupational therapy. Completion of Plan B project.

**PMed 8320. Fieldwork Education in Occupational Therapy I.** (1-6 cr [max 6 cr]; S-N only. Prereq–Occupational therapy student or #)  
Supervised clinical practice in affiliated hospitals and community agencies. Students apply critical thinking through supervised application of theory/skills.

**PMed 8321. Fieldwork Education in Occupational Therapy II.** (1-6 cr [max 6 cr]; S-N only. Prereq–Occupational therapy student or #)  
Supervised clinical practice in affiliated hospitals and community agencies. Students apply critical thinking through supervised application of theory/skills.

**PMed 8322. Fieldwork Education in Occupational Therapy III: Optional.** (1-6 cr [max 6 cr]; S-N only. Prereq–Occupational therapy student or #)  
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/skills.

## Physical Therapy (PT)

### Department of Physical Medicine and Rehabilitation Medical School

**PT 8131. Research Seminar I.** (1 cr; A-F only. Prereq–Grad PT major)  
Scientific thinking in physical therapy. Preparation to execute research project or literature review. Analysis of current literature. Basic features of research design. Elements of evaluating treatment efficacy. Students interact with their research adviser and with research faculty in various specialties.

**PT 8132. Research Seminar in Physical Therapy II.** (1 cr; A-F only. Prereq–8131, Grad PT major)  
Scientific thinking in physical therapy. Preparation to execute research project or literature review. Analysis of current literature. Basic features of research design. Elements of evaluating treatment efficacy. Students interact with their research adviser and with research faculty in various specialties.

**PT 8193. Research Problems in Physical Therapy.** (1-7 cr [max 7 cr]; A-F only. Prereq–Grad PT major)  
Process of developing/completing a scholarly research project or literature review related to rehabilitation science. Type of research experience is determined by adviser.

**PT 8333. FTE: Master's.** (1 cr. Prereq–Master's student, adviser and DGS consent)

**PT 8777. Thesis Credits: Master's.** (1-18 cr [max 50 cr]. Prereq–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. Prereq–4101 or equiv or #)  
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. Prereq–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. Prereq–4001, 4002 or #)  
Classical mechanics: Lagrangian/Hamiltonian mechanics, orbital dynamics, rigid body motion, special relativity.

**Phys 5012. Classical Physics II.** (4 cr. Prereq–5011 or #)  
Classical electromagnetism: electrostatics, magnetostatics, Maxwell's equations, electromagnetic waves, radiation, interaction of charged particles with matter.

**Phys 5022. Relativity, Cosmology, and the Universe.** (4 cr. \$AST 5022. Prereq–2601 or #)  
Large-scale structure and history of universe. Introduction to Newtonian and relativistic world models. Physics of early universe. Cosmological tests. Formation of galaxies.

**Phys 5041. Analytical and Numerical Methods of Physics I.** (4 cr. Prereq–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. Prereq–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. Prereq–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 5081. Introduction to Biopolymer Physics.** (3 cr. \$PHYS 4911. Prereq–Working knowledge of [thermodynamics, statistical mechanics])  
Introduction to biological and soft condensed matter physics. Emphasizes physical ideas necessary to understand behavior of macromolecules and other biological materials.

**Phys 5201. Thermal and Statistical Physics.** (3 cr; A-F only. \$PHYS 4201. Prereq–2601 or equivalent)  
Principles of thermodynamics and statistical mechanics. Selected applications such as kinetic theory, transport theory, and phase transitions.

**Phys 5401. Physiological Physics.** (4 cr. Prereq–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. Prereq–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. Prereq–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. Prereq–5701 or #)  
Diamagnetism and paramagnetism; ferromagnetism and antiferromagnetism; optical phenomena; lasers; superconductivity; surface properties; ferroelectricity.

**Phys 5950. Colloquium Seminar.** (1 cr; S-N only. Prereq–[Grad student or advanced undergrad in physics])  
Colloquium of School of Physics and Astronomy.

**Phys 5980. Introduction to Research Seminar.** (1 cr [max 3 cr]; S-N only. Prereq–Grad or upper div phys major)  
Introduction to the research activities of the School of Physics and Astronomy.

**Phys 5993. Directed Studies.** (1-5 cr [max 15 cr]. Prereq–#)  
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]. Prereq–Jr)  
Problems, experimental or theoretical, of special interest to students. Written reports.

**Phys 8001. Advanced Quantum Mechanics.** (3 cr. Prereq–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. Prereq–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. Prereq–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. Prereq–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])  
Lectures and informal discussions of courses and curricula, techniques, and materials important in undergraduate physics instruction; relation to general problems of higher education.

**Phys 8161. Atomic and Molecular Structure.** (3 cr. Prereq–Level of mathematics associated with BS in physical sciences)  
Emphasizes interpretation of quantum numbers and selection rules in terms of symmetry. Experimental data summarized and compared with theoretical predictions.

**Phys 8200. Seminar: Cosmology and High Energy Astrophysics.** (1 cr [max 6 cr]; S-N only. Prereq–#)  
Current topics in cosmology and high energy astrophysics.

**Phys 8301. Symmetry and Its Application to Physical Problems.** (3 cr. Prereq–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. Prereq–Master's student, adviser and DGS consent)

**Phys 8444. FTE: Doctoral.** (1 cr. Prereq–Doctoral student, adviser and DGS consent)

**Phys 8500. Plan B Project.** (4 cr. Prereq–#; may be taken once to satisfy Plan B master's project requirement; no cr toward PhD)  
Project topic arranged between student and instructor. Written report required.

**Phys 8501. General Relativity and Cosmology I.** (3 cr. Prereq–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, Reissner-Nordstrom, and Kerr solutions.

**Phys 8502. General Relativity and Cosmology II.** (3 cr. Prereq–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]; S-N only)  
Current topics in space physics and plasma physics.

**Phys 8601. Plasma Physics I.** (3 cr. Prereq–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. Prereq–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. Prereq–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]. Prereq–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]. Prereq–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]; S-N only. Prereq–#)  
Current research.

**Phys 8701. Statistical Mechanics and Transport Theory I.** (3 cr. Prereq–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. Prereq–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. Prereq–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. Prereq–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]. Prereq–8712 or #)  
Sample research topics: magnetism, superconductivity, low temperature physics, superfluid helium.

**Phys 8777. Thesis Credits: Master's.** (1-18 cr [max 50 cr]. Prereq–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**Phys 8800. Seminar: Nuclear Physics.** (1 cr [max 6 cr]; S-N only)  
Current research topics.

**Phys 8801. Nuclear Physics I.** (3 cr. Prereq–5001 or concurrent reg in 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. Prereq–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]. Prereq–8802 or #)  
Research topics.

**Phys 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq–Max 18 cr per semester or summer; 24 cr required)

**Phys 8900. Seminar: Elementary Particle Physics.** (1 cr [max 6 cr]; S-N only)  
Elementary particle physics, high energy physics, particle astrophysics and cosmology.

**Phys 8901. Elementary Particle Physics I.** (3 cr. Prereq–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. Prereq–8901 or #)  
Deep inelastic scattering. Weak interactions of leptons. Semileptonic and nonleptonic weak processes with hadrons. 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 8911. Introduction to Supersymmetry.** (3 cr. Prereq–8011 or #)  
Motivation. Coleman-Mandula theorem. Supersymmetric Quantum Mechanics. 4D supersymmetry algebra and representations. Extended supersymmetry. N=1 superspace and superfields. Supersymmetric gauge theories. Chiral/vector multiplets. Non-renormalization theorems. Supersymmetry breaking. Supersymmetric Standard Model. Phenomenology. Nonperturbative supersymmetry. Supergravity.

**Phys 8950. Advanced Topics in Elementary Particle Physics.** (3 cr [max 9 cr]. Prereq–8902 or #)  
Research topics.

**Phys 8994. Research in Physics.** (1-12 cr [max 24 cr]. Prereq–#)  
Research under faculty direction.

## Physiology (Phsl)

### Department of Physiology Medical School

**Phsl 5061. Principles of Physiology for Biomedical Engineering.** (4 cr. Prereq–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]. Prereq–#)  
Independent lab research project in physiology, supervised by physiology faculty.

**Phsl 5095. Problems in Physiology.** (1-5 cr [max 20 cr]. Prereq–#)  
Individualized study in physiology. Students address selected problem through library or lab research, supervised by physiology faculty.



**Phsl 5101. Human Physiology.** (5 cr. Prereq—§: 6101; Grad student in biomedical sciences)  
Survey of human physiology. Muscle, cardiovascular, respiratory, gastrointestinal, renal physiology. Integrative, systems approach. Emphasizes normal function.

**Phsl 5115. Advanced Clinical Physiology I for Nurse Anesthetists.** (3 cr; A-F only. Prereq—#)  
Cellular mechanisms underlying systems physiology. Cellular physiology, physiology of excitable tissues, renal physiology, cardiovascular physiology.

**Phsl 5116. Advanced Clinical Physiology II for Nurse Anesthetists.** (3 cr; A-F only. Prereq—5115, #)  
Respiratory physiology, acid-base physiology, gastrointestinal physiology, metabolism, endocrinology, physiology of pregnancy and labor.

**Phsl 5201. Computational Neuroscience I: Membranes and Channels.** (3 cr. §NSc 5201. Prereq—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. Theoretical Neuroscience: Systems and Information Processing.** (3 cr. Prereq—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. §BioC 5444. Prereq—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. Prereq—#)  
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. Prereq—#)  
Fundamental concepts and advanced topics related to clinical/biomedical aspects of neuromuscular junction physiology. Lectures, laboratories, workshops, anatomical dissections. Intense, one week course.

**Phsl 5520. Advanced Pulmonary Mechanics: Physiology and Pathophysiology.** (2-3 cr. Prereq—#)  
Fundamental concepts and advanced topics related to mechanical aspects of pulmonary function (e.g., elastic recoil, airway resistance). Lectures, laboratories, demonstrations. Intense, one week course.

**Phsl 5530. Physiology of Drug Absorption, Distribution, and Elimination.** (1-2 cr [max 2 cr]. Prereq—Two semesters of calculus, #)  
Topics in pharmacokinetics. Non-compartmental calculations of clearance and volume of distribution. Compartmental modeling. Deconvolution approaches. Physiologically-based pharmacokinetic modeling. Course is designed around the pharmacokinetic program PKQuest.

**Phsl 5540. Advanced Exercise Medicine: Physiology and Bioenergetics.** (1-2 cr [max 2 cr]. Prereq—[Grad student or practicing health professional], #)  
Three-day intensive course. Physiology, bioenergetics, nutrition, and sports medicine. Focuses on application of principles to treatment of diseases and functional deficits. Lectures, demonstrations, hands-on experiences in an exercise medicine facility.

**Phsl 5701. Physiology Laboratory.** (1-2 cr [max 2 cr]; A-F only. Prereq—#)  
Experiments in physiology. Emphasizes quantitative aspects, including analysis of organ systems.

**Phsl 8216. Selected Topics in Autonomic and Neuroendocrine Regulation.** (1 cr; S-N only. §NSc 8216)  
Advanced seminar.

**Phsl 8222. Central Regulation of Autonomic Function.** (3 cr; A-F only. §NSc 8222. Prereq—NSc 5561 or #)  
Neural/hormonal sensory pathways affecting central autonomic nuclei involved in maintenance of homeostasis. Current research on physiological control systems at cellular, organ, and integrative levels. Offered fall of odd-numbered years.

**Phsl 8294. Research in Physiology.** (1-18 cr [max 18 cr]. Prereq—Grad cellular and integrative Phsl major, #)  
Directed laboratory research.

**Phsl 8310. Advanced Topics in Cellular Physiology.** (1 cr [max 4 cr]. Prereq—#)  
Discussion of primary research publications. Topics vary by semester.

**Phsl 8333. FTE: Master's.** (1 cr. Prereq—Master's student, adviser and DGS consent)

**Phsl 8444. FTE: Doctoral.** (1 cr. Prereq—Doctoral student, adviser and DGS consent)

**Phsl 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq—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]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**Phsl 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—Max 18 cr per semester or summer; 24 cr required)

## Plant Biological Sciences (PBS)

### College of Biological Sciences

**PBS 8081. Current Topics in Plant Biology: Molecular Biology-Physiology-Cell Biology.** (1 cr; S-N only)  
Background information and review of selected current literature. For first-year students in plant biological sciences and other biological science graduate programs.

**PBS 8082. Current Topics in Plant Biology: Structure-Evolution-Ecology.** (1 cr; S-N only)  
Background information and review of selected current literature. For first-year students in plant biological sciences and other biological science graduate programs.

**PBS 8123. Research Ethics in the Plant and Environmental Sciences.** (.5 cr; S-N only. Prereq—Grad student in [applied plant sciences or plant pathology or plant biological sciences or soil science])  
History/values relating to research/scholarship. Social responsibility/reporting misconduct. Authorship plagiarism. Peer review. Copyright/intellectual property. Conflicts of interest. Research data management. Fiscal responsibility/management. Environmental health/safety. Research involving humans/animals. Mentorship presentations by faculty and invited speakers. Meets first seven weeks of spring semester.

**PBS 8333. FTE: Master's.** (1 cr. Prereq—Master's student, adviser and DGS consent)

**PBS 8444. FTE: Doctoral.** (1 cr. Prereq—Doctoral student, adviser and DGS consent)

**PBS 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq—Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

**PBS 8777. Thesis Credits: Master's.** (1-18 cr [max 50 cr]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**PBS 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—Max 18 cr per semester or summer; 24 cr required)

**PBS 8900. Seminar.** (1-2 cr [max 4 cr]; S-N only)  
Current scientific research.

**PBS 8910. Journal Club.** (1 cr [max 4 cr]; S-N only)  
Critical evaluation of selected current literature.

**PBS 8993. Directed Studies.** (1-5 cr [max 15 cr]. Prereq—PBio grad student, #)

**PBS 8994. Research.** (1-5 cr [max 10 cr]. Prereq—PBio grad student, #)  
Independent research determined by student's interests, in consultation with faculty mentor.

## Plant Biology (PBio)

### Department of Plant Biology

### College of Biological Sciences

**PBIO 5109. Current Questions in Fungal Biology.** (2 cr; A-F only)  
Diversity of fungi and their interactions with other organisms. Pathogenic/mutualistic interactions with animals/plants. Use of fungal systems for drug discovery and understanding pathogenicity, signal transduction, morphogenesis, and evolution.

**PBIO 5301. Plant Genomics.** (3 cr. §PIPa 5301. Prereq—[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. Prereq—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 5416. Plant Morphology, Development, and Evolution.** (4 cr. Prereq—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 5514. Plant Molecular Biology.** (3 cr. Prereq—BioC 3021 or Biol 3021 or Biol 4003 or BioC 4332 or equiv)  
Survey topics in plant molecular biology. How advances in molecular/genomic biology are being used to better understand plant physiology and developmental biology. Uses of transgenic plants in research/biotechnology.

**PBIO 5516. Plant Cell Biology.** (3 cr. §PBio 4516W. Prereq—[Biol 2022 or Biol 3007 or Biol 3022], [Biol 3021 or BioC 3021 or Biol 4003])  
Structure, function, and dynamic properties of plant cellular components such as organelles, cytoskeleton, and cell wall. How cellular structures are assembled, how it contributes to cell growth/division. Cell fate/development. Responses to hormones and external signals.

**PBIO 5960. Special Topics.** (1-3 cr [max 6 cr]. Prereq—Biol 2022 or Biol 3002 or Biol 3007)  
In-depth treatment of specialized topics in plant biology.

## Plant Pathology (PIPa)

### Department of Plant Pathology

### College of Agricultural, Food and Environmental Sciences

**PIPa 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.

**PIPa 5090. Issues in Plant Pathology.** (1-4 cr [max 4 cr])  
See *Class Schedule* or department for current offerings.

**PIPa 5102. Epidemiology and Genetics of Host-Parasite Interactions.** (3 cr; A-F only. Prereq-[5201 or equiv], GCD 3022)

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.

**PIPa 5103. 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.

**PIPa 5201. Biology of Plant Diseases.** (4 cr. Prereq-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.

**PIPa 5202. Field Plant Pathology.** (2 cr)

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.

**PIPa 5203. Biology and Ecology of Fungi.** (3 cr. Prereq-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.

**PIPa 5204. Plant Disease Management.** (3 cr; A-F only. Prereq-3001 or 3002)

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.

**PIPa 5300. Current Topics in Molecular Plant Pathology.**

(1 cr [max 2 cr]. Prereq-[BioC 4125, course in [plant pathology or microbiology], course in genetics, [lab in [molecular biology, Biotechnology] or equivalent]] or #)

Interactive class. Students read, discuss, and critique publications in molecular plant pathology. Each week, students focus on one article and examine it from different dimensions (underlying principles, experimental strategies, data analysis, impact on the broader discipline).

**PIPa 5301. Plant Genomics.** (3 cr. \$PBio 5301. Prereq-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.

**PIPa 5302. Genomics of Plant-Associated Microbes.** (3 cr; A-F only. Prereq-[BioC 4125, course in [plant pathology or microbiology], course in genetics, [lab in [molecular biology, biotechnology] or equiv]] or #)

Genomics research for plant-associated microbes. Journal articles, discussions, case studies. Identification/characterization of genes in plant-microbe interactions. Analysis of plant pathogens, research methodologies. Linkage/gene/physical mapping, candidate genes, sequencing, gene silencing, knock-out, ESTs, microarrays, bioinformatics. Online training modules, field trips, guest lectures, individual/group projects.

**PIPa 5999. Special Workshop in Plant Pathology.** (1-4 cr [max 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.

**PIPa 8005. Supervised Classroom or Extension Teaching Experience.** (2 cr; S-N only. \$Agro 8005, BAE 8005, Hort 8005, Soil 8005. Prereq-#)

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.

**PIPa 8090. Advanced Procedures and Research in Plant Pathology.** (1-8 cr [max 8 cr])

Special assignment in lab and field problems in pathological research.

**PIPa 8101. Causal Organisms of Plant Disease.** (4 cr. Prereq-5201 or equiv)

Laboratory-based intensive examination of bacteria, viruses, and nematodes as causal agents of plant disease.

**PIPa 8102. Epidemiology and Genetics of Host-Parasite Interactions.** (3 cr [max 4 cr]; A-F only. Prereq-5201, GCD 3022)

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.

**PIPa 8103. Plant-Microbe Interactions.** (3 cr. Prereq-Intro course in biochem or plant physiology or equiv)

Genetics, physiology, and molecular biology of plant-microbe interactions. Communication between plants/microbes. Signal transduction, control of gene expression, symbiosis/parasitism, plant host response mechanisms, plant disease physiology.

**PIPa 8123. Research Ethics in Plant and Environmental Sciences.** (.5 cr; S-N only. \$ApSc 8123, Soil 8123. Prereq-Enrolled in a plant/environmental grad research prog)

History/values relating to research/scholarship. Social responsibility, reporting misconduct. Authorship. Plagiarism. Peer review. Copyright, intellectual property. Conflicts of interest. Research data management. Fiscal responsibility/management. Environmental health/safety. Research involving humans/animals. Mentorship. Presentations by faculty, invited speakers. Meets during first seven weeks of spring semester.

**PIPa 8200. Seminar.** (1-2 cr [max 2 cr]; A-F only)

Critical review and presentation of current problems and progress in plant pathology.

**PIPa 8302. Genomics of Plant-associated Microbes.** (3 cr; A-F only. Prereq-[BioC 4125, course in [plant pathology or microbiology], course in genetics, [lab in molecular biology/biotechnology or equiv]] or #)

Identification/characterization of genes involved in plant-microbe interactions. Genome analysis of plant pathogens. Innovative research methodologies. Linkage/gene/physical mapping. Identification of candidate genes. Genome sequencing, gene silencing, knock-out, ESTs/microarrays, bioinformatics. Online training modules. Field trips. Guest lectures. Individual/group projects. Journal articles, case studies.

**PIPa 8333. FTE: Master's.** (1 cr. Prereq-Master's student, adviser and DGS consent)

**PIPa 8444. FTE: Doctoral.** (1 cr. Prereq-Doctoral student, adviser and DGS consent)

**PIPa 8500. Perspectives in Plant Pathology.** (2 cr [max 4 cr]; S-N only)

Integrative overview of the field. For Ph.D. students nearing end of formal classroom experience.

**PIPa 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq-Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

**PIPa 8777. Thesis Credits: Master's.** (1-18 cr [max 50 cr]. Prereq-Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**PIPa 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq-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 [max 3 cr])

Topics specified in *Class Schedule*.

**Plsh 5993. Directed Readings.** (1-3 cr [max 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 [max 9 cr]; A-F only. \$Pol 4210. Prereq-[3210, grad student])

**Pol 5251. Greeks, Romans, and Christians: Ancient and Medieval Political Thought.** (4 cr. Prereq-\$: 3251)

Politics/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. Prereq-\$: 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. \$Pol 4253. Prereq-\$: 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 cr. Prereq-\$: 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. Prereq-\$: 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. \$Pol 4303. Prereq-Grad student 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 cr. \$Pol 4306. Prereq—Grad student 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 cr. \$Pol 4308. Prereq—Grad student 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. Prereq—\$: 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. Prereq—Grad student or #) See *Class Schedule* for description.
- Pol 5315. State Governments: Laboratories of Democracy.** (4 cr. \$Pol 4315W. Prereq—Grad student 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. Prereq—\$: 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. Prereq—\$: 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. Prereq—\$: 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. Prereq—\$: 4410; grad student) Topics of current analytical or policy importance. Topics vary, see *Class Schedule*.
- Pol 5441. Environmental Policy.** (3 cr. \$Pol 3441. Prereq—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 5461. European Government and Politics.** (4 cr. \$Pol 4461W. Prereq—Grad student or #) European political institutions in their social settings. Power and responsibility. Governmental stability. Political decision making. Government and economic order.
- Pol 5473. Chinese Politics.** (3 cr. Prereq—\$: 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.** (4 cr. Prereq—\$: 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.** (4 cr. \$Afro 4478, Afro 5478, Pol 4478. Prereq—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. \$LAS 4479, Pol 4479. Prereq—Grad student or #) Overview of Latin American politics and political economy. Authoritarianism, human rights, redemocratization. Development and economic policy. Social movements. Ethnicity/race. Religion. Revolution. U.S.-Latin American relations.
- Pol 5481. Governments and Markets.** (3-4 cr; S-N only. Prereq—\$: 4481; 1054 or 3051 or non-pol sci grad student or #) Connection between democracy and markets. Focuses on countries in North America, Europe.
- Pol 5485. Human Rights and Democracy in the World.** (3 cr. \$Pol 4485. Prereq—Grad student or #) History of ideas about human rights and democracy. Economic, political, psychological, and ideological explanations for repression.
- Pol 5487. Struggle for Democratization and Citizenship.** (4 cr. \$Pol 4487, Pol 4501. Prereq—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. Prereq—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 5502. Supreme Court, Civil Liberties, and Civil Rights.** (3 cr. Prereq—\$: 4502; 1001 or 1002 or equiv or non-pol sci grad student or #) Supreme Court's interpretation of Bill of Rights, 14th amendment. Freedom of speech, press, religion. Crime/punishment. Segregation/desegregation, affirmative action. Abortion/privacy.
- Pol 5525. Federal Indian Policy.** (3 cr; A-F only. Prereq—\$: 4525, Amln 4525; grad student) 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. \$Pol 4561. Prereq—Grad student or #) 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 cr. \$Pol 4737. Prereq—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. Prereq—\$: 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 cr. \$Pol 4767. Prereq—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]. Prereq—\$: 4810; grad student) Selected issues in contemporary international relations. Topics vary, see *Class Schedule*.
- Pol 5833. The United States in the Global Economy/US For Econ Policy.** (3-4 cr. Prereq—\$: 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 5872. Global Environmental Politics.** (3 cr. Prereq—\$: 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 cr. \$Pol 4881. Prereq—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. Prereq—\$: 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 cr. \$Pol 4885. Prereq—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; A-F only. Prereq—\$: 4887; grad student) Applications of game theory to international politics. Conflict/cooperation, global environmental commons, deterrence/reputation.
- Pol 5889. Governments and Global Trade and Money.** (3 cr. \$Pol 4889. Prereq—3835 or grad student or #) Politics of international trade and monetary affairs, including north-south and east-west relations.
- Pol 5970. Individual Reading and Research.** (1-4 cr [max 4 cr]. Prereq—#, □) Guided individual reading or study.
- Pol 8101. Introduction to Political Science.** (3 cr [max 4 cr]; A-F only. Prereq—Grad pol sci major or #) 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]; S-N only. Prereq—Pol student, ABD status) Research ethics. Completion of dissertation prospecti or early dissertation chapters.
- Pol 8105. Professional Development II.** (1 cr [max 2 cr]; S-N only. Prereq—Pol student, ABD status) Research ethics. Skills for teaching undergraduate courses in political science. Completion of dissertation prospecti or early chapters.

**Pol 8120. Core Course in Political Methodology: Modeling Political Processes.** (3 cr. Prereq—Pol sci grad major or #)  
Methods used and potential for creating models of political processes. Designing political institutions, discerning/forecasting election outcomes, producing early warnings of international conflicts, increasing turnout in elections. Using mathematics to study political strategy and collective decision making in committees/legislatures. Using statistics to measure political variables, design experiments with human subjects, and test micro/macro political theories.

**Pol 8122. Positive Theory.** (3 cr. Prereq—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; A-F only. Prereq—Pol sci grad student or #)  
Principles of regression analysis, use of regression model in political science.

**Pol 8124. Game Theory.** (3 cr. Prereq—[8122, grad pol sci major] 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. Prereq—Pol sci grad student or #)  
Time series method, its application in political science.

**Pol 8126. Qualitative Methods.** (3 cr. Prereq—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. Prereq—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.** (1-3 cr [max 12 cr]. Prereq—Grad pol sci major or #)  
Seminars on selected topics.

**Pol 8201. Understanding Political Theory.** (3 cr [max 4 cr]. Prereq—Grad pol sci major or Δ)  
Key concepts and major approaches.

**Pol 8215. Philosophy of Political Inquiry.** (3 cr. Prereq—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. Prereq—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. Prereq—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. Prereq—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. Prereq—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. Prereq—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]. Prereq—Grad pol sci major or #)  
Readings and research in special topics or problems.

**Pol 8275. Contemporary Political Thought.** (3 cr. Prereq—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 [max 4 cr]. Prereq—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. Prereq—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. Prereq—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 and Social Movements.** (3 cr. Prereq—Grad pol sci major or #)  
Theoretical/empirical work on role of interest groups and social/political movements in American politics and policy-making processes. Theories of interest group and social/political movement formation, maintenance, and decline. How interest groups and social/political movements attempt to influence public policy. Impact/effectiveness groups/movements as agents of democratic representation, particularly for marginalized groups.

**Pol 8307. Proseminar in Political Psychology I.** (1 cr; S-N only. \$Psy 8211. Prereq—Grad pol sci major or pol psych minor or #)  
Readings, discussion, and guest speakers. Topics vary by semester.

**Pol 8308. Proseminar in Political Psychology II.** (1 cr; S-N only. \$Psy 8212. Prereq—Grad pol sci major or pol psych minor or #)  
Readings, discussion, and guest speakers. Topics vary by semester.

**Pol 8311. Political Psychology and Socialization.** (3 cr; A-F only. Prereq—Grad pol sci major or pol psych minor or #)  
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. Prereq—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. Prereq—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. Prereq—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 8320. Social Psychology of Prejudice and Intergroup Relations.** (3 cr; A-F only)  
Approaches, findings, and controversies in research on social psychology of prejudice, racial attitudes, and intergroup relations. Focuses on approaches based in social psychology and on related work from political science and sociology.

**Pol 8321. Urban Politics.** (3 cr; A-F only. Prereq—Grad pol sci major or #)  
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. Prereq—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. Prereq—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. Prereq—Master’s student, adviser and DGS consent)

**Pol 8335. Public Policy.** (3 cr. Prereq—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. Prereq—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]. Prereq—Grad pol sci major or #)  
Readings/research in special topics or problems.

**Pol 8401. International Relations.** (3 cr [max 4 cr]. Prereq—Grad pol sci major)  
Basic theories/approaches to study of international politics. Surveys representative work/central issues of scholarship.

**Pol 8402. Conflict Dynamics and Security.** (3 cr. Prereq—Grad pol sci major or #)  
Introduction to contending theories of international conflict and national security.

**Pol 8403. International Norms and Institutions.** (3 cr. Prereq–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. §CSDS 8404. Prereq–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; A-F only. Prereq–Grad pol sci major or #)  
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. Prereq–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. Prereq–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. Prereq–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. Prereq–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. Prereq–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. Prereq–Doctoral student, adviser and DGS consent)

**Pol 8460. Topics in International Relations.** (3 cr [max 6 cr]. Prereq–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. Prereq–Grad pol sci major)  
Main theoretical approaches and issues: comparative method, the state and class; political culture; development, democratization, rational choice, social movements.

**Pol 8602. Families, Children, and the State.** (3 cr; A-F only)  
Politics of family, sex, and children. Comparative perspective. Family autonomy vs. state authority. Political struggles over the definition of family, sex, and marriage. Crisis in fatherhood. Children's rights. Globalization of Western ideology of childhood. Political realities of third-world childhood. Theories of political efficacy in family/child advocacy.

**Pol 8603. European Government and Politics.** (3 cr; A-F only. Prereq–Grad pol sci major or #)  
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; A-F only. Prereq–Grad pol sci major or #)  
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; A-F only. Prereq–Grad pol sci major or #)  
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. Prereq–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. Prereq–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. Prereq–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. Prereq–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. Prereq–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; A-F only. Prereq–Grad pol sci major or #)  
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; A-F only. Prereq–Pol sci grad student or #)  
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.** (3 cr [max 9 cr]. Prereq–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]. Prereq–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]. Prereq–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**Pol 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq–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]. Prereq–16 cr 8xxx pol sci courses, #)

## Portuguese (Port)

### Department of Spanish and Portuguese Studies College of Liberal Arts

**Port 5520. Portuguese Literary and Cultural Studies.** (3 cr [max 9 cr])  
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])  
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]. Prereq–#)  
Origins/development of Lusophone Africa (Angola, Mozambique, Cape-Verde, Guinea-Bissau, S.,o 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])  
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])  
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])  
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]. Prereq–MA or PhD candidate, #, □)  
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]. Prereq-#, □)  
Graduate-level research in literatures and cultures of the Portuguese-speaking world. Topics vary.

**Port 8333. FTE: Master's.** (1 cr. Prereq-Master's student, adviser and DGS consent)

**Port 8777. Thesis Credits: Master's.** (1-18 cr [max 50 cr]. Prereq-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 5012. Learning and Cognition in Animals.** (4 cr. Prereq-3011 or 4011 or honors or grad student or #)  
Review/evaluation of key questions, methods, theories, and data about forms of learning and elementary cognitive processes. Emphasizes animal models. Implications for human learning/behavior.

**Psy 5014. Psychology of Human Learning and Memory.** (3 cr. Prereq-3011 or 3051 [except for honors/grad student])  
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. Prereq-3051 [except for honors/grad student])  
Human cognitive abilities (perception, memory, attention) from different perspectives (e.g., cognitive psychological approach, cognitive neuroscience approach).

**Psy 5018. Mathematical Models of Human Behavior.** (3 cr. Prereq-Math 1271 or #)  
Mathematical models of complex human behavior, including individual/group decision making, information processing, learning, perception, and overt action. Specific computational techniques drawn from decision theory, information theory, probability theory, machine learning, and elements of data analysis.

**Psy 5031. Perception.** (3 cr. §NSc 5031W. Prereq-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. §NSc 5034. Prereq-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. Prereq-[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 5037. Psychology of Hearing.** (3 cr. §NSc 5037. Prereq-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 5038. Introduction to Neural Networks.** (3 cr. Prereq-[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 5051. Psychology of Human-Machine Interaction.** (3 cr. Prereq-3031 or 3051 or #)  
Cognitive-science approach to human-machine interaction. Analysis of human errors, human-machine system evaluation, human-computer interaction, bionic interfaces, adaptive technology for visually impaired people.

**Psy 5054. Psychology of Language.** (3 cr. Prereq-3005W or honors or grad student)  
Theories/experimental evidence in past/present conceptions of psychology of language.

**Psy 5061. Neurobiology of Behavior.** (3 cr. §Psy 3061. Prereq-3005W 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. Prereq-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; A-F only. Prereq-3061 or 5061 or #)  
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. §Psy 3101. Prereq-§: 3101; 3005W, [honors or grad student])  
Theories and major issues/findings on personality functioning, personality structure, and personality assessment. Historically important and currently influential perspectives.

**Psy 5135. Psychology of Individual Differences.** (3 cr. §Psy 3135. Prereq-3005W or 5862 or equiv or #)  
Differential methods in study of human behavior. Psychological traits. Influence of age, sex, heredity, and environment in individual/group differences in ability, personality, interests, and social attitudes.

**Psy 5137. Introduction to Behavioral Genetics.** (3 cr. Prereq-3005W or equiv or #)  
Genetic methods for studying human/animal behavior. Emphasizes nature/origin of individual differences in behavior. Twin and adoption methods. Cytogenetics, molecular genetics, linkage/association studies.

**Psy 5138. Psychology of Aging.** (3 cr. Prereq-3005W or equiv)  
Theories/findings concerning age-related changes in mental health, personality, cognitive functioning, productivity are reviewed/interpreted within context of multiple biological, social, and psychological changes that accompany age.

**Psy 5202. Attitudes and Social Behavior.** (3 cr. Prereq-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; A-F only. Prereq-3201 or honors or grad student or #)  
Introduction to interpersonal relationship theory/research findings. Emphasizes conceptual/methodological issues.

**Psy 5205. Applied Social Psychology.** (3 cr. Prereq-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; A-F only. Prereq-3201 or grad student or #)  
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; A-F only. Prereq-3101 or 3201 or honors or grad student or #)  
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. Prereq-3005 or #)  
Survey of history, concepts, theories, methods, and findings of vocational/occupational health psychology. Burnout, vocationality, violence, stressors/stress-relations, counter productive behaviors, coping in workplace. Vocational development/assessment, career decision-making/counseling, person-environment fit.

**Psy 5604. Abnormal Psychology.** (3 cr. §Psy 3604. Prereq-honors or grad student or #)  
Comprehensive review of psychopathological disorders. Etiology, diagnostic criteria, clinical research findings.

**Psy 5606. Clinical Psychophysiology.** (3 cr. Prereq-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 5707. Personnel Psychology.** (4 cr. Prereq-[3005W or equiv], 3711) or #)  
Application of psychological research/theory to organizational staffing, evaluation, and training. Principles of individual differences and psychological measurement applied to decision making, staffing, and instruction in organizations. Job analysis, recruitment, screening, selection, performance appraisals, criterion measurement, organizational training, learning, aptitude treatment interactions.

**Psy 5708. Organizational Psychology.** (4 cr. §Psy 5702, Psy 5705. Prereq-[3005W or equiv], 3711) or #)  
Psychological causes of behavior in work organizations. Consequences for individual fulfillment and organizational effectiveness. Individual differences, social perception, motivation, stress, job design, leadership, job satisfaction, teamwork, organizational culture.

**Psy 5862. Psychological Measurement: Theory and Methods.** (3 cr. Prereq-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. §EPsy 8222. Prereq-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 [max 8 cr]. Prereq-1001, [jr or sr or grad student])  
Special course or seminar. Topics listed in psychology office.

**Psy 8004. Philosophical Psychology.** (2 cr; S-N only. Prereq-logic or phil course, psych, ICD, or phil PhD student, or #)  
Selected philosophical and methodological problems.

**Psy 8010. Advanced Topics in Learning.** (2 cr; S-N only. Prereq-5012 or #)  
Contemporary topics in learning and behavior theory.

- Psy 8020. Seminar in Conditioning and Learning.** (2 cr; S-N only. Prereq–5012 or grad psych major or #)  
Review and discussion of ongoing research and perspectives on future research.
- Psy 8026. Neuro-Immune Interactions.** (3 cr. §CMB 8361, NSc 8026. Prereq–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.** (2 cr [max 3 cr]. Prereq–5031 or #)  
Cognitive, psychological, neurophysiological determinants of visual perception. Current research.
- Psy 8036. Topics in Computational Vision.** (3 cr [max 12 cr]. Prereq–5031 or 5036 or equiv or #)  
Recent research in visual psychophysics, visual neuroscience, and computer vision.
- Psy 8037. Psychophysics and Audition.** (3 cr. Prereq–#)  
Modern/classical psychophysics. Psychophysical/physiological correlates of audition. Theories of hearing.
- Psy 8055. Seminar: Cognitive Neuroscience.** (1-4 cr [max 3 cr]. Prereq–5015 or #)  
Recent advances in analysis of neural bases of cognitive functions.
- Psy 8056. Seminar: Psychology of Language.** (3 cr; A-F only. Prereq–Grad psych major or #)  
Selected topics in psycholinguistics.
- Psy 8060. Seminar: Neural Substrates of Mental Processes.** (3 cr [max 12 cr]. Prereq–5012 or 5061 or 5062 or 5064 or NSci 5661 or 8010 or CPsy 8301 or NSci 8401 or #)  
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]. §NSc 8207, Phcl 8207. Prereq–#)  
Basic issues, contemporary research. Lectures, student presentations.
- Psy 8107. Personality, Culture, and Society.** (3 cr; A-F only. Prereq–[5101, 5604] or equiv or #)  
Methodological issues and status of current research in intersection of personality, social, and cultural psychology.
- Psy 8108. Theories of Personality and Intervention.** (3 cr)  
Historical perspective on relationship between theories of personality and formulations of etiology/course of types of psychopathology. Treatment techniques ensuing from different theoretical perspectives. Psychoanalytic thought, works of Carl Rogers, existentialism, Gestalt therapists.
- Psy 8111. Psychopathology I.** (4 cr; A-F only. Prereq–Psychology grad student or #)  
Descriptive psychopathology. Theory/research. Evaluation of current experimentation in various behavior disorders.
- Psy 8112. Psychopathology II.** (3 cr; A-F only. Prereq–[8111, psych grad student] or #)  
Descriptive psychopathology. Theory/research. Evaluation of current experimentation in various behavior disorders.
- Psy 8201. Social Cognition.** (3 cr; A-F only. Prereq–Psych PhD candidate)  
Theory and research in stereotyping, social inference, and person memory.
- Psy 8202. Close Relationships.** (3 cr; A-F only. Prereq–5204 or #)  
Recent theory and research.
- Psy 8203. Impression Management.** (3 cr. Prereq–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 8204. Social Psychology of Prejudice and Intergroup Relations.** (3 cr)  
Approaches, findings, and controversies in research on social psychology of prejudice, racial attitudes, and intergroup relations. Focuses on approaches based in social psychology and on related work from political science and sociology.
- Psy 8205. Proseminar: Research in Social Psychology.** (2 cr [max 8 cr]; S-N only. Prereq–Psych PhD student)  
Contemporary theoretical positions and related research.
- Psy 8206. Proseminar: Research in Social Psychology.** (2 cr [max 6 cr]; S-N only. Prereq–Psych PhD student, 8205)  
Contemporary theoretical positions and related research.
- Psy 8208. Social Psychology: The Self.** (3 cr; A-F only. Prereq–Psych background especially in personality and soc psych)  
Social psychological theory and research concerning the self and social behavior.
- Psy 8209. Research Methods in Social Psychology.** (3 cr; A-F only. Prereq–Grad psych major)  
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; S-N only. §Pol 8307. Prereq–Political Psychology grad minor)  
Readings, discussion, and guest speakers. Topics vary each semester.
- Psy 8212. Proseminar in Political Psychology II.** (1 cr; S-N only. §Pol 8308. Prereq–Political Psychology grad minor)  
Readings, discussion, and guest speakers. Topics vary each semester.
- Psy 8333. FTE: Master's.** (1 cr. Prereq–Master's student, adviser and DGS consent)
- Psy 8410. Perspectives in Learning, Perception, and Cognition.** (1 cr [max 12 cr])  
Lectures and discussions in cognitive sciences by local and visiting faculty.
- Psy 8444. FTE: Doctoral.** (1 cr. Prereq–Doctoral student, adviser and DGS consent)
- Psy 8501. Counseling Psychology: History and Theories.** (3 cr. Prereq–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. Prereq–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. Prereq–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 [max 6 cr]; S-N only. Prereq–Counseling psych grad student, 8501, 8502, 8503 or equiv, #)  
Beginning applied experiences in counseling psychology settings.
- Psy 8511. Counseling Psychology Beginning Practicum: General.** (1-6 cr [max 18 cr]; S-N only. Prereq–[[8501, 8502, 8503] or equiv], counseling psych grad student, or #)  
Beginning applied experiences in counseling psychology settings.
- Psy 8512. Counseling Psychology Beginning Practicum: General.** (1-6 cr [max 18 cr]; S-N only. Prereq–Counseling psych grad student, 8501, 8502, 8503 or equiv, #)  
Beginning applied experiences in counseling psychology settings.
- Psy 8514. University Counseling Practicum I.** (4-6 cr [max 6 cr]; S-N only. §EPsy 8513. Prereq–Counseling psych grad student, 8501, 8502, 8503 or equiv, #)  
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 [max 6 cr]; S-N only. §EPsy 8514. Prereq–Counseling psych grad student, 8501, 8502, 8503 or equiv, #)  
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.** (3 cr. Prereq–Counseling psych grad student or #)  
Theory, research, and practice of multiculturally competent counseling in diverse settings/communities. Emphasizes self-awareness, knowledge, and skills. Discussion, lecture, readings, lab, guest lectures.
- Psy 8542. Ethics in Psychology.** (3 cr; S-N only. Prereq–Counseling or clinical psych grad student or #)  
Ethical principles and codes of conduct for psychologists. Ethical dilemmas faced by researchers, practitioners, and teachers.
- Psy 8544. Vocational and Occupational Health Psychology Research.** (3 cr. Prereq–[[8501, 8502, 8503] or equiv], counseling psych grad student, #)  
Research problems specific to special populations, vocational research, assessment/testing, findings in these areas useful to counseling psychology practice.
- Psy 8545. Counseling Psychology Process and Outcome Research.** (3 cr. Prereq–[[8501, 8502, 8503] or equiv], counseling psych grad student, #)  
Introduction to methods/content domains. Research design, methodological issues, analogue research, process/outcome research.
- Psy 8550. Assessment: WAIS-III.** (3 cr. Prereq–Counseling psych grad student or #)  
Skills acquisition for administering, scoring, summarizing results of Wechsler Adult Intelligence Scale-III (WAIS-III).
- Psy 8554. Career and Occupational Health Psychology Assessment.** (3 cr. Prereq–Counseling psych grad student, or #)  
History of vocational interest inventories/measures related to career development, and of assessments used in occupational health psychology. Scale construction methodology. Research applications. Interpretation/use of instruments.
- Psy 8560. Counseling Psychology Advanced Practicum I: General.** (1-6 cr [max 6 cr]; S-N only. Prereq–[[[[8501, 8502, 8503] or equiv], [[8510, 8511] or [8514, 8515] or equiv]], counseling psych grad student] or #)  
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 [max 6 cr]; S-N only. Prereq–Counseling psych grad student, 8501-8502-8503 or equiv, 8510-8511 or 8514-8515 or equiv, or #)  
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 [max 6 cr]; S-N only. Prereq–Counseling psych grad student, 8501-8502-8503 or equiv, 8510-8511 or 8514-8515 or equiv, #)  
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 8565. Counseling Psychology Advanced Practicum I: Vocational Assessment Clinic.** (1-6 cr [max 6 cr]; S-N only. Prereq—[[8501, 8502, 8503] or equiv], [[8514, 8515] or equiv], counseling psych grad student) or #)

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 [max 6 cr]; S-N only. Prereq—8501, 8502, [8503 or equiv], 8514, [8515 or equiv], counseling psych grad student, or #)

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 [max 6 cr]; S-N only. Prereq—Counseling psych grad student, 8501, 8502, 8503 or equiv, 8514, 8515 or equiv, #)

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]; S-N only. Prereq—Counseling psych PhD candidate, #) First part of counseling psychology internship.

**Psy 8571. Counseling Psychology Internship II.** (1-12 cr [max 36 cr]; S-N only. Prereq—Counseling psych PhD candidate, #)

Second part of counseling psychology internship.

**Psy 8572. Counseling Psychology Internship III.** (1-12 cr [max 36 cr]; S-N only. Prereq—Counseling psych PhD candidate, #)

Third part of counseling psychology internship.

**Psy 8611. Assessment I.** (5 cr; A-F only. Prereq—Clinical psych grad student)

Theory and practice in clinical application of assessment techniques and interviewing. Lab: observations, administration, scoring, interpretation.

**Psy 8612. Assessment II.** (5 cr; A-F only. Prereq—8611, clinical psych grad student)

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]; S-N only. Prereq—#)

Field experience in professional work in clinical settings.

**Psy 8621. Clinical Intervention I.** (1-3 cr [max 3 cr]; A-F only. Prereq—Clinical psych grad student)

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; A-F only. Prereq—8111, CSPR grad student)

Methodological issues in treatment research, theories of change/motivation. Empirically supported therapies for anxiety, mood, and personality disorders, psychosis, and addiction. Simulating therapeutic interactions to prepare students to provide therapy.

**Psy 8640. Research Seminar.** (2 cr; S-N only. Prereq—Clinical psych grad student)

Current topics for first-year clinical psychology graduate students.

**Psy 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq—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; 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; A-F only. Prereq—#)

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; 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]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**Psy 8814. Analysis of Psychological Data.** (4 cr. Prereq—Undergrad course in statistics, grad student in [psychology or child psychology], #)

Data-analytic procedures used in psychological research. Types of variables used in psychological research. Data collection designs, their limitations. Procedures for analyzing experimental/non-experimental data, both univariate and multivariate. Emphasizes selection of data-analytic procedures. Procedures and their assumptions. Computation using statistical software. Limitations, interpretation. Lecture, lab.

**Psy 8815. Analysis of Psychological Data.** (4 cr. Prereq—Undergrad course in statistics, grad student in [psychology or child psychology], #)

Data-analytic procedures used in psychological research. Types of variables used in psychological research. Data collection designs, their limitations. Procedures for analyzing experimental/non-experimental data, both univariate and multivariate. Emphasizes selection of data-analytic procedures. Procedures and their assumptions. Computation using statistical software. Limitations, interpretation. Lecture, lab.

**Psy 8881. Seminar: Psychometric Methods.** (1 cr)

Reviews and individual research on current topics in psychological measurement, statistics.

**Psy 8882. Seminar: Psychometric Methods.** (1 cr. Prereq—5862, 5865, #)

Reviews. Individual research on topics in psychological measurement, statistics.

**Psy 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—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]; S-N only. Prereq—5135, 5137 or #)

Each week participants read and discuss one or two primary research articles.

**Psy 8937. Seminar in Human Behavioral Genetics.** (3 cr [max 6 cr]. Prereq—5137 or #)

Advanced topics vary with each offering. Sample topics: gene identification in complex human traits, behavioral genetics of alcoholism, twin-family methodology.

**Psy 8960. Graduate Seminar in Psychology.** (1-4 cr [max 36 cr]. Prereq—Psychology grad student or #)

Graduate seminar in subject of current interest in psychology.

**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 36 cr]. Prereq—#)

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; A-F only. Prereq—Major in publ aff or publ policy or sci, tech, and environ policy or urban and regional planning or publ hlt or #)

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; A-F only. Prereq—Major in public policy or #)

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; A-F only. Prereq—Major in public policy or #)

Basic finance/accounting concepts/tools used in public/nonprofit organizations. Fund accounting, balance sheet and income statement analysis, cash flow analysis, and public/nonprofit sector budgeting processes. Lectures, discussions. Cases/examples from nonprofit and public sector organizations.

**PA 5004. Introduction to Planning.** (3 cr; A-F only. Prereq—Major in urban/regional planning or #)

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. Public Management and Leadership.** (3 cr; A-F only. Prereq—Major in public policy or #)

Challenges facing higher-level managers in public/nonprofit organizations in a mixed economy and democratic republic. Distinctive features of public/nonprofit management, skills necessary for effective management, manager's role as creator of public value. Lectures, case discussions.

**PA 5012. The Politics of Public Affairs.** (3 cr; A-F only. Prereq—Major in public policy or [sci, tech, and environ policy] or #)

Stages of policy making from agenda setting to implementation. Role/behavior of political institutions (courts, legislatures, executives, bureaucracies) and citizens, social movements, and interest groups. Concepts of political philosophy. Theories of the state. Team taught, interdisciplinary course. Small discussion sections.

**PA 5013. Law and Urban Land Use.** (1.5 cr; A-F only. Prereq—Major in urban/regional planning or #)

Role of law in regulating/shaping urban development, land use, environmental quality, and local/regional governmental services. Interface between public/private sector.

**PA 5021. Economics For Policy Analysis and Planning I.** (2-3 cr [max 3 cr]; A-F only. Prereq—[[Econ 1101 or equiv], Major in public policy or [sci, tech, and environ policy]] or #)

Introduction to tools useful for public policy: intermediate microeconomics, macroeconomics, concepts of international trade.

**PA 5022. Economics For Policy Analysis and Planning II.** (1.5-3 cr [max 3 cr]; A-F only. Prereq—[[5021 or equiv], public policy major] or #)

Application of economic reasoning to various public policy issues. Cost-benefit analysis, nonmarket valuation, and tax analysis.



- PA 5031. Empirical Analysis I.** (4 cr; A-F only. Prereq—Major in publ policy or [sci, tech, and environ policy] or urban/regional planning or #)  
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/multiple regression analysis.
- PA 5032. Intermediate Regression Analysis.** (1-2 cr [max 2 cr]; A-F only. Prereq—[[5031 or equiv], major in [public policy or [sci, tech, and environ policy]]] or #)  
Bivariate/multivariate models of regression analysis, assumptions behind them. Problems using these models when such assumptions are not met.
- PA 5033. Multivariate Techniques.** (1-2 cr [max 2 cr]; A-F only. Prereq—[[5031 or equiv], major in [public policy or [sci, tech, and environ policy]]] or #; [5032 or equiv] recommended)  
Public affairs topics using maximum-likelihood estimation approaches.
- PA 5034. Community Analysis and Planning Techniques.** (1.5 cr [max 3 cr]. Prereq—[[5031 or equiv], [major in publ policy or [sci, tech, and environ policy] or urban/regional planning]] 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/local economic analysis such as shift-share analysis, economic base, and location quotient analysis.
- PA 5035. Survey Research and Data Collection.** (1.5 cr; A-F only. Prereq—[[5031 or equiv], [major in publ policy or [sci, tech, and environ policy] or urban/regional planning]] or #)  
Introduction to survey research methods. Emphasizes applications to policy and applied research. Research design choices (e.g., descriptive, experimental, case studies), sampling, variable specification, measurement. Conducting interviews, mailed questionnaires. Qualitative techniques.
- PA 5101. Management and Governance of Nonprofit Organizations.** (3 cr. Prereq—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.** (3 cr. Prereq—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. Prereq—[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.** (3 cr. Prereq—Grad student 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. Prereq—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 5122. Law and Public Affairs.** (3 cr. Prereq—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. Financing Nonprofits: Philosophies and Realities.** (3 cr. Prereq—Grad student or #)  
Brief history of philanthropy in the United States. Foundation/other sources of funding for nonprofit activity. Philosophies of fundraising/grantmaking. Types of foundations/agencies that fund. Practical approaches to getting/managing money.
- PA 5131. Conflict Management: Readings in Theory and Practice.** (3 cr. Prereq—Grad or #)  
Current theory. Review of conflict resolution strategies. Aspects of interpersonal, group, organizational, and systemic conflict.
- PA 5132. Mediation Training.** (3 cr. Prereq—Grad 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. Prereq—Grad 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. Prereq—Grad or #)  
Topics in conflict management. Theoretical implications, practical applications from the perspectives of participants. National/international issues.
- PA 5142. Public Issues Facilitation Strategies.** (1 cr. Prereq—Grad student or #)  
Course equips facilitators with processes that encourage civic participation and effective, timely decision-making. Students identify and examine facilitation components and link them to public issues, examine one approach or theory of facilitation and apply it to a case study, and share experiences and cases with other learners.
- PA 5143. Teaching Leadership for the Common Good.** (1 cr. Prereq—Grad student or #, basic ability to use the Internet and Web browsers)  
Introduces learners to main concepts in “Leadership for the Common Good” framework, offers a number of tools and exercises for applying these concepts, and prepares learners to teach others about leadership for the common good.
- PA 5190. Topics in Public and Nonprofit Leadership and Management.** (1-3 cr [max 9 cr]. Prereq—Grad or #)  
Selected topics.
- PA 5201. American Cities I: Population and Housing.** (4 cr. §Geog 5371W. Prereq—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 5202. American Cities II: Land Use, Transportation, and the Urban Economy.** (4 cr. §Geog 5372W. Prereq—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 5203. Geographical Perspectives on Planning.** (3 cr. §Geog 3605V, Geog 3605W, Geog 5605V, Geog 5605W. Prereq—Grad student or #)  
Includes additional weekly seminar-style meeting and bibliography project on topic selected in consultation with instructor.
- PA 5211. Land Use Planning.** (3 cr. Prereq—Grad student or #)  
Physical/spatial basis for land use planning at community/regional level. Role of public sector in guiding private development. Land use regulations, comprehensive planning, growth management, innovative land use planning/policies.
- PA 5212. Managing Urban Growth and Change.** (3 cr. Prereq—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. Prereq—Grad 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. Prereq—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 5232. Transportation Policy, Planning, and Deployment.** (3 cr. Prereq—Sr or grad student or #)  
Development of transportation policy, making of transportation plans, deployment of transportation technologies. Lectures, interactive case studies, role playing.
- PA 5251. Strategic Planning and Management.** (3 cr. Prereq—Grad student or #)  
Theory/practice of strategic planning/management for public/nonprofit organizations/networks. Strategic planning process, management systems; stakeholder analyses. Tools/techniques such as purpose expansions, SWOT analyses, oval mapping, portfolio analyses, and logic models.
- PA 5252. Strategy and Tactics in Project Planning and Management.** (1.5 cr. Prereq—Grad 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. Designing Planning and Participation Processes.** (3 cr. Prereq—Grad student or #)  
Theory/practice of design, implementation, and evaluation of planning/participation processes in an increasingly diverse society. Types of planning. Stakeholders, including typically under-represented groups. Costs/benefits of participation. Participant roles. Planning/participation tools/techniques.
- PA 5254. Strategic Planning Tools and Techniques.** (1.5 cr; A-F only. Prereq—Grad student or #)  
Techniques may include purpose expansions, competitive/collaborative analysis methods, core/distinctive competency identification, portfolio methods, logic and business process models, scenario construction, balanced scorecards, and related strategy mapping tools.
- PA 5255. Stakeholder Identification, Analysis, and Influence Techniques.** (1.5 cr; A-F only. Prereq—Grad student or #)  
Techniques include basic identification, power vs. interest grids, stakeholder influence diagrams, discerning the common good, support vs. opposition matrices, participation planning matrices, and ethical analysis.
- PA 5261. Housing Policy.** (3 cr; A-F only. §DHA 5463. Prereq—Grad 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 5271. Geographic Information Systems: Applications in Planning and Policy Analysis.** (3 cr. Prereq—Grad student or #) Introduction to GIS. Applications in public planning and policy analysis. Operational skills in GIS software. Mapping analysis of U.S. Census material. Local/state government management/planning. Spatial statistical analysis for policy/planning.

**PA 5290. Topics in Planning.** (1-3 cr [max 9 cr]. Prereq—Grad student or #) Selected topics.

**PA 5301. Population Methods and Issues for the United States and Third World.** (3 cr. Prereq—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. Prereq—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]. Prereq—Grad student or #) Topics in advanced policy analysis methods.

**PA 5401. Poverty, Inequality, and Public Policy.** (3 cr. Prereq—Grad 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. \$SW 5107. Prereq—Grad or publ hith or non-degree seeking 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. Prereq—Grad 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. Prereq—Grad 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. Prereq—[[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. Prereq—Grad 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. Prereq—Grad or #) Designing effective educational policies. Using interdisciplinary approaches to identify/understand core variables (economic, psychological, etc). Work on policy design.

**PA 5451. Immigrant Health Issues.** (3-4 cr. \$PubH 6281. Prereq—Grad student or #) How to access demographic, health, background information on U.S. immigrants. Characteristics and health needs of immigrants. Designing culturally competent health programs. How to advocate for change to promote immigrant health. Community visits required. Online course.

**PA 5480. Topics in Race, Ethnicity, and Public Policy.** (1-3 cr [max 9 cr]. Prereq—Jr or sr or grad student or #) Link between race/ethnicity and public policy. How to identify/measure racial/ethnic disparities and their historical/cultural origins and policy impacts and to craft politically feasible remedies. Topics may include criminal justice, housing, child welfare, and education.

**PA 5490. Topics in Social Policy.** (1-4 cr [max 9 cr]. Prereq—Grad student or #) Selected topics.

**PA 5501. Economic Development I.** (2 cr. Prereq—Grad 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. Prereq—Grad student or #) 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. Prereq—Grad 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.** (4 cr. Prereq—[[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. Prereq—[[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.** (2 cr. Prereq—[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]. Prereq—Grad student or #) Selected topics.

**PA 5601. Survey of Women, Law, and Public Policy in the United States.** (3 cr. Prereq—Grad 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.** (2 cr. Prereq—[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]. Prereq—Grad student or #) Selected topics.

**PA 5701. Science and State.** (3 cr. Prereq—Grad 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, Technology, and International Affairs.** (3 cr. Prereq—Grad student or #) Effect of science/technology on relations among nations in such matters as autonomy, national security, economic strength, environment, cultural identity, and international cooperation. Negotiating international agreements with S&T implications.

**PA 5721. Energy and Environmental Policy.** (3 cr. Prereq—Grad 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. Prereq—[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]. Prereq—Grad or #) Selected topics.

**PA 5801. U.S. Foreign Policy: Process and Analysis.** (3 cr. Prereq—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 5812. Open Economy Models: An Assessment.** (3 cr. Prereq—[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.** (1-5 cr [max 9 cr]. Prereq—Grad student or #) Selected topics.

**PA 5900. Computer Applications in Public Affairs (Summer).** (.5 cr; S-N only. Prereq—#) Introduction to basic computer systems/applications in public affairs practice (e.g., MS Windows, MS Word). Offered summer.

**PA 5901. Computer Applications in Public Affairs.** (.5-3 cr [max 6 cr]; S-N only. Prereq—#) Introduction to computer systems/applications in public affairs practice.

- PA 5902. Computer Applications in Public Affairs.** (.5-3 cr [max 6 cr]; 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; S-N only. Prereq—International HHH fellow)  
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 5910. Developing Your Public Service Career.** (1 cr; S-N only. Prereq—Major in [public affairs or public policy or urban/regional planning or [science, technology/environmental policy]] or #)  
Students investigate/analyze interests, skills, and abilities and combine them in a career plan. Students develop tools to demonstrate their abilities, document their experiences/knowledge, and explore public service career options.
- PA 5931. Role of the Media in Public Affairs.** (3 cr. Prereq—Grad 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. Prereq—Grad student in public affairs or #)  
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]; S-N only. Prereq—International Hubert H. Humphrey Fellows)  
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.** (.5-3 cr [max 9 cr]. Prereq—Grad student or #)  
General topics in public policy.
- PA 8001. Transforming Public Policy.** (4 cr; A-F only. Prereq—Grad PA major or #)  
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; A-F only. Prereq—[8001, grad PA major] or #)  
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; A-F only. Prereq—[Grad major in [public policy or [urban and regional planning] or [science, technology, and environment policy]], completion of core courses] or #)  
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. Working Group.** (3 cr; A-F only. Prereq—[Grad major in [public policy or [urban and regional planning] or [science, technology, and environment policy]], completion of core courses] or #)  
Facilitates completion of research paper on current issue in public policy and management. Students apply interdisciplinary methods, approaches, and perspectives studied in core courses. Written report includes analysis of issue, policy recommendations. Concentration/topic vary term-to-term.
- PA 8105. Human Resources and Organizational Performance.** (2 cr. §HRIR 8063. Prereq—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.** (1.5 cr; A-F only)  
Theory, strategy, politics, and practical mechanics required to adapt public service systems given constraints on resources and continuing pressure for effectiveness/equity. In-class interviews with persons involved in redesign. Student presentations on current redesign issues.
- 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; A-F only. Prereq—[Urban and regional planning] grad student or #)  
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; A-F only. Prereq—S: 8212; [urban and regional planning] grad student or #)  
Relationship between land use and 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; A-F only. Prereq—[Urban and regional planning] grad student or #)  
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. Creating Good Work: Economic and Workforce Development.** (4 cr; A-F only. Prereq—[5021 or 5202 or equiv], [5034 or 15034])  
Job-oriented economic development. Theories on how/why jobs are created. Tools used by communities and economic developers (e.g., tax abatement, infrastructure, job training, entrepreneurship). Strategy, politics, effectiveness.
- PA 8212. Networks and Places: Transportation, Land Use, and Design.** (3 cr; A-F only. Prereq—S: 8202; Transportation Certificate student or #)  
Relationship between land use and transportation. Developing synthetic design skills for linking land use transportation in urban/regional settlements. Economic, political, legal, institutional frameworks for planning.
- PA 8286. International Development and 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. Prereq—Master's student, adviser and DGS consent)
- PA 8386. Research Methods in Social and Labor Policy.** (3 cr; A-F only. §HRIR 8013. Prereq—5032 or 5033, 5022 or equiv)  
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 8687. Women and Electoral Politics.** (3 cr; A-F only)  
Political science and women's studies literature on American women and electoral politics.
- 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]. Prereq—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]. Prereq=#)

## Public Health (PubH)

### School of Public Health

**PubH 5060. Smoking Intervention.** (2 cr. Prereq=[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 5070. Alcohol and Other Drugs: Epidemiology, Prevention, and Control.** (3 cr. Prereq=[Professional school student in PubH or CVM or Dent or Med or Pharm] or [grad student in biostatistics or environmental health or epidemiology or health services research policy/administration or nursing] 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 5592. Readings in Clinical Research.** (1-4 cr [max 20 cr]. Prereq=CR grad student, #)  
Current readings in clinical research.

**PubH 5760. Healthcare Financial Management: Public Sector Emphasis.** (2 cr. Prereq=\$: MHA 6758; Grad student or professional school student or #)

Theory of managerial/financial accounting and of healthcare finance as they relate to program development for non-profit organizations. Emphasizes methods whereby programmatic goals/objectives can be integrated into financial planning, budget preparation, and budget control. Examining an overall program through financial analytical techniques.

**PubH 8100. Topics: Environmental Health.** (1-4 cr [max 20 cr])  
New course offerings or topics of interest in environmental health.

**PubH 8120. Occupational Injury Prevention Research Training Program Research Seminar.** (1 cr [max 12 cr]. Prereq=[5120, 5330, 5450, Eh grad major, [OIPRT specialty or equiv] ] or #)

Facilitates student research training in occupational injury prevention. Roundtable discussions, interdisciplinary involvement.

**PubH 8140. Validity Concepts in Epidemiologic Research.** (2 cr. Prereq=5330, 5340 (with grade of at least B))

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 8141. Doctoral Seminar in Observational Inference.** (2 cr [max 20 cr]; S-N only. Prereq=8140, doctoral student in public health, #; 5330, 5340 recommended)  
Fundamentals of epidemiologic inference. Methods for designing, analyzing, and interpreting epidemiologic studies.

**PubH 8160. Advanced Toxicology.** (2 cr. Prereq=[5160, one course in biochem, one course in molecular bio] or #)  
Cellular/molecular mechanisms by which xenobiotics cause toxicity. Investigative approaches to current research problems in toxicology/carcinogenesis. Apoptosis, cell cycle regulation, genetic toxicology, molecular mechanisms of chemical carcinogenesis, genetic basis for susceptibility to environmental toxicants.

**PubH 8161. Current Literature in Toxicology.** (1 cr [max 3 cr]; S-N only. Prereq=5104)  
Modern methods in toxicology, critical thinking skills. Topics vary each semester. Students read/discuss toxicological literature.

**PubH 8162. Chemical Carcinogenesis and Chemoprevention.** (3 cr; A-F only. \$Nutr 8617. Prereq=[BioC 3001, BioC 3021, BioC 4331] or equiv). [Chem 2302 or equiv]  
Fundamental background in chemical carcinogenesis, carcinogen activation/detoxification, carcinogen-DNA adduct formation, cellular oncogenesis, cancer chemoprevention, nutrition/cancer. Topics integrated/interrelated.

**PubH 8170. Advanced Industrial Hygiene Applications.** (2 cr; A-F only. Prereq=5170, eh grad major)  
Recognition, evaluation, and control of occupational health/safety hazards. Application of concepts to specific industrial hygiene problems related to gases/vapors, aerosols, and physical agents.

**PubH 8194. Directed Research: Environmental Health.** (1-6 cr [max 6 cr]. Prereq=#)

Research, with direction from faculty member, in environmental/occupational stresses on human health.

**PubH 8300. Topics: Epidemiology.** (1-4 cr [max 20 cr])

New course offerings or topics of interest in epidemiology.

**PubH 8333. FTE: Master's.** (1 cr. Prereq=Master's student, adviser and DGS consent)

**PubH 8350. Advanced Epidemiologic Theory.** (2 cr; S-N only. Prereq=Epi PhD major or #)

Integrates concepts from Epidemiology I/II. Current theoretical paradigms of epidemiology. Philosophy of causal inference in epidemiology. Estimation of causal parameters.

**PubH 8355. Teaching Practicum in Epidemiology.** (2 cr; S-N only. Prereq=Epi grad major or #)

Instruction/hands-on experience in teaching methods.

**PubH 8377. Seminar: Chronic Disease and Behavioral Epidemiology.** (1 cr [max 2 cr]; S-N only. Prereq=Epi grad major or #)

Readings, presentations, classroom discussions, and exercises in epidemiologic research methods in chronic/behaviorally-based diseases other than infectious/cardiovascular diseases and cancer.

**PubH 8379. Seminar in Epidemiology.** (2 cr; S-N only.

Prereq=Epi grad or MPH major or #)  
Selected current problems.

**PubH 8392. Readings in Clinical Research.** (1-4 cr [max 4 cr]. Prereq=Clinical research major, #)

Current readings in clinical research.

**PubH 8393. Directed Study: Clinical Research.** (1-4 cr [max 20 cr]. Prereq=Clinical research major, #)

Directed research or field practice in clinical research.

**PubH 8429. Probability Models for Biostatistics.** (3 cr. Prereq=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.** (3 cr. Prereq=[8420, 8429, Stat 5102, advanced biostats] or stats major or #)

Statistical methods for design and analysis of sequential experiments. Wald theorems, stopping times, martingales, Brownian motion, dynamic programming. Compares Bayesian/frequentist approaches. Emphasizes applications to interim monitoring of clinical trials, medical surveillance.

**PubH 8431. Bayesian Decision Theory and Data Analysis.** (3 cr [max 4 cr]. Prereq=[5421 or experience with FORTRAN or with [C, S+]], Stat 5101, Stat 5102, Stat 8311, grad student in [biostatistics or statistics] or #)

Theory/application of Bayesian methods. Bayesian methods compared with traditional, frequentist methods.

**PubH 8436. Spatial Biostatistics.** (3 cr. Prereq=Stat 5101, Stat 5102, some experience with S-plus; [5470 or 8431], Stat 8311 recommended)

Spatial data, spatial statistical models, and spatial inference on unknown parameters or unobserved spatial data. Nature of spatial data, special analysis tools that help to analyze such data. Theory, applications.

**PubH 8444. FTE: Doctoral.** (1 cr. Prereq=Doctoral student, adviser and DGS consent)

**PubH 8452. Advanced Longitudinal Data Analysis.** (3 cr. Prereq=[Stat 5102, Stat 8311, experience with [SAS or S+], advanced [biostats 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 8462. Advanced Survival Analysis.** (3 cr. Prereq=[7450, 8432, Stat 5102, advanced [biostatistics or statistics] major] or #)

Statistical methods for counting processes. Martingale theory (transforms, predictable processes, Doob decomposition, convergence, submartingales). Applications to nonparametric intensity estimation. Additive/relative risk models. Inference for event history data, recurrent events, multivariate survival, diagnostics.

**PubH 8470. Topics: Biostatistics.** (1-4 cr [max 20 cr])

New course offerings or topics of interest in biostatistics.

**PubH 8494. Directed Research: Biostatistics.** (1-4 cr [max 4 cr]; S-N only. Prereq=#)

Research, with direction from a faculty member, in biostatistics.

**PubH 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq=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]. Prereq=Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**PubH 8800. Topics of Interest in Health Services Research and Policy.** (1-4 cr [max 20 cr]. Prereq=HSRP/A major, SPH or graduate student, or #)

First-time offering. Course title, content, instructor and credit load vary.

**PubH 8801. Health Services Policy Analysis: Theory.** (3 cr. Prereq=[Grad or professional school] student or #)

Integrated overview of U.S. health services policy. Related theoretical/empirical literature. Analysis of alternative policy-making models, political/philosophical underpinnings of those models.

**PubH 8802. Health Services Policy Analysis: Applications.** (2 cr; A-F only. Prereq=Hsrp&a grad major or #)

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. Prereq=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; A-F only. Prereq=Hsrp&a grad major or #)

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. Prereq–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. Research Studies in Health Care.** (3 cr [max 6 cr]. Prereq–[Grad or professional school] student or #) Introduction to philosophy of science, conceptual modeling, experimental design, survey/sample design, issues relevant to health services research.

**PubH 8811. Research Methods in Health Care.** (3 cr. Prereq–[8810, [grad or professional school] student] or #) Research methods commonly used in analysis of health services research and health policy problems.

**PubH 8813. Measurement of Health-Related Social Factors.** (3 cr; A-F only. Prereq–Intro stat course, understanding of simple correlations or #) 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; A-F only. Prereq–One course each in intermediate microeconomics, calculus, intro to linear algebra) 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; A-F only. Prereq–8820 or #) 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. Prereq–[Grad or professional school] student or #) Development/articulation of a research proposal.

**PubH 8831. Research Project in Health Care.** (1 cr; A-F only. Prereq–8830 or #) Development and articulation of a research proposal.

**PubH 8836. Integration of Public Health Research Methods in Health Services Research and Policy.** (2 cr. Prereq–Professional school or grad student or #) Integration of concepts/designs of public health research methods, how they can be integrated into health services research and policy analysis. Experiential learning opportunities in clinical settings that illustrate need for integration.

**PubH 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq–Max 18 cr per semester or summer; 24 cr required)

**PubH 8893. Directed Study: Health Services Research, Policy, and Administration.** (1-3 cr [max 3 cr]. Prereq–HSRPA grad student, #)

**PubH 8894. Directed Research: Health Services Research, Policy, and Administration.** (1-8 cr [max 8 cr]. Prereq–HSRPA grad student, #)

## Radiology (Rad)

### Department of Radiology Medical School

**Rad 8200. Nuclear Medicine.** (1-15 cr [max 15 cr])

**Rad 8210. Fundamentals of Nuclear Medicine.** (1 cr. Prereq–1st-yr resident)

**Rad 8250. Research: Nuclear Medicine.** (1-15 cr [max 15 cr])

**Rad 8450. Research: Radiation Biology.** (1-15 cr [max 15 cr])

**Rad 8550. Research: Radiological Physics.** (1-15 cr [max 15 cr])

## Recreation Resource Management (RRM)

### Department of Forest Resources College of Natural Resources

**RRM 5101. Natural and Heritage Based Tourism.** (3 cr; A-F only. §RRM 3101. Prereq–Grad student or #) Interaction of resource based tourism with cultural/natural environments. Impacts of tourism on environment.

**RRM 5201. Introduction to Travel and Tourism.** (3 cr §RRM 3201. Prereq–Grad student or #) Nature, structure and complexity of tourism industry. Overview of travel/tourism: definition, evolution, magnitude globally. Types/functions of various sectors, tourism distribution system, role of various stakeholders in creation/delivery of tourism. Motivations for travel as means of understanding demand for tourism.

**RRM 5232. Managing Recreational Lands.** (4 cr; A-F only. §RRM 4232W. Prereq–Grad student or #) Recreation management tools from a public agency perspective. Social carrying capacity, recreation opportunity spectrum, limits of acceptable change, benefits based management, visitor experience/resource protection. Various projects. Group project to develop a management plan.

**RRM 5259. Visitor Behavior Analysis.** (3 cr; A-F only. Prereq–RRM major or ENR major or grad student or #) Application of social science theory/methods to recreation and resource-based tourism visitor behavior. Culture and cultural identity. Influences on behavior. Mitigating environmental impacts. Theory/analysis of surveys, observation, and content. Implications for sustainable resource management.

## Recreation, Park, and Leisure Studies (Rec)

### School of Kinesiology College of Education and Human Development

**Rec 5101. Foundations of Recreation.** (3 cr; A-F only. Prereq–MED or grad student or #) 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; A-F only. §Kin 5111. Prereq–Kin or Rec major or #) Steps in planning and building facilities for athletics, physical education, and sport for college, professional, and public use.

**Rec 5115. Event Management in Sport.** (3 cr; A-F only. Prereq–§: Kin 5115; Grad student, #) Techniques/principles of planning, funding, and managing sport events. Collegiate championships, non-profit events/benefits, professional events.

**Rec 5161. Recreation Land Policy.** (3 cr; A-F only. Prereq–1501 or 5101 or #) 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; A-F only. Prereq–3551 or #) Scope and development of profit-oriented recreation agencies, including an emphasis on the tourism industry.

**Rec 5211. Introduction to Therapeutic Recreation.** (3 cr; A-F only. Prereq–1501 or ¶5101, rec major or #) 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. Prereq–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. Prereq–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; A-F only. Prereq–5211 or #) 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; A-F only. Prereq–3541 or 5111 or #) 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; A-F only. Prereq–1501, Rec major or #) 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; 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 5371. Sport and Society.** (3 cr; A-F only. §Kin 5371. Prereq–[3126, grad student] or #) Sport, sporting processes, social influences, systems, and structures that have effected and exist within/among societies, nations, and cultures. Issues concerning social differentiation. Social concerns such as violence and honesty.

**Rec 5421. Sport Finance.** (3 cr; A-F only. §Kin 5421. Prereq—Grad student or #)  
Introduction to financial analysis in sport. Cash flow statements, budgeting issues, traditional/innovative revenue producing strategies available to sport organizations. Discussion, practical analysis of current market.

**Rec 5461. Foundations of Sport Management.** (3 cr; A-F only. Prereq—[Rec or Kin] student or #)  
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; A-F only. §Kin 5511)  
Critically examines women's involvement in/contributions to sport, physical activity, and leisure.

**Rec 5601. Sport Management Ethics and Policy.** (3 cr; A-F only. §Kin 5601. Prereq—Grad student or # #)  
Ethical concepts that underpin or inform sport policies. Evaluating sport policies from a normative point of view. Selected sport policy issues are used to illustrate relevance of ethical considerations in policy development, ethical implications of sport policy.

**Rec 5631. Programming and Promotion in Sport.** (3 cr; A-F only. §Kin 5631. Prereq—Kin or Rec grad student or #)  
Introduction to marketing concepts as they apply to sport industry. Consumer behavior, market research, marketing mix, corporate sponsorship, licensing concepts. Discussion, practical application.

**Rec 5801. Legal Aspects of Sport and Recreation.** (4 cr; A-F only. Prereq—3551 or 5461 or #)  
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, Recreation, and Sport.** (3 cr; A-F only. §Kin 5981. Prereq—MEd or grad student or #)  
Defines/reviews various types of research in exercise and sport science, physical education, and recreation studies. Qualitative research, field studies, and introspective research strategies as alternatives to traditional scientific paradigm.

**Rec 5992. Readings: Recreation.** (1-3 cr [max 9 cr])  
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]. Prereq—MEd 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; A-F only. Prereq—Rec MEd or grad student or #)  
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; A-F only. Prereq—5101 or #)  
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. Prereq—Master's student, adviser and DGS consent)

**Rec 8390. Seminar: Administrative Problems in Leisure Services and Therapeutic Recreation.** (3 cr; A-F only. Prereq—Rec MEd or grad student or #)  
Administrative and management issues and problems in leisure services and therapeutic recreation.

**Rec 8777. Thesis Credits: Master's.** (1-18 cr [max 50 cr]. Prereq—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 [max 3 cr]; S-N only. Prereq—5981, EPsy 5261 or #)  
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]; 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 5135. Advanced Biomechanics I: Kinematics.** (2 cr; A-F only. Prereq—#)  
How to describe/measure movement. Emphasizes three-dimensional techniques. Basic/applied biomechanics, pathokinesiology, rehabilitation literature. Held with 8135. Assignments vary for those registered at different levels. Lecture, laboratory exposure, seminar discussion.

**RSc 5294. Independent Study in Rehabilitation Science.** (1-3 cr [max 3 cr]. Prereq—Rehabilitation science student or program approval)  
Independent exploration into topics related to rehabilitation science.

**RSc 5814. Age, Exercise, and Rehabilitation.** (2 cr. Prereq—Rehabilitation science student or program permission)  
Overview of normal physiological responses to exercise in the elderly. Comparison of exercise-induced responses of physiological systems throughout aging process. Focuses on importance of exercise from rehabilitation perspective. Offered Fall semesters of even-numbered years.

**RSc 5841. Rehabilitation Science Instrumentation and Methodology.** (4 cr; A-F only. Prereq—[[Phys 1031, Phys 1032] or equiv], #, [rehabilitation science student or program permission])  
Theory/application of kinesiological EMG and other common instruments used to measure human motion.

**RSc 8100. Rehabilitation Science Seminar.** (1 cr [max 6 cr]; A-F only. Prereq—Rehabilitation science student or program permission)  
Critically reading/discussing rehabilitation science literature. Identifying important researchable questions, methods to answer them. Speaking/writing persuasively on scientific topics.

**RSc 8130. Current Literature Seminar.** (1 cr; A-F only. Prereq—Grad student in PT or rehabilitation science major or #)  
Critical review of literature to evaluate efficacy of selected physical therapy interventions.

**RSc 8135. Advanced Kinesiology.** (2 cr; A-F only. Prereq—[Rehabilitation science student or program permission], #)  
How to describe/measure movement. Emphasizes three-dimensional techniques. Lecture, lab exposure. Seminar discussion of basic/applied biomechanics, pathokinesiology, and rehabilitation literature.

**RSc 8170. Special Topics in Rehabilitation Science.** (1 cr [max 3 cr]; A-F only. Prereq—[Rehabilitation science student or program permission], #)  
Topics vary by semester. Papers required.

**RSc 8185. Problems in Rehabilitation Science.** (1-3 cr [max 3 cr]. Prereq—[Rehabilitation science student or program permission], #)  
Research practicum on selected topic. Use of systematic literature search. Critical analysis of scientific literature. Specific measurement systems. Data collection/reduction methods of on-going or new research projects. Preparing/defending research reports.

**RSc 8188. Teaching Practicum.** (1-5 cr [max 5 cr]; A-F only. Prereq—[Rehabilitation science student or program permission], #)  
Supervised experience in teaching/evaluation. Effective use of instructional materials in lecture/lab courses. Students create learning objectives for teaching unit(s), conduct a review of current literature on topic, prepare/deliver presentations, compose test questions. Offered by individual arrangement with faculty.

**RSc 8192. Research Design in Physical Therapy.** (3 cr; A-F only. Prereq—[Grad student in PT or rehabilitation science student or program permission], #)  
Critical appraisal of current medical literature. Fundamentals of research design, data analysis, and medical writing.

**RSc 8282. Problems in Human Movement.** (4 cr; A-F only. Prereq—[Rehabilitation science student or program permission], #)  
Fundamental principles of neurophysiology, neurology, motor control, and motor learning as a basis for therapeutic intervention in motor dysfunction.

**RSc 8333. FTE: Master's.** (1 cr. Prereq—Master's student, adviser and DGS consent)

**RSc 8444. FTE: Doctoral.** (1 cr. Prereq—Doctoral student, adviser and DGS consent)

**RSc 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq—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]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**RSc 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—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. §JwSt 3013W, JwSt 5013, RelA 3013W)  
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 [max 18 cr]. §CNES 5070. Prereq—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 5112. Jewish Mysticism, Magic, and Kabbalah.** (3 cr; A-F only. §JwSt 3112, JwSt 5112, RelA 3112)  
Mystical traditions from early rabbinic traditions to Zohar (Book of Splendor) in 13th century. Literature of heavenly ascent (Hekhalot, Merkavah), Book of Creation (Sefer Yetzirah), precursors of Zohar. the Bahir. Schools of Provence, Gerona, and Zohar. Tension between legal/mystical aspects, magical theurgic techniques, evolution of doctrine of Sefirot, mystical interpretation of Scripture, erotic dimension.

**ReIA 5115. Mishnah and Midrash in Translation.** (3 cr. §JwSt 3115, JwSt 5115, ReIA 3115)  
Jewish law studies as mirror of society and as way to actualize its value. Original socioreligious contexts, current applications. Selections include biblical interpretations addressing moral, theological, legal, and literary problems.

**ReIA 5251. Archaeology of Herodian Israel.** (3 cr; A-F only. §CNES 5251, ReIS 5251. Prereq—One course in [archaeology or ancient history] or grad student)  
Archaeological sites in Israel dating to era of Herod the Great (37-4BC). Palaces, religious edifices, and remains from Jewish/gentile settlements throughout the kingdom. Course readings consist of contemporary literary sources and excavation reports.

**ReIA 5503. History and Development of Israelite Religion I.** (3 cr. §ANE 3503, ANE 5503, CNES 3503, CNES 5503, ReIA 3503)  
Survey of the evolution of Israelite religion. Cultic practices, law and religion, prophecy, religion and historiography. Relationship to surrounding religious systems.

**ReIA 5504. Development of Israelite Religion II.** (3 cr. §ANE 3504, ANE 5504, ReIA 3504)  
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.

**ReIA 5513. Scripture and Interpretation.** (3 cr; A-F only. §JwSt 5513)  
Idea of divine revelation, its impact upon religion/literature. How history of Bible's creation, transmission, and interpretation helps us think critically about role of idea of revelation in history of religious traditions. What is revelation? How does belief that a text is revealed affect the way it is read within the community for which it constitutes revelation?

**ReIA 5993. Directed Studies.** (2-4 cr [max 10 cr])  
Guided individual reading or study.

**ReIA 8190. Comparative Seminar in Religions in Antiquity.** (3 cr [max 6 cr]; A-F only. Prereq—Grad student in relevant field; reading knowledge of Greek or Latin or Coptic or Arabic recommended)  
Topics vary, see *Class Schedule*. Major cultural movement as it developed over several centuries. Draws on evidence in literature, archival records, inscriptions, documentary papyri, and archaeological remains. Artistic media such as wall painting, architectural ornament, funerary sculpture, or manuscript illumination.

## Religious Studies (ReIS)

*Department of Classical and Near Eastern Studies*

*College of Liberal Arts*

**ReIS 5111. Problems in Historiography and Representation of the Holocaust.** (3 cr. §JwSt 5111. Prereq—§: JwSt 5111 or Hist 5285; JwSt 3521/ReIS 3521 [formerly 3541] 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.

**ReIS 5251. Archaeology of Herodian Israel.** (3 cr; A-F only. §CNES 5251, ReIA 5251. Prereq—One course in [archaeology or ancient history] or grad student)  
Archaeological sites in Israel dating to era of Herod the Great (37-4BC). Palaces, religious edifices, and remains from Jewish/gentile settlements throughout the kingdom. Course readings consist of contemporary literary sources and excavation reports.

**ReIS 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. Information Design: Theory and Practice I.** (3 cr; A-F only. Prereq—Grad student or #)  
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. Information Design: Theory and Practice II.** (3 cr; A-F only. Prereq—Grad student or #)  
Political, economic, social, and technical aspects of media selection and message design. Media analyses, scripts, budgets, treatments, project-design plans, interactive screens. Online design project.

**Rhet 5196. Internship in Scientific and Technical Communication.** (3-6 cr [max 6 cr]; S-N only. Prereq—STC grad or #)  
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)  
Informational, employment-cycle, and problem-solving interviews. Emphasizes guides, schedules, questioning techniques, and communication theories. Descriptive statistics used to analyze data for various projects.

**Rhet 5270. Special Topics.** (1-3 cr [max 3 cr]; A-F only. Prereq—[STC or RSTC] [major or grad student]], #)  
Topics specified in *Class Schedule*.

**Rhet 5291. Independent Study.** (1-3 cr [max 3 cr]. Prereq—#)  
Supervised reading/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; A-F only. Prereq—Grad)  
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; A-F only. Prereq—5531 or #)  
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; A-F only. Prereq—5531 or 5532)  
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 5664. Science Writing for Popular Audiences.** (3 cr; A-F only. Prereq—Rhet 3562 or #)  
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)  
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. Francis 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; A-F only. Prereq—STC/RSTC grad or #)  
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; A-F only. Prereq—STC/RSTC grad student or #)  
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. Prereq—Master's student, adviser and DGS consent)

**Rhet 8444. FTE: Doctoral.** (1 cr. Prereq—Doctoral student, adviser and DGS consent)

**Rhet 8505. Design Project.** (5 cr; A-F only. Prereq—STC/RSTC grad student, Δ, #)  
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]; A-F only. Prereq—5775 or equiv)  
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])  
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]. Prereq—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]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**Rhet 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—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])  
Research and readings on special problems or projects.

## Russian (Russ)

*Institute of Linguistics, ESL, and Slavic Languages and Literatures*

*College of Liberal Arts*

**Russ 5021. Russia Study Tour.** (6-18 cr [max 18 cr]. Prereq—3002 or equiv)

Study of Russian language & culture in an accredited institution in Russia.

**Russ 5104. Introduction to Literary Analysis.** (3 cr. Prereq—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. Prereq—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. \$Russ 3211)

Literary, cultural, and political significance of modern Russian literary works.

**Russ 5404. Tolstoy in Translation.** (3 cr. \$Russ 3404)

Novels, stories, and philosophical writings of Leo Tolstoy.

**Russ 5407. Stories and Plays of Anton Chekhov in Translation.** (3 cr. \$Russ 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. \$Russ 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. \$Russ 3411)

Novels, stories, and other writings of Fyodor Dostoevsky.

**Russ 5421. Literature: Middle Ages to Dostoevsky in Translation.** (3 cr. \$Russ 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. \$Russ 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. Prereq—\$: 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 [max 3 cr]. Prereq—1102 for language topics)  
Variable topics in Russian language, literature, and culture.

**Russ 5993. Directed Studies.** (1-4 cr [max 16 cr]. Prereq—#, □)

Guided individual study.

## 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. Prereq—5001 or equiv)  
Introduction to the classical language of ancient India.

**Skt 5201. Intermediate Sanskrit.** (3 cr. Prereq—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)  
Selected reading and/or study of linguistic problems in Sanskrit.

**Skt 5992. Directed Readings.** (3 cr. Prereq—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 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 5704. History of the Scandinavian Languages.** (3 cr)  
Investigation of the development of the Scandinavian languages from the earliest periods to the present.

**Scan 5710. Topics in Old Norse Literature.** (3 cr [max 9 cr]. Prereq—5701 or equiv)

Topic may focus on Old Norse prose or poetry. Primary texts read in Old Norse. Critical literature about texts, medieval Icelandic culture in English. Topics specified in *Class Schedule*.

**Scan 5993. Directed Studies.** (1-4 cr [max 12 cr]. Prereq—#, □)

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 8630. Seminar in Scandinavian Criticism.** (3 cr [max 9 cr])

Sample topics: feminist theory in Scandinavia, writing literary history in Scandinavia.

**Scan 8994. Directed Research.** (1-3 cr [max 12 cr]. Prereq—#, may be taken as tutorial with #)

## Scientific Computation (SciC)

*Institute of Technology*

**SciC 8001. Parallel High-Performance Computing.** (3 cr. Prereq—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. Prereq—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. Prereq—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. Prereq—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. Prereq—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]. Prereq—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]. Prereq—Undergrad degree in field using sci comp or #) Series of seminars by distinguished lecturers.

**SciC 8333. FTE: Master's.** (1 cr. Prereq—Master's student, adviser and DGS consent)

**SciC 8444. FTE: Doctoral.** (1 cr. Prereq—Doctoral student, adviser and DGS consent)

**SciC 8594. Scientific Computation Directed Research.** (1-4 cr [max 9 cr]. Prereq—Undergrad degree in field using sci comp or #)

**SciC 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq—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]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**SciC 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—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 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. Students 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]. Prereq—Grad SAPh major or #)

Contemporary issues and research problems in sociobehavioral pharmacy, pharmacoconomics and policy, and clinical research.

**SAPh 8173. Principles and Methods of Implementing Research.** (3 cr. §NURS 8173. Prereq—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]. Prereq—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; A-F only. Prereq—Grad SAPh major or #)

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; A-F only. Prereq—Grad SACP major or #)

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. Prereq—Grad SAPh major or #)

**SAPh 8420. Social and Behavioral Aspects of Pharmacy Practice.** (3 cr; A-F only. Prereq—Grad SAPh major or #) 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; A-F only. Prereq—Grad SAPh major or #)

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; A-F only. Prereq—Grad SAPh major or #)

History, classification, organization, and functions of hospital departments in relation to the pharmacy service.

**SAPh 8702. Hospital Pharmacy Survey.** (1 cr [max 3 cr]. Prereq—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. Prereq—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; A-F only. Prereq—Intro stat course, understanding of simple correlations or #)

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 [max 3 cr]; A-F only. Prereq—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. Prereq—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 [max 4 cr]; A-F only. Prereq—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 Welfare Policy.** (3 cr. §PA 5411. Prereq—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. Prereq—Grad or non-degree seeking student 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. Prereq—Grad or non-degree seeking student or #)

The practice components of social work with older adults including assessment, intervention, and case management. Taught from the perspective of bi-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. Prereq—Grad or non-degree seeking student 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. Prereq—Grad or non-degree seeking student 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 health care.

**SW 5316. Brief Treatment and the Task-Centered Approach.** (2 cr. §SW 8303. Prereq—§: 8303; grad or non-degree seeking student 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. Prereq—Grad or non-degree seeking student 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. §SW 8314. Prereq-§: 8314; grad or non-degree seeking student 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. Prereq-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. Prereq-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. Prereq-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. Prereq-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. Prereq-§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. Prereq-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. Prereq-§: 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. Prereq-Grad student or adult special or #)

Major issues/interventions in child sexual abuse. 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. Prereq-§: 5705; grad or non-degree seeking student 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. Prereq-Grad or non-degree seeking student 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 5709. Applied Psychopharmacology for Human Service Professionals.** (2 cr; A-F only)

Categories of psychoactive drugs. Medications to treat mental disorders. Legal drugs such as alcohol, nicotine, cocaine, and marijuana. What is occurring physiologically when someone takes a psychoactive drug.

**SW 5711. Co-Occurring Addictive and Mental Health Disorders.** (2 cr; A-F only. Prereq-Cannot be taken for cr by MSW students)

Mentally ill, chemically abusive, or dependent clients. Intervention, advocacy, education, and support for client and those who are part of his or her environment. Social, environmental, and multicultural factors. Meets partial state requirements for becoming licensed as an alcohol/drug counselor.

**SW 5810. Seminar: Special Topics.** (1-4 cr [max 10 cr])

Topics specified in *Class Schedule*.

**SW 5811. Social Work Ethics.** (2 cr. Prereq-§: 8801, grad student or non-degree seeking student 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 5813. Child Welfare and the Law.** (2 cr. Prereq-2nd yr MSW or advanced standing or #)

Social work practice in juvenile court. Child abuse/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. Seminar: Field Practicum I.** (1-8 cr [max 8 cr]; S-N only. Prereq-8201)

Integrates classroom learning with direct experience of a social work field internship. Professional support/learning groups focus on student-and facilitator-identified issues. Students discuss professional/personal biases, ethical dilemmas, and supervisory issues. Cross-cultural understanding, implications of cross-cultural practice.

**SW 8020. Field Practicum II.** (1-6 cr [max 6 cr]; S-N only. Prereq-8010)

Integrates classroom learning within a concentration with the direct experience of an internship. Students expand competency in cross-cultural practice.

**SW 8030. Advanced Standing Social Work Practicum.** (1-8 cr [max 8 cr]; S-N only. Prereq-Adv standing)

Integrates classroom learning with direct experience of a social work field internship. Professional support/learning groups discuss issues raised in field placement. Groups focus on professional/personal biases, ethical dilemmas, supervisory issues, cross-cultural sharing, and implications of students' privilege/power in relation to client systems.

**SW 8041. Specialized Field Placement.** (3-4 cr; S-N only. Prereq-8030, MSW adv-standing)

Internship within an agency or a specific population. Applied practical experience in specialized concentration area of practice.

**SW 8051. Psychopathology and Social Work Practice.** (3 cr. Prereq-All foundation courses for full program 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. Prereq-[8211, 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. Prereq-[8211, 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, issues in need of policy development.

**SW 8105. Economic Security of Disadvantaged Populations.** (3 cr. Prereq-[8211, advanced standing] or #)

Impact of social policy and macro economic trends on economic security of disadvantaged populations. Focuses on antipoverty/welfare programs in the United States, although international perspective is used as well.

**SW 8150. Special Topics in Social Policy.** (1-9 cr [max 9 cr])

**SW 8201. Social Work Methods: Practice With Individuals and Systems.** (3 cr; A-F only. Prereq-MSW student)

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; A-F only. Prereq-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; A-F only. Prereq-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. Prereq-All foundation courses for full program or advanced standing or #)

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. §SW 5316. Prereq-8051 or ¶8051 or all foundation courses for full program or advanced 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. Prereq—All foundation courses for full program or advanced 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 8312. Advanced Social Work Practice With Groups.** (3 cr. Prereq—[8201, 8202, adv standing] or #)  
Advanced clinical social work practice with groups. How to differentiate among available models of group work and select an appropriate model based on needs of client population and on context in which they are served.

**SW 8313. Professional Practice in Interdisciplinary Teams and Collaboratives.** (3 cr. Prereq—[Foundation curriculum, [advanced standing or grad student in health and human service or in educational professional program]] or #)  
Principles of interdisciplinary/interorganizational collaboration in human services, health, and educational settings. Team building, decision-making models, engaging value differences, managing conflict on team, role/status disparities, relational communications. Emerging approaches to interorganizational collaboration.

**SW 8314. Social Work Interventions With Families.** (3 cr. SSW 5318. Prereq—\$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. Prereq—Master's student, adviser and DGS consent)

**SW 8444. FTE: Doctoral.** (1 cr. Prereq—Doctoral student, adviser and DGS consent)

**SW 8501. Planning, Marketing, and Program Development.** (3 cr. Prereq—[Foundation curriculum, 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 seeks to achieve positive social change.

**SW 8502. Resource Development and Management.** (3 cr. Prereq—[Foundation curriculum, advanced 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. Prereq—[Foundation curriculum, advanced standing] or #)  
Skills/principles in effective leadership. Legal/strategic considerations in personnel management. 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. Prereq—[Foundation curriculum, advanced standing] or #)  
Methods for stimulating/supporting joint action for constructive change to fulfill community needs. Principles of working with local organizations. Social action to accomplish specific changes.

**SW 8507. Community Practice Seminar.** (1 cr. Prereq—[Foundation curriculum, advanced standing] or #)  
Links content from human services management and from community organization and advocacy. Integrating framework that draws upon knowledge/skills used in agency/organizational management and in community organization/change.

**SW 8519. Mediation and Conflict Resolution for Social Workers.** (3 cr. Prereq—\$: 5519; MSW 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. Prereq—[8211, advanced standing] 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/political systems. Emphasizes Third World nations. Skills for social workers and other professionals in the helping professions.

**SW 8601. Social Work Research Methods.** (3 cr; A-F only. Prereq—MSW 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. Prereq—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. Prereq—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]. Prereq—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]. Prereq—#)  
Independent study under tutorial guidance.

**SW 8694. Directed Research.** (1-6 cr [max 6 cr]. Prereq—#)  
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. Prereq—All foundation courses for full program or advanced standing 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. Prereq—\$: 5811; 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. Prereq—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. Prereq—Required research courses for soc work PhD 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. Prereq—Soc wk PhD 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. Prereq—Soc wk PhD 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. Prereq—Soc wk PhD student or 2nd-yr MSW 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. Prereq—Soc wk PhD 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. Prereq—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]; S-N only. Prereq—Soc wk PhD student or #)  
Experience in conduct of research, following completion of 8871 and 8872. Students work under faculty direction.

**SW 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—Max 18 cr per semester or summer; 24 cr required)

## Social, Administrative, and Clinical Pharmacy (SACP)

### College of Pharmacy

**SACP 8333. FTE: Master's.** (1 cr. Prereq—Master's student, adviser approval, DGS approval)  
Directed research

**SACP 8444. FTE: Doctoral.** (1 cr. Prereq—Doctoral student, adviser approval, DGS approval)  
Directed research

**SACP 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq—Doctoral student who has not passed prelim oral)

**SACP 8777. Thesis Credits: Master's.** (1-18 cr [max 50 cr]. Prereq—Plan A)

**SACP 8888. Thesis Credits: Doctoral.** (1-24 cr [max 100 cr]. Prereq—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 [max 3 cr]. Prereq—1001 or #)

Topics specified in *Class Schedule*.

**Soc 5455. Sociology of Education.** (3 cr. §EdPA 5041. Prereq—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. Prereq—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 [max 2 cr]; S-N only. Prereq—Grad soc major)

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. Prereq—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 [max 12 cr]. Prereq—#) Topics specified in *Class Schedule*.

**Soc 8091. Independent Study.** (1-5 cr [max 20 cr])

Independent study of an established 8xxx course.

**Soc 8093. Directed Study.** (1-4 cr [max 20 cr]. Prereq—Grad soc major or #)

Directed study in sociology.

**Soc 8094. Directed Research.** (1-4 cr [max 20 cr])

May be used to fulfill sociology graduate requirement for advanced methodological training.

**Soc 8101. Sociology of Law.** (3 cr)

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; A-F only. Prereq—[Grad student, 4148] or #)

Intensive survey of psychopathology. Reference to criminal behavior, criminal justice system.

**Soc 8190. Topics in Law, Crime, and Deviance.** (3 cr [max 12 cr]. Prereq—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. Prereq—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. §WoSt 8202)

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 [max 12 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)

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. Prereq—Master's student, adviser and DGS consent)

**Soc 8390. Topics in Political Sociology.** (3 cr [max 12 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)

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 8412. Social Network Analysis: Theory and Methods.** (3 cr)

Introduction to theoretical/methodological foundations of social network analysis. Concepts/principles, measurements, computer techniques. Substantive applications to friendships, communities, workteams, intra-/inter-organizational relations, international systems. Focuses on network visualizations.

**Soc 8421. Work and Occupations.** (3 cr)

Sociological analysis of work, occupations, and labor markets, including contemporary theory and research. Course emphasis varies with instructor.

**Soc 8444. FTE: Doctoral.** (1 cr. Prereq—Doctoral student, adviser and DGS consent)

**Soc 8490. Advanced Topics in Social Organization.** (3 cr [max 12 cr]. Prereq—#)

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 [max 12 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. Prereq—Soc grad major or #)

Central concepts/premises of life course analysis as applied to intersocietal (comparative); intrasocietal (socioeconomic status, race, gender); and historical variability. Institutional patterning of life course (family, education, work, polity). deviance and criminal careers. changes in the self. methodological strategies.

**Soc 8590. Topics in Life Course Sociology.** (3 cr [max 12 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]. Prereq—Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

**Soc 8701. Sociological Theory.** (4 cr; A-F only. Prereq—Grad soc major or #)

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)

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]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**Soc 8790. Advanced Topics in Sociological Theory.** (3 cr [max 12 cr])

Sample topics: theories of conflict, theories of purposive action, Marxist theory, and structure-agency debate.

**Soc 8801. Sociological Research Methods.** (4 cr; A-F only. Prereq—Grad soc major or #)

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; A-F only. Prereq—5811 or equiv, grad soc major or #)

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]. Prereq—Max 18 cr per semester or summer; 24 cr required)

**Soc 8890. Advanced Topics in Research Methods.** (3-4 cr [max 12 cr]. Prereq—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; A-F only. Prereq—Grad SEng major)  
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 [max 3 cr]; A-F only. Prereq—Grad SEng major)  
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: Distributed Objects.** (3 cr [max 23 cr]; A-F only. Prereq—Grad SEng major)  
Java programming, concurrent programming, workflow, distributed database, security, collaborative computing, object-oriented architecture/design, network publishing, messaging architecture, distributed object computing, and intranet.

**SEng 5199. Topics in Software Engineering.** (2-3 cr [max 6 cr]; A-F only. Prereq—SEng grad student)  
Topics specified in *Class Schedule*.

**SEng 5511. Artificial Intelligence.** (2-3 cr [max 3 cr]; A-F only. Prereq—Grad SEng major)  
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; A-F only. Prereq—Grad SEng major)  
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; A-F only. Prereq—Grad SEng major)  
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 [max 3 cr]; A-F only. Prereq—Grad SEng major)  
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; A-F only. Prereq—Grad SEng major)  
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; A-F only. Prereq—Grad SEng major)  
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; A-F only. Prereq—5801, grad SEng major)  
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 test report.

**SEng 5831. Software Development for Real-Time Systems.** (2-3 cr [max 3 cr]; A-F only. Prereq—Grad SEng major)  
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; A-F only. Prereq—Grad SEng major)  
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; A-F only. Prereq—Grad SEng major)  
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; A-F only. Prereq—Grad SEng major)  
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 5861. Introduction to Software Architecture.** (3 cr; A-F only. Prereq—2nd year, MSSE grad student)  
Software/systems architecture. Representation/design, how they fit into software engineering process. Description of architectures, including representation and quality attributes.

**SEng 5899. Software Engineering Seminar.** (1 cr [max 2 cr]. Prereq—Grad SEng major, #)  
Software engineering trends. Talks by invited speakers, selected readings.

**SEng 5900. Directed Study.** (1-3 cr [max 3 cr])  
Directed study/research in software engineering. Topics/scope decided in collaboration with instructor.

**SEng 8333. FTE: Master's.** (1 cr. Prereq—Master's student, adviser and DGS consent)

**SEng 8494. Capstone Project (Plan B Project).** (3 cr; S-N only. Prereq—SEng major)  
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, Water, and Climate (Soil)

Department of Soil, Water, and Climate  
College of Agricultural, Food and Environmental Sciences

**Soil 5111. Practicum Internship in Precision Agriculture.** (2-5 cr [max 5 cr]; 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 5232. Vadose Zone Hydrology.** (3 cr. Prereq—[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. Prereq—[[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 5515. Soil Genesis and Landscape Relations.** (3 cr; A-F only. Prereq—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.** (3 cr; A-F only. \$ES 5555. Prereq—1125 or 2125 or equiv or #, ¶4511 recommended)  
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 5611. Soil Biology and Fertility.** (3 cr. Prereq—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 8005. Supervised Classroom or Extension Teaching Experience.** (2 cr; S-N only. \$Agro 8005, BAE 8005, Hort 8005, PLPA 8005. Prereq—#)  
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 8123. Research Ethics in the Plant and Environmental Sciences.** (.5 cr; S-N only. \$APSC 8123, PLPA 8123. Prereq—Enrolled in a plant/environmental sci grad research prog)  
History/values relating to research and scholarship. Social responsibility, reporting misconduct. Authorship. Plagiarism. Peer review. Copyright, intellectual property. Conflicts of interest. Research data management. Fiscal responsibility, management. Environmental health/safety. Research involving humans/animals. Mentorship. Presentations by faculty and invited speakers. Meets during first seven weeks of spring semester.

**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]. Prereq—[Grad research 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. Prereq—[5232, differential equations] or #)  
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 8282. Modeling Water, Carbon, and Nitrogen Dynamics in the Soil-Plant-Air System.** (3 cr; A-F only)  
Integrative/quantitative treatment of dynamics of water, carbon, and nitrogen in soil-plant-air continuum.

**Soil 8333. FTE: Master's.** (1 cr. Prereq—Master's student, adviser and DGS consent)

**Soil 8444. FTE: Doctoral.** (1 cr. Prereq—Doctoral student, adviser and DGS consent)

**Soil 8510. Advanced Topics in Pedology.** (2-4 cr [max 12 cr]; A-F only. Prereq—5515)  
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; A-F only. Prereq—§: CE 8541; 5311 or CE 4541)  
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]; S-N only. Prereq—Grad major in soil sci or related field, #)  
Provides students with practical experiences in instructional techniques in a university setting.

**Soil 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq—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]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**Soil 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—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 [max 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. §SALC 3413)  
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. §SALC 3414)  
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. §SALC 3456)  
Survey of cinema of South Asia; aesthetic, social, economic, and political perspectives.

**SALC 5500. Problems in Indian Philosophy.** (3 cr. Prereq—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. §SALC 3521)  
Character of Gandhi, his influence over contemporaries, and his hold on the world today.

**SALC 5556. Women in India: Role and Repression.** (3 cr. §SALC 3556)  
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 [max 5 cr])  
Selected topics on South Asian languages; no knowledge of South Asian languages required.

**SALC 5720. Seminar in South Asian Literature.** (3-4 cr [max 4 cr])  
Selected topics on South Asian literature.

**SALC 5730. Seminar in South Asian Culture.** (4-5 cr [max 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 [max 5 cr]. Prereq—#, 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 [max 5 cr]. Prereq—#, 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. Prereq—Master's student, adviser and DGS consent)

**SALC 8444. FTE: Doctoral.** (1 cr. Prereq—Doctoral student, adviser and DGS consent)

**SALC 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq—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 [max 5 cr])  
Topic specified in *Class Schedule*.

**SALC 8720. Seminar: Interdisciplinary Study of South Asian Topics.** (1-5 cr [max 5 cr])  
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 [max 5 cr])  
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]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**SALC 8790. Research.** (1-5 cr [max 5 cr])

**SALC 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—Max 18 cr per semester or summer; 24 cr required)

## Spanish (Span)

### Department of Spanish and Portuguese Studies College of Liberal Arts

**Span 5012. Advanced Problems in the Spanish Language.** (.02 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. Prereq—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. Prereq—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. Prereq—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. Prereq—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. Prereq—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. Prereq—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. Prereq—three 3xxx or 5xxx literature courses in Spanish or Portuguese)

Major dramatists of the Spanish comedia (e.g., Cervantes, Lope, Tirso, Calderbn). 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. Prereq—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. Prereq—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. Prereq—Three 3xxx or 5xxx literature courses in Spanish or Portuguese)

Major picaresque narratives—*Lazarillo*, *Guzmán*, *Buscán*, 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. Prereq—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. Prereq—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. Prereq—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. Prereq—Three 3xxx or 5xxx lit courses in Spanish or Portuguese)

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. Prereq—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. Prereq—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. Prereq—Three 3xxx or 5xxx lit courses in Spanish or Portuguese)

Latin American feminism in thought and practice; literature, cultural discourse, literary theory.

**Span 5701. History of Ibero-Romance.** (3 cr. Prereq—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. Prereq—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)

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. Prereq—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. Prereq—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)

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. Prereq—#)

Concepts used in current literature in Spanish pragmatics, such as deixis, presupposition, conversational implicature, speech act theory, and conversational structure.

**Span 5721. Spanish Laboratory Phonology.** (3 cr; A-F only. Prereq—[5711, honors] or grad student or #)

Core literature on Spanish laboratory phonology. Phonology from a laboratory perspective. Students evaluate laboratory research methodologies, perform basic acoustic analyses, and design laboratory phonology studies.

**Span 5731. Spanish Dialectology: Regional and Social Dialects of Modern Spain.** (3 cr. Prereq—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. Prereq—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).** (.01 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]. Prereq—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]. Prereq—3104)

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])

Problems in Hispanic linguistics; a variety of approaches and methods.

**Span 5970. Directed Readings.** (1-4 cr [max 9 cr]. Prereq—MA or PhD candidate, #, □)

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. Prereq—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]. Prereq—#, □)

**Span 5991. The Acquisition of Spanish as a First and Second Language.** (3 cr. Prereq—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]. Prereq—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]. Prereq—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. Prereq—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. Prereq—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 8300. The Construction of Spanish Literary History.** (3 cr [max 9 cr]. Prereq—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. Prereq—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. Prereq—Master's student, adviser and DGS consent)

**Span 8444. FTE: Doctoral.** (1 cr. Prereq—Doctoral student, adviser and DGS consent)

**Span 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq—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]. Prereq—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]. Prereq—5714 or #) Critical examination of readings and research on specific topic.

**Span 8750. Seminar in Spanish and Portuguese Pragmatics.** (3 cr [max 9 cr]. Prereq—5716 or #) Critical examination of readings and research in specific topic.

**Span 8777. Thesis Credits: Master's.** (1-18 cr [max 50 cr]. Prereq—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]. Prereq—5731 or 5732 or 5985 or #) Current issues.

**Span 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—Max 18 cr per semester or summer; 24 cr required)

**Span 8900. Spanish Seminar.** (3 cr [max 9 cr]. Prereq—Span 5xxx series required for MA 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]; A-F only. Prereq—Reading knowledge of Spanish and Portuguese) 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]. Prereq—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 and Portuguese (SpPt)

*Department of Spanish and Portuguese Studies  
College of Liberal Arts*

**SpPt 5930. Selected Topics in Hispanic and Lusophone Cultural Discourse.** (3 cr [max 9 cr]; A-F only. Prereq—Reading knowledge of Span and Port) Cultural discourses in Spanish- and Portuguese-speaking areas. Historical intersections/divergences. Taught in Spanish or Portuguese, and in English when cross-listed. Topics specified in *Class Schedule*.

**SpPt 5999. The Teaching of College-Level Spanish: Theory and Practice.** (3 cr. Prereq—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]. Prereq—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-Language-Hearing Sciences (SLHS)

*College of Liberal Arts*

**SLHS 5304. Phonetics.** (3 cr. §SLHS 3304) Phonetic analysis, transcription of speech. Articulatory correlates of speech sounds. Extensive practice transcribing. Emphasizes narrow transcription of normal adult English, special populations in Speech-Language Pathology. Non-English IPA sounds needed for special populations.

**SLHS 5401. Counseling and Professional Issues.** (3 cr. Prereq—[[¶ 8720 or ¶8820], grad student] recommended) 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.

**SLHS 5402. Assessment and Treatment in Speech-Language Pathology.** (3 cr; A-F only. Prereq—Grad student or #) Introduction to clinical methods/issues in communication disorders. Professional/legal mandates, collection/analysis of clinical data, principles/models of intervention with adults/children, clinical reporting.

**SLHS 5501. Fluency and Phonological Disorders.** (3 cr. Prereq—Grad student or #) Description, nature, and treatment of fluency disorders in children/adults. Involvement in therapeutic/research activities.

**SLHS 5502. Voice and Cleft Palate.** (3 cr. Prereq—[3305, 4301] or [CDis 3305, CDIs 4301] or #) Normal/disordered aspects of voice and resonance. Organic/functional voice disorders, laryngectomy, cleft palate. Nature and clinical management of these disorders.

**SLHS 5503. Dysphagia and Motor Speech Disorders.** (3 cr. Prereq—[3305, 4301] or [CDIs 3305, CDIs 4301] or #) Nature/management of motor speech disorders in adults/children. Dysarthria, apraxia.

**SLHS 5503. Language and Cognitive Disorders in Children.** (3 cr. Prereq—3303 or CDIs 3303 or equiv or 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.

**SLHS 5505. Language and Cognitive Disorders in Adults.** (3 cr. Prereq—[3302, 4301] or [CDIs 3302, CDIs 4301] 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.

**SLHS 5606. Introduction to Augmentative and Alternative Communication.** (3 cr) Description of the range of augmentative and alternative communication applications for persons with developmental and acquired disabilities.

**SLHS 5607. Electronic Communication Aids.** (3 cr. Prereq—5606 or #)

**SLHS 5801. Audiologic Assessment I.** (3 cr. Prereq—4801 or CDIs 4801 or #) Basic audiometric battery, including pure tones, speech, masking, and immittance in adults. Industrial audiology, otoacoustic emissions.

**SLHS 5802. Hearing Aids I.** (3 cr. Prereq—[3305, 4801] or [CDIs 3305, CDIs 4801] or #) Survey of modern hearing aids including history of development, electroacoustic functions, clinic and laboratory measurement techniques, sound field acoustics, techniques for selection.

**SLHS 5803. Hearing Loss in Children: Diagnosis.** (3 cr. Prereq—4801 or CDIs 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.

**SLHS 5804. Cochlear Implants.** (3 cr; A-F only. Prereq—[4802, 5801, 5802] or [CDIs 4802, CDIs 5801, CDIs 5802] or #) Implantable auditory prostheses. History of device development, including cochlear implants and auditory brainstem implants. Signal processing. Techniques for selection, fitting, and rehabilitation. Behavioral/physiological changes across lifespan.

**SLHS 5806. Auditory Processing Disorders.** (2 cr; A-F only. Prereq—4802 or CDIs 4802) Normal/disordered auditory processing abilities. Anatomy/physiology of central auditory pathway, assessments to evaluate auditory processing skills, techniques to address auditory processing weaknesses. Current/historical theories/controversies surrounding auditory processing assessment.

**SLHS 5807. Noise and Hearing Conservation.** (3 cr; A-F only. Prereq—[8801, 8802] or [CDIs 8801, CDIs 8802]) Formative Assessment in Hearing Conservation. Auditory/nonauditory effects of noise on humans. Designing a hearing conservation program. Measuring noise levels. Monitoring hearing. Measuring hearing protection devices. Developing educational materials Describe federal/state regulations on hearing conservation. Students work in groups to measure noise in campus settings, perform real-ear assessment of hearing protectors, and develop/pilot-test educational materials on effects of noise on hearing.



**SLHS 5808. Hearing Disorders.** (3 cr; A-F only. Prereq—[8801, 8802] or [CDis 8801, CDis 8802]) Disorders of auditory system, including anatomical, physiological, perceptual, and audiological manifestations of pathologies affecting hearing.

**SLHS 5810. Laboratory Module in Audiology.** (1-2 cr [max 5 cr]. Prereq—4801 or CDis 4801 or #) Intensive study of clinical methods in audiology. Supplements didactic courses in audiology curriculum. Laboratory study, individually or in small groups.

**SLHS 5820. Clinical Research and Practice: Grand Rounds.** (1-6 cr [max 6 cr]; S-N only. Prereq—4801 or CDis 4801 or equiv or #)

Students participate in group discussions of current professional issues in audiology. Case presentations, guest presentations on current technology, clinical/research ethics. Group meet for an hour weekly with faculty coordinator who leads discussion. Integrates academic/clinical education.

**SLHS 5900. Topics: Communication Disorders.** (1-3 cr [max 4 cr]) Topics listed in communication disorders office.

**SLHS 5993. Directed Study.** (1-12 cr [max 18 cr]. Prereq—#) Directed readings and preparation of reports on selected topics.

**SLHS 8333. FTE: Masters.** (1 cr. Prereq—Master's student, adviser and DGS consent)

**SLHS 8410. Seminar: Research.** (3 cr) Advanced study exploring application of experimental and quasi-experimental research designs used in single-subject and group research.

**SLHS 8420. Seminar: Teaching.** (3 cr [max 9 cr]. Prereq—Grad com dis major) Advanced study to prepare doctoral students for careers in undergraduate and graduate teaching.

**SLHS 8444. FTE: Doctoral.** (1 cr. Prereq—Doctoral student, adviser and DGS consent)

**SLHS 8501. Interdisciplinary Management in Cleft Palate and Craniofacial Disorders.** (3 cr. Prereq—3305 or CDis 3305 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.

**SLHS 8530. Seminar: Speech.** (3 cr [max 12 cr]) Advanced study and analysis of research in speech science and speech pathology.

**SLHS 8602. Traumatic Brain Injury.** (3 cr. Prereq—[3302, 4301] or [CDis 3302, CDis 4301] or #) Survey of communicative/cognitive disorders in adults who have traumatic brain injuries. Demographics, neuropathologic substrates, assessment/diagnosis, clinical applications.

**SLHS 8630. Seminar: Language.** (3 cr [max 12 cr]) Advanced study and analysis of research in language acquisition, language science, and language disorders.

**SLHS 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq—Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

**SLHS 8720. Clinical Education in Speech-Language Pathology.** (1-8 cr [max 24 cr]; S-N only. Prereq—Grad CDis major, adviser, DGS consent) Clinical experience.

**SLHS 8777. Thesis Credits: Master's.** (1-18 cr [max 50 cr]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**SLHS 8801. Audiologic Assessment II.** (3 cr. Prereq—5801 or CDis 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.

**SLHS 8802. Hearing Aids II.** (3 cr. Prereq—5802 or CDis 5802 or #)

Instrumentation and methods for fitting and evaluating personal hearing aids; ear impression techniques and materials; repair and modification of hearing aids.

**SLHS 8803. Signals and Systems in Audiology.** (3 cr. Prereq—[3305, 3306, 4801] or [CDis 3305, CDis 3306, CDis 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.

**SLHS 8805. Hearing Science Foundations of Audiology.** (3 cr. Prereq—Knowledge of acoustics, basic anatomy/physiology of ear, intro coursework in hearing/speech science)

Physiological/psychological acoustics. Emphasizes hearing loss. Models of middle ear, bone conduction hearing, cochlear mechanics, frequency selectivity, intensity resolution, temporal resolution, and binaural hearing.

**SLHS 8806. Audiology Capstone.** (1-6 cr [max 6 cr]; S-N only. Prereq—8802, 8807)

Students research a case history of patient with an auditory disorder, write paper that summarizes the literature on the disorder, and recommend assessment tools and treatment plans.

**SLHS 8807. Audiologic Assessment III.** (2 cr. Prereq—5801, 8801)

Anatomy/physiology of vestibular mechanism, assessment techniques to evaluate balance function. Treatment options available for persons with balance disorders.

**SLHS 8820. Clinical Education in Audiology.** (1-8 cr [max 24 cr]; S-N only. Prereq—Grad CDis major) Clinical experience.

**SLHS 8830. Seminar: Hearing.** (3 cr [max 12 cr])

Advanced study/analysis of research in hearing science and audiology.

**SLHS 8840. Audiology Externship.** (1-7 cr [max 7 cr]; S-N only. Prereq—[8802, 8807] or [CDis 8802, CDis 8807])

Students intern at external clinical setting under supervision of certified audiologist. Entry-level knowledge/skills required for professional practice as clinical audiologist. External internship settings may include hospitals, schools, private otolaryngology practices, hearing aid dispensing practices, industrial settings, and community clinics.

**SLHS 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—Max 18 cr per semester or summer; 24 cr required)

**SLHS 8994. Directed Research.** (1-12 cr [max 18 cr]. Prereq—#)

Directed research.

## Statistics (Stat)

### School of Statistics College of Liberal Arts

**Stat 5021. Statistical Analysis.** (4 cr. \$AnSc 2211, Stat 3011. Prereq—\$: 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. Prereq—[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. Prereq—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. \$Math 4653, Math 5651, Stat 4101. Prereq—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. \$Stat 4102.

Prereq—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. Prereq—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. Prereq—3022 or 4102 or 5021 or 5102 or #)

Simple, multiple, and polynomial regression. Estimation, testing, prediction. Use of graphics in regression. Stepwise and nonnumerical methods. Weighted least squares, nonlinear models, response surfaces. Experimental research/applications.

**Stat 5303. Designing Experiments.** (4 cr. Prereq—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. Prereq—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. Prereq—5302 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. Prereq—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]. Prereq—#)

Directed study in areas not covered by regular offerings.

**Stat 8061. Applied Statistical Methods I.** (4 cr; A-F only. Prereq—Grad stat major or #)

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; A-F only. Prereq—8061, grad stat major or insr consent)

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. Prereq—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. Prereq—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. Prereq—[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. Prereq—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. Theories of Inference.** (3 cr. Prereq—8102, 8112, or #)  
Topics 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; nonparametric, sequential, likelihood, and Bayesian inference.

**Stat 8131. Predictive Inference.** (3 cr. Prereq—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. Prereq—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; S-N only. Prereq—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. Prereq—8112)  
Wald'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; S-N only. Prereq—8102 or #)  
Sampling theory; stratified sampling, ratio estimators, cluster sampling, double sampling, superpopulation theory, Bayesian methods, multiple imputation, nonresponse.

**Stat 8311. Linear Models.** (4 cr. Prereq—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. Prereq—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. Prereq—8311)  
Optimal, Bayes, and nonlinear designs; algorithms for computing designs; sample size; recent developments.

**Stat 8321. Regression Graphics.** (3 cr. Prereq—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. Prereq—Master's student, adviser and DGS consent)

**Stat 8401. Topics in Multivariate Methods.** (3 cr. Prereq—8311)  
Bivariate and multivariate distributions. Multivariate normal distributions. Hotelling'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. Prereq—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. Prereq—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. Prereq—Doctoral student, adviser and DGS consent)

**Stat 8501. Introduction to Stochastic Processes with Applications.** (3 cr. Prereq—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. Prereq—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. Doct Pre-Thesis Cr.** (1-18 cr [max 60 cr]. Prereq—Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

**Stat 8701. Computational Statistical Methods.** (3 cr. Prereq—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. Prereq—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. Prereq—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]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**Stat 8801. Statistical Consulting.** (3 cr; S-N only. Prereq—Grad stat major or #)  
Principles of effective consulting/problem-solving, meeting skills, and reporting. Aspects of professional practice/behavior, ethics, and continuing education.

**Stat 8811. Statistical Consulting Practicum.** (3 cr [max 12 cr]; S-N only. Prereq—Statistics grad student or #)  
Providing (under faculty supervision) statistical support to clients, primarily University researchers. Exercises in problem solving, ethics, listening/communication skills.

**Stat 8821. Curricular Practical Training.** (1 cr. Prereq—Statistics grad student)  
Industrial work assignment using advanced statistical techniques. Grade based on final report and presentation covering work assignment.

**Stat 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—Max 18 cr per semester or summer; 24 cr required)

**Stat 8900. Student Seminar.** (1 cr [max 2 cr]; S-N only. Prereq—Statistics graduate student)  
Preparation or presentation of seminar on statistical topics.

**Stat 8931. Advanced Topics in Statistics.** (3 cr [max 12 cr])  
Topics vary according to student needs and available staff.

**Stat 8932. Advanced Topics in Statistics.** (3 cr [max 12 cr])  
Topics vary according to student needs and available staff.

**Stat 8933. Advanced Topics in Statistics.** (3 cr [max 12 cr])  
Topics vary according to student needs and available staff.

**Stat 8992. Directed Readings and Research.** (1-6 cr [max 12 cr]. Prereq—#)  
Directed study in areas not covered by regular offerings.

## Studies in Cinema and Media Culture (SCMC)

*Department of Cultural Studies and Comparative Literature*

*College of Liberal Arts*

**SCMC 5001. Critical Debates in the Study of Cinema and Mass Culture.** (4 cr)

Basic concepts in historical/international debates over production/reception of mass culture. Emphasizes cinema. Advanced orientation toward intellectual traditions that inform contemporary scholarship.

**SCMC 5993. Directed Study.** (1-3 cr [max 6 cr])  
Guided individual reading or study.

## Studies of Science and Technology (SST)

*Institute of Technology*

**SST 8000. Colloquium.** (1.5 cr [max 3 cr]; S-N only. Prereq—Grad SST minor)

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. Prereq-HSci 8111 or [Phil 8601 or Phil 8602 or Phil 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: Philosophy of the Physical Sciences.** (3 cr [max 6 cr]. Prereq-#) 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. Prereq-HSci 8111 or [Phil 8601 or Phil 8602 or Phil 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. Prereq-HSci 8111 or [Phil 8601 or Phil 8602 or Phil 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. Seminar: Social and Cultural Studies of Science.** (3 cr [max 6 cr]. \$Phil 8660) 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. Prereq-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. Prereq-5011) Reading from classical literary and historical texts.

## Surgery (Surg)

*Department of Surgery*

### Medical School

**Surg 8200. Clinical Surgical Problems in Management.** (3 cr; A-F only. Prereq-Grad surg major) Diagnostic and management instruction in all phases of clinical surgery, inpatient and outpatient.

**Surg 8201. Surgery Roentgenological Pathology Conference.** (1 cr; A-F only. Prereq-Grad surg major) 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; A-F only. Prereq-Grad surg major) Graduate students undertake original investigation of problems in either experimental or clinical surgery.

**Surg 8203. Surgery Complications and Research Conference.** (1 cr; A-F only. Prereq-Grad surg major) Evaluation of surgical patients, including postoperative course. Discussion and critical evaluation of current research problems.

**Surg 8207. Transplantation Conference.** (1 cr; A-F only. Prereq-Grad surg major) Interdepartmental discussion and evaluation of current clinical and research problems.

**Surg 8293. Applied Statistics.** (1 cr; S-N only. Prereq-Grad student in [surgery or experimental surgery or health sciences]) Interactive computer course. Concepts of applied statistics. Examples, problem sets based on surgical research. How to independently set up appropriate experiments and perform basic descriptive/inferential analysis.

**Surg 8333. FTE: Master's.** (1 cr. Prereq-Master's student, adviser and DGS consent)

**Surg 8444. FTE: Doctoral.** (1 cr. Prereq-Doctoral student, adviser and DGS consent)

**Surg 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq-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]. Prereq-Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**Surg 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq-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; A-F only. Prereq-Coursework in biological or social sciences that provides intro to ag practices or issues) 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 [max 3 cr]; S-N only. Prereq-Coursework in biological or social sciences that provides intro to ag practices or issues) 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 5101. Academic Writing in TESOL.** (1 cr; S-N only. Prereq-[5721, grad ESL student] or #) Research writing conventions in the profession. University rules on ethical use of human subjects, research paper rhetorical structure, literature sources/searches, literature review coherence, hedging markers, basic research methods, research result reporting, APA-formatted bibliographies, writing strategies.

**TESL 5401. Language Analysis for Teachers of English as a Second Language.** (4 cr. Prereq-Ling 3001 or Ling 5001 or #) 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. Prereq-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 5610. Research Methods in Applied Language Study.** (3 cr [max 12 cr]. Prereq-Ling 5505 or #) Key issues in second language acquisition/learning research. Focuses on learning a second or foreign language in the classroom.

**TESL 5721. Methods in Teaching English as a Second Language.** (3 cr. Prereq-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.** (6 cr [max 12 cr]. Prereq-[5401 or 5402], [5402 or 5402], 5721, ESL major or ESL minor or #) Observation of, and practice in, teaching English as a second language to adults at college or university level.

**TESL 5723. Materials for Teaching English as a Second Language.** (3 cr. Prereq-5721, 5722 or #) Evaluation and preparation of teaching materials for English as a second language.

**TESL 5724. Intro to Language Assessment.** (3 cr; A-F only) How to engage in meaningful, appropriate, and fair second-language assessment practices; interpret test results; and construct new forms of assessment.

**TESL 5900. Topics in Second Language Learning and Teaching.** (1-4 cr [max 16 cr]) Topics vary. See *Class Schedule*.

**TESL 5910. Seminar in Teaching English as a Second Language.** (3 cr [max 9 cr]) 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]. Prereq-#, □) Directed study for teaching English as a second language.

**TESL 8333. FTE: Master's.** (1 cr. Prereq-Master's student, adviser and DGS consent)

**TESL 8751. English for Specific Purposes.** (3 cr. Prereq-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]. Prereq-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]. Prereq-#, 4 cr or 3100 for undergrads) Individual creative projects in production of approved plays as an actor, director, dramaturg, or playwright. (See 5500 for design practicums.)

**Th 5103. The Theatre Dramaturg.** (3 cr. Prereq-[4177 or 4178], [jr or sr], #) Theoretical/practical aspects of dramaturgy in American theater. Historical perspectives. Research/production history of classics. Development of new scripts. Dramaturgical structure and interpretive choices. Dramaturgy as it relates to playwrights/directors. Preparing/editing the rehearsal script. Production dramaturgy.

**Th 5117. Performance and Social Change.** (3 cr; A-F only. Prereq–Jr or sr or grad student)  
Reading, writing, research, presentations and workshops explore activist performance projects. Theories of social formation and ideology provide framework to discuss/animate theater’s potential for social change.

**Th 5178. History and Theory of Performance Conventions.** (3 cr; A-F only. Prereq–[1322, 3171 or 3172]) or grad student)  
Draws on visual materials, practical exercises, and theories of spatial representation in context of political/social function. Historical/cross-cultural overview of performance conventions and theatrical space from City of Dionysia to site-specific happenings of 20th century.

**Th 5179. Text and Performance.** (3 cr; A-F only. Prereq–[1322, 3171 or 3172]) or grad student)  
How to read texts toward performance in various dramatic/nondramatic material. Method of unlocking metaphorical energy of texts. Vocabulary/techniques of analysis that transform text from page to stage.

**Th 5181. Blacks in American Theatre.** (3 cr. \$Afro 5181)  
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. \$Afro 5182)  
Essays, plays, playwrights, and theatres that have contributed to contemporary Black theatre. From the beginning of the Black Arts Movement to the present.

**Th 5355. Puppetry: Techniques and Practice in Contemporary Theater.** (3 cr. Prereq–[[3513 or ¶3513], #] or grad student)  
Fundamentals of puppet and object theater/performance are introduced through traditional/contemporary puppetry forms. Focuses on object theater, toy theater, hand puppets, and shadow/Bunraku-style puppets. Readings, in-class screenings of videos/slides. Students build/create series of short works for in-class performance.

**Th 5500. Theatre Design Practicum.** (1-3 cr [max 20 cr]. Prereq–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. Prereq–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. Prereq–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]. Prereq–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]. Prereq–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]. Prereq–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. Prereq–3515 or grad or #)  
The lighting technician’s skills and crafts: equipment, techniques, control operation, wiring, and maintenance.

**Th 5550. Video Project.** (3 cr [max 6 cr]. Prereq–[4550 or 4560 [preferred]], #)  
Students participate in a video-shoot project serving in various positions, including camera operator, gaffer, grip, audio engineer, cast, and possibly director and director of photography.

**Th 5551. Editing and Post Production for Video and Film.** (3 cr. Prereq–#)  
Students manipulate software and other technologies used in post production. Editing, audio, image manipulation.

**Th 5553. Video Production Design and Aesthetics.** (3 cr. Prereq–4553 or #)  
Use of technologies in video/film in making a statement or communicating an idea/emotion. Creativity, sensitivity to an audience. Students explore different creative uses of technologies/medium.

**Th 5554. Multimedia Production for Live Performance.** (3 cr. Prereq–5553 or #)  
Use of multimedia production technologies in actual production. Students apply knowledge/skill in conjunction with an artistic team on a production and are an integral part of the development/realization of that production.

**Th 5556. Audio Engineering.** (3 cr. Prereq–4555 or #)  
Mixing/recording techniques specific to music and dramatic dialogue. Students explore recording different styles of music. Hands-on experience in recording bands and doing final mixes to a demo CD. Field trips to professional studios and club/concert recordings.

**Th 5558. Audio Systems Analysis and Installation.** (3 cr. Prereq–4555 or #)  
Analyzing, designing, developing specifications, and installing sound systems. Students work from client program lists, with given resources and given spaces, to arrive at best possible audio system. Hands-on experience.

**Th 5559. Sound Design for Performance.** (3 cr. Prereq–4555 or #)  
Audio technology/psychology, their impact on audience in a performance. Communication, design process, psychoacoustics, script analysis.

**Th 5560. Drawing, Rendering, and Painting for the Theatre Designer II.** (3 cr. Prereq–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]. Prereq–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.** (3 cr [max 15 cr]. Prereq–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]. Prereq–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. Prereq–[4711, #] or grad student)  
Realistic/nonrealistic dramatic forms. Theory/technique of rehearsal. Production problems. Includes directing of three one-act plays.

**Th 5713. Theory and Practice of Performance.** (3 cr; A-F only. Prereq–[3171, 3172, [4177 or 4178], 5711] or grad student)  
Traditions of thinking about theatre, from ancient Greece to present, in practical applications. Focuses on epistemological significance of performance in current critical practices of postmodernism, psychoanalysis, and phenomenology.

**Th 5714. The Drama of Myth.** (3 cr. Prereq–[1322, 3171, 3172] or #)  
Role of myth in performance. Students choose a myth and study its iconography, tracing its journey in painting, sculpture, music, and other texts that accumulated around it throughout history. Course culminates in creation of a non-traditional performance score that embodies/reveals energies of contemporary culture within ancient metaphor of a chosen myth.

**Th 5715. Actor-Director Collaboration.** (3 cr. Prereq–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. Prereq–[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. Prereq–#)  
Nonprofit theatre structure: concept; mission; organization; financial, marketing, fund-raising, and grant-writing strategies. Discussion/guest professionals from Twin Cities’ arts/funding communities.

**Th 5725. The Alchemy of an Object.** (3 cr. Prereq–[[1322, 3171, 3172] or #], grad student)  
Stage object as vehicle for investigating role of drama in culture from Middle Ages to present. Object as first connection that dramatic text makes with materialworld. Object as culturally inscribed link between language of drama and world of action in a historically given moment. Object as metaphor of cultural praxis.

**Th 5753. Text Analysis for Drama.** (3 cr. Prereq–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 [max 3 cr]. Prereq–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]. Prereq–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])  
Topics specified in *Class Schedule*.

**Th 5993. Directed Study.** (1-5 cr [max 20 cr]. Prereq–6 Th cr, #, □)  
Guided individual reading or study.

**Th 8100. Theatre Practicum.** (1-4 cr [max 20 cr]. Prereq–#, 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 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. Prereq—Master's student, adviser and DGS consent)

**Th 8444. FTE: Doctoral.** (1 cr. Prereq—Doctoral student, adviser and DGS consent)

**Th 8500. Theatre Design Practicum.** (1-3 cr [max 20 cr]. Prereq—#)

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]. Prereq—#)

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]. Prereq—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-Meinigen, 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]; A-F only. Prereq—MFA directing specialization)

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]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**Th 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—Max 18 cr per semester or summer; 24 cr required)

**Th 8950. Topics in Theatre.** (1-4 cr [max 8 cr])  
Topics specified in *Class Schedule*.

**Th 8980. Internship.** (1-5 cr [max 10 cr]. Prereq—#)

**Th 8990. MFA Creative Thesis.** (3-4 cr [max 4 cr]. Prereq—#)

**Th 8994. Directed Research.** (1-5 cr [max 5 cr]. Prereq—#)

**Therapeutic Radiology (TRad)**

*Department of Therapeutic Radiology*

**Medical School**

**TRad 8204. Tumor Clinic Conference.** (0 cr)

**TRad 8240. Radiation Therapy Conference.** (0 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 [max 15 cr])

**TRad 8450. Research: Radiation Biology.** (1-15 cr [max 15 cr])

**TRad 8550. Research: Radiological Physics.** (1-15 cr [max 15 cr])

**Toxicology (Txcl)**

*College of Veterinary Medicine*

**Txcl 5000. Directed Research in Toxicology.** (1-4 cr [max 16 cr]; A-F only. Prereq—#)

Special project that addresses specific issue in toxicology. Under guidance of faculty member.

**Txcl 5011. Principles of Toxicology.** (2 cr; A-F only. Prereq—Grad txcl major or #)

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; A-F only. §CVM 6195. Prereq—Grad student or #)

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 cr; A-F only. §CVM 6545. Prereq—Grad student or #)

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; A-F only. Prereq—5011 or BioC 4331, PubH 5104 or #)

Absorption, distribution, metabolism, and excretion of xenobiotics; toxicokinetics; mechanisms of toxicity or specific classes of chemical agents.

**Txcl 8013. Advanced Toxicology II.** (3 cr; A-F only. Prereq—8012, BioC 4332, Phsl 5062 or Phsl 6101 or #)

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]; A-F only. Prereq—8013 or #)

Evaluating toxicology research issues and literature.

**Txcl 8333. FTE: Master's.** (1 cr. Prereq—Master's student, adviser and DGS consent)

**Txcl 8444. FTE: Doctoral.** (1 cr. Prereq—Doctoral student, adviser and DGS consent)

**Txcl 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq—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]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**Txcl 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—Max 18 cr per semester or summer; 24 cr required)

**Translation and Interpreting (Trln)**

*Institute of Linguistics, ESL, and Slavic Languages and Literatures*

**College of Continuing Education**

**Trln 5900. Topics in Translation and Interpreting.** (1-4 cr [max 16 cr])

Topics specified in *Class Schedule*.

**Trln 5993. Directed Study.** (1-3 cr [max 3 cr]. Prereq—#, 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 cr. Prereq—Grad student or [adv Urbs undergrad, #])

The City and the Metropolis as places that result from important acts of human creativity. Interdisciplinary/exploratory perspectives. Building/developing (North American) cities, Construction of “urban culture.”

**Veterinary and Biomedical Sciences (VBS)**

*College of Veterinary Medicine*

**VBS 8333. FTE: Master's.** (1 cr. Prereq—Master's student, adviser and DGS consent)

**VBS 8444. FTE: Doctoral.** (1 cr. Prereq—Doctoral student, adviser and DGS consent)

**VBS 8666. Doctoral Pre-Thesis Credits.** (1-18 cr. Prereq—Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

**VBS 8700. Seminar: Veterinary Pathobiology.** (1 cr [max 5 cr])

**VBS 8777. Thesis Credits: Master's.** (1-18 cr. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**VBS 8888. Thesis Credit: Doctoral.** (1-24 cr. Prereq—Max 18 cr per semester or summer; 24 cr required)

**Veterinary Medicine, Graduate (VMed)**

*College of Veterinary Medicine*

**VMed 5080. Problems in Veterinary Epidemiology and Public Health.** (1-3 cr [max 5 cr]; A-F only)

Individual study on problem of interest to epidemiology or public health student.

**VMed 5090. Seminar: Veterinary Epidemiology.** (1 cr [max 3 cr]; S-N only. Prereq—Veterinary Medicine grad student)

Each student leads at least one seminar. Reviews of current research, literature reviews, and technique development. Students and participating faculty participate in presentation, discussion, and administration of the seminars.

**VMed 5093. Directed Studies in Population Medicine.** (1-4 cr [max 8 cr]; A-F only. Prereq—Grad student, #)

Directed studies arranged between student and instructor.

**VMed 5165. Surveillance of Foodborne Diseases and Food Safety Hazards.** (2 cr. §PubH 6181. Prereq—[PubH 5330, [professional school or grad student]] or #)

Principles/methods for surveillance of foodborne diseases. Investigation of outbreaks. Assessment of food safety hazards. Focus on integration of epidemiologic/lab methods.

**VMed 5193. Dairy Decision Making in a Financial Context.** (2 cr; A-F only. Prereq—Earned DVM, #)  
Economic/decision making principles applied to commercial dairy farms in North America. Economic techniques, decision making under financially constrained conditions. Financial evaluation of a dairy operation. Modules assignments, written work submitted via the Internet, discussions at online course site.

**VMed 5210. Advanced Large Animal Physiology I.** (1-3 cr [max 6 cr])  
Review of large animal physiology at level needed for specialty board certification or beginning research. Students present topics in physiology and supplement reading with clinical case material or journal articles.

**VMed 5211. Advanced Large Animal Physiology II.** (1-3 cr [max 6 cr]; A-F only. Prereq—5210 recommended)  
Review of large animal physiology at level needed for specialty board certification or beginning research. Students present topics in physiology and supplement reading with clinical case material or journal articles.

**VMed 5212. Large Animal Diagnostic Ultrasonography.** (1 cr; A-F only. Prereq—#)  
Fundamentals of diagnostic ultrasound in large animal patient. Ultrasonography of the equine limbs/joints, large animal abdomen/thorax. Lectures, lab.

**VMed 5232. Comparative Clinical Veterinary Dermatologic Pathology.** (1 cr; A-F only. Prereq—Grad student, #)  
Microscopic pathology of basic dermatologic reactions and of variable disease states.

**VMed 5274. Diseases of the Urinary System.** (1 cr; A-F only. Prereq—#)  
Expands on disorders of small animal urinary system. Introduction to core and to additional disorders.

**VMed 5291. Independent Study in Veterinary Medicine.** (2 cr. Prereq—DVM, #)  
Arranged independent study in a clinical area of veterinary medicine.

**VMed 5293. Directed Studies in Comparative Medicine and Pathology.** (1-4 cr [max 8 cr]; A-F only. Prereq—Grad student, #)  
Directed studies arranged between student and instructor.

**VMed 5295. Problems in Large Animal Clinical Medicine/ Surgery and Theriogenology.** (1 cr [max 3 cr]; A-F only. Prereq—VMed grad student, possess DVM)  
Hospital cases using standardized format, audiovisual aids. Review literature pertaining to case. One or two cases presented by enrolled participants per month.

**VMed 5493. Directed Studies in Infectious Disease.** (1-4 cr [max 8 cr]; A-F only. Prereq—Grad student, #)  
Directed studies arranged between student and instructor.

**VMed 5496. Training in Swine Production and Management.** (4 cr. Prereq—VMed grad student or #)  
Production module introduces techniques/protocols for swine production system operation. Research module covers applied research trials for viral/bacterial pathogens in pigs.

**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 5610. Companion Animal Oncology.** (2 cr; S-N only. Prereq—DVM, #)  
Principles of veterinary oncology. Biologic behaviors, treatments, and prognosis of neoplastic disorders.

**VMed 5621. Principles of Veterinary Anesthesiology.** (2 cr. Prereq—VMed grad student, [DVM degree or foreign equiv], instr consent)  
In-depth training in principles of veterinary anesthesiology. Lectures, anesthesia labs, presentations by students.

**VMed 5670. Bovine Surgery Practicum.** (2 cr. Prereq—[VMed grad student, [DVM or equiv foreign degree]] or #)  
Intensive training in ruminant surgery. Evaluation of food animal surgery principles, hands-on laboratory components.

**VMed 5691. Independent Research in Veterinary Anesthesiology.** (1-6 cr [max 6 cr]; A-F only. Prereq—[Biology major or prevet or vet or grad student], #)  
Independent research supervised by faculty member.

**VMed 5693. Directed Studies in Surgery/Radiology/ Anesthesiology.** (1-4 cr [max 8 cr]; A-F only. Prereq—Grad student, #)  
Directed studies arranged between student and instructor.

**VMed 5720. Small Animal Orthopedic Radiology.** (2 cr. Prereq—#)  
Roentgen signs of common bone diseases of small animals.

**VMed 5722. Large Animal Orthopedic Radiology.** (1-2 cr [max 2 cr]. Prereq—#)  
Roentgen signs of common bone diseases of large animals. Emphasizes the horse.

**VMed 5893. Directed Studies in Theriogenology.** (1-4 cr [max 8 cr]; A-F only. Prereq—Grad student, #)  
Directed studies arranged between student and instructor.

**VMed 8090. Epidemiology of Zoonoses and Diseases Common to Animals and Humans.** (3 cr; A-F only. Prereq—Epidemiology and infectious disease course or #)  
Major human zoonotic diseases, methods of transmission, diagnosis, control, and prevention.

**VMed 8134. Ethical Conduct of Animal Research.** (2 cr; A-F only. \$ANSC 8134. Prereq—[Grad or professional school] student or #)  
Ethical considerations in use of animal subjects in agricultural, veterinary, and biomedical research. Federal, state, and University guidelines relating to proper conduct for acquisition/use of animals for laboratory, observational, epidemiological, and clinical research. Regulatory requirements. Bases for proper conduct. Societal impact on scientific investigations utilizing animal subjects.

**VMed 8195. Pre-Harvest Food Safety and Public Health Aspects of Food Animal Production.** (1-3 cr [max 3 cr])  
Includes presentations and discussions on on-farm HACCP principles and prudent use of antibiotics.

**VMed 8201. Advanced Small Animal Veterinary Medicine.** (1-5 cr [max 5 cr]; A-F only. Prereq—#)  
Discussions of diseases of organs or systems in animals, including degenerative, psychological, anomalous, metabolic, nutritional, neoplastic, immune, inflammatory, toxic, and traumatic disorders.

**VMed 8202. Internal Medicine in Small Companion Animals.** (1-3 cr [max 3 cr]; A-F only. Prereq—#)  
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 [max 2 cr]; A-F only. Prereq—#)  
Detailed examination, treatment, and discussions of naturally occurring disease in patients admitted to Veterinary Teaching Hospital.

**VMed 8210. Seminar: Veterinary Medicine.** (1 cr. Prereq—#)  
Participation and presentations of regularly scheduled seminars about internal medicine.

**VMed 8220. Advanced Nephrology/Urology Clinics.** (1-3 cr [max 3 cr]. Prereq—#)  
Clinical investigation of naturally occurring urinary diseases in patients admitted to Veterinary Teaching Hospital.

**VMed 8230. Medical Conference.** (1-3 cr [max 3 cr]. Prereq—#)  
Participation in weekly conference about internal medical disorders.

**VMed 8250. Problems in Acid-base, Electrolyte, and Fluid Metabolism.** (2-4 cr [max 4 cr]; A-F only. Prereq—#)  
Clinical problems and physiology of acid-base, electrolyte, and fluid disorders of dogs and cats.

**VMed 8292. Journal Club: Large Animal Internal Medicine.** (1 cr [max 3 cr]; A-F only. Prereq—#)  
Students/faculty keep abreast of current literature in large animal internal medicine. Students critically evaluate the literature.

**VMed 8293. Advanced Studies in Nephrology and Urology.** (1-3 cr [max 3 cr]; A-F only. Prereq—#)  
Studies of urinary tract disease with goal of generating new knowledge.

**VMed 8294. Research Studies in Nephrology and Urology.** (1-3 cr [max 3 cr]. Prereq—#)  
Individual research on selected problems

**VMed 8296. Advanced Large Animal Veterinary Medicine.** (1-3 cr [max 6 cr]; A-F only. Prereq—DVM student, vet med grad student, #)  
Discussions of diseases of organs or systems in animals in a clinical setting.

**VMed 8333. FTE: Master's.** (1 cr. Prereq—Master's student, adviser and DGS consent)

**VMed 8360. Evidence-based Medicine.** (2 cr; A-F only. Prereq—#)  
Use of medicine literature in clinical problem solving.

**VMed 8393. Medical Conference.** (1-3 cr [max 6 cr]; 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 [max 3 cr]. Prereq—#)  
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]. Prereq—DVM student, vet med student, #)  
Detailed examination, discussions, and treatments of cases of animal diseases in a clinical setting.

**VMed 8444. FTE: Doctoral.** (1 cr. Prereq—Doctoral student, adviser and DGS consent)

**VMed 8492. Seminar: Infectious Diseases and Swine Medicine.** (1-2 cr [max 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 [max 3 cr])  
Directed research.

**VMed 8495. Problems in Infectious Diseases.** (1-3 cr [max 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 [max 3 cr])  
Discussion and laboratory practice.

**VMed 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq—Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

**VMed 8681. Advanced Small Animal Surgery.** (1-3 cr [max 3 cr])  
Advanced techniques and procedures.

**VMed 8682. Advanced Large Animal Surgery.** (1-3 cr [max 6 cr]; A-F only. Prereq—DVM or equiv degree, #)  
Surgery of various systems in large animals, with preoperative and postoperative evaluation and management.

**VMed 8683. Surgery of the Gastrointestinal System.** (2-4 cr [max 4 cr]; A-F only)  
Advanced techniques and problems.

**VMed 8684. Surgical Physiology.** (1-3 cr [max 3 cr])  
Discussions on pathophysiology of surgical diseases in dogs and cats.

**VMed 8685. Neurosurgery.** (2-3 cr [max 3 cr]; A-F only)  
Advanced neurosurgical diseases of small animals amenable to surgical treatment.

**VMed 8686. Thoracic and Cardiovascular Surgery.** (2-4 cr [max 4 cr]; A-F only)  
Advanced thoracic and cardiovascular diseases of small animals amenable to surgical treatment.

**VMed 8688. New Techniques in Large Animal Surgery.** (1-6 cr [max 6 cr]; A-F only. Prereq—DVM or equiv degree, #)

**VMed 8691. Research in Large Animal Surgery.** (1-6 cr [max 6 cr]; A-F only. Prereq—DVM or equiv degree, #)  
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]; A-F only. Prereq—DVM or equiv degree, #)  
Discussion of current literature and surgery board preparation.

**VMed 8694. Research in Small Animal Surgery.** (1-3 cr [max 3 cr]; S-N only)

**VMed 8695. Problems in Large Animal Surgery.** (1-3 cr [max 6 cr]; A-F only. Prereq—DVM or equiv degree, #)  
New techniques and procedures in large animal orthopedic surgery.

**VMed 8696. Research in Critical Care/Emergency Medicine.** (1-3 cr [max 3 cr]. Prereq—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]. Prereq—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; A-F only. Prereq—Course each in vet pathology, physiology, pharmacology, anatomy, small animal anesthesiology and critical care)  
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 [max 3 cr]; A-F only. Prereq—[[CVM 6321, CVM 6322] or equiv], grad student)  
Active interaction around topics of advanced anesthesiology in veterinary species.

**VMed 8782. Advanced Veterinary Abdominal Imaging.** (1-3 cr [max 3 cr])  
Applications and discussion of basic principles through emerging techniques.

**VMed 8783. Advanced Veterinary Thoracic Imaging.** (1-3 cr [max 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; A-F only. Prereq—DVM or equiv degree)  
Current topics.

**VMed 8789. Research in Avian Clinical Problems and Procedures.** (1-3 cr [max 3 cr]; A-F only. Prereq—DVM, #)  
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 [max 3 cr]; A-F only. Prereq—8781 or equiv, SACS 5380 or equiv)  
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 [max 2 cr]; A-F only. Prereq—[CVM 6321 or equiv], DVM degree)  
Discussion and presentations; for veterinary anesthesiology and surgery residents and graduate students.

**VMed 8794. Research in Veterinary Radiology.** (1-3 cr [max 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 [max 3 cr]; A-F only. Prereq—courses in vet anesthesia, vet small animal orthopedics)  
Current methods for anesthetizing raptors, psittacine birds, and waterfowl. Lecture and lab on current methods for avian fracture bone fixation.

**VMed 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—Max 18 cr per semester or summer; 24 cr required)

## Water Resources Science (WRS)

### College of Natural Resources

**WRS 5001. Introduction to Field Research in Water Resources.** (2 cr. Prereq—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. Prereq—Grad student or #)  
Socio-cultural, legal, and economic forces that affect use of water resources by individuals/institutions. Historical trends in water policy, resulting water laws in the United States. Institutional structures whereby water resources are managed at federal, state, and local levels.

**WRS 5241. Ecological Risk Assessment.** (3 cr. Prereq—#)  
Evaluating current/potential impact of physical, chemical, and biological agents on ecosystems. Identifying ecological stressors, assessing level of exposure, measuring ecological responses, communicating/managing risks. Class participation, two reaction papers, final exam, small-group project.

**WRS 8050. Special Topics in Water Resources Science.** (1-3 cr [max 6 cr]; A-F only)

**WRS 8060. Directed Studies in Water Resources Science.** (1-3 cr [max 6 cr]; A-F only)

**WRS 8095. Plan B Project.** (3 cr; 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. Prereq—Master's student, adviser and DGS consent)

**WRS 8444. FTE: Doctoral.** (1 cr. Prereq—Doctoral student, adviser and DGS consent)

**WRS 8581. Research and Professional Ethics in Water Resources and Environmental Science.** (.5 cr; S-N only. §CE 8581. Prereq—[Environmental engineering or water resources science] grad student or #)

Ethics of water resources science and environmental engineering research/practice. Societal responsibility, plagiarism, recording-keeping, authorship, confidentiality, conflicts of interest, professional relationships, fraud, reporting misconduct. Meets during first eight weeks of spring semester.

**WRS 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq—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]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**WRS 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq—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. Prereq—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. Prereq—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 5104. International Feminist Theory.** (3 cr. §WoSt 4103H)  
Third World and transnational feminisms. Interrogating the categories of "women," "feminism," and "Third World." Varieties of power/oppression that women have endured/resisted, including colonization, nationalism, globalization, and capitalism. Concentrates on postcolonial context.

**WoSt 5105. Gendered Rhetoric of Science and Technology.** (3 cr. Prereq—[§Rhet 5108, §Rhet 8530]; 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 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 5122. Philosophy and Feminist Theory.** (3 cr. §Phil 4622, Phil 5622, WoSt 4122. Prereq—8 crs in [philosophy or women's studies] or #)  
Encounters between philosophy/feminism. Gender's influence in traditional philosophical problems/methods. Social role of theorist/theorizing as they relate to politics of feminism.

**WoSt 5190. Topics: Theory, Knowledge, and Power.** (3 cr)  
Topics specified in *Class Schedule*.

**WoSt 5201. Global Processes and the Politics of Sexuality.** (3 cr. Prereq—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 5203. Women and Madness in History and Literature.** (3 cr. Prereq—S; 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, Health, and Environmental Studies.** (3 cr)  
Topics specified in *Class Schedule*.

**WoSt 5300. Communication and Gender.** (3 cr; A-F only. Prereq—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.

**WoSt 5390. Topics: Visual, Cultural, and Literary Studies.** (3 cr)  
Topics specified in *Class Schedule*.

**WoSt 5403. Chicana/Latina Feminisms.** (3 cr. Prereq—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. Prereq—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. Prereq—#)  
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: Political Economy and Global Studies.** (3 cr [max 12 cr])  
Topics specified in *Class Schedule*.

**WoSt 5501. Women and the Law.** (3 cr. Prereq—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 5590. Topics: Social Change, Activism, Law, and Policy Studies.** (3 cr [max 12 cr])  
Topics specified in *Class Schedule*.

**WoSt 5690. Topics: Women, Society, and Race in the United States.** (3 cr)  
Topics specified in *Class Schedule*.

**WoSt 5790. Topics: Sexuality Studies.** (3 cr)  
Topics specified in *Class Schedule*.

**WoSt 5993. Directed Study.** (1-12 cr [max 12 cr])

**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. \$Phil 8133)  
Interdisciplinary seminar. Feminist approaches to knowledge and to criticism of paradigms of knowledge operative in the disciplines. Feminist use of concepts of subjectivity, objectivity, and intersubjectivity. Feminist empiricism, standpoint theory, and contextualism. Postmodern and postcolonial theorizing.

**WoSt 8108. Feminist Theories and Methods I.** (3 cr. Prereq—Feminist studies PhD 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. Prereq—8108, feminist studies PhD 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])  
Topics in feminist theory.

**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 8290. Topics: Social Sciences and Public Policy.** (1-3 cr [max 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. Prereq—Master's student, adviser and DGS consent)

**WoSt 8390. Topics: Literary Studies.** (1-3 cr [max 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. Prereq—Doctoral student, adviser and DGS consent)

**WoSt 8490. Topics: Comparative and Global Studies.** (1-3 cr [max 3 cr])

**WoSt 8590. Topics: Historical Studies.** (1-3 cr [max 3 cr])

**WoSt 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq—Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

**WoSt 8888. Thesis Credit: Doctoral.** (1-24 cr [max 24 cr]. Prereq—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 cr [max 4 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. Prereq—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.

## 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 5011. 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 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 Career and Technical Education.** (2 cr; A-F only)  
Purposes/goals of contemporary career/technical education. Governance structure, historical perspectives, industry-education relationship, current education practices. Possible future trends and their implications. Development of a personal philosophy of career/technical 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 of Extension.** (2 cr; A-F only. \$AFEE 5341)

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. \$AFEE 5351)

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 5511. Education for Work.** (3 cr)

Examination of contextual bases underlying education for work; implications for practice.

**WCFE 5521. Work-Based Learning Policies.** (2 cr)

Aims/purposes of federal, state, and local policies, related to work-based learning.

**WCFE 5522. Work-Based Learning Practices.** (3 cr)

Learning in context. Curricular integration. Educational systems articulation. Educational partnerships. Best practices in school-/work-/service-based learning/connecting activities. Building community support. Leadership relating to active, community-based learning.

**WCFE 5601. Student and Trainee Assessment.** (2 cr; A-F only. \$HRD 5601. Prereq-§: BIE 5601)

Developing learning progress reporting systems and tests of knowledge, affect, and processes for programs focused on instruction of skills associated with business/industry. Evaluating instructional effectiveness. Applying tests and other evaluation instruments to assess/report learning in business/industry and career/technical education fields. Students develop each type of test and an overall evaluation plan for a course.

**WCFE 5629. Course Development for Business and Industry.** (2 cr; A-F only. \$HRD 5629)

Designing instructional programs/courses that help learners develop desired competence. Designing instruction for performance based training and vocational/technical education. Developing course syllabus components that clarify course expectations. Developing academic/community-based elements that complement course goals. Reflect on and compare performance-based instruction with other curriculum models for the field.

**WCFE 5661. Instructional Methods for Business and Industry.** (2 cr. \$HRD 5661. Prereq-§: HRD 5661 or BIE 5661)

Theory/practice in instructional methods for career/technical education (CTE) instructors and human resources/development (HRD) professionals. How to select variousteaching methods and plan for their delivery. Preparing an instructional methods plan to clarify course content, teaching methods selected, rationale for their selection, and how a student organization might facilitate student learning.

**WCFE 5696. Teaching Internship: Introduction.** (1 cr. \$CI 5924. Prereq-Admission to initial licensure program)

Initial experiences in teaching profession. Observation of school organization/administration, seminars, relationship building with cooperating teachers, reflection on personal involvement as a beginning student teacher.

**WCFE 5697. Teaching Internship: School and Classroom Settings.** (2 cr. \$CI 5925. Prereq-5696 for initial licensure program)

Part-time supervised teaching experience in a school. Seminars on managing student's learning in 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]. Prereq-Admission to initial licensure program)

Teaching experience in a school system that provides programs for grades 5-12.

**WCFE 5699. Teaching Internship: Extended.** (1 cr. \$CI 5926, CI 5927. Prereq-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. Enhancing Work-based Learning Through Collaboration.** (2 cr)

Interagency planning issues/practices relating to special populations for educational, business, and human service organization personnel, family members, and advocates.

**WCFE 5803. Developmental Writing and the College Student: Theory and Practice.** (3 cr. Prereq-Bachelor's degree)

Basic grounding in theory/practice of college-level developmental writing instruction. History of "basic writing," development of notions of "academic discourse," error/grammar in student writing, best classroom practices, current issues.

**WCFE 5804. Research in Postsecondary Developmental Education.** (3 cr. Prereq-Bachelor's degree, courses in [intro psychology, basic statistics])

Strategies for conducting three types of research that are central to developmental education: placement test validation, program evaluation, and classroom research. Students read examples and learn what constitutes best practices in each type.

**WCFE 5821. Diversity Issues and Practices in Work, Community, and Family Settings.** (3 cr. \$HRD 5821)

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.** (3 cr. \$HRD 5822)

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])

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 12 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. Prereq-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. Prereq-Doctoral student, adviser and DGS consent)

**WCFE 8666. Doctoral Pre-Thesis Credits.** (1-18 cr [max 60 cr]. Prereq-Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

**WCFE 8888. Thesis Credit: Doctoral.** (1-24 cr [max 100 cr]. Prereq-Max 18 cr per semester or summer; 24 cr required)

**WCFE 8896. Internship.** (1-10 cr [max 10 cr]; 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.** (3 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. Positivist, interpretive, and critical science research perspectives.

**WCFE 8912. Quantitative Research.** (3 cr. Prereq-8911)

Assumptions, procedures for, and considerations in planning/conducting quantitative research in work, community, and family education.

**WCFE 8913. Interpretive Research.** (3 cr; A-F only. Prereq-8911)

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; A-F only. Prereq-8911)

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]; S-N only. Prereq-8911, [8912 or 8913 or 8914] or Δ)

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. Prereq-CPsy or EPsy 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. Prereq—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.

Prereq—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.

Prereq—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. Prereq—

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.

Prereq—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. Prereq—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. Prereq—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]. Prereq—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. Prereq—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])

Independent reading and/or research under faculty supervision.

**YoSt 5301. Communicating with Adolescents About**

**Sexuality.** (2 cr. Prereq—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. Prereq—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 “lifespace” in everyday life, rather than in one-to-one office-based interactions.

**YoSt 5321. Work with Youth—Individual.** (2 cr. Prereq—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. Prereq—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. Prereq—5321 or

CPsy or EPsy course or #)

Adolescent group needs/associations. Group process. Working with groups of adolescents in the community, in group living situations, and in group therapy.

**YoSt 5401. Young People’s Spirituality and Youthwork: an**

**Introduction.** (3 cr; A-F only)

Adolescent spirituality, its relation to working with young people. Faith/spirituality as actual/necessary aspects of healthy youth development. Research, active community-based programs. Knowledge, attitudes, and skills to meet adolescent needs/wants.

**YoSt 5402. Youth Policy: Enhancing Healthy Development**

**in Everyday Life.** (3 cr. Prereq—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.



*This is the Duluth Degree Programs and Related Fields, maps, index, and course designator listing sections of the 2005-2007 Graduate School Catalog for the University of Minnesota.*



# 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, criminology, 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, geological sciences, and physics. In addition, master of business administration, master of fine arts in art (emphasis in graphic design), master of electrical and computer engineering, master of engineering management, 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,

molecular biology, and biophysics; 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 reduced 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.

## Program Descriptions

Brief descriptions of the various degree programs are listed on the following pages. 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](http://www.d.umn.edu/grad).

## 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

**Senior Member (SM)**— Authorization to advise students at all levels, including the doctorate; to serve as a thesis reviewer and as an examiner on student examining committees, including service as chair of doctoral committees; to teach courses for graduate credit; and to participate in governance. In fields that also offer a professional doctorate, some senior member appointments may be restricted to the supervision of students seeking the professional degree.

**Affiliate Senior Member (ASM)**— Authorization to assume the same responsibilities as senior member, but not to participate in governance. In fields that also offer a professional doctorate, some affiliate senior member appointments may be restricted to the supervision of students seeking the professional degree.

**Member/Advising (M2)**— Authorization to advise students at the master's level; to serve as a thesis reviewer at the master's level and as an examiner on student examining committees at the master's and postbaccalaureate certificate levels; to teach courses for graduate credit; and to participate in governance. At the discretion of the appointing program, may also include authorization to co-advise doctoral students with a senior member or affiliate senior member of the graduate faculty, and to serve as a thesis reviewer and examining committee member for doctoral students, but not as chair.

**Affiliate Member/Advising (AM2)**— Authorization to assume the same responsibilities as member/advising, but not to participate in governance.

**Member (M)**— Authorization to serve as a thesis reviewer at the master's level and as an examiner on student examining committees at the master's and postbaccalaureate certificate levels; to teach courses for graduate credit; and to participate in governance. At the discretion of the appointing program, may also include authorization to serve as a thesis reviewer and examining committee member for doctoral students, but not as chair.

**Affiliate Member (AM)**— Authorization to assume the same responsibilities as member, but not to participate in governance.

**Examining Status (E)**— Authorization to serve as a thesis reviewer and as an examiner on student examining committees at all levels, but not as chair, and to teach courses for graduate credit. Examining status does not include membership on the graduate faculty and does not confer governance privileges.

### Tests

The following test abbreviations appear throughout graduate program listings.

**ECFMG**— Educational Commission Foreign Medical Graduates

**GMAT**— Graduate Management Admission Test

**GRE**— Graduate Record Examination

**IELTS**— International English Language Testing System

**MELAB**— Michigan English Language Assessment Battery

**SPEAK**— Speaking Proficiency English Assessment Kit

**TOEFL**— Test of English as a Foreign Language

**TSE**— Test of Spoken English

**USMLE**— United States Medical Licensing Examination

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

## Applied and Computational Mathematics

**Contact Information**—Department of Mathematics and Statistics, University of Minnesota Duluth, 140 Solon Campus Center, 1117 University Drive, Duluth, MN 55812 (218-726-8747; fax 218-726-8399; math@d.umn.edu; www.d.umn.edu/math).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

Richard A. Davis, Chemical Engineering, M2  
 Douglas J. Dunham, Computer Science, M2  
 Joseph A. Gallian, M2  
 Richard F. Green, M2  
 Abu Rashid-Hasan, Chemical Engineering, M2  
 Barry R. James, M2  
 Kang Ling James, M2  
 Zhuangyi Liu, M2  
 John Pastor, Biology, M2  
 Ronald R. Regal, M2  
 Marian S. Stachowicz, Electrical and Computer Engineering, M2  
 Harlan W. Stech, M2  
 Jiann Shiou Yang, Electrical and Computer Engineering, M2

### Associate Professor

Linda L. Deneen, Computer Science, M2  
 Dalibor Froncek, M2  
 John R. Greene, M2  
 Kathryn E. Lenz, M2  
 Robert L. McFarland, M2  
 Bruce B. L. Peckham, M2  
 James W. Rowell, M2  
 Gary M. Shute, Computer Science, M2  
 Steven P. Sternberg, Chemical Engineering, M2  
 Steven A. Trogdon, M2

### Assistant Professor

Guihua Fei, M2  
 Carmen M. Latterell, M2  
 Yongcheng Qi, M2

**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, Chemical Engineering, and Biology.

**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.

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 applications materials by January 15 for fall semester is strongly encouraged to ensure priority consideration for university fellowships. The deadline for applying for assistantships awarded for the next academic year is March 1. Students can be admitted any term. Students whose native language is not English must submit their TOEFL scores.

**Use of 4xxx Courses**—Inclusion of 4xxx courses (maximum of 8 credits) on degree program forms is subject to program approval.

### 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). As part of these 33 credits Plan A requires 10 thesis credits and Plan B requires a 2-credit project and an additional 8 credits from approved graduate-level mathematics, statistics, or related-field courses.

**Language Requirements**—None.

**Final Exam**—There is a written comprehensive exam and an oral final exam.

### 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 and Design, University of Minnesota Duluth, 317 Humanities Building, 1201 Ordean Court, Duluth, MN 55812 (218-726-8225; fax 218-726-6532; art@d.umn.edu; www.d.umn.edu/art/program/mfa.html).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

Gloria Brush, M2  
 James C. Klueg, M2  
 Thomas G. Kovacs, M2  
 Dean Lettenstrom (emeritus), M2

### Associate Professor

Robert Appleton, M2  
 Alyce L. Coker (emeritus), M2  
 Catherine Jo Ishino, M2  
 Janice D. Kmetz, M2  
 Robert A. Repinski, M2  
 Robyn S. Roslak, Art History, M2

### Assistant Professor

Alison J. Aune-Hinkel, M2  
 Sarah Bauer, M2  
 Philip Choo, M2  
 Jennifer L. Dietrich, AM2  
 Victoria D. Lehman, M2  
 Mariana M. Waisman, M2

**Curriculum**—The master of fine arts: emphasis in graphic design at UMD may be earned full or part-time, in three years of graduate study in design. Within a liberal arts setting, the program explores each individual's educational, artistic, and professional strengths. Expanding the boundaries of conventional design education, it includes the following areas of study: new media, motion graphics, sound art, book arts, design in the public realm, experience design, typographic design, design theory, and preparation for college teaching. There is equal commitment to academic study and studio practice. The program draws on an international faculty of designers and artists recognized for the quality of their work and experience.

**Admission Requirements**—Applicants must have adequate undergraduate education and experience in the area of emphasis, and a B.A., B.S., or B.F.A. in graphic design or art. Individuals with undergraduate degrees in other disciplines who have completed a substantial number of design courses also may be considered for admission. A portfolio of the applicant's design work submitted on slides and/or videotape, Mac-formatted zip, CD, or DVD, 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. A minimum GPA of 3.00 is required for admission. A TOEFL score of 550 is required for students whose second language is English (see section 2.1E1 in the MFA Student Handbook). All additional program details, including complete application requirements, are described fully in the Student Handbook, which may be downloaded in PDF format from [www.d.umn.edu/art/program/mfa.html](http://www.d.umn.edu/art/program/mfa.html). Please download and read this handbook before submitting a final application.

**Use of 4xxx Courses**—Inclusion of 4xxx courses on degree program forms is subject to program approval.

### M.F.A. Plan B Degree Requirements

The M.F.A. is offered under Plan B and 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 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 also take other forms such as a book, video, Web site, or interactive project.

**Language Requirements**—None.

**Final Exam**—An oral exam based on the project and a supporting thesis are required.

## Biology

**Contact Information**—Department of Biology, University of Minnesota Duluth, 221 Life Science Building, 1110 Kirby Drive, Duluth, MN 55812 (218-726-6262; fax 218-726-8142; [biol@d.umn.edu](mailto:biol@d.umn.edu); <http://www.d.umn.edu/biology/graduate/index.htm>).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

Matthew Andrews, M2  
Lester R. Drewes, Biochemistry and Molecular Biology, M2  
Stephen C. Hedman, M2  
Randall E. Hicks, M2  
Muhammad R. Ul Karim, M2  
Andrew R. Klemmer, M2  
Gerald J. Niemi, M2  
John Pastor, M2  
Arlen R. Severson, Anatomy and Cell Biology, M2  
George J. Trachte, Pharmacology, M2

### Associate Professor

Benjamin L. Clarke, Medical Microbiology and Immunology, M2  
Timothy P. Craig, M2  
Stephen W. Downing, Anatomy and Cell Biology, M2  
Donna J. Forbes, Anatomy and Cell Biology, M2  
Kent M. Froberg, Pathology and Laboratory Medicine, M2  
Linda L. Holmstrand, M2  
Jon M. Holy, Anatomy and Cell Biology, M2  
Robert L. Lloyd, Psychology, M2  
David J. Schimpf, M2

### Assistant Professor

Lucia P. Barker, Medical Microbiology and Immunology, M2  
Donn K. Branstrator, M2  
Julie R. Etterson, M2  
Thomas R. Hrabik, M2  
Allen Mensinger, M2  
Anna Rachinsky, M2

### Instructor

Lyle J. Shannon, M

### Research Fellow

JoAnn M. Hanowski, Natural Resources Research Institute, M

### Research Associate

Richard P. Axler, Natural Resources Research Institute, M2  
Valerie J. Brady, Natural Resources Research Institute, M  
John C. Brazner, Natural Resources Research Institute, M2  
Sigmund J. Degitz, Jr., Natural Resources Research Institute, M2  
Philip A. Fay, Natural Resources Research Institute, M2  
Durba Ghosal, M  
Glenn R. Guntenspergen, Natural Resources Research Institute, M2  
Brian H. Hill, Natural Resources Research Institute, M2

George E. Host, Natural Resources Research Institute, M2  
Lucinda B. Johnson, Natural Resources Research Institute, M2  
Rodney D. Johnson, Natural Resources Research Institute, M2  
John R. Kelly, Natural Resources Research Institute, M2  
Richard L. Leino, Anatomy and Cell Biology, M2  
Joseph M. Mayasich, Natural Resources Research Institute, M2  
Ron Moen, Natural Resources Research Institute, M2  
David R. Mount, Natural Resources Research Institute, M2  
Patrick K. Schoff, Natural Resources Research Institute, M2

### Program Director

Thomas Malterer, Natural Resources Research Institute, M2  
Neil D. Nelson, Natural Resources Research Institute, M  
Carl R. Richards, Sea Grant, M2

**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 is required. 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 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.

**Use of 4xxx Courses**—Inclusion of 4xxx courses on degree program forms is subject to program approval.

### 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 and Biol 8099—The Biological Practitioner; 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 Biol 8099—The Biological Practitioner, at least 13 other 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.

**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 to give a minimum total of 6 credits.

## Business Administration

**Contact Information**—M.B.A. Department, Labovitz School of Business and Economics, University of Minnesota Duluth, 21 School of Business and Economics Building, 412 Library Drive, Duluth, MN 55812 (218-726-8986; fax 218-726-6789; [sbe@d.umn.edu](mailto:sbe@d.umn.edu); [www.d.umn.edu/sbe/degreeprogs/MBA/](http://www.d.umn.edu/sbe/degreeprogs/MBA/)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

Curt L. Anderson, Economics, AM  
Stephen B. Castleberry, Management Studies, M2  
Ehsan H. Feroz, Accounting, M2  
Richard W. Lichty, Economics, M2  
Rodrigo J. Lievano, Finance and Management Information Sciences, M2  
Patricia A. Merrier, Finance and Management Information Sciences, M2  
Jerold M. Peterson, Economics, AM  
Jon L. Pierce, Management Studies, M2  
Raymond L. Raab, Economics, M2  
Stephen A. Rubinfeld, Management Studies, M2  
Donald N. Steinnes, Economics, M2  
Shee Q. Wong, Finance and Management Information Sciences, AM

### Associate Professor

Praveen Aggarwal, Management Studies, M2  
Rodger L. Brannan, Accounting, AM  
Anne Cummings, Management Studies, M2  
Manjeet Dhatt, Finance and Management Information Sciences, M2  
Kjell R. Knudsen, Management Studies, M2  
June F. Li, Accounting, M2  
Jerry W. Lin, Accounting, M2  
A. Maureen O'Brien, Economics, M2  
Linda Rochford, Management Studies, M2  
Alan C. Roline, Accounting, M2  
Rajiv Vaidyanathan, Management Studies, M2

### Assistant Professor

Geoffrey G. Bell, Management Studies, M2  
Jannifer G. David, Management Studies, M2  
David Doorn, Economics, M2  
Sanjay Goel, Management Studies, M2  
Nik R. Hassan, Finance and Management Information Sciences, AM  
Seung C. Lee, Finance and Management Information Sciences, M2  
Dahui Li, Finance and Management Information Sciences, AM  
Jennifer Mencl, Management Studies, M2  
Sebastien Oleas, Economics, M2  
Jennifer Schultz, Economics, M2  
Randall K. Skalberg, Accounting, AM  
Bedassa Tadesse, Economics, M2

**Instructor**

John L. Kratz, Management Studies, AM  
Peter J. Stark, Management Studies, AM  
Shannon Studden, Management Studies, AM

**Curriculum**—The M.B.A. program meets the needs of those who are currently employed full-time in professional managerial careers and would like to pursue a graduate management education primarily on a part-time basis. The program offers courses in both Duluth and Rochester, Minnesota. Most courses offered in Duluth meet one evening per week from 6:00 to 9:00 p.m. during the 15 weeks of the semester. Most courses offered in Rochester meet from 3:00 to 9:30 p.m. on Fridays and 8:00 a.m. to 12:30 p.m. on Saturdays every other week over a period of seven weeks. It is possible to enroll in the program on a full-time basis by registering for 6 or more credits per semester. However, only a relatively small number of domestic and international students are enrolled full-time.

**Admission Requirements**—Applicants must have a bachelor's degree from an accredited college or university; completed 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, 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 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.

**Use of 4xxx Courses**—M.B.A. students may include 4xxx courses for electives in their degree programs subject to M.B.A. director approval.

**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).

**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, 1039 University Drive, Duluth, MN 55812 (218-726-7212; fax 218-726-7394; chem@d.umn.edu; www.d.umn.edu/chem/graduate/index.html).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

**Professor**

Ronald Caple, M2  
Robert M. Carlson, M2  
Lester R. Drewes, Biochemistry and Molecular Biology, M2  
John F. Evans, M2  
Vincent R. Magnuson, M2  
Donald P. Poe, M2  
Joseph R. Prohaska, Biochemistry and Molecular Biology, M2  
James P. Riehl, M2  
Bilin P. Tsai, M2  
Kendall B. Wallace, Biochemistry and Molecular Biology, M2  
Viktor Zhdankin, M2

**Associate Professor**

Benjamin L. Clarke, Medical Microbiology and Immunology, M2  
Thomas E. Huntley, Biochemistry and Molecular Biology, M2  
Paul Kiprof, M2  
Keith B. Lodge, Chemical Engineering, M2  
Paul D. Siders, M2

**Assistant Professor**

Grant W. Anderson, Pharmacy, M2  
Leng Chee Chang, M2  
Robert T. Cormier, Biochemistry and Molecular Biology, M2  
Venkatram R. Mereddy, M2  
Viktor N. Nemykin, M2  
Edward L. Perkins, Biochemistry and Molecular Biology, M2  
Jon N. Rumbley, M2  
Josef Werne, M2

**Senior Research Associate**

Subhash C. Basak, Natural Resources Research Institute, M2

**Research Fellow**

Pavel A. Krasutsky, Natural Resources Research Institute, M2

**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, the Departments

of Biochemistry and Molecular Biology and Medical Microbiology & Immunology in the School of Medicine, the College of Pharmacy, and the Natural Resources Research Institute.

**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.

**Use of 4xxx Courses**—Inclusion of 4xxx courses on degree program forms is subject to program approval.

**M.S. 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 is 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, 1207 Ordean Court, Duluth, MN 55812 (218-726-7974; fax 218-726-8693; cd@d.umn.edu; www.d.umn.edu/csd/general/csdgrad.html).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

**Professor**

Paul N. Deputy, M2  
Mark I. Mizuko, M2

**Associate Professor**

Faith C. Loven, M2  
Cynthia S. Spillers, M2

**Assistant Professor**

Kent R. Brorson, M2  
Amy Meredith, M2

**Instructor**

La Vonne Levar, M2

**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, 1114 Kirby Drive, Duluth, MN 55812 (218-726-7678; fax 218-726-8240; cs@d.umn.edu; www.d.umn.edu/cs/degr/grad).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

Donald B. Crouch, M2  
Douglas, J. Dunham, M2  
Marian Stachowicz, Electrical and Computer Engineering, AM2

### Associate Professor

Carolyn C. Crouch, M2  
Richard F. Maclin, M2  
Theodore D. Pedersen, M2  
Gary M. Shute, M2  
Masha Sosonkina, M2  
C. Hudson Turner, M2

### Assistant Professor

Baek Young Choi, AM  
Christopher G. Prince, M2

**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 designed 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 Analysis and Design; CS 2521—Computer Organization and Architecture; CS 3511—Computer Science Theory or both CS 4511—Computability and Complexity and CS 4521—Algorithms and Data Structures; CS 5621—Computer Architecture or CS 5651—Computer Networks; and CS 5631—Operating Systems. Appropriate math prerequisites, namely Math 1296-1297—Calculus I-II, and Statistics 3611—Introduction to Probability and Statistics, are also required. Students who lack only a small number of these required courses may be admitted provisionally and must complete them before proceeding with their graduate work. The GRE General Test is required of all applicants; the TOEFL is also required of international students.

**Use of 4xxx Courses**—4xxx computer science courses may not be included in degree programs.

### M.S. Degree Requirements

The M.S. is offered under Plan A (thesis) and Plan B (without 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 requires 10 thesis credits and Plan B requires a minimum of 10 credits in computer science at 5xxx or above. All courses are chosen in consultation with the student's adviser, subject to approval by the director of graduate studies.

**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.

## Criminology

**Contact Information**—Department of Sociology Anthropology, University of Minnesota Duluth, 228 Cina Hall, 1123 University Drive, Duluth, MN 55812 (218-726-7551; fax 218-726-6386; crimma@d.umn.edu; www.d.umn.edu/socanth/CrimMA/).

For up-to-date graduate faculty listings, see: [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp)

### Professor

John A. Arthur, M2  
William A. Fleischman, M2  
J. Clark Laundergan, M2

### Associate Professor

Sheryl J. Grana, M2  
John E. Hamlin, M2  
Janelle L. Wilson, M2

### Assistant Professor

Jeffrey R. Maahs, M2  
Deborah M. Plechner, M2  
Robert R. Weidner, M2

### Instructor

Gary Gasele, M2  
Bruce Mork, M2

**Curriculum**—The core courses for the M.A. in criminology feature relevant theoretical perspectives in understanding criminal behavior, methods of research and data analysis, and critical analysis of the criminal justice system. The curriculum is based on the premise that a liberal education in the social sciences includes the development of a student's ability to a) define problems effectively by asking appropriate questions, b) understand and respect people with diverse opinions, backgrounds, characteristics, and lifestyles, c) respect the right of freedom of inquiry, to willingly challenge conventional wisdom, and to be intellectually flexible when challenged by factual information, and d) understand the significance of inequality in the way that criminal justice is administered. The departmental theme of inequality is incorporated into the graduate program as it is in the undergraduate program. In particular, structural forms of oppression are examined, and emphasis is placed on issues of social justice, human rights, and treatment/rehabilitation.

The framework of the program provides students with opportunities to develop a knowledge base that enhances understanding of criminal behavior and the workings of the criminal justice system. Core requirements give students experience in utilizing various methods of research, analyzing and interpreting data, understanding and critiquing the main theoretical traditions in the field, and examining the organization of the criminal justice system. Furthermore, course electives enable students to focus on more specific interests (e.g., policing, courts, youth justice).

The M.A. in criminology provides an opportunity for both intellectual and professional development. The program serves those students with undergraduate degrees in criminology (or a related social science) who are interested in pursuing advanced study in the study of crime and the administration of criminal justice. The program also serves those who have been employed in organizations and agencies in the criminal justice system (and related organizations) who wish to expand their knowledge and understanding that may result in career advancement and/or career shifts.



**Admission Requirements**—Applicants must have a baccalaureate degree from an accredited U.S. institution or a foreign equivalent for admission to the M.A. Program.

Preference will be given to applicants with undergraduate degrees with majors in criminology, criminal justice, corrections, or sociology. Applicants with an undergraduate minor in criminology, criminal justice, corrections, sociology, law enforcement or a major in a related field may also be considered. Undergraduate degrees in criminology, criminal justice, corrections, or sociology or a related field from foreign universities may also be considered, as long as those degrees are equivalent to a four-year American university baccalaureate degree.

Applicants are expected to have successfully completed an introduction to criminology or criminal justice course, the equivalent of one semester of research methods and/or statistics beyond the introductory level, and a course devoted primarily to social/behavioral theory. The minimum GPA for regular admissions is 3.00 on a 4-point scale. Students with a GPA less than 3.00 are considered on an individual basis and may be admitted conditionally. Students admitted with a conditional status are reviewed after completing six credit hours of graduate work and are expected to have received grades of B or better and have successfully completed remedial work with grade(s) of B or better to receive full admission to the M.A. Program

Applicants must supply: official transcripts from all colleges and universities attended and three letters of recommendation evaluating the applicant's scholarship and potential for graduate study. At least two letters should be from academic faculty familiar with the applicant. An essay explaining why an advanced degree in criminology is of interest and why the applicant merits serious consideration must also be submitted. The essay should include a personal statement of the applicant's short and long-term professional goals and commitment and preparation for graduate study in criminology (1-2 pages). International students whose native language is not English are required to submit scores from the TOEFL examination (550 minimum score, 213 minimum computer-based score).

Admission to the M.A. program is competitive.

**Use of 4xxx Courses**—Upon the advice and approval of the director of graduate studies, students may use 4xxx courses in related fields as appropriate. Sociology 4xxx courses may not be included in the degree programs.

### M.A. Degree Requirements

The M.A. is offered under both Plan A and Plan B and each requires 38 credits.

The Plan A option involves thesis work; the Plan B option involves a special project based upon a student's practicum work. The

Plan B paper combines theories, concepts, and principles from at least one course in the student's program of study with work being done in a practicum. All students must take both Soc 8200 (4 credits) and Soc 8300 (3 credits). Plan A students must enroll in Soc 8777 (Thesis Credits: Master's; minimum of 10 credits required). Plan B students must enroll in Soc 8600 (Criminology Practicum; minimum of 10 credits required). In addition to the listed credits, all students must choose at least one course in each of department elective categories (Systems, Methods and Statistics, and Theory). Additional credits may be taken from any of the three categories and/or directed readings for a total of 15 credits.

Students are expected to include additional elective courses (6 credits) outside the major (in a minor or related field) as part of their program of study. The choice and approval of related field courses is done in consultation with and approval of the student's advising/examining committee. Upon the advice and approval of the director of graduate studies, students may use 4xxx courses in related fields as appropriate. Sociology 4xxx courses may not be included in the degree programs for the M.A. in criminology.

**Language Requirements**—None.

**Final Exam**—Students present a department colloquium, followed by an oral examination

**Minor Requirements for Students**

**Majoring in Other Fields**—A master's minor requires 4 credits in methods/statistics, 3 credits in theory, and 3 elective credits.

## Electrical and Computer Engineering

**Contact Information**—Department of Electrical and Computer Engineering, University of Minnesota Duluth, 271 Marshall W. Alworth Hall, 1023 University Drive, Duluth, MN 55812 (218-726-6147; fax 218-726-7267; ece@d.umn.edu; www.d.umn.edu/ece).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

Stanley G. Burns, M2  
Taek Mu Kwon, M2  
Marian Stachowicz, M2  
Jiann-Shiou Yang, M2

### Associate Professor

Christopher R. Carroll, M2  
Mohammed Hasan, M2  
M. Imran Hayee, M2

### Assistant Professor

Rocio Alba-Flores, M2  
Fernando Rios-Gutierrez, M2  
Bassam Shaer, M2

**Curriculum**—The master of science in electrical and computer engineering (M.S.E.C.E.) combines scholarship and research in a program oriented towards students and engineering practitioners

in the private and public sectors who are interested in advanced coursework and applied research. The program requires 31 credits of graduate coursework and research and focuses on core departmental strengths of design and implementation of computer hardware/software including digital circuits and VLSI, embedded controllers, computer networks, distributed computing, analog and digital circuit design and application, instrumentation, communication systems, soft computing, robotics, and control systems.

**Admission Requirements**—Applicants should have a bachelor's degree in electrical and/or computer engineering or related field by time of enrollment. Applicants should meet the general admission requirements of the Graduate School of the University of Minnesota. Preferred performance level is 3.0/4.0 GPA from an accredited U.S. institution or foreign equivalent. Two letters of recommendation concerning the student's readiness for graduate education and academic abilities are required. Minimum performance on the TOEFL is 550 or 213 on the computerized test. GRE scores are recommended but not required. Industrial experience and professional licensure will be considered for admittance. Previous graduate-level coursework completed after receiving a baccalaureate degree may qualify for transfer credit upon recommendation and approval by the M.S.E.C.E. director of graduate studies.

### M.S.E.C.E. Degree Requirements

M.S.E.C.E. Degree Requirements—The M.S.E.C.E. is offered under Plan A (thesis) and Plan B (non-thesis). The director of graduate studies must approve all programs.

Plan A is primarily for those students wishing to prepare themselves for Ph.D. studies and careers in research and academia. Students must complete a minimum of 31 semester credits in graduate courses. At least 15 credits must be electrical and computer engineering courses with at least 6 credits in courses numbered 4xxx or higher, 6 credits in courses numbered 5xxx or higher, and at least 3 credits in courses at 8xxx. An additional 6 credits must be in a related field or minor. A minimum of 10 credits must be taken in ECE 8777.

Plan B is primarily for new engineering graduates and practicing engineers who want and need more technical education than would be provided by courses and an applied research-oriented project component. Students must complete a minimum of 31 credits in graduate courses. At least 9 credits must be ECE courses numbered 5xxx and higher with at least 3 of those credits numbered 8xxx, excluding colloquium and Plan B project credits. At least 12 of the remaining credits must be in ECE courses number 4xxx or higher and at least 6 credits must be outside of electrical and computer engineering. The program cannot include more than 4 credits from projects.

**Language Requirements**—None.

**Final Exam**—A formal defense of the thesis is required for Plan A students. The final exam for Plan B is a formal report and oral presentation.

### Minor Requirements for Students

**Majoring in Other Fields**—A master's minor requires 6 ECE courses. Individual programs must be approved by the director of graduate studies in electrical and computer engineering.

## Engineering Management

**Contact Information**—Department of Mechanical and Industrial Engineering, University of Minnesota Duluth, 229 Voss-Kovach Hall, 1305 Ordean Court, Duluth, MN 55812 (218-726-8117; fax 218-726-8581; msemm@d.umn.edu; http://ie.d.umn.edu/MSEM/).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

Mark A. Fugelso, M2  
Abu Rashid Hasan, Chemical Engineering, M2  
Thys B. Johnson (emeritus), AM2  
L. Alden Kendall (emeritus), M2  
Richard R. Lindeke, AM2  
David A. Wyrick, M2

### Associate Professor

Hamid Fonooni, M2  
Dale A. Krageschmidt, M2  
Ryan G. Rosandich, M2

### Assistant Professor

Emmanuel Enemuoh, M2  
Bill Pedersen, M2  
John Voss, M2

### Adjunct Professor

Richard Hansen, AM

**Curriculum**—The master of science in engineering management (M.S.E.M.) program provides engineers with tools to more effectively manage people, projects, technology, and information in their careers to promote economic growth, competitiveness, ethical decision-making, and environmental responsibility. As people in engineering positions often manage technical projects of varying size and complexity, the M.S.E.M. provides an excellent foundation. To meet the needs of practitioners, courses are offered in the evening and are available to remote sites by interactive television. Full-time enrollment is possible and the course structure allows for unique research opportunities.

**Admission Requirements**—All applicants must meet the general admission requirements of the Graduate School. 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 are asked to

submit documentation that substantiates their engineering and technology experience and responsibilities.

Applicants must provide two letters of recommendation concerning their academic ability and readiness for graduate education. A minimum 3.00 GPA from an accredited U.S. institution or foreign equivalent is required. International students must submit a score of at least 550 on the paper-based or 213 on the computer-based TOEFL.

**Use of 4xxx Courses**—Upon the advice and approval of the director of graduate studies, students may use 4xxx courses in related fields as appropriate.

### M.S.E.M. Degree Requirements

Plan A students must complete at least 31 credits, including a minimum of 15 credits in the major, 6 credits from a related program, and 10 thesis credits. Individual programs are designed to best serve the interests of the student. The director of graduate studies must approve all programs.

Plan B 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 all programs.

**Language Requirements**—None.

**Final Exam**—A formal defense of the thesis is required for Plan A students. The final exam is a formal report and oral presentation in EMgt 8310 for Plan B students.

### 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, 412 Humanities Building, 1201 Ordean Court, Duluth, MN 55812 (218-726-8228; fax 218-726-6882; engl@d.umn.edu; [www.d.umn.edu/engl/englishgrad/main/index.php](http://www.d.umn.edu/engl/englishgrad/main/index.php)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

Stephen J. Adams, M2  
Thomas D. Bacig, Sociology-Anthropology, M2  
Martin F. Bock, M2  
Thomas J. Farrell, Composition, M2  
William A. Gibson (emeritus), Composition, AM2  
Michael D. Linn, Composition, M2

Joseph C. Maiolo, M2  
Linda Miller-Cleary, M2

### Associate Professor

Katherine L. Basham, M2  
Carol A. Bock, M2  
Roger C. Lips, M2  
Kenneth C. Risdon, Composition, M2

### Assistant Professor

Paul D. Cannan, M2  
James Hewitson, AM  
Richard Hillyer, AM  
Jill D. Jensen, Composition, M2  
Jo M. Mackiewicz, Composition, M2  
Kathleen Maurer, Composition, M2  
John D. Schwetman, M2  
Carolyn Sigler, M2  
Craig Stroupe, Composition, M2  
Krista Sue-Lo Twu, M2

### Instructor

Rob Wittig, Art and Design, 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 and 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 semester 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 are 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.

**Use of 4xxx Courses**—Use of 4xxx courses is permitted for courses taken to satisfy requirements in a related field. 4xxx courses in English, composition, and linguistics may not be included on degree program forms in English.

### M.A. Plan B Degree Requirements

Literary Studies Emphasis: 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: 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: 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.

**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.

## Geological Sciences

**Contact Information**—Department of Geological Sciences, University of Minnesota Duluth, 229 Heller Hall, 1114 Kirby Drive, Duluth, MN 55812 (218-726-7238; fax 218-726-8275; geol@d.umn.edu; <http://www.d.umn.edu/geology/programs/grad.html>).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

Steve Colman, M2  
John W. Goodge, M2  
James A. Grant (emeritus), M2  
Vicki L. Hansen, M2  
Timothy B. Holst, M2  
Thomas C. Johnson, M2  
Charles L. Matsch (emeritus), AM2  
James D. Miller, Jr., AM2  
Howard D. Mooers, M2  
Ronald L. Morton, M2  
Richard W. Ojakangas (emeritus), AM2

### Associate Professor

Erik T. Brown, M2  
Penelope Morton, M2  
Nigel J. Wattrus, M2

### Assistant Professor

Timothy M. Demko, M2  
Christian D. Gallup, M2  
George J. Hudak III, AM2  
Richard D. Ricketts, AM2

John B. Swenson, M2  
Josef P. Werne, Chemistry, AM2

### Research Associate

Dean M. Peterson, Natural Resources Research Institute, AM2

**Curriculum**—The M.S. program in geological sciences includes areas of economic geology, geophysics, glacial geology and geomorphology hydrogeology, igneous and metamorphic petrology, isotope and aqueous geochemistry, limnogeology, paleoclimatology, planetary geology, sedimentary and stratigraphy, surface processes, and structure tectonics. See the geology Web site at [www.d.umn.edu/geology](http://www.d.umn.edu/geology).

**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. Field camp and/or undergraduate research experience is recommended. GRE General Test scores are required.

**Research Facilities**—Research facilities include those for microscopy, XRD, isotope and trace element analysis, digital imagery, ground-penetrating radar, and near-surface seismic profiling. There is a departmental computer lab and ready access to the mainframe system. Additional facilities are available at the Large Lakes Observatory (including an 87' research vessel) and at the Natural Resources Research Institute (including a GIS system), both affiliated with UMD, and the Department of Geology and Geophysics in Minneapolis (particularly an electron microprobe lab).

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

### M.S. Degree Requirements

The M.S. is offered under Plan A (thesis) and Plan B (without thesis). Courses are selected with approval of the student's adviser and the director of graduate studies; 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 31 credits, including 14 course credits in the major, 6 course credits in a minor or related field, 1 credit course (Geol 8200) and 10 thesis credits. All courses must be 4xxx or 5xxx. Plan B requires 31 credits in approved courses, including 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 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, 1201 Ordean Court, Duluth, MN 55812 (218-726-8149; fax 218-726-6386; caker@d.umn.edu; [www.d.umn.edu/ce/html/mls.html](http://www.d.umn.edu/ce/html/mls.html)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

Stephen Adams, English, M2  
John Arthur, Sociology-Anthropology, M2  
Elizabeth Bartlett, Women's Studies, M2  
James H. Fetzer, Philosophy, M2  
William Fleischman, Sociology-Anthropology, M2  
Thomas F. Hedin, Art, M2  
Thomas F. Jordan (emeritus), Physics, AM2  
Andrew R. Klemer, Biology, M2  
Lawrence Knopp, Geography, M2  
Fred E. Schroeder (emeritus), Humanities, AM2  
Richard A. Seybolt, Foreign Languages and Literatures, M2  
David M. Smith (emeritus), Sociology-Anthropology, M2  
Neil T. Storch, History, M2  
Judith Ann Trolander, History, M2

### Associate Professor

Stephen P. Chilton, Political Science, M2  
Scott Freunds Schuh, Geography, M2  
Tom K. Isbell, Theatre, M2  
AnnaMarie E. Roos, History, M2  
Robyn S. Roslak, Art, M2  
Janelle L. Wilson, Sociology-Anthropology, M2

### Assistant Professor

Eleanor Hannah, History, M2  
Michael W. Pfau, Communication, M2  
Thomas F. Powers, Political Science, M2  
Rosemary Stanfield-Johnson, History, M2  
Steven J. Vanderheiden, Political Science, M2

**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.

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

### 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

### Minor Only

**Contact Information**—Program in Linguistics, University of Minnesota Duluth, 457 Humanities Building, 1201 Ordean Court, Duluth, MN 55812 (218-726-8525 fax 218-726-6882; linn@d.umn.edu; www.d.umn.edu/ling).

For up-to-date graduate faculty listings, see www.grad.umn.edu/faculty\_rosters/step1.asp.

#### **Professor**

Michael D. Linn, Composition, M

#### **Associate Professor**

Jonathan B. Conant, Foreign Languages and Literatures, M

Milan Kovacovic, Foreign Languages and Literatures, M

#### **Assistant Professor**

Jo Mackiewicz, Composition, M

**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.

### Minor Only Requirements

The minor in linguistics requires a minimum of 6 credits selected from Anth 4628—Language and Culture (3 cr), Engl 5811—Introduction to Modern English (4 cr), Engl 5821—History of the English Language (4 cr), Ling 5195—Special Topics (3 cr), Ling 5802—Applied Linguistics (4 cr), Ling 5852—Practicum in Teaching Linguistics (3 cr), Ling 8500—Graduate Seminar (3 cr), and Ling 8591—Independent Study (1-3 cr).

## Music

**Contact Information**—Department of Music, University of Minnesota Duluth, 231 Humanities Building, 1201 Ordean Court, Duluth, MN 55812 (218-726-8207; fax 218-726-8210; mu@d.umn.edu; www.d.umn.edu/music/degree/index.html).

For up-to-date graduate faculty listings, see www.grad.umn.edu/faculty\_rosters/step1.asp.

#### **Professor**

Ann C. Anderson, AM  
Judith Ann Kritzmire, M2  
Thomas J. Wegren, M  
Stanley R. Wold, M2

#### **Associate Professor**

Justin H. Rubin, M2  
David J. Schmalenberger, M2  
Mark E. Whitlock, M2

#### **Assistant Professor**

Jeanne A. Doty, M2  
Ryan J. Frane, M  
Rachel L. Inselman, AM  
Jean R. Perrault, AM  
Theodore A. Schoen, M  
Joseph S. Spann, AM  
Tina L. Thielen-Gaffey, AM  
Ramon F. Vasquez, AM

#### **Lecturer**

Maria T. Annoni, AM

**Curriculum**—The M.M. program offers students an opportunity to acquire advanced understandings and skills in music education theory and practice or in 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 with an undergraduate GPA of 3.00 or higher and must 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 performance or 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.

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

### 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 (includes recital credit), 8 credits in music theory and literature, 6 credits in research/foundation courses, 2 elective credits and a solo recital.

**Language Requirements**—Voice performance majors must demonstrate foreign language proficiency or enroll in remedial courses.

**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, 1023 University Drive, Duluth, MN 55812 (218-726-7124; fax 218-726-6942; phys@d.umn.edu; www.d.umn.edu/~jmaps/gradpgm.html).

For up-to-date graduate faculty listings, see www.grad.umn.edu/faculty\_rosters/step1.asp.

#### **Professor**

John R. Hiller, M2  
Thomas F. Jordan (emeritus), AM2  
Michael Sydor, M2

#### **Associate Professor**

Bo R. Casserberg, M2  
Elise A. Ralph, M2

#### **Assistant Professor**

Alec T. Habig, M2  
Jonathan Maps, M2  
Brian D. May, M2

**Curriculum**—The M.S. program provides a grounding in the fundamentals of physics, combined with significant research involvement. The primary areas of research are computational physics, high-energy neutrino physics, experimental work in condensed-matter physics, and observational and theoretical work in physical limnology.

**Admission Requirements**—An undergraduate degree in physics or the equivalent is required.

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

### M.S. Degree Requirements

The M.S. is offered under both Plan A and Plan B. All students take 11 credits in a common core of courses (including Phys 5501, 5511, 5521, and 2 credits in 5090), 3 credits in a methods course (Phys 5052 or 5053 or 5061), and 6 credits in a minor or related field. Plan A also requires 10 thesis credits. Plan B requires one or more projects for a total of 120 hours of work, preparation of a written report for each project, and 10 additional course credits in physics. These courses may include 4xxx courses 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, 1207 Ordean Court, Duluth, MN 55812 (218-726-7245; fax 218-726-7185; sw@d.umn.edu; www.d.umn.edu/sw).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty\\_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

### Professor

Dennis R. Falk, M2  
Melanie F. Shepard, M2

### Associate Professor

Priscilla A. Day, M2  
Kathleen E. Nuccio, M2  
R. Michael Raschick, M2

### Assistant Professor

Lynn Ellen H. Bye, M2  
Donald Carpenter, M2  
Ann Tellett, M2

### Instructor

Kathleen V. Heltzer, M2

**Curriculum**—The master of social work (M.S.W.) program offers a concentration in advanced generalist practice that prepares students to practice in a variety of human service settings. Graduates undertake a variety of professional social work roles ranging from counselor and case manager to community organizer and administrator. The curriculum has a special focus on services to American Indians and their communities. Coursework is also available in the area of child welfare practice. 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. The bachelor's degree should include a solid background in the liberal arts, as evidenced on the transcript by courses in the arts, cultural studies, 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 degree majors in social work or a related field or discipline are given preference over applicants with other majors. 2) Completion of at least 18 semester credits in two or more social science disciplines, such as sociology, psychology, economics, anthropology, or political science. 3) Strong academic preparation as demonstrated by

a minimum undergraduate GPA of 3.00.

4) Potential to contribute to the social work profession. 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.

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

### M.S.W. Degree Requirements

The M.S.W. requires 51 credits (34 credits for students admitted with advanced standing), including a minimum of 41 credits in social work courses (28 credits for advanced standing students), at least 2 credits in a related field, a master's project and final examination. 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 considered satisfactory for entrance into the profession of social work, as indicated by course and field placement evaluations, is required.

**Language Requirements**—None.

**Final Exam**—None.

## 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

## Anthropology

### Professor

Linda S. Belote, E  
Michael D. Linn, Composition, E  
Ron T. Marchese, E  
Timothy G. Roufs, E  
David M. Smith (emeritus), E

### Associate Professor

Sharon R. Kemp (emeritus), E

### Assistant Professor

Jennifer E. Jones, E  
David Syring, 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

Mustafa al'Absi, E  
James G. Boulger, E  
Gary L. Davis, E  
Richard Hoffman, E

## Chemical Engineering

### Professor

Richard A. Davis, E  
A. Rashid Hasan, E

### Associate Professor

Keith B. Lodge, E  
Steven P. Sternberg, E

### Assistant Professor

Michael A. Rother, E  
Gregory Rutkowski, E

## Communication

### Professor

Mike Sunnafrank, E

### Associate Professor

Virginia T. Katz (emeritus), E  
Linda T. Krug, E  
Elizabeth J. Nelson, E  
Gerald L. Pepper, E  
Deborah Petersen-Perlman, E

### Assistant Professor

Ryan Goei, E  
Michael W. Pfau, E

## Cultural Studies

### Professor

Thomas D. Bacig, Sociology-Anthropology, E  
Thomas J. Farrell, Composition, E  
Ronald T. Marchese, History, E

### Assistant Professor

Mitra C. Emad, Sociology-Anthropology, E

## Education

### **Professor**

Dennis R. Falk, Social Work, E  
David A. McCarthy, E  
Linda Miller-Cleary, English, E

### **Associate Professor**

Kenneth Gilbertson, Health, Physical Education, and Recreation, E  
Francis Guldbrandsen, 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. Kreutzkamp, E  
Edmond F. Lundstrom (emeritus), Health, Physical Education, and Recreation, E  
Helen Mongan-Rallis, E  
Bruce H. Munson, E  
Thomas D. Peacock, E  
Terrie M. Shannon, E

### **Assistant Professor**

Mary R. Hermes, E  
Trudie A. Hughes, E  
Susan Larson-Kidd, E  
Mary A. Marchel, E  
Chang'aa Mwetii, E  
Jean M. Stevenson, E  
Joyce Strand, E  
Joan Varney, E  
Jiyoon, Yoon, E

### **Instructor**

Molly H. Minkinen, E

## French

### **Associate Professor**

Yolande J. Jenny, Foreign Languages and Literatures, E  
Milan Kovacovic, Foreign Languages and Literatures, E

## Geography

### **Professor**

Lawrence M. Knopp, E

### **Associate Professor**

Tongxin Zhu, E

### **Assistant Professor**

Gordon L. Levine (emeritus), E

### **Instructor**

Stacey L. Stark, E

## German

### **Assistant Professor**

Gesa Zinn, Foreign Languages and Literatures, E

## Health Education

### **Professor**

Eugene S. Ley, Health, Physical Education, and Recreation, E

### **Associate Professor**

Lori Dewald, Health, Physical Education, and Recreation, E  
Georgia L. Keeney, Health, Physical Education, and Recreation, E

### **Assistant Professor**

Ladona Tornabene, Health, Physical Education, and Recreation, E

## Industrial Engineering

### **Professor**

David Wyrick, E

### **Associate Professor**

Ryan Rosandich, E  
John C. Voss, E

### **Assistant Professor**

Emmanuel Enemuoh, E  
Bill Pedersen, E

## Journalism

### **Instructor**

Abhinav K. Aima, Composition, E  
Drew Digby, History, E  
Catherine E. Winter, Composition, E

## Mechanical Engineering

### **Professor**

David A. Wyrick, E

### **Associate Professor**

Ryan Rosandich, E

### **Assistant Professor**

Emmanuel Enemuoh, E  
Bill Pedersen, E  
Daniel Pope, E

## Philosophy

### **Professor**

James H. Fetzer, E  
David J. Mayo, E

### **Associate Professor**

David J. Cole, E  
Eve Browning, E

### **Assistant Professor**

Steven J. Vanderheiden, E

## Physical Education

### **Associate Professor**

Lori Dewald, E  
Kenneth Gilbertson, E  
John R. Keener, E  
Duane Millslagle, E  
Mark Nierengarten, E

### **Assistant Professor**

Jane Carlson, E  
Donald Collins, E  
Morris Levy, E

## Political Science

### **Professor**

Elizabeth Bartlett, Women's Studies, E  
Paul Sharp, E

### **Associate Professor**

Stephen P. Chilton, E  
Craig H. Grau, E

### **Assistant Professor**

Thomas F. Powers, E  
Steven Vanderheiden, E

## Recreation

### **Associate Professor**

Lori Dewald, Health, Physical Education, and Recreation, E  
Kenneth Gilbertson, Health, Physical Education, and Recreation, E  
Edmond F. Lundstrom, Health, Physical Education, and Recreation, E

### **Instructor**

Thomas Beery, 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  
Janelle L. Wilson, E

### **Assistant Professor**

Jeffrey Maahs, E  
Deborah Plechner, E  
Robert Weidner, E

### **Instructor**

Gary Gasele, E  
Bruce Mork, E

## Spanish

### **Professor**

Richard A. Seybolt, Foreign Languages and Literatures, E  
Eileen M. Zeitz, Foreign Languages and Literatures, E

## Theatre

### **Professor**

Ann A. Bergeron, E  
Arden W. Weaver, E

### **Associate Professor**

Jon M. Berry, E  
Patricia Dennis, E  
Mark A. Harvey, E  
Karen Hoffman, E  
Thomas K. Isbell, E  
William Payne, E  
Cathryn F. Ufema, E

## Women's Studies

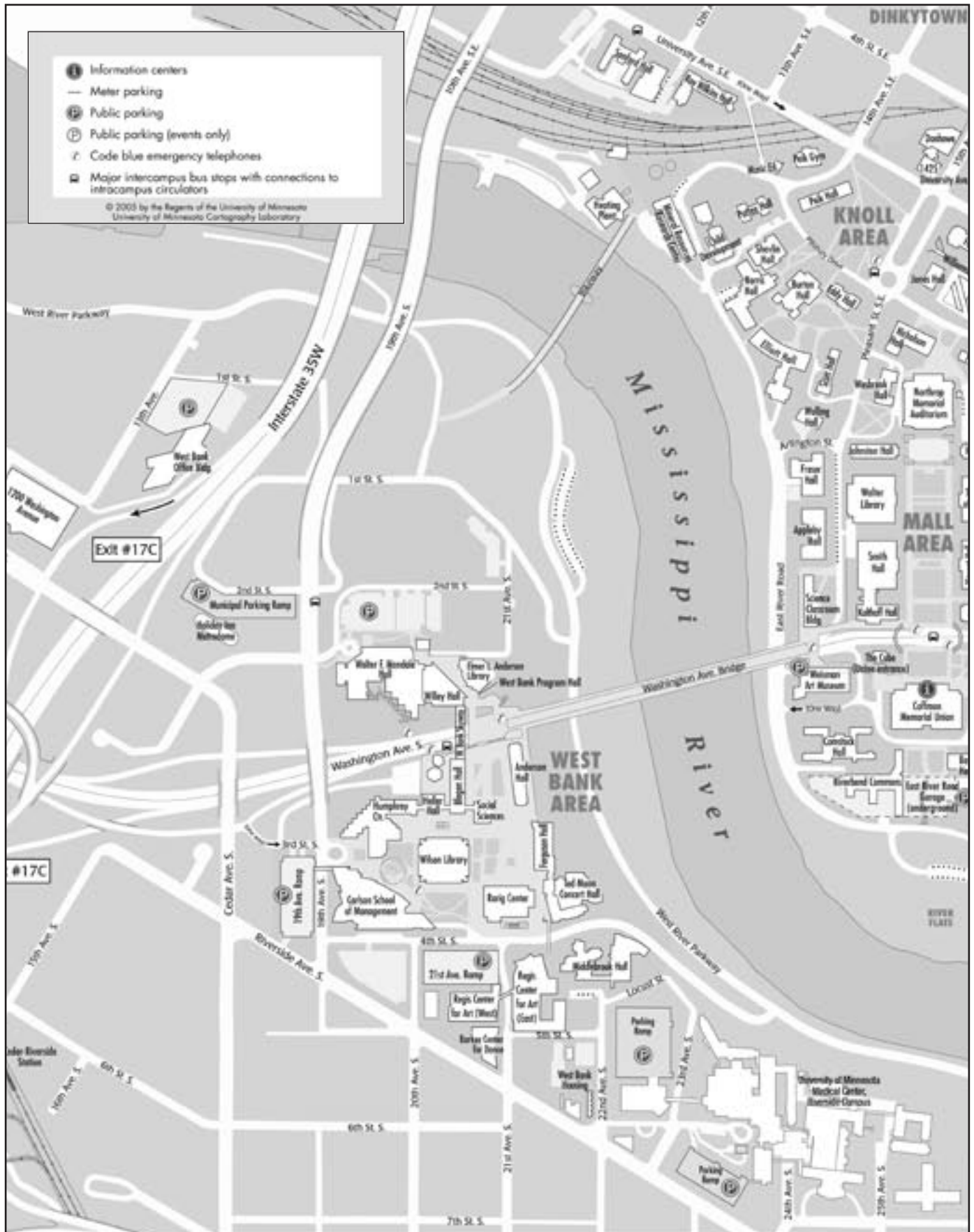
### **Associate Professor**

Margaret N. Kamau, E  
Tineke A. Ritmeester, E

# University of Minnesota, Twin Cities East Bank

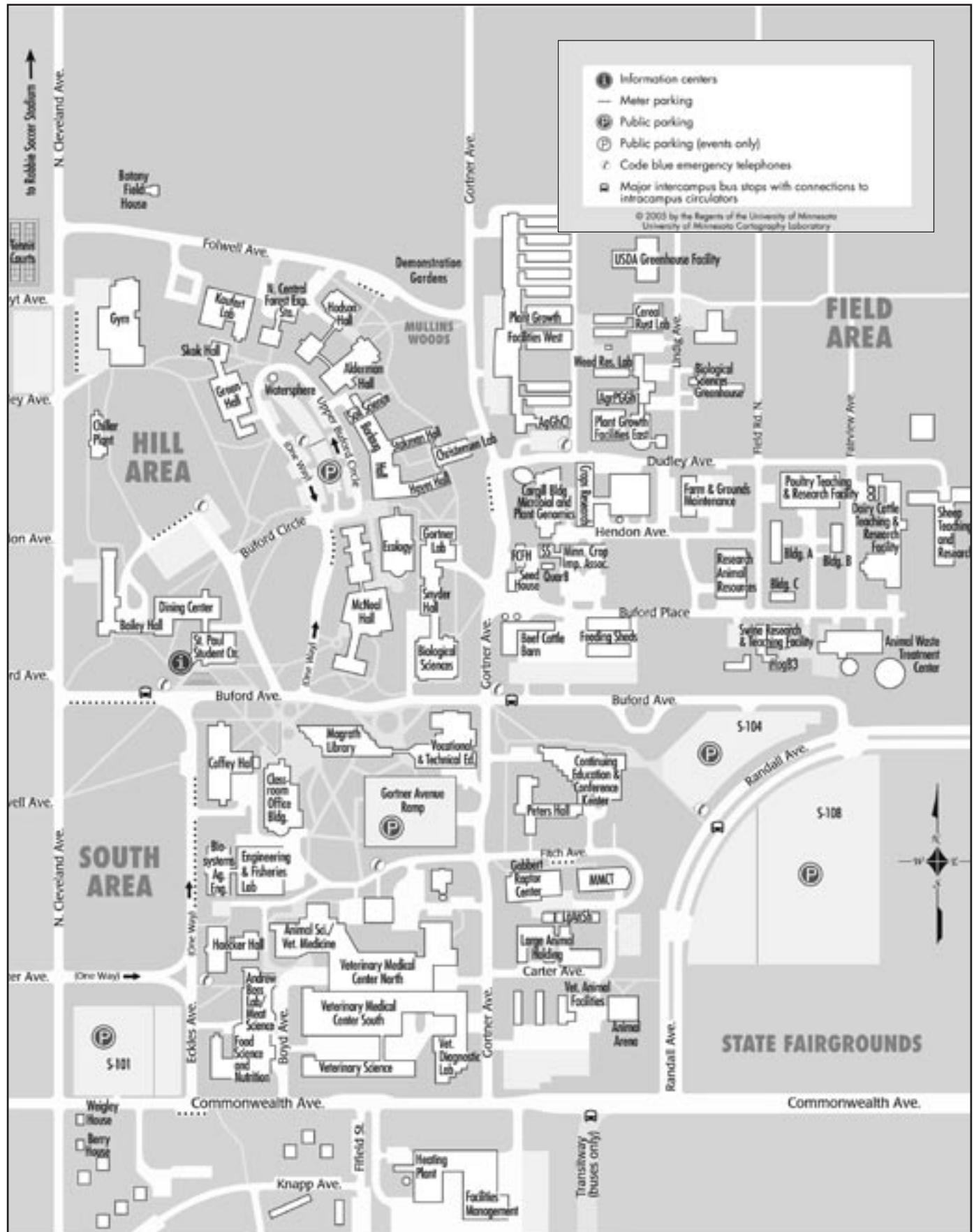


# University of Minnesota, Twin Cities West Bank





# University of Minnesota, Twin Cities St. Paul



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# 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  | BP   | Bio-based Products—see Natural Resources Sciences and Management  | FE   | Family Education—see Education—Work, Community, and Family Education; Work, Community, and Family Education           |
| AdEd | Adult Education—see Education—Work, Community, and Family Education; Work, Community, and Family Education                                 | BPhy | Biophysical Sciences—see Biophysical Sciences and Medical Physics   | Fina | Finance—see Business Administration; Business Taxation  |
| AdPy | Adult Psychiatry—related courses   | CAPy | Child and Adolescent Psychiatry—related courses   | FMCH | Family Medicine and Community Health  |
| AEM  | Aerospace Engineering and Mechanics—see Aerospace Engineering; Mechanics   | CAS  | Central Asian Studies—see Russian Area Studies  | FR   | Forest Resources—see Natural Resources and Science Management   |
| Afro | Afro-American Studies—see Studies in Africa and the African Diaspora   | CBio | Conservation Biology  | Fren | French  |
| AFEE | Agricultural, Food, and Environmental Education—see Education—Work, Community, and Family Education; Work, Community, and Family Education | CDis | Communication Disorders   | FrIt | French and Italian—see French; Italian  |
| Agro | Agronomy and Plant Genetics—see Applied Plant Sciences   | CE   | Civil Engineering   | FScN | Food Science and Nutrition—see Food Science; Nutrition  |
| Akka | Akkadian—see Classical and Near Eastern Studies  | CgSc | Cognitive Science   | FSoS | Family Social Science   |
| ALL  | Asian Languages and Literatures  | Chem | Chemistry   | FW   | Fisheries and Wildlife—see Wildlife Conservation  |
| AmIn | American Indian Studies  | ChEn | Chemical Engineering—see also Materials Science and Engineering   | GCD  | Genetics, Cell Biology, and Development—see Molecular, Cellular, Developmental Biology and Genetics                   |
| AmSt | American Studies   | Chic | Chicano Studies—related courses   | Geo  | Geology and Geophysics—see Geology; Geophysics  |
| Anes | Anesthesiology   | Chn  | Chinese—see East Asian Studies  | GeoE | Geological Engineering  |
| AnSc | Animal Science   | ChPh | Chemical Physics  | Geog | Geography   |
| Anth | Anthropology   | CI   | Curriculum and Instruction—see Education—Curriculum and Instruction   | Ger  | German—see Germanic Studies   |
| ApEc | Applied Economics—see Agricultural and Applied Economics   | CLit | Comparative Literature  | Gero | Gerontology   |
| APSc | Applied Plant Sciences   | CLS  | Clinical Laboratory Science   | GIS  | Geographic Information Science  |
| Arab | Arabic   | CMB  | Comparative and Molecular Biosciences   | GloS | Global Studies—see East Asian Studies   |
| Arch | Architecture   | CmpE | Computer Engineering  | Grad | Graduate School   |
| Arm  | Aramaic—see Classical and Near Eastern Studies   | CNES | Classical and Near Eastern Studies  | Grk  | Greek—see Classical and Near Eastern Studies  |
| ArtH | Art History  | Comm | Communication Studies   | GSD  | German, Scandinavian, and Dutch—see Germanic Studies  |
| ArtS | Art  | Copt | Coptic—see Classical and Near Eastern Studies   | Hebr | Hebrew—see Classical and Near Eastern Studies   |
| ASL  | American Sign Language   | CPsy | Child Psychology  | HInf | Health Informatics  |
| Ast  | Astronomy—see Astrophysics   | CSci | Computer Science—see Computer and Information Sciences; Computer Engineering  | Hist | History   |
| BA   | Business Administration  | CSCl | Cultural Studies and Comparative Literature—related courses   | HMed | History of Medicine—see History of Medicine and Biological Sciences   |
| BAE  | Biosystems and Agricultural Engineering  | CSDS | Comparative Studies in Discourse and Society  | Hndi | Hindi—see South Asian Languages   |
| BIE  | Business and Industry Education—see Education—Work, Community, and Family Education; Work, Community, and Family Education                 | CSDy | Control Science and Dynamical Systems   | Hort | Horticultural Science—see Applied Plant Sciences  |
| Binf | Bioinformatics   | CSpH | Center for Spirituality and Healing—See Complementary Therapies and Healing Practices   | HRD  | Human Resource Development—see Education—Work, Community, and Family Education; Work, Community, and Family Education |
| BioC | Biochemistry—see Biochemistry, Molecular Biology, and Biophysics   | Dent | Dentistry   | HRIR | Human Resources and Industrial Relations  |
| Biol | Biology  | DesI | Design Institute—See Architecture and Landscape Architecture  | HSci | History of Science and Technology   |
| BLaw | Business Law—see Business Administration; Business Taxation  | DHA  | Design, Housing, and Apparel  | HumF | Human Factors—see Human Factors/ Ergonomics   |
| BME  | Biomedical Engineering   | Dnce | Dance—see Theatre Arts  | IDSc | Information and Decision Sciences—see Business Administration; Business Taxation                                      |
| BMSC | Biomedical Science   | DSSC | Development Studies and Social Change   | IE   | Industrial Engineering—see also Mechanical Engineering  |
|      |  | Dtch | Dutch—see Germanic Studies  | InAr | Interdisciplinary Archaeological Studies  |
|      |  | EAS  | East Asian Studies  | Ins  | Insurance and Risk Management—see Business Administration; Business Taxation  |
|      |  | Econ | Economics   | IntR | International Relations—related courses   |
|      |  | ECP  | Experimental and Clinical Pharmacology  | IRel | Interpersonal Relationships Research  |
|      |  | EdHD | Education and Human Development   | ISE  | Infrastructure Systems Engineering  |
|      |  | EdPA | Educational Policy and Administration   | Ital | Italian   |
|      |  | Educ | Education—see Art Education; Education—Curriculum and Instruction; Education—Recreation, Park, and Leisure Studies; Education—Work, Community, and Family Education | Jour | Journalism and Mass Communication—see Mass Communication  |
|      |  | EE   | Electrical Engineering—see also Computer Engineering  | Jpn  | Japanese  |
|      |  | EEB  | Ecology, Evolution, and Behavior  | JwSt | Jewish Studies—related courses  |
|      |  | EngC | English: Composition  | Kin  | Kinesiology   |
|      |  | EngL | English: Literature—see Creative Writing; English   |      |   |
|      |  | EngW | English: Creative Writing   |      |   |
|      |  | ENR  | Environment and Natural Resources—see Natural Resources Science and Management  |      |   |
|      |  | Ent  | Entomology  |      |   |
|      |  | EPsy | Educational Psychology  |      |   |
|      |  | ES   | Environmental Science   |      |   |

## Course Designators

|      |   |      |  |      |  |
|------|---|------|--|------|--|
| LA   | Landscape Architecture  | Phys | Physics  | VBS  | Veterinary and Biomedical Sciences   |
| LaMP | Laboratory Medicine and Pathology   | PIPa | Plant Pathology  | VMed | Veterinary Medicine  |
| LASK | Learning and Academic Skills—related courses  | Plsh | Polish—see Russian Area Studies  |      |  |
| Lat  | Latin—see Ancient and Medieval Art and Archaeology; Classical and Near Eastern Studies; Classics                  | PMed | Physical Medicine and Rehabilitation—see Occupational Therapy; Physical Therapy; Rehabilitation Science  | WCFE | Work, Community, and Family Education—see also Education—Work, Community, and Family Education |
| LgTT | Language, Teaching, and Technology—related courses  | Pol  | Political Science  | WoSt | Women's Studies—see Feminist Studies   |
| Ling | Linguistics   | Port | Portuguese—see Hispanic and Luso-Brazilian Literatures and Linguistics; Hispanic Linguistics; Hispanic Literature; Luso-Brazilian Literature         | WRS  | Water Resources Science  |
| LM   | Logistics Management—see Business Administration; Business Taxation   | Psy  | Psychology   | YoSt | Youth Development and Research—see Social Work   |
| LS   | Liberal Studies   | PT   | Physical Therapy   |      |  |
|      |   | PubH | Public Health—see also Biostatistics; Environmental Health; Epidemiology; Health Services Research, Policy and Administration                        |      |  |
| Mar  | Marathi—see South Asian Languages   |      |  |      |  |
| Math | Mathematics   |      |  |      |  |
| MatS | Materials Science—see Chemical Engineering; Materials Science and Engineering                                     | Rad  | Radiology  |      |  |
| MBT  | Master of Business Taxation—see Business Taxation   | Rec  | Recreation, Park, and Leisure Studies—see also Education—Recreation, Park, and Leisure Studies   |      |  |
| MCDG | Molecular, Cellular, Developmental Biology and Genetics   | ReLA | Religions in Antiquity—see Classical and Near Eastern Studies  |      |  |
| MCom | Managerial Communications   | ReIS | Religious Studies  |      |  |
| ME   | Mechanical Engineering—see also Industrial Engineering  | Rhet | Rhetoric—see Rhetoric and Scientific and Technical Communication; Scientific and Technical Communication   |      |  |
| MedC | Medicinal Chemistry   | RRM  | Recreation Resource Management   |      |  |
| MELC | Middle Eastern Languages and Cultures—see South Asian Languages   | RSc  | Rehabilitation Science   |      |  |
| MeSt | Medieval Studies  | Russ | Russian  |      |  |
| Mgmt | Management—see Business Administration; Business Taxation   |      |  |      |  |
| MHA  | Master of Healthcare Administration—related courses   | SACP | Social, Administrative, and Clinical Pharmacy  |      |  |
| MICa | Microbiology, Immunology, and Cancer Biology  | SAgr | Sustainable Agricultural Systems   |      |  |
| MicB | Microbiology  | SALC | South Asian Languages and Cultures—see South Asian Languages   |      |  |
| MicE | Microbial Engineering   | SAPh | Social and Administrative Pharmacy—see Social, Administrative, and Clinical Pharmacy   |      |  |
| Mktg | Marketing—see Business Administration; Business Taxation  | Scan | Scandinavian—see Germanic Studies  |      |  |
| MOT  | Management of Technology  | SciC | Scientific Computation   |      |  |
| MS   | Manufacturing Systems   | SCMC | Studies in Cinema and Media Culture  |      |  |
| MSt  | Museum Studies  | SEng | Software Engineering   |      |  |
| MthE | Mathematics Education   | SLHS | Speech-Language-Hearing Sciences   |      |  |
| MuEd | Music Education—see also Music  | Skt  | Sanskrit—see South Asian Languages   |      |  |
| Mus  | Music—see also Music Education  | Slav | Slavic—see Russian Area Studies  |      |  |
| MusA | Music Applied—see Music; Music Education  | Soc  | Sociology  |      |  |
|      |   | Soil | Soil, Water, and Climate   |      |  |
|      |   | Span | Spanish—see Hispanic and Luso-Brazilian Literatures and Linguistics; Hispanic Linguistics; Hispanic Literature; Luso-Brazilian Literature            |      |  |
| NpSE | Nanoparticle Science and Engineering  |      |  |      |  |
| NR   | Natural Resources Science and Management  | SpPt | Spanish-Portuguese—see Hispanic and Luso-Brazilian Literatures and Linguistics; Hispanic Linguistics; Hispanic Literature; Luso-Brazilian Literature |      |  |
| NSc  | Neuroscience  |      |  |      |  |
| NSci | Neuroscience Department   | SST  | Studies of Science and Technology  |      |  |
| NSu  | Neurosurgery  | Stat | Statistics   |      |  |
| Nurs | Nursing   | Sum  | Sumerian—see Classical and Near Eastern Studies  |      |  |
| Nutr | Nutrition   | Surg | Surgery—see also Experimental Surgery  |      |  |
|      |   | SW   | Social Work  |      |  |
| OBio | Oral Biology  |      |  |      |  |
| OMS  | Operations and Management Science—see Business Administration; Business Taxation                                  | TESL | Teaching English as a Second Language—see English as a Second Language   |      |  |
| OT   | Occupational Therapy  | Th   | Theatre Arts   |      |  |
| Otol | Otolaryngology  | TRad | Therapeutic Radiology—related courses  |      |  |
|      |   | TrIn | Translation and Interpreting—see English as a Second Language  |      |  |
| PA   | Public Affairs—see also Public Policy; Science, Technology, and Environmental Policy; Urban and Regional Planning | Txcl | Toxicology   |      |  |
| PBio | Plant Biology—see Plant Biological Sciences   |      |  |      |  |
| PBS  | Plant Biological Sciences   | UrbS | Urban Studies—see Urban and Regional Planning  |      |  |
| Phcl | Pharmacology  |      |  |      |  |
| Phil | Philosophy  |      |  |      |  |
| Phm  | Pharmaceutics   |      |  |      |  |
| Phsl | Physiology—see Cellular and Integrative Physiology  |      |  |      |  |