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Northwestern

Undergraduate Study 1997–99

# Northwestern

*Undergraduate Study 1997–99*

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## Here's a partial list of what's on NUInfo

***General Information***
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Student handbook

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# Northwestern

Undergraduate Study 1997–99

Northwestern Undergraduate Study 1997–99
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This bulletin for the two academic years beginning September 1, 1997, contains University regulations and information about the programs and courses offered by the College of Arts and Sciences, School of Education and Social Policy, Robert R. McCormick School of Engineering and Applied Science, Medill School of Journalism, School of Music, School of Speech, and other undergraduate programs. Northwestern University reserves the right to change without notice any statement in this bulletin concerning, but not limited to, rules, policies, tuition, fees, curricula, and courses.

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# Contents

# Academic Calendar

## Academic Year 1997–98

### Fall Quarter

***September 1997***

| | | |
|---|---|---|
| 2 | Tuesday | Tuition due |
| 15 | Monday | New Student Week begins |
| 18 | Thursday | Registration for fall quarter begins |
| 19 | Friday | Registration for fall quarter ends |
| 22 | Monday | Classes for fall quarter begin 8 a.m. |
| 26 | Friday | Last day for late registration, adding any course, or changing a section (no refund or bill reduction made on any change of registration after this date) |

***October 1997***

| | | |
|---|---|---|
| 31 | Friday | Last day for dropping any course (no tuition adjustment after Friday, September 26)<br>Last day to withdraw without academic review<br>No refund on tuition for students withdrawing from the University after today |

***November 1997***

| | | |
|---|---|---|
| 17 | Monday | Advance registration for winter quarter begins |
| 26 | Wednesday | Thanksgiving vacation begins 6 p.m. |
| 27 | Thursday | Thanksgiving Day |

***December 1997***

| | | |
|---|---|---|
| 1 | Monday | Classes resume 8 a.m.<br>Last day for current students to file an undergraduate financial aid application for winter quarter |
| 6 | Saturday | Last day of classes for fall quarter |
| 8 | Monday | Fall quarter examinations begin |
| 13 | Saturday | Examinations end; vacation begins 6 p.m. |

### Winter Quarter

***January 1998***

| | | |
|---|---|---|
| 2 | Friday | Tuition due |
| 5 | Monday | Classes for winter quarter begin 8 a.m.<br>Registration for winter quarter |
| 12 | Monday | Last day for late registration, adding any course, or changing a section (no refund or bill reduction made on any change of registration after this date) |

***February 1998***

| | | |
|---|---|---|
| 13 | Friday | Last day for dropping any course (no tuition adjustment after Monday, January 12)<br>Last day to withdraw without academic review<br>No refund on tuition for students withdrawing from the University after today |

***March 1998***

| | | |
|---|---|---|
| 2 | Monday | Last day for current students to file an undergraduate financial aid application for spring quarter |
| 3 | Tuesday | Advance registration for spring quarter begins |
| 14 | Saturday | Last day of classes for winter quarter |
| 16 | Monday | Winter quarter examinations begin |
| 21 | Saturday | Examinations end; vacation begins 6 p.m. |

### Spring Quarter

***March 1998***

| | | |
|---|---|---|
| 30 | Monday | Classes for spring quarter begin 8 a.m.<br>Registration for spring quarter |

***April 1998***

| | | |
|---|---|---|
| 1 | Wednesday | Tuition due |
| 6 | Monday | Last day for late registration, adding any course, or changing a section (no refund or bill reduction made on any change of registration after this date) |

NOTE: Before the end of spring quarter, students planning to graduate in June or August 1999 must file an application for a degree in arts and sciences, education and social policy, journalism, music, or speech at the Registrar's Office. Others must file at the appropriate school office. Students completing requirements in December or March should file an application for a degree one year in advance.

***May 1998***

| | | |
|---|---|---|
| 1 | Friday | Last day for current students to file undergraduate financial aid applications for Summer Session and for academic year 1998–99 |
| 8 | Friday | Last day for dropping any course (no tuition adjustment after Monday, April 6)<br>Last day to withdraw without academic review<br>No refund on tuition for students withdrawing from the University after today |
| 25 | Monday | Memorial Day—legal holiday; no classes |
| 28 | Thursday | Advance registration for fall quarter 1998–99 begins |

***June 1998***

| | | |
|---|---|---|
| 4 | Thursday | Advance registration for Summer Session begins |
| 6 | Saturday | Last day of classes for spring quarter |
| 8 | Monday | Spring quarter examinations begin |
| 13 | Saturday | Examinations end 6 p.m. |
| 19 | Friday | Baccalaureate<br>140th annual commencement |

### Summer Session

***June 1998***

| | | |
|---|---|---|
| 22 | Monday | Tuition due<br>Registration for Summer Session |
| 23 | Tuesday | Classes for Summer Session begin 8 a.m. |
| 26 | Friday | Last day for late registration, adding any course, or changing a section (no refund or bill reduction made on any change of registration after this date) |

***July 1998***

| | | |
|---|---|---|
| 3 | Friday | Independence Day observance—legal holiday; no classes |
| 31 | Friday | Six-week Summer Session examinations begin 8 a.m. |

***August 1998***

| | | |
|---|---|---|
| 1 | Saturday | Six-week Summer Session ends 6 p.m. |
| 14 | Friday | Eight-week Summer Session examinations begin 8 a.m. |
| 15 | Saturday | Eight-week Summer Session ends 6 p.m. |

## Academic Year 1998–99

### Fall Quarter

***September 1998***

| | | |
|---|---|---|
| 1 | Tuesday | Tuition due |
| 14 | Monday | New Student Week begins |
| 17 | Thursday | Registration for fall quarter begins |
| 18 | Friday | Registration for fall quarter ends |
| 22 | Tuesday | Classes for fall quarter begin 8 a.m. |
| 28 | Monday | Last day for late registration, adding any course, or changing a section (no refund or bill reduction made on any change of registration after this date) |

***October 1998***

| | | |
|---|---|---|
| 30 | Friday | Last day for dropping any course (no tuition adjustment after Monday, September 28)<br>Last day to withdraw without academic review<br>No refund on tuition for students withdrawing from the University after today |

***November 1998***

| | | |
|---|---|---|
| 16 | Monday | Advance registration for winter quarter begins |
| 25 | Wednesday | Thanksgiving vacation begins 6 p.m. |
| 26 | Thursday | Thanksgiving Day |
| 30 | Monday | Classes resume 8 a.m.<br>Last day for current students to file an undergraduate financial aid application for winter quarter |

***December 1998***

| | | |
|---|---|---|
| 5 | Saturday | Last day of classes for fall quarter |
| 7 | Monday | Fall quarter examinations begin |
| 12 | Saturday | Examinations end; vacation begins 6 p.m. |

### Winter Quarter

***January 1999***

| | | |
|---|---|---|
| 4 | Monday | Tuition due<br>Classes for winter quarter begin 8 a.m.<br>Registration for winter quarter |
| 11 | Monday | Last day for late registration, adding any course, or changing a section (no refund or bill reduction made on any change of registration after this date) |

***February 1999***

| | | |
|---|---|---|
| 12 | Friday | Last day for dropping any course (no tuition adjustment after Monday, January 11)<br>Last day to withdraw without academic review<br>No refund on tuition for students withdrawing from the University after today |

***March 1999***

| | | |
|---|---|---|
| 1 | Monday | Last day for current students to file an undergraduate financial aid application for spring quarter |
| 2 | Tuesday | Advance registration for spring quarter begins |
| 13 | Saturday | Last day of classes for winter quarter |
| 15 | Monday | Winter quarter examinations begin |
| 20 | Saturday | Examinations end; vacation begins 6 p.m. |

## Spring Quarter

***March 1999***

| | | |
|---|---|---|
| 29 | Monday | Classes for spring quarter begin 8 a.m.<br>Registration for spring quarter |

***April 1999***

| | | |
|---|---|---|
| 1 | Thursday | Tuition due |
| 5 | Monday | Last day for late registration, adding any course, or changing a section (no refund or bill reduction made on any change of registration after this date) |

NOTE: Before the end of spring quarter, students planning to graduate in June or August 2000 must file an application for a degree in arts and sciences, education and social policy, journalism, music, and speech at the Registrar's Office. Others must file at the appropriate school office. Students completing requirements in December or March should file an application for a degree one year in advance.

***May 1999***

| | | |
|---|---|---|
| 3 | Monday | Last day for current students to file undergraduate financial aid applications for Summer Session and for academic year 1999–2000 |
| 7 | Friday | Last day for dropping any course (no tuition adjustment after Monday, April 5)<br>Last day to withdraw without academic review<br>No refund on tuition for students withdrawing from the University after today |
| 26 | Wednesday | Advance registration for fall quarter 1999–2000 begins |
| 31 | Monday | Memorial Day—legal holiday; no classes |

***June 1999***

| | | |
|---|---|---|
| 3 | Thursday | Advance registration for Summer Session begins |
| 5 | Saturday | Last day of classes for spring quarter |
| 7 | Monday | Spring quarter examinations begin |
| 12 | Saturday | Examinations end 6 p.m. |
| 18 | Friday | Baccalaureate<br>141st annual commencement |

## Summer Session

***June 1999***

| | | |
|---|---|---|
| 21 | Monday | Tuition due<br>Registration for Summer Session |
| 22 | Tuesday | Classes for Summer Session begin 8 a.m. |
| 25 | Friday | Last day for late registration, adding any course, or changing a section (no refund or bill reduction made on any change of registration after this date) |

***July 1999***

| | | |
|---|---|---|
| 5 | Monday | Independence Day observance—legal holiday; no classes |
| 30 | Friday | Six-week Summer Session examinations begin 8 a.m. |
| 31 | Saturday | Six-week Summer Session ends 6 p.m. |

***August 1999***

| | | |
|---|---|---|
| 13 | Friday | Eight-week Summer Session examinations begin 8 a.m. |
| 14 | Saturday | Eight-week Summer Session ends 6 p.m. |

The University reserves the right to make changes in this calendar. A detailed, current calendar will appear in each quarterly *Class Schedule.*

# The University

## The Mission of Northwestern University

The mission of Northwestern University is to establish and enhance excellence in its academic and professional programs. This includes superior undergraduate education for a highly selective student body in a comprehensive range of academic and professional fields. At the graduate level, Northwestern's role encompasses offerings in the major academic and professional fields, closely related to research, creative activities, and clinical services. The research program at Northwestern is a major component of University efforts, assuring institutional leadership in scientific discovery, intellectual inquiry, and creative performance. The character of this research shapes all areas of University endeavor, especially graduate education as well as undergraduate studies.

In its effort to fulfill its unique potential for combining the best features of world-class research institutions with the advantages of smaller, teaching-oriented schools, Northwestern seeks to maintain the highest standards of teaching excellence in all divisions of the University. Teaching is given significant weight in faculty personnel decisions, and special programs have been instituted to strengthen and reward the teaching skills of faculty members.

Through teaching and research, the University also serves society. Northwestern continues its commitment to diversity in its student body. Further, it is the role of the University to participate vigorously in discussions of important public policy issues and to engage in selective, cooperative ventures with government and private organizations external to the University.

## The Goals of Undergraduate Education

Consistent with its dedication to excellence, Northwestern provides both an educational and an extracurricular environment that enables its undergraduate students to become accomplished individuals and informed and responsible citizens. To the students in all its undergraduate schools, Northwestern offers liberal learning and professional education to help them gain the depth of knowledge that will empower them to become leaders in their professions and their communities. Furthermore, Northwestern fosters in its students a broad understanding of the world in which we live as well as excellence in the competencies that transcend any particular field of study: writing and oral communication, analytical and creative thinking and expression, quantitative and qualitative methods of inquiry. Northwestern expects its graduates, by their experiences in the classroom and in their lives on campus, to have developed the attributes of an educated person: responsibility, both personal and social; critical ability; scientific, technological, and aesthetic awareness; reflectiveness; creativity; and commitment to learning as a lifelong process.

Undergraduate education at Northwestern strongly reflects the University's commitment to excellence in teaching and scholarship and its conviction that at a great university students also will learn from each other, both within the classroom and beyond it. The goal each year is to enroll a class of talented young men and women who not only will take full advantage of the University's resources and location but also will challenge the faculty and each other to keep the enterprise of learning a rich and vital activity. The hallmarks of education at Northwestern, throughout its undergraduate schools, are its dedication to liberal learning and its insistence that students have the opportunity to work with teachers who are active and distinguished scholars. Although the University shares with other institutions an investment in the traditional components of undergraduate education—particularly the intellectual range of general education requirements and the advanced work of departmental majors—it also prides itself on making unusual academic opportunities available. At Northwestern, students regularly study with senior faculty members, whose scholarship often crosses the boundaries of a single discipline. Students also are encouraged to pursue independent study and research within their fields

of specialization. Through its commitment to a variety of innovative and often interdisciplinary programs and a renewed emphasis on international studies, Northwestern provides its students with the knowledge and skills that allow them to become leaders in their chosen careers as well as thoughtful and sensitive global citizens with a commitment to learning as a lifetime experience.

To attain these goals, Northwestern recruits students of demonstrated academic achievement from diverse social, ethnic, and economic backgrounds. Diversity is taken very seriously on campus. Northwestern is committed to a classroom and living environment in which students learn to understand and respect the rights and beliefs of others. Northwestern also ensures that students will actively participate in molding their own undergraduate experience. One of Northwestern's strongest traditions is the energetic involvement of its undergraduates in campus life, a tradition that often leads them beyond the campus itself as they explore the rich cultural, political, and intellectual life of Chicago. In both its academic and extracurricular programs, Northwestern encourages its students to develop a sense of responsibility, to obtain a broad understanding of the world in which they live, and to cultivate those abilities—of critical inquiry, creativity, and reflectiveness—that characterize an educated person. The University places particular value on the ability of its undergraduates to communicate effectively, to interpret the developments in science and technology that shape our changing world, and to use the techniques of quantitative analysis that are necessary to effective professional and social life. Northwestern believes that knowledge—of ourselves as well as others—provides the foundation of personal as well as professional growth. Armed with the knowledge and habits of mind they acquire at Northwestern, graduates are prepared to formulate ambitious goals and make intelligent choices for themselves and their society.

## An Overview of Northwestern

Northwestern University was established in 1851 by nine members of the Methodist faith: a physician, three attorneys, two businessmen, and three clergymen. The founders' immediate goal was to create an institution of "the highest order of excellence" to serve the people of the original Northwest Territory (Ohio, Indiana, Illinois, Michigan, Wisconsin, and part of Minnesota). On the date of its founding, Northwestern had no faculty, students, campus, or buildings and only $9.92 in the treasury.

In 1853, as a site for the new University, the founders purchased a 379-acre tract of farmland along Lake Michigan 12 miles north of Chicago—then a thriving frontier city. The town that grew up around Northwestern was named Evanston to honor one of the University's most prominent founders, John Evans. A well-known physician and researcher, who taught at Rush Medical College in Chicago, Evans established the first Indiana mental hospital and organized the Illinois Medical Society. Evans also became a successful real estate speculator and railroad builder and served as governor of the Colorado Territory, where he helped to found the University of Denver. Evans was a continuous contributor of his time, energy, and money to Northwestern, serving as chairman of the board from the founding of the University in 1851 until his death in 1897.

Having completed its first building in the fall of 1855, Northwestern's College of Liberal Arts opened its doors with two faculty members and ten male students. A pioneer in the education of women, Northwestern first enrolled female students in 1869. With the 1873 merger of Northwestern and the Evanston College for Ladies, Frances E. Willard became the first dean of women. By 1900, Northwestern was composed of not only a liberal arts college but also six undergraduate and graduate professional schools, including the schools of law, medicine, and dentistry, with 2,700 students, 680 acres in Evanston plus properties in Chicago, and an annual budget of more than $200,000. Thus, by the year of Evans's death, Northwestern had made considerable progress toward the founders' initial goal of creating a genuine "university."

With the establishment of the Graduate School in 1910, Northwestern, like Johns Hopkins and other major institutions, adopted the German university model of providing graduate as well as undergraduate instruction and stressing research along with teaching. Today, Northwestern is a major private research university with 12 academic divisions located on two lakefront campuses in Evanston and Chicago, 2,044 full-time faculty and 13,618 full-time students, approximately 7,570 of whom are undergraduates

on the Evanston campus, and an annual budget exceeding $803 million.

Education at Northwestern since its founding has been based on the liberal arts as administered through the University's oldest school, now called the College of Arts and Sciences. In addition to completing the requirements for a major field of specialization, all undergraduates must participate in a program of general education, which has recently been restructured and reaffirmed. The main academic linkages between the divisions of the University are the basic departments in the College of Arts and Sciences and the research centers, which foster interdisciplinary study across department and school lines.

While the liberal arts are its foundation, Northwestern is known also for its strong professional programs. Its undergraduate schools offer excellent programs in the visual and performing arts, journalism, engineering, and education. In addition, interdisciplinary and cross-school programs such as the American Studies, Mathematical Methods in the Social Sciences, Integrated Science, Integrated Arts, Music Theatre, and Undergraduate Leadership programs provide unique opportunities for undergraduates to enjoy a broad and rich educational experience. Other significant opportunities offered by the University include the five-year cooperative engineering education program and the seven-year Honors Program in Medical Education.

Northwestern is a member of the Association of American Universities—the 29 private and 31 public universities that constitute the nation's most distinguished educational institutions as defined by the quality and scope of their research and graduate programs. Recent assessments of the quality of faculty research and doctoral programs include the comprehensive rankings of basic disciplines conducted by the National Research Council (1993). According to this assessment, Northwestern has one program in the top 5 and one in the top 10 nationally, plus one doctoral program in the top 5, five more in the top 10, four more in the top 15, two more in the top 20, and seven more in the top 25 nationally. Over the past decade Northwestern's J. L. Kellogg Graduate School of Management has been consistently ranked among the nation's top six graduate business schools in surveys conducted by *Business Week* and by *U.S. News & World Report*.

In American universities, faculty prominence is based primarily on research, which is highly integrated with graduate education because graduate training is, to a large degree, apprenticeship in research. However, a factor that distinguishes Northwestern from other major research universities is that all faculty members not only perform research but also teach, the majority at the undergraduate as well as the graduate level. Even full professors, the most senior faculty, teach undergraduate courses, with approximately 90 percent doing so each year. No university of comparable size has a research faculty that provides such a range of academic programs and such direct access through instruction.

In support of the faculty's commitment to innovative instruction, the University recently completed installing a fiber-optic network that connects all academic and administrative buildings and residence halls. Classroom experiments with the new technology involved more than a thousand students during the first quarter the network was operating. Now, from their own room or a microcomputer lab, all students may enhance their learning by participating in campus-based electronic discussion groups and by exploring the array of electronic resources available through the Internet. These innovative approaches to learning are energized by the presence at the University of a leading center on the cognitive sciences, with a primary goal of enhancing the quality of education by applying theories of learning to the design of educational software.

Northwestern strives to offer high-quality education while adhering to a program of careful financial management. In overall quality, *U.S. News & World Report* recently ranked Northwestern ninth among national universities. The fiscal health of the University is reflected in the major building and renovation projects undertaken in the past 10 years and the transformation of the Evanston campus on the shores of Lake Michigan into one of the most attractive university campuses in the nation.

In recent years, the cumulative rate of freshmen graduating from Northwestern has increased:

| *Freshmen entering in* | *1988* | *1989* | *1990* |
|---|---|---|---|
| *Percent graduating in 4 years* | 80.2 | 81.8 | 81.9 |
| *Percent graduating in 5 years* | 87.7 | 89.0 | 90.4 |
| *Percent graduating in 6 years* | 88.2 | 89.4 | 91.1 |
| *Total entering freshmen* | 1,816 | 1,858 | 1,775 |

The five-year totals include students in programs designed to be completed in five years, such as cooperative engineering education, combined bachelor's/master's programs, and dual bachelor's programs. Students in the seven-year Honors Program in Medical Education are counted as graduated when they begin the Medical School portion of their program after three years enrolled in an undergraduate school on the Evanston campus.

## Schools and Divisions

The undergraduate schools offer the programs and courses of instruction described in the respective sections of this catalog. Undergraduate study may lead to the bachelor's degree as a final academic goal or to advanced work toward a graduate or professional degree.

### Evanston Campus

The schools and other institutional divisions, in order of establishment, are as follows:

- The College of Arts and Sciences (1851) offers the degree of bachelor of arts. Through University College, the College of Arts and Sciences also offers the degrees of bachelor of philosophy and bachelor of science in general studies and two certificates in arts and sciences.
- The School of Speech (1878), with departments of communication sciences and disorders, communication studies, performance studies, radio/television/film, and theater, offers the bachelor of science in speech degree. Through University College, the School of Speech offers the bachelor of philosophy in communication. The school also offers the degree of master of science in communication.
- The School of Music (1895) offers students the degrees of bachelor of music and bachelor of arts in music. In its graduate division, the School of Music offers the degrees of doctor of music and master of music and a certificate in performance.
- The J. L. Kellogg Graduate School of Management (1908) offers the master of management degree. It provides students with the opportunity to study business, health services, manufacturing, public and nonprofit, real estate, and transportation management. In addition to the full-time program, Kellogg also offers a part-time evening degree program (Managers' Program) on Northwestern's Chicago campus and the weekend Executive Master's Program on the Evanston campus.
- The Robert R. McCormick School of Engineering and Applied Science of the Technological Institute (1909) offers the bachelor of science degree in applied mathematics, biomedical engineering, chemical engineering, civil engineering, computer engineering, computer science, electrical engineering, engineering science, environmental engineering, industrial engineering, manufacturing engineering, materials science and engineering, mechanical engineering, and medical engineering (for students enrolled in the Honors Program in Medical Education). All departments offer advanced study for graduate students. The McCormick School also offers master's degrees in engineering management, manufacturing engineering, and project management and, jointly with the Kellogg School, the master of management in manufacturing.
- The Graduate School (1910) controls all advanced programs leading to the degrees of doctor of philosophy, master of arts, master of fine arts, and master of science. The Graduate School bulletin, describing master's and doctoral programs in all schools and departments, is available on request.
- The Summer Session (1920) provides summer programs for undergraduate, graduate, and visiting students.
- The Medill School of Journalism (1921) offers the degree of bachelor of science in journalism as well as master of science degrees in journalism and integrated marketing communications.
- The School of Education and Social Policy (1926) offers the degrees of bachelor of science in education and social policy, master of science in education and social policy, master of arts in learning sciences, and master of science in marital and family therapy.

### Chicago Campus

Schools and institutional divisions on the Chicago campus, in order of establishment, are as follows:

- The Medical School (1859) offers the degrees of doctor of medicine, bachelor of science in medicine, master of public health, and master of physical therapy. High school graduates accepted for the Honors Program in Medical Education can receive the MD degree from the Medical School seven years after they enter the College of Arts and

Sciences, McCormick School, or School of Speech as freshmen. The Medical School and McCormick School cooperate in biomedical engineering programs, and joint degree programs with the Graduate School and Kellogg Graduate School of Management offer an MD degree as well as a PhD or master of management degree.
- The School of Law (1859) offers the degrees of juris doctor, master of laws, and doctor of juridical science. The School of Law and the J. L. Kellogg Graduate School of Management offer a joint degree program through which students can earn both juris doctor and master of management degrees in four years. The School of Law also participates in a program by which students can earn a JD and a PhD in one of the social sciences in five years.
- The Dental School (1891) offers the degree of doctor of dental surgery. It also offers a combined BS/DDS degree in conjunction with the McCormick School's biomedical engineering program. Students apply to the Dental School through the American Association of Dental Schools Application Service (AADSAS).
- University College (1933) is the continuing education division of the University, providing an opportunity for adults to return to school in the evenings or on Saturdays on a part-time or full-time basis to earn a degree or to take courses for personal enrichment or professional mobility. Classes are offered on both the Chicago and Evanston campuses. Through University College, the College of Arts and Sciences offers the degrees of bachelor of philosophy and bachelor of science in general studies; the School of Speech offers the bachelor of philosophy in communication; and the Graduate School offers the master of arts in liberal studies and the master of arts in English. University College also offers several certificate programs, including business programs in accounting and administrative techniques and a postbaccalaureate premedicine program.

## University Centers

University-wide and specialized research centers facilitate new scholarly approaches to problems by enabling faculty to collaborate across the boundaries of traditional disciplines. These interdisciplinary centers have profound implications for undergraduates, because such research often alters theory and practice within a given academic discipline and results in the development of new curricular programs.

Students also are involved directly with the centers through lectures or other special events and, in some cases, through research projects. The University's centers and programs include the following:
- Program of African Studies
- Center for Biotechnology
- Center for Catalysis and Surface Science
- Center for Circadian Biology and Medicine
- Institute for Health Services Research and Policy Studies
- Center for International and Comparative Studies
- Law and Social Science Program
- Institute for the Learning Sciences
- Materials Research Center
- Center for Mathematical Studies in Economics and Management Science
- Institute for Neuroscience
- Institute for Policy Research
- Center for Reproductive Science
- Science and Technology Center for Superconductivity
- Traffic Institute
- Transportation Center

For detailed information about these centers, see the Graduate School bulletin.

## Libraries

Undergraduates at Northwestern have access to a wealth of library resources and services. With more than 3.8 million volumes in the University Library system, the Galter Health Sciences Library, and the Law Library, Northwestern offers its students the 10th largest library collection among private universities in the United States. Undergraduates are encouraged to explore the full range of resources available to them and to develop their skills as information seekers.

Northwestern undergraduates have full access to interlibrary loan services and to materials from libraries worldwide. Through the Infopass program, students can gain admittance to other collections in the Chicago area, including those of the Newberry Library, the Field Museum of Natural History Library, the Art Institute of Chicago Library, and other academic and private libraries.

## University Library

The University Library consists of the main library, which houses the University's major collections in the humanities and social sciences, as well as several specialized research collections; the adjoining Charles Deering Library, which houses fine arts and other specialized collections; the Seeley G. Mudd Library for Science and Engineering; the Geology Library; the Mathematics Library; and the Joseph Schaffner Library, which supports the research needs of students on the Chicago campus.

The University Library offers many electronic research and textual resources, both within the library and on the campus network. NUcat, the on-line catalog of the Northwestern University Library and of the United Library of the Garrett Evangelical and Seabury Western Seminaries, provides bibliographic, location, and circulation status information for materials from these libraries. NUcat and many other resources and services are available on the World Wide Web at <http://www.library.nwu.edu>.

### *Main Library (Evanston Campus)*

The main library building houses collections in three research towers: north for the social sciences, east for history and Africana, and south for the humanities.

The main library's General Information Center and Reference Department, both located on level 1, offer students research assistance and support. The General Information Center, which serves as a gateway to the library, has staff to answer questions and state-of-the-art workstations to access information electronically. The Reference Department offers in-depth research assistance and consultation and instructional services. A 60,000 volume reference collection and many research databases make the Reference Department an important resource.

Also located on level 1 are the Circulation Department, the Current Periodicals Reading Room, the New Book Alcove, the Interlibrary Loan Department, and the Government Publications Department, featuring an extensive collection of federal, state, and international documents. The Government Publications Department is a depository for official documents of the United States, the United Nations, the state of Illinois, and the European Union, as well as selected publications of other international agencies and state and local governments.

On the lower level of the library is the Newspaper Microtext Reading Room, which contains extensive collections of newspapers in print and microform versions and of periodicals and primary research materials in microform. Also on the lower level is the Transportation Library, one of three major collections of its kind in the United States. It specializes in transportation socioeconomics and law enforcement.

The Marjorie Iglow Mitchell Multimedia Center, Forum Room and Video Theater (for special programs and video presentations), Core Collection, Reserve Book Room, a microcomputer lab, and a student lounge occupy level 2. The Multimedia Center features a videotape collection of classic films, documentaries, and performing arts titles, as well as a multimedia development lab with high-end Macintosh and Pentium workstations for multimedia and Internet projects. The noncirculating Core Collection holds 50,000 books in all disciplines, ensuring easy access and permanent availability of works essential to undergraduates.

Two special units are located on Level 5. The Curriculum Collection houses elementary and secondary teaching materials, courses of study, and children's literature. The Melville J. Herskovits Library of African Studies (popularly called Africana) is known internationally for its comprehensive collection of materials on every aspect of Africa.

### *Charles Deering Library (Evanston Campus)*

The Charles Deering Library, attached to the main library, houses the Art Collection, University Archives, Charles Deering McCormick Library of Special Collections, and Music Library and Listening Center. The holdings of Special Collections include 20th-Century Collections, underground press publications, women's movement literature, and numerous rare books, manuscripts, limited editions, and fine bindings.

The Music Library meets the practical and research needs of students and faculty at Northwestern's School of Music. This library contains scores, journals, books, and nearly 50,000 sound recordings, which can be heard in the Listening Center.

***Seeley G. Mudd Library for Science and Engineering, Geology Library, and Mathematics Library (Evanston Campus)***
The Seeley G. Mudd Library for Science and Engineering houses books and journals in applied mathematics, astronomy, biological sciences, chemistry, engineering, and physics. Two smaller departmental libraries also serve the Evanston campus: the Geology Library in Locy Hall and the Mathematics Library in the Lunt Building.

***Joseph Schaffner Library (Chicago Campus)***
The Joseph Schaffner Library (Wieboldt Hall, second floor), largely an electronic library, serves University College (the University's evening degree and continuing education program), the evening Managers' Program of the J. L. Kellogg Graduate School of Management, and the Medill School of Journalism graduate programs.

### Other Libraries

The Galter Health Sciences Library, which serves the Medical and Dental Schools, and the Law Library, which serves the School of Law, are located on the Chicago campus and are open to all Northwestern students. The collections of these libraries are listed in NUcat, the library's on-line catalog. Materials can be checked out directly or can be sent to Evanston through interlibrary loan.

Also open to all Northwestern students are the outstanding collections on religion held in the United Library of Garrett-Evangelical and Seabury Western Theological Seminaries, located on the Evanston campus. The United Library's holdings are listed in NUcat.

## Computing

### Computer Study

Students interested in majoring in computing are referred to the Computing and Information Systems Program in the College of Arts and Sciences and the Departments of Computer Science and of Electrical and Computer Engineering in the McCormick School of Engineering and Applied Science.

### Information Technology

At Northwestern, computers are used in a wide variety of applications designed to enhance the education of students both inside and outside the classroom. The need to understand computer applications cuts across disciplines. Students in the arts, humanities, journalism, and law have as much to gain from computer use as do those in the physical and social sciences, engineering, medicine, and business.

Northwestern's Information Technology (IT) division is the principal campus unit charged with managing and coordinating computing facilities and services for students, faculty, and staff.

Buildings on the Evanston and Chicago campuses are connected through high-speed networks to the Internet, allowing access to a wealth of information at other universities and organizations worldwide. All sleeping rooms in University residence halls are connected to the University's network, giving students with network services accounts (see below) convenient access to electronic mail, to the card catalog and other resources of the University's libraries, as well as to NUInfo <http://nuinfo.nwu.edu>, the campus electronic bulletin board and calendar.

Through IT's Academic Technologies, students can access a variety of resources in a networked environment, including computer lab/classrooms with Windows and Macintosh units and a UNIX workstation lab/classroom. In addition, students may use specialized computer labs available in the six undergraduate schools.

Students may apply for a network services account through IT's Technology Support Services. At the beginning of each academic year, Technology Support Services offers new students orientation sessions that introduce the various network services available, teach students how to connect their computers to the campus network, and provide an overview of electronic resources.

The Information Center, located in the Vogelback Building on the Evanston campus, is the primary information resource on computing and networking at Northwestern. The center provides walk-in and phone consultation on University-supported hardware, software, operating systems, and computing facilities. To speak to a consultant, students should call 847/467-ITSS.

A walk-in help desk is available on the Chicago campus at Abbott Hall.

# Student Services

## Student Affairs

The Office of the Vice President for Student Affairs is responsible for many programs and services available to Northwestern students. Students are encouraged to take advantage of these opportunities and services, which are designed to help them establish and meet personal, academic, and career goals; assist them in acquiring skills to confront problems and issues in their lives; and provide them with essential services as part of a residential community.

In recognition of students as members of the Northwestern University community, the University has adopted a statement on student rights and responsibilities (see the *Student Handbook* for the complete statement).

### *African American Student Affairs*

The services and activities of African American Student Affairs include advice, support, and referral on personal, academic, and career issues; cocurricular group advising; tutoring in math, the sciences, economics, and writing; New Student Week activities, lectures, receptions, the annual Black History Month observance; and the spring blues, gospel, and jazz revue, *A Musical Evening with Our Elders.*

The African American Student Affairs building is home to a number of student organizations and provides office and meeting space for students as well as staff. The programs of this office are designed to promote academic achievement, provide cultural and social outlets, and give voice to the needs and concerns of the African American student community.

### *Career Development Center*

The Career Development Center offers counseling, advising, and testing to help students choose a career, plan graduate or professional study, and enhance study skills. The center's career resource library has books and other printed materials as well as video- and audiotapes and other media on careers, financial aid for graduate education, and study skills. The collection also includes self-assessment inventories, college catalogs on microfiche, and graduate and professional school directories.

Individual and group career counseling is available to help students discuss career possibilities, declare a major, explore options for graduate school, and improve their ability to make decisions. Through use of assessment inventories and software applications, counselors assist students in identifying factors to consider as they search for a career.

Advising, workshops, and printed materials are available to students seeking to enhance their study skills or time management techniques.

Northwestern is a national test center for the GRE, GMAT, LSAT, and MCAT. The Career Development Center has information about the dates and locations, calendars, bulletins, and registration forms for these tests.

### *Counseling and Psychological Services Center*

The Counseling and Psychological Services Center (CAPS) is the University's primary counseling resource. The CAPS counselors, social workers, psychologists, and psychiatrists offer students a variety of academic and personal services, including individual and group counseling. When students have problems, talking with an experienced counselor often can provide great relief. Students may talk with a counselor confidentially about specific problems such as managing stress and difficult relationships or about nonspecific feelings of anxiety or loneliness.

CAPS offers group counseling on eating behavior, self-esteem, sexual identity, shyness, grief, diabetes, and parental divorce. Groups and topics can be added in response to student interests or needs.

While there is a limit of 12 individual CAPS counseling sessions, this office can refer students who will benefit from additional help to other appropriate and affordable counseling facilities. Students who participate in group counseling are still eligible for 12 individual sessions.

Counseling is available to full-time students (those registered for at least three courses). Crisis intervention and consultation, assessment, and referral resources are available to part-time students.

### *Health Service*

All students are required to have hospitalization insurance coverage. For information about the program offered through the University, consult the Health Service insurance office.

The University maintains a comprehensive health service, including a pharmacy, laboratory, radiology suite, health education program, and six-bed infirmary for students at Searle Hall. Students registered

for at least three courses are entitled to full privileges of this service. Students registered for fewer than three courses may have the same privileges by purchasing an optional program within one week after registration. The Health Service has forms for the optional program; the fee may be paid by check.

Full-time students must comply with state of Illinois and Northwestern University health, immunization, and insurance requirements, which are described in Health Service and insurance office letters sent to them after they are accepted to the University. They must return the completed medical and insurance forms sent with the letters at least six weeks before registration. If they fail to comply, they will be subject to late fees and their registration will be withheld until they meet these requirements.

Former Northwestern students who have been absent from the campus for two or more years must meet the same requirements as new students. Students continuing into a new program must notify the Health Service to reactivate and update their medical records. See the Health Service brochure for more information.

### *Norris University Center*

Norris University Center is the community center of the University. It provides programs and services that enhance the quality of campus life for students, faculty, parents, staff, alumni, and guests. The Norris Center Program Board sponsors a variety of activities that promote social, cultural, and educational interaction outside the classroom. Norris Center works to develop a campus environment that enables students to become accomplished and informed individuals, sensitive to the needs of a pluralistic society.

Additionally, Norris Center provides amenities and conveniences that enrich the quality of daily campus life for the University community. These include the campus bookstore, a food court, an ice cream parlor, a coffeehouse, meeting rooms, personal banking machines, a box office, a convenience store, and more than 25 student organization offices. Special services include student check cashing, game room, outdoor recreation equipment rental, sound and sight equipment rental, leisure library, and an interactive information kiosk. Through the Dittmar Memorial Art Gallery and the craft studio, Norris demonstrates the importance of the visual arts to the campus environment.

#### Organizations and Activities

The Campus Activities Office at Norris Center provides leadership development and advice to student groups, many of which are headquartered at Norris. Students brought together by common interests, projects, or cultural heritage may petition for recognition as a student organization. Student organizations are recognized by the University chaplain, University departments, the Office of the Vice President for Student Affairs, or the Associated Student Government, which also is liaison for students, student organizations, and the University administration. Other representative organizations include the Interfraternity Council; Panhellenic Association; Residence Halls Association; For Members Only; Black Greek Council; Asian American Advisory Board; Bisexual, Gay, and Lesbian Alliance; Casa Hispana; and Women's Coalition.

Programs and services to the campus are provided by such groups as the Activities and Organizations Board, Arts Alliance, Dance Marathon, Northwestern Volunteer Network, Legal Aid, Student Blood Services, and Wildcat Council. Other organizations, particularly in the areas of cultural/ethnic affiliation and performing arts, complement academic interests and are open to all students. Music, dance, and theater groups as well as a daily newspaper, yearbook, radio station, and literary magazines provide outlets for a variety of talents. The Campus Activities Office also offers minicourses for fun and leisure learning.

#### Information Desk

The information desk at Norris provides the University with a central location for inquiries regarding general campus and event information. The desk has access to NUInfo, a computerized campuswide information system. Visitors are welcome to call or drop by when on campus to ask about University services and special events.

### *Northwestern University Student Employment Program*

The Northwestern University Student Employment Program (NUSEP) offers students information to assist them in finding part-time jobs, full-time summer employment, and academic-year internships.

### *Placement Center*

The Placement Center offers a broad array of services, programs, and resources to assist students in

developing and implementing career plans. It works closely with the Career Development Center and NUSEP to provide students with comprehensive career planning and employment services.

The Placement Center, which is located in Scott Hall, provides the following services exclusively to enrolled Northwestern students. Some services also are available to alumni.

- Candidate referral: All students registered at the Placement Center have their electronic resumes listed in the Placement Center's candidate database. Candidate referral electronically links qualified individuals with bona fide employers with immediate professional openings. Candidate referral is appropriate for all graduating students seeking full-time employment; it serves employers in all fields nationwide.
- Campus interviews: Each year hundreds of organizations from business, industry, government, and education send representatives to campus to interview graduating students for postgraduation employment. Campus interviews attract large employers with recurring employment needs. The interviews normally begin in October and continue through April of each academic year.
- Job listings: The Placement Center annually receives and posts thousands of job openings. Job vacancies are entered into the center's database, which students may review.
- Credential and dossier services: Graduates interested in teaching, educational administration, research, or social service occupations are encouraged to established a professional credential file that includes written recommendations. This file is used to support employment applications.
- Career information: The Placement Center has employer files, literature, and videotapes; occupational and salary information; and general reference materials on careers and employment. State-of-the-art computer programs at Hardy Lounge also assist students in researching occupations, employers, and career options.
- Workshops and presentations: Workshops on developing a resume, finding a job, and interviewing are offered regularly throughout the year. Dozens of employers schedule preinterview presentations in the fall and winter to give students information about their employment opportunities. In addition, the Placement Center provides special topic programs and several special events each year, including Career Expo, a campuswide job fair held each January.
- Individual consultation: Students may schedule individual appointments with a placement consultant who is assigned to an academic major. Individual consultation is provided on planning a career, preparing a resume, interviewing, and job search strategies.

To meet the needs of individuals seeking careers in journalism or music, specific school-based placement services also are available. The Medill School of Journalism Placement Office seeks job opportunities in journalism and invites recruiters to campus from the media, advertising, and publishing to interview graduating seniors and alumni. The School of Music placement services are available for graduating music students and alumni. The office assists job seekers registered there in preparing and maintaining a credential file and notifies them of vacancies for music teachers and performers.

### *Residence Halls and Food Services*

Students at Northwestern have a variety of living facilities available to them. Smaller residences accommodate as few as 27 students; larger units house more than 600. Most rooms are doubles, but residences also contain single, triple, quadruple, and suite arrangements. A student may select a coeducational residence or one where all members are of the same sex. Some of the houses are older, ivy-covered residences; others are modern, recently built halls. Each building has its own character and spirit and its own distinct advantages.

Approximately 4,100 undergraduate students live in the University's residences; about 1,000 students have chosen to live in fraternity and sorority houses; and the approximately 2,500 remaining undergraduates commute from home or live off campus.

Individual students with diverse backgrounds and various interests come together in University residences. Each residence is free to set its own norms of behavior within the general guidelines of the law and University policy. Students adopt constitutions and elect residence officers. Living in a residence makes a student a member of its government, with the rights, privileges, and responsibilities of membership.

Residence activities are planned by the officers and developed by the residents to provide social, academic, and cultural experiences. These programs are financially supported through nonmandatory social fees determined by the residents.

Students take their meals at any of the six dining facilities located in the larger residence halls. Breakfast, lunch, and dinner on Monday through Saturday and brunch on Sunday are available for a total of 19 meals each week. Residents may sign a contract for a minimum of 13 meals per week, selecting whichever 13 meals meet their individual needs and schedules. They also have the option of a 16-meal or 19-meal contract.

Complete information about Northwestern's residences, including rental rates, is mailed to applicants after they have been admitted to the University and paid the required tuition deposit.

***Student Affairs Office***

The Office of Student Affairs in Scott Hall is a general source of information and referral for students with personal and academic problems or concerns. This office also coordinates orientation programs for new students, plans student programs, and produces publications for parents of undergraduates.

In addition, the Office of Student Affairs implements educational programs on the prevention of sexual harrasment and assault. Students who believe they have been victims of sexual harassment may file a complaint with the assistant vice president for student affairs, who coordinates the University disciplinary process, including the University Hearing and Appeals System and the Sexual Assault Hearing and Appeals System.

***University Chaplain***

The Office of the University Chaplain is available to meet the religious concerns and needs of members of the University community. Several religious groups, including major Protestant denominations, the Roman Catholic church, and the Jewish community, sponsor ministries to the University's students and faculty. Although these campus ministries are independent of Northwestern University, the Chaplain's Office serves as the University's liaison with all religious groups represented there, and it facilitates and coordinates their activities. Information about campus religious organizations is published in "Religious Life at Northwestern University," available from the Chaplain's Office. The Chaplain's Office also recognizes student religious organizations on behalf of the University.

The Alice S. Millar Chapel and Religious Center, which includes Parkes Hall and the Jeanne Vail Meditation Chapel, has facilities for religious programs and services such as lectures, study groups, discussions on faith and life, weddings, baptisms, and other special events. The facilities are available to religious groups of all faiths and to other University and community groups by arrangement through the Chaplain's Office. The university chaplain and other campus religious counselors can meet with individuals and groups as counselors, teachers, or resource persons.

***Services for Students with Disabilities***

The Office of Services for Students with Disabilities provides services and referrals for Northwestern students with disabilities. Students with disabilities should contact the office for assistance and guidance in meeting their academic obligations.

It is Northwestern University policy to ensure that no qualified student with a disability is denied the benefits of, excluded from participation in, or otherwise subjected to discrimination in any University program or activity. In response to a request made by a qualified student with a documented disability, the University will arrange, at no cost to the student, for the provision of educational auxiliary aids, including sign language interpreters, real-time captioners, note takers, readers, and tutors, determined by the University to be necessary to afford such student with the opportunity for full participation in University programs.

Northwestern University's programs and activities are accessible for full participation to all its students, including those with mobility problems and with difficulties such as learning disabilities or auditory, visual, or other special problems.

A brochure, "Services for Students with Disabilities," describing various support services for students with disabilities is available in University admission offices and in the Office of Services for Students with Disabilities. The brochure includes maps of the Evanston and Chicago campuses indicating building access and parking locations.

### International Office

Foreign students, visiting scholars, faculty, and staff will find assistance for themselves and their families at the International Office. The main focus of the office is immigration and visa-related matters. The office provides specific instruction on the rights and responsibilities of each visa category, including the proper forms for arrival, travel, sending for families, and work permission. In addition, it serves as an information center to help visitors locate the services and activities available both on campus and in the larger community.

A volunteer organization, the Community Council for International Students, works with the office to provide international visitors such services as a resale shop, English tutoring, the International-American Women's Group, and a play group for children. All international visitors are encouraged to ask for information at the International Office.

### Women's Center

The Women's Center is an advocacy program serving the Northwestern community. The center is also a gathering place for women staff, faculty, and students who seek support in their academic, professional, and personal lives. The center's staff includes community activists, counselors, and educators. The primary mission of the center is to address issues of sexual harassment and sexual assault. The center also offers a variety of services, including advocacy; individual, group, and couples counseling for sexual violence, childhood sexual abuse, and relationship violence; educational programming related to other women's issues (e.g., body image, self-esteem, women and anger); and referral and resource information.

### Fitness and Recreation

All students at Northwestern are strongly encouraged to participate in recreational and fitness activities, including intramural, club, informal, and instructional sport and fitness programs.

Intramural competition is conducted in a variety of individual and team sports. League play and tournaments are provided for men and women, both separately and "co-recreationally." Competition is organized for individuals and teams, by independent groups, living units, fraternities, sororities, and University departments and organizations.

Sport clubs offer competitive and noncompetitive sports experiences. Extramural competition, with outside institutions and sports groups, is available in baseball, basketball, crew, cycling, equestrian events, fencing, ice hockey, lacrosse, rugby, running, sailing, ski racing, soccer, synchronized swimming, tennis, Ultimate Frisbee, volleyball, and water polo. Noncompetitive, special interest clubs include aikido, karate, tae kwon do, jujitsu, and wado kai. Clubs are student directed.

Drop-in recreation periods are scheduled throughout the day and evening at Blomquist Recreation Center, Patten Gymnasium, and the Henry Crown Sports Pavilion/Norris Aquatics Center. Included are facilities for aerobics, badminton, basketball, fitness activities, floor hockey, jogging, racquetball, squash, swimming, tennis, volleyball, and weight training.

Noncredit instructional sports classes are offered in more than 30 areas. Students can register for sports and fitness classes by visiting the fitness and recreation registration office in the sports pavilion. Courses for each quarter are listed in the *Programs and Services* guide.

The Sailing Center offers instructional and informal sailing programs for beginning and novice sailors. The fleet consists of 420 class and laser sailboats as well as Windsurfers.

The Vandy Christie Tennis Center also offers instructional and informal tennis programs on 15 outdoor courts.

### University Police

The University Police Department is responsible for crime prevention, law enforcement, parking control, special events, and emergency management on both the Evanston and Chicago campuses. University police officers are on duty 24 hours a day, seven days a week. They are graduates of a police academy with full police authority; most have bachelor's degrees.

The police division on the Evanston campus provides a number of services, including a crime prevention program, speaking engagements, unlocking of vehicles, residence hall security checks, sale of bicycle locks (at cost), and loan of battery jumper cables. Emergency phones on campus, marked by blue lights, operate when an individual lifts the receiver or pushes the button.

Additional information about campus crime and crime prevention programs is available by requesting a copy of "Campus Safety: A Shared Responsibility" from the University Police Department, 1819 Hinman Avenue, Evanston, Illinois 60208-1320.

***Motor Vehicles***

Regulations governing the possession, operation, and parking of motor vehicles on the Evanston campus are described in the parking regulations handout available at the Parking Office, 1819 Hinman Avenue. Under most circumstances, freshmen and sophomores may not have motor vehicles while living on campus. A lottery distributes a limited number of parking permits for juniors living on campus. Exceptions to these rules may be granted only by the Parking Committee.

Parking permits are required in campus lots from 7:30 a.m. to 5 p.m., Monday through Friday (official holidays excluded), except in lots that are designated in the regulations as 24-hour enforced. Students who live off campus in the area bounded by Davis and Central Streets, Sherman Avenue, and Lake Michigan may not purchase parking permits.

***Personal Losses***

The University is not responsible for the loss of or damage to personal property belonging to students in any building owned by the University, whether the loss or damage occurs by theft, fire, or an unknown cause.

# Undergraduate Education

## Admission

### General Requirements for Admission

Northwestern University historically has sought a student body of high ability and diversity representing a cross section of American society.

It is the policy of Northwestern University not to discriminate against any individual on the basis of race, color, religion, national origin, sex, sexual orientation, marital status, age, disability, or veteran status in matters of admissions, employment, housing, or services or in the educational programs or activities it operates, in accordance with civil rights legislation and University commitment.

Any alleged violations of this policy or questions regarding the law with respect to nondiscrimination should be directed to Director of Equal Employment Opportunity, Affirmative Action, and Disability Services, 720 University Place, Evanston, Illinois 60208-1147, phone 847/491-7458; Office of the Provost, Rebecca Crown Center, Evanston, Illinois 60208-1101, phone 847/491-5117.

Candidates for admission should demonstrate a level of performance in curricular and extracurricular areas that indicates they will be able to compete successfully in a competitive academic environment. In the selection of students, careful attention is given to the ability of each candidate as evidenced by academic record and the results of entrance tests as well as by character and personality. The University attempts to select students who are committed to scholarship and who have shown a willingness to become involved in their expressed interest areas. In determining whether to accept a candidate, the University considers the following:

- Secondary school record
- College record (required for transfer candidates)
- Recommendations from school officials and other persons who have information pertinent to the candidate's probable success at Northwestern
- Results of required or recommended tests (the Scholastic Assessment Test [SAT I] of the College Entrance Examination Board or American College Test [ACT], required of all candidates; three Scholastic Assessment Tests [SAT IIs], required of candidates for certain special programs and of all home schooled applicants [see table on page 16] and recommended for other candidates)
- Music audition (required for School of Music candidates)
- The candidate's statements on the application and other evidence of special skills, such as writing, art, music, mathematics, and science, or of special accomplishments in extracurricular areas of interest
- Any other information received by the University that bears on the candidate's readiness for study at Northwestern

### SAT IIs

***Recommended for Regular Programs***

- College of Arts and Sciences, School of Education and Social Policy, Medill School of Journalism, School of Music, and School of Speech: Writing and two others of student's choice
- McCormick School of Engineering and Applied Science: Writing, Mathematics I or IIC, and Chemistry or Physics

***Required for Special Programs and Home Schooled Applicants***

- Honors Program in Medical Education: Writing, Mathematics IIC, and Chemistry
- Integrated Science Program: Mathematics IIC, Chemistry or Physics, and another science unless Writing is required for another application
- Home schooled applicants: Writing, Mathematics IIC, and a third test of their choice

### Required Subjects

A broad academic experience in high school is the best preparation for admission to Northwestern. Whatever fields of study students follow, the best foundation consists of reading, writing, and mathematics. The value of thorough training in

fundamental subjects cannot be overemphasized.

In considering the academic record of a candidate for admission to Northwestern, the Office of Undergraduate Admission notes the subjects studied and the grades received. The student's record should include a minimum of 16 units. (A unit represents a course studied for one year.)

The subject recommendations in the following list represent the minimum requirements for entrance to the University. Allowances are made to permit students to pursue special areas of academic interest.

### Required Units

The College of Arts and Sciences, Medill School of Journalism, and Schools of Education and Social Policy, Music, and Speech require 16 units drawn from the following academic areas. The required academic areas with recommended units are

- English: 4 units
- Foreign language: 2 to 4 units
- Mathematics: 3 to 4 units
- Laboratory science: 2 to 3 units
- History, social studies: 2 to 4 units
- Electives: 1 to 3 units in the academic areas listed above

Students preparing for college are strongly recommended to take four years of work in English with as much emphasis on composition as the curriculum allows. Two units of the same foreign language should be offered. Three or four years of the same language are strongly recommended.

The McCormick School of Engineering and Applied Science requires a sound secondary school education as described above, with strong preparation in mathematics and science. Specifically recommended are

- Mathematics: 3½ to 4 units (the minimum requirements for mathematics include algebra [2 units], plane geometry [1 unit], and trigonometry [½ unit])
- Science: 2 units (credit in both chemistry and physics is recommended)

Credit in other subjects should bring the total to 16 units or more, which include 4 units of English and work in social studies and foreign languages.

#### *Admission Notification*

Northwestern offers freshman candidates a choice of two notification plans, Early Decision and Regular Decision. Early Decision is a binding admission commitment. Candidates accepted to Northwestern under Early Decision must withdraw all other university applications. Unlike other selective schools, Northwestern does not normally defer Early Decision applicants into its Regular Decision pool.

The accompanying table outlines these plans, the notification plans for transfer students, and the financial aid application procedure, including deadlines and the forms available through the College Scholarship Service.

#### *Admission Procedure*

To be considered for admission to Northwestern, candidates must complete the following three steps:

- File a completed application form. This may be obtained from the Office of Undergraduate Admission, Northwestern University, 1801 Hinman Avenue, P.O. Box 3060, Evanston, Illinois 60204-3060. A form may also be requested via the World Wide Web at <http://www.ugadm.nwu.edu/ROFM_CGI/request.html>. Applications for admission may be submitted before candidates take the standardized tests required for college admission.
- Arrange with the officials of their high school to complete and forward the Secondary School Report to the Office of Undergraduate Admission. All candidates should have their records through the sixth semester sent to Northwestern as early in the senior year as possible. Regular Decision candidates should have seventh semester grades sent as soon as they are available.
- Take standardized tests. The official results of the SAT I or the ACT are required for all students applying for admission to Northwestern as freshmen. In addition, all the special programs require each matriculant to present three SAT IIs as specified in the accompanying table. SAT IIs are recommended for all candidates. Home schooled applicants are also required to submit three SAT II results.

### Advanced Placement

In nearly all areas, Northwestern awards credit for Advanced Placement Examination scores of 4 and 5;

## Application and Testing Deadlines: Notification Plans

### Regular Programs for Fall Quarter Matriculation

Freshman candidates for other quarters should request information from the Office of Undergraduate Admission.

| | Early Decision | Regular Decision |
|---|---|---|
| Apply by | November 1 | January 1 |
| Take tests by (SAT I or ACT required; 3 SAT IIs recommended[1]) | October test | December test |
| To apply for financial aid, file FAFSA and CSS Profile by | November 1 | February 1 |
| Northwestern mails decision letter by | December 15 | April 15 |
| Reply by | February 1 | May 1 |

### Honors Program in Medical Education

| | Regular Decision |
|---|---|
| HPME preapplication deadline | December 1 |
| HPME application deadline | January 1 |
| Freshman application to Northwestern by | January 1 |
| Take tests by (SAT I or ACT required; 3 SAT IIs required[1]) | December test |
| To apply for financial aid, file FAFSA and CSS Profile by | February 1 |
| Northwestern mails decision letter by | April 15 |
| Reply | Within two weeks |

### Transfer Students for Any Quarter of Matriculation

| | Fall | Winter | Spring | Summer |
|---|---|---|---|---|
| Apply by | June 1[2] | November 1 | February 1 | May 1 |
| (Because space is limited in some programs, transfer candidates should apply well before these dates) | | | | |
| Take tests by | June 1 | November 1 | February 1 | May 1 |
| (SAT I or ACT; scores from previous academic years are acceptable) | | | | |
| Apply for financial aid by | May 1 | October 1 | January 1 | April 1 |
| (Consult with Office of Undergraduate Admission) | | | | |
| Northwestern mails decision letter as soon as possible after the application deadline; reply within three weeks. | | | | |

[1]Required for Integrated Science Program, Honors Program in Medical Education, and home schooled applicants. Scores from previous academic years are acceptable.

[2]Foreign transfer students for fall quarter should apply by May 1.

in some cases, credit is also awarded for scores of 3. Specific questions concerning Northwestern's advanced placement policies should be addressed to the College of Arts and Sciences Office of Studies. In some fields, primarily in mathematics, the sciences, and foreign languages, advanced placement and/or credit can be earned through appropriate performance on examinations administered by Northwestern departments.

Northwestern awards credit for distinguished performance on the British General Certificate of Education (A-Level) Examinations, the higher-level examinations of the International Baccalaureate, and certain other foreign university entrance examinations.

Northwestern also recognizes college credits earned by students before entering the University as freshmen. To qualify for such recognition, the courses must be similar to courses offered at Northwestern, must have been taken at an accredited college or university, must not have been submitted in partial fulfillment of the normal secondary school graduation requirement, and must have been given on the campus of a college or university and taken primarily by bona fide college students (i.e., high school graduates pursuing a college degree). Credit is *not* granted for courses taken outside the United States or Canada. If candidates have taken college courses that do not qualify for credit under these conditions, they should take Advanced Placement Examinations in the appropriate subjects.

## Transfer Candidates

Students may be considered for admission as a transfer from another college or university provided they have completed one full year of university studies by the application deadline, are in good standing at their postsecondary institution, and have maintained at least a B average in rigorous academic courses. If students have been enrolled full-time at any institution except Northwestern, they cannot be considered for freshman admission and must meet the stated criteria to apply as a transfer candidate. Some undergraduate schools at Northwestern enroll transfer students in the fall quarter only. Transfer students must complete at least the last 23 quarter-courses and six full-time quarters in residence at Northwestern to be eligible for a bachelor's degree.

### *Admission Procedure*

To be considered for admission, transfer students must complete the following steps:

- File a completed application form available from the Office of Undergraduate Admission, Northwestern University, 1801 Hinman Avenue, P.O. Box 3060, Evanston, Illinois 60204-3060. A form may also be requested via the World Wide Web at <http://www.ugadm.nwu.edu/ROFM_CGI/request.html>.
- Arrange with the officials of the high school to forward the complete high school report to the Office of Undergraduate Admission.
- Submit the results of the Scholastic Assessment Test (SAT I) or the American College Test (ACT).
- Arrange with the registrar of each college previously attended to forward transcripts of record to the Office of Undergraduate Admission.
- Request a statement of good academic and social standing from the dean of students at the college from which the student is transferring.
- Present a music audition (in person or a taped recording) if applying for admission to the School of Music (audition guidelines will be furnished on request).
- Submit application for admission before the deadline of June 1 (for admission in the fall quarter), November 1 (winter), February 1 (spring), May 1 (summer).

### *Evaluation of Credits*

Before matriculation, transfer candidates who are accepted by Northwestern will receive a preliminary evaluation of the credits they have earned to date, assuming all pertinent transcripts have been received. An official evaluation of credits earned will be made by the Registrar's Office when the admitted student matriculates.

## Foreign Students

In addition to meeting all regular admission requirements, foreign students are required to present evidence of their ability to speak, read, and write the English language and to meet the financial obligations associated with their study at Northwestern University. Students for whom English is a second language must present the results of the Test of English as a Foreign Language (TOEFL). Foreign students must have achieved outstanding school

records to be considered for admission. Foreign transfer candidates may apply for fall quarter admission only and must submit their completed application by May 1.

### Returning Adult Students

Adults who interrupt their education following high school or during college and, after several years, decide to complete their undergraduate education are considered by the Office of Undergraduate Admission as "returning adult students." Ordinarily, returning adult students have been out of high school for seven years or more. Depending on the amount of college credit previously earned, returning adult students apply as freshman or transfer candidates.

When admitted to Northwestern, returning adult students may begin studies on a full-time or half-time basis. A full-time program includes three or four academic courses per quarter; a half-time program includes no fewer than two courses per quarter. See also Returning Students in the Financial Regulations section.

### Evening Students

Adult students who wish to pursue a degree or certificate program through evening or Saturday study or who wish to enroll in courses for personal enrichment, preparation for graduate study, or professional mobility may enroll in University College, Northwestern's continuing education division. Courses are offered on the Chicago and Evanston campuses on a semester basis.

University College has an open enrollment policy, which allows adults with a college degree, some college credit if they left their previous school in good standing, or a high school diploma but no prior college work to enroll in courses to establish an academic record. After the semester in which students complete a fourth course, one of which must be a course in writing, their academic record is reviewed and, if they have done well, they are invited to matriculate into an evening degree or certificate program or to continue enrolling in courses as a student-at-large.

Students may transfer to University College up to 90 semester hours of credit, of which 60 hours may be from community colleges.

### Special Students

Properly qualified persons who demonstrate a need for certain courses required for their academic or professional advancement may apply to the University as special nondegree-seeking students. Applicants must present official transcripts of previous study and show evidence of successful academic achievement. *Persons who do not meet these requirements should not apply.*

Enrollment as a special student does not constitute admission to any degree program at the University, and credits earned as a special student may not be counted toward a degree at Northwestern. (Exception: Special students who subsequently become eligible to matriculate in University College may apply these credits toward a degree.) Special students are granted academic credit for course work satisfactorily completed, and these credits may be transferred to another institution.

Special students are admitted with the understanding that they may register only after students working toward Northwestern degrees have registered. Some classes will be closed, and some schools or departments may not accept nondegree students. However, these restrictions do not apply to the Summer Session.

Special students are not permitted to enroll in C99 or D99 Independent Study courses.

All tuition and fees for special students are charged at the undergraduate rate. Complete instructions and application forms may be obtained from the Office of Special Students, 162 Walter Annenberg Hall, Northwestern University, Evanston, Illinois 60208-2650.

### Auditors

Auditors, who are charged a special tuition rate, are persons who enroll in a course to observe or listen only. They are not permitted to engage in class discussion, submit written or oral assignments, or take examinations, and they do not receive academic credit.

Only students who qualify as special students or are taking University College classes are permitted to audit classes. Special students must consult with the Office of Special Students; University College students must consult an adviser or the University College bulletin. Formal auditor status and registration are not normally available to regularly enrolled Northwestern students in daytime courses.

## Financial Aid

The University awards financial aid on the basis of need as determined by the financial circumstances of the family. Aid may be a loan, part-time employment, a grant, or a combination of these. Recipients may accept all or any part of the aid offered. The amount of an award is confidential between the University and the family of the student. For entering freshmen, financial aid is generally renewable for up to 12 quarters of enrollment, even if they are not offered financial aid for those quarters. For transfer students, the maximum number of quarters of assistance depends on the number of quarters of transfer credit accepted, as determined by the Registrar's Office (i.e., a student who transfers with 3 quarters of acceptable credit is eligible for 9 quarters of assistance). The amount of financial aid may change based upon the family's financial circumstances. Students must reapply each year and maintain the requirements established by the Financial Aid Committee of the University.

During the 1996–97 academic year, undergraduate students at Northwestern received more than $41 million in grant assistance: $31.1 million from Northwestern, $6.5 million from federal and state governments, and $4 million from outside sources. The average Northwestern grant for the 3,434 students receiving aid at Northwestern was $9,071. In addition, $13.7 million in loan assistance and 3,000 campus jobs were available.

Assistance that is not need-based is provided by the Reserve Officers Training Corps (see Military Studies) and from other sources discussed in the Northwestern publication "Invest in Your Future: Affording a Northwestern Education," distributed by the Office of Undergraduate Admission (see Where to Write).

### Who Should Apply

Any undergraduate students who believe they cannot afford the full cost of a Northwestern education may apply for financial aid.

Students graduating from community colleges and transfer students from four-year colleges may apply for financial assistance. However, since funding is limited, full funding may not be available for the first year of study. Transfer students must obtain transfer financial aid application materials and financial aid transcript requests from the Office of Undergraduate Admission.

### Application Procedure

Applicants request consideration for financial aid when submitting an application for admission. The Financial Aid Committee cannot make a decision until the University has admitted the applicant. Candidates should do the following:

- Complete and submit the application for admission, which provides a place to request financial aid
- File the Free Application for Federal Student Aid (FAFSA) and the Financial Aid Profile of the College Scholarship Service (CSS) and request that copies of both reports be sent to Northwestern (the forms are available at local high schools)
- File the applications as soon as the need for assistance is realized by the family, but not later than the dates indicated in the table titled Application and Testing Deadlines: Notification Plans (page 16).

### Satisfactory Academic Progress

To comply with federal regulations, students at Northwestern University are considered to be maintaining "satisfactory academic progress" for the disbursement of federal student assistance funds if they complete an average of nine units of academic credit per year and complete their educational programs within 18 quarters of enrollment. Federal regulations also state: "If a student does not have a C average or equivalent or the required academic standing at the end of the second academic year, he or she may not receive further aid from the federal financial aid programs." These policies are supplemented by the qualitative requirements established by the undergraduate schools (see each school's section in this catalog).

If students fail to maintain satisfactory academic progress as defined above, they may be awarded assistance for one additional payment period to reestablish "satisfactory" standing. Students who successfully complete a minimum full-time course load during this period will be considered again to be making satisfactory academic progress. Students who fail to successfully complete a minimum full-time course load during this period will remain ineligible for any additional assistance during subsequent quarters, unless they, while ineligible, successfully complete a minimum full-time course load for one payment period at Northwestern. Students may also submit within two weeks of their notification of ineligibility a written appeal to the Office of Financial

Aid presenting evidence of unusual circumstances. The appeal is then reviewed to determine if an exception to this policy is justified.

The above procedure will be followed except when students (1) are academically dismissed from the University according to the academic policies of their particular school and program or (2) have been in attendance at Northwestern for 12 quarters or the equivalent (unless the course of study normally requires more than 12 quarters of enrollment). As to the first case, students will be eligible for federal financial assistance during the first quarter of full-time study on returning to Northwestern in order to reestablish satisfactory academic progress. On successful completion of a minimum full-time course load with a 2.0 grade point average, they will again be considered to be making satisfactory academic progress and will be eligible for federal and institutional financial assistance in subsequent quarters. As to the second case, students are ineligible for financial assistance from University funds beyond the 12th quarter, even if they are maintaining satisfactory academic progress. However, students admitted to the five-year BA/BMus, BS/BAMus, and BS/BMus programs will be eligible for University funds for up to 15 quarters of enrollment. The Committee on Financial Aid to Students may decide to continue aid when unusual circumstances exist and students demonstrate academic promise.

## Financial Regulations

### University Enrollment Requirement

The University Enrollment Requirement policy applies only to undergraduates in bachelor's degree programs. It does not apply to graduate students or special students. This requirement must be completed in addition to the degree requirements established by the various school faculties.

All students, except those enrolled in accelerated programs designed to be completed in fewer than four years, are expected to be enrolled for full-time study for 12 regular academic-year quarters. This 12-quarter requirement is referred to as the University Enrollment Requirement (UER). Note that the degree requirements set by the various school faculties are separate from the UER. Although some students may be able to complete their academic degree requirements, as established by the faculty, in fewer than 12 academic-year quarters, such students must still fulfill the 12-quarter UER. Students who, due to circumstances beyond their control, are unable to complete the bachelor's degree requirements in 12 quarters may petition to the University Enrollment Committee for a 13th or final quarter at no additional tuition charge.

For purposes of the UER, full-time study is determined by the payment of full-time tuition. Students who withdraw and receive a partial refund will receive a prorated credit toward the UER based on the tuition paid. The normal full-time course load is three or four courses per quarter.

Students may, with approval of their school, take more than four courses per quarter without additional charge. These excess courses may be applied toward fulfillment of degree requirements of the various schools so long as they are not used to accelerate graduation. However, for students who desire to apply the excess courses toward the UER, there will be an excess course charge for each course of 25 percent of the full-time quarter's tuition in effect at the time of graduation. Such acceleration must be approved by the dean of the student's school. Students wishing to apply excess courses toward the UER must indicate their desire to do so when applying for the degree. Any excess course charges will appear on the bill for the last quarter of enrollment. Financial aid recipients will not receive additional grant assistance to cover excess course charges; however, they may apply for additional loan assistance.

Normally, the UER will be fulfilled by three quarters of full-time study during each of four academic years. In addition, credits from one or a combination of the following sources may be applied toward the UER. Each course credit fulfills one-fourth of a quarter of the UER. That is, four course credits are required to reduce the UER by one quarter. Students who enter as freshmen with 10 or more course credits will reduce their UER by one year. Regardless of the amount of credit earned outside the University, the minimum UER for all entering students as freshmen is nine quarters, which may include approved study abroad.

The approved sources of credit are

- Advanced placement credit through the College Board
- Placement credit awarded by Northwestern University

- Approved foreign study during the academic year
- Approved credit from another college or university, subject to restriction. Students entering with four or more courses from another institution may not apply any additional credit from another institution toward the UER, except for approved foreign study. Students entering with fewer than four courses from another institution may apply a maximum of four courses toward the UER, including those taken before matriculation. Any courses from another institution must be completed before the student achieves senior standing. Courses beyond the maximum may be applied toward academic requirements but *not* toward the UER.
- Summer Session at Northwestern. All students may apply four Summer Session courses toward the UER. Although four courses are normally required to reduce the UER by a quarter, a three-course Northwestern Summer Session load may be used to reduce the UER by one quarter. All three courses must be taken the same summer and this exception may be used only once.

Students who are denied any exceptions to the UER may appeal to the University Enrollment Appeals Committee. For further information about the UER or the appeals process, contact the Registrar's Office, 633 Clark Street, Evanston, Illinois 60208-1118, 847/491-5234.

***Returning Students***

Students who withdraw from the University and wish to return must submit a Returning Student Application form to the Registrar's Office six weeks before the desired date of reentry. Students who want credit for course work taken at another institution must submit an official transcript to the Registrar's Office. The Registrar's Office will determine the extent to which credit earned away from Northwestern may reduce the four-year UER. Students who wish to apply more than four courses taken at another institution toward the UER must petition the University Enrollment Committee.

***Transfer Students***

Students who transfer to Northwestern from another institution will be informed of the extent to which their previous work reduces their 12-quarter UER. A transfer student is one who enrolled for a minimum of one year as a degree-seeking student at another institution. All transfer students have a six-quarter minimum UER. Transfer students who enter the University with four or more credits will not be allowed any further credit toward the UER for courses taken at other institutions. All transfer students, regardless of the amount of credit previously earned, must complete nine full-time quarters at Northwestern before becoming eligible for a quarter at no tuition charge.

***Special and Part-Time Students***

Special and part-time students are subject to the tuition rates shown under Undergraduate Tuition: Exceptions. Students must be approved for part-time study by the Office of Undergraduate Admission, the University Enrollment Committee, or the associate dean of their school. The Registrar's Office determines the extent to which the UER will be satisfied by part-time study.

***Financial Aid Recipients***

Students who elect to accelerate their education by taking course overloads while receiving grant assistance from the University will not receive additional grant assistance to pay for the cost of acceleration. The University may provide such students additional loan assistance.

***Summer Session Students***

The tuition policies of the Northwestern Summer Session are independent of the University's tuition policies for the normal academic year. Enrollment in the Summer Session may reduce the 12-quarter requirement, subject to the restrictions previously cited.

***Cooperative Engineering Students***

Students enrolled in the Murphy Cooperative Engineering Education Program will be charged tuition consistent with that of their entering class for the quarters they are enrolled in classes.

## Tuition and Fees

The cost of education at Northwestern is only partly covered by tuition charges. The balance is met by the income from invested funds and by the gifts of alumni and other supporters of the University.

Tuition and fees for 1997–98 are listed below. Rates are subject to change without notice, and increases should be expected in subsequent years. For tuition purposes, the term *course* refers to course credit. Some course offerings carry more than one course credit.

***Undergraduate Tuition***

All undergraduate students in degree programs must fulfill the University Enrollment Requirement (see the previous two pages).

Tuition: each quarter $6,384

***Undergraduate Tuition: Exceptions***

These rates apply only to special students, part-time students, and other students not subject to the University Enrollment Requirement.

Full-time: each quarter $6,384
Full-time registration is three or four courses.

Excess courses: each course $2,272
Excess courses are more than four courses.

Part-time:
One course, each quarter $2,272
Two courses, each quarter $4,544

Auditor's fee:
Each course audited, each quarter $1,763

Performance study:
P01 Private Instruction $1,136
P02 Private Instruction $2,272
Students who pay full tuition and take only three credit courses may take P01 or P02 at no additional charge.

***Service Fees***

Student Hospitalization Plan $564
Required for all students unless they have equivalent hospitalization coverage.

Study abroad enrollment fee $1,500

Tuition deposit fee $200
Required for each new undergraduate student; applied on the first tuition bill and not refundable.

Application fee (not refundable) $55

Returned check service fee $35

Replacement WildCARD fee $20

Transcript fee $3

Makeup laboratory time, breakage fee varies

***Other Fees***

Late registration fee $25

If fee is billed $30
For registering at other than the scheduled times.

Retroactive registration fee $200

If fee is billed $225
For registering for a term after the last day of classes for that term.

Housing deposit fee $200

Late payment penalty fee $100
For late payment of bills.

Associated Student Government $22
Activity fee, each quarter.

Dependent Hospitalization Plan $1,744
For each dependent.

Field trip fee varies
For courses in which field trips are required to earn credit.

## Bills and Payments

The Office of Student Accounts issues student bills at Northwestern. A due date is shown on each University bill. Payment must be received by the due date. Due dates cannot be extended because bills are not received.

## Installment Payment Plan

The University provides a tuition and fee installment payment plan, 9PAY, which offers the benefit of dividing the educational costs for the academic year into nine monthly payments. For information, contact the Office of Student Accounts, Northwestern University, 619 Clark Street, Evanston, Illinois 60208-1132, phone 847/491-5224, fax 847/467-2451.

## Withdrawal from the University: Refunds

Students who withdraw from the University must immediately file a withdrawal form, available at the Registrar's Office, Rebecca Crown Center. The completed form, bearing the required signatures, must be filed at the Registrar's Office.

The Office of Student Accounts considers the date the completed form is received at the Registrar's Office as the effective date in making financial adjustments.

Tuition deposits are not refundable under any circumstances. Tuition is refunded in full if the student withdraws on or before the seventh day of classes. After that the following policy applies:

- Between the eighth day of classes and the third Friday after classes begin, three-fourths of the tuition is refunded.

- Between the third Friday and the sixth Friday after classes begin, one-half of the tuition is refunded.
- After the sixth Friday of classes, no refunds are given.

Residence and meal contracts are signed for the full school year. Students who leave a residence before the end of the year are liable for the entire year's rent or for charges to the date another student takes the vacated space in University housing. Meal charges are assessed until the end of the week in which withdrawal is effected. Adjustments may be made at the discretion of the Housing Office for students who for financial reasons must make other room and board arrangements than those for which they first contracted.

First-time attendees of the University who receive Title IV assistance are subject to pro rata refunds. If a first-time attendee withdraws from the University within the 60 percent point in the quarter, the refund (of tuition, refundable fees, and other institutional charges) will be calculated based on a percentage derived from the number of weeks remaining in the quarter divided by the number of weeks in the quarter, rounded down to the nearest 10 percent, less any unpaid charges. No refunds will be offered after the 60 percent point in the quarter. Students may request samples of the applications of these refund policies from the Office of Student Accounts or the Office of Financial Aid.

### Change of Registration

No refund or bill reduction is made on any course dropped after the fifth day of classes in the quarter.

### Financial Obligations

Students whose University bills are overdue may not be given an academic transcript until all financial obligations are paid in full. Students whose accounts are overdue must pay a late payment penalty fee of $100. The director of student accounts may cancel or prevent the registration of a student whose bills are past due.

Each student is liable for any costs associated with the collection of his or her past due account, including but not limited to collection agency costs, court costs, and legal fees.

## Academic Regulations

### Registration for All Students

- Instructions for registration are contained in the *Class Schedule* issued each quarter. Failure to read the *Class Schedule* does not excuse students from compliance with the information and regulations stated therein.
- The dates of registration for each quarter are announced in advance, and students not registered at the time specified are subject to a fee for late registration. This fee is not intended as a penalty but is assessed to cover in part the cost of registration at other than the scheduled time. Inconvenience, illness, and other personal reasons for registering late are not accepted as reasons for waiving the fee. Late registration is permitted only through the fifth full day (Saturday is not a full day) of classes in any quarter during the regular academic year and through the fourth full day in the Summer Session.
- Credit is not given for work in a course in which a student is not properly registered.
- Any course duplicated for credit increases the required number of credits to graduate by an equal amount. Both the original and the duplicated course entries remain on the student's permanent record and are used to calculate the cumulative grade point average.
- Credit is not given for a course that is a prerequisite for a more advanced course if that prerequisite is taken after the more advanced course has been completed. Waiver of prerequisites for admission to courses may be obtained from the instructor concerned or the chair of the department in which the course is offered.
- Undergraduate students may not enroll in fewer than three quarter-courses except by permission of the dean of their school. Permission is given only in extraordinary circumstances.
- In the College of Arts and Sciences and Medill School of Journalism, undergraduate students may not enroll for more than four quarter-courses except by permission of the dean's office. This regulation applies to total credit for courses taken in other institutions in addition to credit obtained in residence at Northwestern. Additional tuition may be charged for excess registration (see University Enrollment Requirement under Financial Regulations).

### Changes of Registration

Changes in registration in fall, winter, and spring quarters are subject to the following provisions:

- In no case may a course be added after the fifth day of classes. No course may be dropped after the sixth Friday of classes.
- Undergraduate students may change registrations from grade to the pass/no credit (P/N) option or vice versa through the third Friday of the quarter. Check regulations of the individual schools for specific information on the P/N option.
- To make any change of registration, students must pick up a Change of Registration form at the Registrar's Office and obtain the signature of the adviser if required by their school.
- To add a course, students must obtain a signature from the instructor or department representative for each course added. The completed form must be returned to the location indicated in the *Class Schedule.*
- To drop a course in the first seven days of class, students must obtain a signature from the instructor or department representative for each course dropped. After the seventh day of class, students do not need an instructor's or department representative's signature, but they are required to complete a drop form at all times. The completed form must be returned to the location indicated in the *Class Schedule.*
- Changes in ungraded sections (laboratory or discussion) are made in the departments and do not require notification of the registrar.
- Students who receive permission to drop a course after the first five days of class must return a properly signed Change of Registration form to the Registrar's Office.
- If students drop a course by the sixth Friday of a quarter, the course does not appear on the permanent academic record and no grade is recorded provided a Change of Registration form has been properly filed. Failure to file this form within the time allowed is regarded as a course dropped without permission. A course dropped without permission is regarded as a failure and is recorded with a grade of F.

See also Withdrawal from the University: Refunds and Change of Registration under Financial Regulations.

### Identification Cards

The University identification card (WildCARD) identifies registered students and should be carried at all times. The WildCARD is the property of the University and is not transferable; its privileges may be canceled at any time the card is misused. Students are required to surrender their WildCARD to University officials upon request.

The student's ID number is encoded on the card and indicates whether the student is currently registered and if the card is valid. The card identifies the holder for admission to the library during hours of limited access and is needed at all times to borrow books. If a student carries a meal plan, the WildCARD admits the student to residence hall dining facilities. It also identifies the holder at the Health Service, Norris University Center, student functions and elections, and University athletic events.

Lost or stolen cards should be reported to the WildCARD office, where replacement cards are issued. For the cost of replacing an ID card, see Service Fees under Tuition and Fees earlier in this section of the catalog.

### Registration in University College

University College, on both the Chicago and the Evanston campuses, operates on the semester system. Students enrolled in an undergraduate school may take courses in University College only with the approval of the office of the dean of their school and only when the courses are not given on the quarter system during the day or when there are clear cases of conflict. Such work is counted as a regular part of a student's registration.

Students enrolled in undergraduate schools are not guaranteed a place in University College courses.

To register for University College courses, students must

- Pick up a Dual Registration form from the Registrar's Office in Evanston
- Secure approval from the office of the dean of their school
- Turn in the form at the Registrar's Office in Evanston before the first meeting of the class

Fall semester courses are included as part of fall quarter registration; spring semester courses are included as part of spring quarter registration.

To drop a University College course, students must pick up a Dual Registration form from the

Registrar's Office, secure approval from the office of their dean, and return the form to the Registrar's Office.

### Interschool Transfers

Undergraduate students who wish to transfer from one school or college of the University to another within the University must have an interschool transfer approved by the dean's office of each school. A return to the original school must be approved in the same way. Approval of an interschool transfer is usually contingent on satisfactory performance in the original school. Consult the *Class Schedule* for appropriate dates to process an application for interschool transfer.

### Cancellation of Registration

Students who complete advance registration for a quarter and later decide not to attend classes that quarter must notify the Registrar's Office in writing before the first day of classes of the quarter to avoid being charged the applicable tuition and fees.

### Withdrawal from the University

Students who wish to withdraw from the University after registering for classes in any quarter must file a withdrawal form available at the Registrar's Office. The withdrawal takes effect the day the completed form, bearing the required signatures, is received at the Registrar's Office. Students who have taken the final exam may not withdraw and must take the grade they earned. See also Withdrawal from the University: Refunds under Financial Regulations.

### Readmission to the University

Undergraduate and graduate students who have not registered for one or more quarters of an academic year must file at the Registrar's Office an application to reenter no later than six weeks before the first day of registration of the quarter in which they plan to return.

Students are not required to file the application to reenter under the following circumstances:

- If they have registered during the spring quarter and intend to return in the fall
- If they have registered in the spring quarter and intend to return during the Summer Session of the same year
- If they are students in the Graduate School who have attended the preceding Summer Session and intend to register during the next Summer Session and have not registered during the academic year

Students must obtain advance approval from the dean of their school if they wish to transfer credit for work taken elsewhere during an absence from Northwestern. An official, signed, and sealed transcript of that work must be furnished to the Registrar's Office before the end of the next quarter in residence at Northwestern University, or credit for such work is not allowed.

If students interrupt a program of study for an extended period of time and if degree requirements are changed during this period, the new requirements normally must be met. Any modification of the requirements is made by the appropriate administrative officers of the school in which the student is registered.

### Residence Requirement

The last 23 quarter-courses of the total required for the bachelor's degree must be taken while students are enrolled as undergraduates at Northwestern University. The last three quarters must be completed while students are enrolled in the school or college of the University that is to grant the degree. (Degree requirements are listed by school in this catalog.) *This residence requirement is in addition to the University Enrollment Requirement.*

To enable qualified undergraduate students to study abroad during their junior year, the residence requirement may be waived. For complete information, including definition of what constitutes qualification, interested students should consult the assistant or associate dean of their school or the Office of Study Abroad.

CAS students desiring to study abroad and students from other schools who wish to participate in one of Northwestern's affiliated programs should consult the Office of Study Abroad. Students participating in an affiliated program retain their enrollment at Northwestern during their study abroad and need not petition for waiver of the residency requirement.

### Work at Other Institutions

After enrolling at Northwestern, students who want to study at other accredited institutions and transfer credit for that work to Northwestern must obtain advance approval of their proposed study. Forms for obtaining such approval are available in the

Registrar's Office. The McCormick School Records Office has forms available for engineering students, and the Medill Office of Student Records and Services has forms available for journalism students. Students in the College of Arts and Sciences should secure the appropriate CAS forms (and a copy of the regulations governing study away from Northwestern) in the CAS Office of Studies. Students also should check the regulations for the University Enrollment Requirement.

If students take course work elsewhere during an absence from Northwestern (or during the summer), an official transcript of that work must be on file in the Registrar's Office before the end of the next quarter in residence at Northwestern, or credit for such work is not allowed.

Students may not register concurrently at Northwestern University and at another institution and receive transfer credit for work taken at the other institution unless permission is granted in advance by the office of the dean of their school. This applies to evening courses as well as to regular courses in residence.

### Application for a Degree

Undergraduates must file a degree application one calendar year before anticipated graduation. Students in the College of Arts and Sciences, Medill School of Journalism, and Schools of Education and Social Policy, Music, and Speech must file their applications with the Registrar's Office. McCormick School of Engineering and Applied Science students must file with the McCormick School Records Office.

### Classification of Students

Students are classified as follows:

- Senior: students who have completed at least 33 quarter-courses
- Junior: students who have completed at least 22 but fewer than 33 quarter-courses (engineering co-op students are considered preseniors when they have completed 32 quarter-courses and seniors when they have completed 40 quarter-courses)
- Sophomore: students who have completed at least 11 but fewer than 22 quarter-courses
- Freshman: students who have completed fewer than 11 quarter-courses
- Graduate student: students who have a bachelor's degree or its equivalent and have been admitted to a graduate program
- Special student: students who are not working toward a degree at Northwestern University but are working for credit
- Auditor: students who attend classes and listen to lectures, are not eligible to participate in class discussions or exercises, and do not receive credit (must have approval of the school and instructor concerned)

All the above except auditors may be either full-time or part-time:

- Full-time: students enrolled in at least three quarter-courses or the equivalent
- Part-time: students enrolled in fewer than three quarter-courses or the equivalent

### Grading Policies

The following grading system is used in computing the grade point average:

| *Grade* | | *Grade Points* |
|---|---|---|
| A | | 4.0 |
| A– | | 3.7 |
| B+ | | 3.3 |
| B | | 3.0 |
| B– | | 2.7 |
| C+ | | 2.3 |
| C | | 2.0 |
| C– | | 1.7 |
| D | | 1.0 |
| F | | 0 |
| X | Failed to earn credit: missed final examination | 0 |
| Y | Failed to earn credit: work incomplete | 0 |

The following notations are ignored in computing the grade point average:

P Pass with credit
N No grade, no credit
K In progress
S Satisfactory: noncredit course
U Unsatisfactory: noncredit course
W Dropped course with permission
V Auditor

At the end of a quarter a grade of X or Y will be given only if the instructor believes the student has a reasonable chance of passing the course by taking an examination or turning in the required work or both.

Some undergraduate schools prohibit the posting of X or Y grades without the approval of the dean's office. Students should contact their school for its regulations concerning X and Y grades.

If a grade of X or Y is to be changed and credit established, the deficiencies must be made up before the end of the next quarter in which the student is in residence in any school of Northwestern, or credit is forfeited. A notation of K must be resolved before graduation. An unresolved K will be changed to Y and the grade point average recomputed.

### Class Attendance and Absence

Students are expected to attend all sessions of the courses for which they are registered. Excessive absence is cause for failure in the course. Some courses require attendance at the first class meeting; students may be dropped for nonattendance (see the *Class Schedule).*

### Grade Reports

At the end of each quarter, a copy of each undergraduate student's grades is sent to the parent or guardian at the home address, except as noted below. Notices of deficiencies in scholarship may be reported to a student before the end of a quarter, but the University does not assume the responsibility of issuing such warnings.

The University will supply grade reports to parents of undergraduates unless the registrar receives written instructions from the parents indicating that the student is not a dependent and was not claimed as an exemption on the previous year's income tax return.

### Transcripts

Students who have satisfied all financial obligations to the University are entitled to an official transcript of their academic record, which they may order from the Registrar's Office. A fee is charged for all transcripts (see Service Fees under Tuition and Fees).

Except for internal educational uses, Northwestern University issues official transcripts only upon written authorization of the student concerned. Because of the confidential nature of a student's record, telephone requests for transcripts will not be accepted. Written requests should be submitted to the Registrar's Office.

Requests for transcripts initiated by persons or agencies other than the student or appropriate educational agencies will not be filled until written authorization has been secured from the student. When these requests can be anticipated, students can avoid delay by providing such authorization in advance.

Allow one week for a transcript to be issued at any time except between quarters, when three weeks is necessary.

### Access to Student Records

Under the Family Educational Rights and Privacy Act (FERPA), all students have certain rights with regard to their educational records. A copy of Northwestern University's student records policy is available via NUInfo at <http://www.nwu.edu/registrar/ferpa>.

FERPA grants students the right to

- Inspect and review their educational records at Northwestern University
- Request an amendment of their records to ensure that they are not inaccurate, misleading, or otherwise in violation of their privacy or other rights
- Consent to disclosure of personally identifiable information contained in their educational records
- File a complaint with the U.S. Department of Education concerning alleged failures by Northwestern University to comply with FERPA requirements

### Academic Integrity

Academic integrity at Northwestern is based on a respect for individual achievement that lies at the heart of academic culture. Every faculty member and student, both graduate and undergraduate, belongs to a community of scholars where academic integrity is a fundamental commitment.

Students enrolled at Northwestern are expected to adhere to the University's standards of academic integrity. Questions about the acceptability of specific behavior should be addressed to the appropriate faculty member or school dean. The following is a nonexhaustive list of types of behavior that violate the standards of academic integrity:

- Cheating: using unauthorized notes, study aids, or information on an examination; altering a graded work after it has been returned, then submitting

the work for regrading; allowing another person to do one's work and submitting that work under one's own name; submitting identical or similar papers for credit in more than one course without prior permission from the course instructors
- Plagiarism: submitting material that in part or whole is not entirely one's own work without attributing those same portions to their correct source (material discussing the use and acknowledgment of sources is available in the Office of the Provost)
- Fabrication: falsifying or inventing any information, data, or citation; presenting data that were not gathered in accordance with standard guidelines defining the appropriate methods for collecting or generating data and failing to include an accurate account of the method by which the data were gathered or collected
- Obtaining an unfair advantage: stealing, reproducing, circulating, or otherwise gaining access to examination materials prior to the time authorized by the instructor; stealing, destroying, defacing, or concealing library materials with the purpose of depriving others of their use; unauthorized collaborating on an academic assignment; retaining, possessing, using, or circulating previously given examination materials, where those materials clearly indicate that they are to be returned to the instructor at the conclusion of the examination; intentionally obstructing or interfering with another student's academic work; otherwise undertaking activity with the purpose of creating or obtaining an unfair academic advantage over other students' academic work
- Aiding and abetting dishonesty: providing material, information, or other assistance to another person with knowledge that such aid could be used in any of the violations stated above; providing false information in connection with any inquiry regarding academic integrity
- Falsification of records and official documents: altering documents affecting academic records; forging signatures of authorization or falsifying information on an official academic document, grade report, letter of permission, petition, drop/add form, ID card, or any other official University document
- Unauthorized access to computerized academic or administrative records or systems: viewing or altering computer records; modifying computer programs or systems; releasing or dispensing information gained via unauthorized access; interfering with the use or availability of computer systems or information

It is the responsibility of every member of the academic community to be familiar with the specific policies of his or her own school. Students who violate these policies are subject to penalties, including course failure and exclusion from the University. Students charged with academic dishonesty may not change their registration in a course in which the charge is pending or in which a finding of academic dishonesty has been made. Information on procedures that will be followed in cases of alleged dishonesty can be obtained from the dean's office of each school. A complete statement of the University's principles regarding academic integrity can be obtained from the Office of the Provost.

The student-faculty Undergraduate Academic Conduct Committee works to maintain a high level of academic integrity at Northwestern; on the request of the provost, that committee also hears appeals from students regarding school decisions concerning academic dishonesty. Such appeals must be in writing and include a detailed statement setting forth the grounds for the appeal. Appeals to the provost are limited to alleged errors in procedures, interpretation of regulations, or the question of whether a finding or sanction appears manifestly contrary to the evidence. The provost will receive appeals only after a sanction has been specified for the alleged violation; an appeal to the provost may concern the finding and/or the proposed sanction.

### Regular Examinations

Regular course examinations are held during the last week of each quarter. Summer Session examinations are held at the times indicated in the quarterly *Class Schedule.* Students are responsible for determining the time and location of each examination. Early examinations are not permitted. Permission to be absent from the final examination is given by the instructor and the dean only for cause beyond the student's control. Normally such permission must be secured in advance of the date of the examination. Any deficiency must be made up before the end of

the next quarter in which the student is in residence in any school of Northwestern University, or credit is forfeited. In no case may such a grade be made up after a lapse of one year.

### Makeup Examinations

All undergraduate students in residence in any school of Northwestern University must make up grades of X (absent) and Y (incomplete) before the end of the next quarter or credit is forfeited. Students not in residence may apply for a makeup examination. All such grades, however, must be made up within one year after the course was taken or credit is forfeited. Permission to take a makeup examination to remove a grade of X must have the written approval of the instructor and the dean. Makeup examinations are conducted by the departments concerned, early in each quarter. An application for a makeup examination must be filed several weeks in advance at the office of the school in which the course is offered. See the *Class Schedule* for exact dates the applications are due.

### Academic Standing

The decision concerning the academic standing of a student is the responsibility of the faculty of the school in which the student is registered.

Academic probation constitutes notice of unsatisfactory academic performance; it is a warning that minimum standards for graduation are not being met. Unless a student demonstrates significant scholastic improvement during the period of probation and thereby indicates ability to fulfill degree requirements within a reasonable period of time, the student may be dismissed from the University. A student will be notified in writing no later than the middle of a term that, because of unsatisfactory work in a previous term or terms, he or she will be excluded in the event of unsatisfactory work during the term for which the notice is issued.

### Academic Probation

The following are ordinarily placed on academic probation:

- Students who, in any quarter or Summer Session, have received final grades below C in two or more courses
- Sophomores, juniors, or seniors who have a cumulative academic record below a C average on all work attempted at Northwestern University
- Students who fail in two consecutive quarters to complete at least three quarter-courses or the equivalent in each of the two quarters or have failed at the end of the sixth quarter of residence to earn credit for an average of three quarter-courses for each quarter of residence by reason of dropped courses, failure, or uncompleted courses
- Students who have failed to maintain a C average in the major or a professional field of study; the faculty of each school may impose such additional conditions of academic probation as they may deem appropriate

### Removal from Academic Probation

Students on academic probation are ordinarily removed from probation if the deficiencies that resulted in probation have been remedied during the next succeeding quarter in residence. Students are rarely removed from probation on the basis of a program consisting of fewer than four courses graded on a basis other than the pass/no credit option.

If students on probation who receive grades of X or Y are not dismissed, probation continues until they have completed all courses or until the end of the next quarter in residence, when the students' records are again subject to scrutiny.

In no case are students removed from probation at the end of a quarter in which they have failed any course.

### Academic Dismissal

The following is a nonexclusive list of categories of students who may be dismissed for academic deficiencies (in every case the decision is determined in part by the student's cumulative academic record):

- Students on academic probation whose academic records have not improved significantly during the period of probation (which will not exceed two consecutive quarters)
- Students not on academic probation who fail in half the work in any quarter or Summer Session
- Students who demonstrate flagrant neglect of academic work at any time
- Students who do not make satisfactory progress toward completion of degree requirements

As a matter of general policy, the probation period for a freshman may be extended to the third quarter of residence if such extension appears to be in the best interests of the student and the University. Such consideration is not granted to a freshman

whose record clearly discloses lack of aptitude or flagrant neglect of work.

### Disciplinary Dismissal

Students suspended from Northwestern by the University Hearing and Appeals Board may not receive credit for academic work at any other institution during the period of suspension.

## Honors and Prizes

### Academic Honors

Degrees with honors are awarded to the top 16 percent of the graduating class of each undergraduate school, as determined by grades in all work at Northwestern University. Students in the highest 3 percent of the class are awarded degrees summa cum laude; those in the next 5 percent, magna cum laude; and those in the next 8 percent, cum laude.

Departmental honors may be granted to graduating seniors who have done outstanding work in a department in connection with a research project or an integrative type of work. Students are nominated for these honors by their departments. The faculty of the school concerned makes the final awards.

### Prizes

Prizes established through gifts and endowments are awarded to undergraduate students at Northwestern. Some are all-University prizes, and others are available only to students registered in the school, department, or program that administers the awards.

### Honorary Organizations

Students who qualify by reason of superior scholarship or outstanding achievement are eligible for membership in certain honorary societies. New members of the following organizations are announced in the annual commencement program.

- Arts and Sciences: Phi Beta Kappa
- Engineering: Eta Kappa Nu, Kappa Theta Epsilon, Omega Chi Epsilon, Tau Beta Pi
- Journalism: Kappa Tau Alpha
- Music: Pi Kappa Lambda

Other honorary organizations in various fields include Alpha Kappa Delta, Alpha Lambda Delta, Deru, Mortar Board, Norleggama, Orchesis, Phi Delta Kappa, Phi Eta Sigma, Pi Mu Epsilon, Sextant, and Shi-Ai. Additional professional and technical societies represented at Northwestern are identified in the *Student Handbook*.

## Academic Options

For more detailed information about the following programs, see other sections of this catalog.

### Accelerated Degree Programs

#### *Honors Program in Medical Education*

The Honors Program in Medical Education (HPME) is designed for highly talented high school seniors who should be able to qualify for advanced placement in chemistry, mathematics, and one of the humanities on the basis of superior achievement in high school. Each year 60 freshmen are admitted to the seven-year program and to the College of Arts and Sciences, McCormick School of Engineering and Applied Science, or School of Speech. Only candidates applying directly from high school are considered.

The first three years of the program are spent on the Evanston campus in the College of Arts and Sciences, McCormick School, or School of Speech and the last four years at the Medical School on the Chicago campus. HPME students must complete 36 courses that meet the requirements for HPME students in one of the three preceding undergraduate schools. They also are responsible for a University Enrollment Requirement of nine full-time quarters. Only courses taken at Northwestern or approved study abroad may be used to satisfy this Enrollment Requirement.

During the first two years in the College of Arts and Sciences, students take required courses in chemistry, physics, and the biological sciences. In addition, they take elective courses in the humanities, social sciences, and arts. The third year is usually devoted to advanced course work in the student's area of concentration or major. This may be done as a senior concentration in a department or program, by studying abroad in a Northwestern-affiliated program, or by completing the requirements for a BA degree in the College of Arts and Sciences. Students may also take an additional undergraduate year at Northwestern or elsewhere.

Students in the McCormick School spend three years pursuing an in-depth education in mathematics, the sciences, and engineering while taking core courses in biomedical engineering. To supplement their technical courses, students also take courses in humanities and the social sciences.

Speech students spend three years in the Department of Communication Sciences and Disorders, studying the anatomy and physiology of hearing, speech, and the central nervous system as it relates to cognition and memory. They have opportunities to learn how people of all ages hear, speak, and learn—both normally and in the presence of disabling conditions. The students also take courses in chemistry, physics, the biological sciences, the social sciences, and the humanities.

After completing the first three years, HPME students move to the Chicago campus as members of the Medical School first-year class, which includes students who have completed the traditional four years of premedical education. After successfully completing their first year at the Medical School, CAS students who have not received a BA degree qualify for a bachelor of science in medicine and Speech students qualify for a bachelor of science in speech. After the second year of medical school, McCormick students qualify for a bachelor of science in medical engineering. At the end of seven years, all HPME students qualify for the doctor of medicine degree from the Medical School.

Students who wish to be considered candidates for the HPME must complete and return before the December 1 deadline the card enclosed in the undergraduate application for admission that reports their test scores and requests an HPME application. If the request is approved, the student is sent and must complete the special HPME application in addition to the regular application for admission to the College of Arts and Sciences, McCormick School, or School of Speech by the appropriate deadlines (see the Application and Testing Deadlines table on page 16).

***Combined BS/DDS for Biomedical Engineers***

Qualified students in the McCormick School who have completed three years of biomedical engineering studies as well as predental courses may apply for admission to the Dental School as candidates for the doctor of dental surgery degree. Accepted students complete the requirements for the bachelor of science degree during their first of four years at the Dental School, following which the McCormick School awards the BS.

***Integrated Science Program***

Northwestern University offers a highly selective undergraduate program of integrated science studies within the College of Arts and Sciences. The Integrated Science Program (ISP) is designed for students with superior high school records and strong motivation in science and mathematics. Its special curriculum provides a thorough and rigorous background in the major scientific disciplines and mathematics. ISP can lead to a bachelor's degree in three years or, after a fourth year at Northwestern, to a double major or an advanced degree.

Enrollment in ISP is limited to assure small class sizes. Selection is made on the basis of scholastic record, test scores, and recommendations. Background requirements are a year of calculus, a year of chemistry, and a year of physics. Students who wish to be considered for ISP should request the special ISP application and brochure in addition to the regular application from the Office of Undergraduate Admission. See Integrated Science Program in the College of Arts and Sciences section of this catalog.

## Four-Year Master's Programs

Exceptional undergraduates at Northwestern University may be able to earn both a bachelor's degree and a master's degree in less than the usual period of time. The combined degree programs—BA/MA, BS/MA, BA/MS, BS/MS—enable students who commit themselves early in a discipline to accelerate their study toward advanced degrees at Northwestern or elsewhere.

Combined degree programs are special in their intellectual demands. Except in the McCormick School, students receive a double count of nine credits—that is, nine credits are applied toward both the bachelor's and master's degrees.

The following departments and programs in the College of Arts and Sciences and the School of Speech have combined degree programs approved by the Graduate School:

- Anthropology
- Art history
- Chemistry
- Classics
- Communication studies
- Economics
- French and Italian
- Geological sciences

- Hispanic studies
- Linguistics
- Mathematics
- Political science
- Sociology
- Statistics

The approved departmental programs vary, but they share a common goal: the selection and training of exceptional students. The programs also share several underlying premises. First, each department invites students to participate in the program. Students do not select themselves, though they may, of course, inquire about their eligibility. Second, selection by a department is a recommendation to the Graduate School for admission. Students are officially admitted to the Graduate School only after their credentials have been thoroughly reviewed and approved by the dean of the Graduate School.

For these reasons, students should be aware of guidelines used by the dean of the Graduate School and other guidelines affecting the operation of the program:

- No particular grade point average, however high, automatically entitles a student to participate in a combined degree program.
- *Only* one academic year—three quarters or two semesters or less—of transfer credit from another institution may be applied as credit toward the bachelor's portion of the combined degree, including credit for a junior year abroad. Any participating department may, if it desires, impose a more restrictive standard.
- A combined degree program requires a minimum of 12 full quarters of work. The master's portion must be completed during the final three contiguous quarters of registration, beginning with the fall quarter. In schools or departments of the University that operate on a four-quarter system, that is, that offer a full program during the Summer Session staffed by the regular faculty, one Summer Session only may be counted toward fulfillment of the 12-quarter requirement. In schools of the University that do not operate on a four-quarter system, cases of one summer of credit will be considered on an ad hoc basis by petitioning the dean of the Graduate School.
- All requirements, both undergraduate and graduate, must be met by the conclusion of the fourth academic year. The bachelor's and master's degrees are awarded simultaneously.
- Both degrees will appear on a single transcript, as will the results of all work completed for both degrees.
- Continuation of graduate work at Northwestern by those who complete a combined degree program must receive separate approval by the department and the dean of the Graduate School.

### Accelerated Master's Program in Education and Social Policy

Students who exhibit exceptional ability as Northwestern undergraduates and wish to become certified in elementary or secondary education as part of a master's degree may apply during the fall quarter of the senior year to the Master of Science in Education and Social Policy Program with the intention of completing the degree and certification requirements at an accelerated pace. See the Accelerated Master of Science in Education and Social Policy Program in the School of Education and Social Policy section of this catalog.

### Accelerated Master's Program in Journalism

Students who exhibit exceptional ability in undergraduate work in the Medill School of Journalism may apply to that school's graduate division for early admission to the graduate editorial program. This program allows students to qualify for bachelor of science in journalism and master of science in journalism degrees in 12 to 14 quarters of full-time study. Students apply for this program during their junior year; however, interested students are encouraged to begin planning for this option early in their undergraduate career. Information and admissions materials are available from the Medill Office of Graduate Admissions and Financial Aid. See Accelerated Master's Program in the Medill School section of this catalog.

### Combined Bachelor's Programs

#### *Combined Liberal Arts and Engineering Program*

Qualified students may undertake a program to earn both a bachelor of arts in a liberal arts discipline from the College of Arts and Sciences and a bachelor of science in an engineering field from the McCormick School. Students in this BA/BS program, which takes four or five years, must complete all

requirements of both schools. To do the necessary planning, interested students should consult with the CAS Office of Studies and the Undergraduate Engineering Office at the McCormick School as soon as possible after enrolling at Northwestern. See Five-Year BA/BS in the McCormick School section of this catalog.

***Combined Liberal Arts and Music Program***
Students accepted into the combined College of Arts and Sciences–School of Music program may simultaneously earn a bachelor of arts degree from CAS and a bachelor of music degree from the School of Music. They must complete all CAS degree requirements, including at least 30 CAS courses, as well as all School of Music bachelor of music degree requirements, including at least 30 music courses. Fulfilling both music and CAS requirements usually takes five years of full-time study, and a University Enrollment Requirement of 15 quarters is obligatory (see Financial Regulations).

Participants in this combined program must be accepted by both the School of Music and CAS. The entrance requirements and structure of the program are currently undergoing revision; interested students should consult with the associate dean for undergraduate studies in CAS and the director of admissions in the School of Music for up-to-date information.

***Combined Music and Engineering Program***
Students accepted into the combined McCormick School of Engineering and Applied Science–School of Music program may simultaneously earn a bachelor of science degree from the McCormick School and a bachelor of music or bachelor of arts in music degree from the School of Music. They must complete all McCormick School degree requirements, including at least 36 McCormick courses, as well as all School of Music degree requirements, including at least 32 music courses. Fulfilling both music and engineering requirements usually takes five years of full-time study, and a University Enrollment Requirement of 15 quarters is obligatory (see Financial Regulations).

Participants in this combined program must be accepted by both the School of Music and the McCormick School. The entrance requirements and structure of the program are currently undergoing revision; interested students should consult with the Undergraduate Engineering Office in the McCormick School and the director of admissions in the School of Music for up-to-date information.

## Interdisciplinary Study

***Mathematical Methods in the Social Sciences Program***
The Program in Mathematical Methods in the Social Sciences (MMSS) in the College of Arts and Sciences enables students to combine the study of social sciences with training in formal analytical methods. The program is intended for students with high mathematical aptitude and strong interest in social problems and issues, including their policy and research implications.

Admission to the MMSS is very selective; it is limited to entering freshmen and students beginning their sophomore year who have earned superior academic records and demonstrated strong aptitude in mathematics. Prerequisite for admission consideration is a full-year course in calculus. See Mathematical Methods in the Social Sciences in the College of Arts and Sciences section of this catalog.

***Integrated Science Program***
See Accelerated Degree Programs.

***Interschool Programs***
Students in any undergraduate school may enroll in the Undergraduate Leadership Program. All undergraduates may enroll in the International Studies Program as an adjunct major. Students in the College of Arts and Sciences and Schools of Music and Speech also are eligible for the Integrated Arts Program, and the Music Theatre Program is open to School of Music voice majors and School of Speech theater majors. (See Other Undergraduate Programs.)

Undergraduates in other schools may enroll in College of Arts and Sciences minor programs. (See Minors under Special Opportunities in the CAS section of this catalog.)

***Center for the Writing Arts***
Northwestern's Center for the Writing Arts sponsors a number of programs as well as a series of courses designed to highlight the University's commitment to excellence in writing. Many of the courses are taught by visiting professional writers. (See Other Undergraduate Programs.)

## McCormick School Honors Programs

***Honors Program in Undergraduate Research***
The Honors Program in Undergraduate Research in the McCormick School provides an unusual opportunity for prospective freshmen with superior motivation and scholastic credentials to be admitted to work with an engineering faculty mentor/adviser in a challenging research project, beginning in the first year and continuing throughout the undergraduate years.

Students may request the names and current research interests of participating faculty, enabling them to apply to a project of their choice. With the participation of a faculty sponsor, students will be selected for the program based on their high school records; SAT I or ACT, SAT II, and Advanced Placement test scores; and, usually, an interview. Interested students may request an application and additional information from the McCormick School Undergraduate Engineering Office. (See Honors Program in Undergraduate Research in the McCormick School section of this catalog.)

***Honors Program in Engineering and Education***
The Honors Program in Engineering and Education is designed for students who have a strong interest in education and training as well as in science, mathematics, and engineering. Students join the program in the belief that a more technical background will give them an advantage in the research and development of educational software or in the understanding and enhancement of human learning in the classroom or workplace.

The program provides undergraduate engineering students possessing strong academic credentials and some advanced placement the opportunity to complete in five years an MA in learning sciences and a BS in engineering. Students also gain industrial and/or research experience related to their area of specialty.

High school students may apply to this program when they apply to the University. McCormick students may apply to the program during their junior year. All applications are reviewed by a committee of faculty and co-op engineering employers, who provide the industrial experience for participants.

***Honors Program in Engineering and Journalism***
The Honors Program in Engineering and Journalism is intended to prepare exceptional students for communications careers emphasizing engineering, science, and technology. This joint program with the Medill School of Journalism involves completing a BS in engineering and an MS in journalism. Although the program normally requires five years of study, unusually capable students may be able to shorten the time through use of advanced placement credits and accelerated scheduling. To be considered for the program, applicants to Northwestern complete a special questionnaire that is evaluated by a Medill faculty panel. (See Honors program in Engineering and Journalism in the McCormick section of this catalog.)

***Honors Program in Engineering and Management***
Honors students are eligible to participate in a joint program of the McCormick School and the J. L. Kellogg Graduate School of Management. High school students with superior scholastic credentials and strong motivation for study beyond the bachelor's degree may be admitted to an undergraduate engineering program at the McCormick School and also granted deferred admission to the Kellogg School.

Interested students should request an application and additional information from the McCormick School Undergraduate Engineering Office. (See Honors Program in Engineering and Management in the McCormick School section of this catalog.)

## CAS Honors Programs

The Honors Program in Medical Education, the Integrated Science Program, and the Program in Mathematical Methods in the Social Sciences are described above. Several CAS majors, e.g., American studies and the Honors in English program, are special-admission majors; see the College of Arts and Sciences section of this catalog.

## CAS Scholars Program

Students who demonstrate exceptional promise for independent work in any field, discipline, or area represented in the College of Arts and Sciences may be asked to participate in the CAS Scholars Program. There is no special application procedure for the program. Participation is by invitation of the faculty

board of the program at the time of admission to CAS and normally continues throughout the student's undergraduate career. Upon acceptance to CAS, potential CAS Scholars are invited to visit the campus and discuss the possibilities available to them with the director and potential faculty mentors.

In addition to completing the requirements for a degree in CAS, participants also are assigned a special faculty mentor (or succession of mentors) to help them in shaping an individualized curriculum of courses, tutorials, and creative or research projects related to their intellectual priorities. Each scholar has access to a research fund to support this course of study and associated summer or travel expenses; the seminars, lectures, and other activities of such facilities as the Kaplan Center for the Humanities and the International Studies Program; and additional advising and other assistance from the director of the program.

Mentors in the CAS Scholars Program are chosen from the faculty on the basis of outstanding scholarship in a field appropriate to a scholar's interest and demonstrated aptitude for working with bright, highly motivated undergraduates.

## Formal Options

***Pass/No Credit (P/N)***
The P (pass) or N (no credit) option allows students to explore fields beyond the areas of their specialization without concern about grade point average. Many undergraduate courses are open to the P/N option. For information about a particular school's P/N policy, see that school's section in this catalog.

***Student Organized Seminars (SOS)***
Students who wish to pursue studies not included in the catalog may plan and initiate their own courses under the supervision of sponsoring faculty members. SOS credit courses may be developed in all undergraduate schools except the Medill School of Journalism.

***Independent Study (C99)***
Many departments offer undergraduate seminars and independent studies for qualified students. C99 in any department enables a student to engage in individual special study and research. Depending on the student's interests, independent projects may involve work in a laboratory or library, fieldwork outside the University, or the creation of a work of art. The maximum credit a student may receive for C99 (or equivalent independent study) during any one quarter is two units.

***Double Major***
A double major is available to all students who complete a full major program in two departments.

***Self-Designed Major***
A self-designed major permits all students, with the permission of the school's curriculum committee or dean, to concentrate advanced study in an area other than one of those recognized through a departmental or interdisciplinary major. This option is identified as an ad hoc major in the College of Arts and Sciences, the interdepartmental studies major in the School of Speech, and the Combined Studies Program in the McCormick School.

***Departmental Honors Programs***
Departmental honors programs are available to students through most departments of the College of Arts and Sciences, some departments in the School of Speech, and all departments of the McCormick School and the School of Education and Social Policy. They involve advanced study through special undergraduate seminars or graduate courses and/or independent work under faculty supervision.

## Teacher Certification

CAS students also may complete the requirements of the secondary teaching program and qualify for Illinois state certification. See Teacher Certification at Northwestern in the School of Education and Social Policy section.

## Off-Campus Programs

***Field Study***
Many off-campus field studies, internships, and research opportunities sponsored by various schools and departments are available to Northwestern students. The programs vary greatly: Some carry academic credit; some are undertaken in conjunction with a class or seminar; some make provision for a stipend; some entail living away from campus.

Following is a representative list of field studies programs with their sponsoring school, department, or program:

- Chicago Field Studies Internship (arts and sciences)
- Communication Studies Field Studies Program (communication studies)
- Education and Social Policy Practicum (education and social policy)
- Internships in the Arts (art history)
- Internships in Business Institutions (business institutions)
- Internships in Environmental Sciences (environmental sciences)
- Internships in the Humanities (Alice Berline Kaplan Center for the Humanities)
- Internships in Television Production (radio/television/film)
- Internship in Women's Services (women's studies)
- Northwestern Archaeological Field School (anthropology)
- Political Campaigning (political science)
- Professional Apprenticeship in Music Education (music)
- Teaching Magazine Program (journalism)
- Teaching Newspaper Program (journalism)
- Teaching Practicum (education and social policy)
- Teaching Television Program (journalism)
- Theatre Field Experience (theater)
- Walter P. Murphy Cooperative Engineering Education Program (engineering)

***Study Abroad***

Northwestern encourages qualified students to pursue study abroad when such study promises to enrich their academic program. The Office of Study Abroad provides advice to students about available foreign study options. Any undergraduate student who desires to transfer credit earned through foreign study to Northwestern must receive the approval of the Office of Study Abroad *prior* to embarking on a foreign study program. Students also are required to review their plans with the dean's office of the school in which they are registered. In most cases, a fee is charged for the transfer of credit earned in study abroad programs.

Most Northwestern students studying abroad do so in one of the University's affiliated foreign study programs. Countries in which affiliated programs are currently available include Egypt, France, Germany, Israel, Italy, Japan, the People's Republic of China, Russia, Spain, and the United Kingdom. Students participating in affiliated programs during the academic year remain registered at Northwestern during their foreign study and are eligible to receive financial aid through Northwestern as necessary.

Qualified students may also participate in nonaffiliated foreign study programs that have been preapproved by Northwestern. Students may also request permission to transfer credit from ad hoc programs. Students participating in nonaffiliated (preapproved or ad hoc) foreign study programs are not registered at Northwestern during their foreign study and are not eligible for any financial assistance from Northwestern.

Since foreign study often requires special language or other preparation, students interested in study abroad are urged to consult with the Office of Study Abroad early in their Northwestern careers. The office sponsors workshops on planning for study abroad as well as sessions on specific foreign study options.

# Undergraduate Schools and Courses

## Key to Course Listings

### Changes

Although the course listings in this catalog are as complete and exact as is possible at the time of printing, some changes may occur later and courses may be dropped or added. The official *Class Schedule* issued for each quarter contains a complete and updated listing of courses for that quarter. The University reserves the right to cancel courses for which registration is not sufficient.

### Arrangement

Courses offered by each school are listed by departments arranged alphabetically. In the departments, courses are arranged by A, B, C, D, and E:

- A-level courses are primarily for freshmen and sophomores, usually without college prerequisite.
- B-level courses are primarily for freshmen, sophomores, and juniors, sometimes with the prerequisite of an A-level course in the same or a related department.
- C-level courses are primarily for upperclass and graduate students, with the prerequisite of junior standing or an A- or B-level course in the same or a related department.
- D-level courses or seminars, in which the major part of the work is not research, are primarily for graduate students; they may be open to advanced undergraduate students with permission.
- E-level courses or seminars, in which the work is primarily research, are only for graduate students.

### Course Credit and Quarters

Daytime work in all the schools on the Evanston campus is on the quarter system. A quarter-course, the unit of instruction, is the work done in a class meeting at least three hours per week and carries the value of one unit of credit. Exceptions are courses meeting fewer than three hours per week, which may carry less than one unit, and 15-week courses, which carry 1.5 units. A quarter-course is the equivalent of $2\frac{2}{3}$ semester hours. (For transfer to other institutions or for certification stated in credit hours, undergraduates may consider a quarter-course equivalent to four quarter hours of credit.)

Summer Session combines the course offerings of University College, which is on the semester system, and the schools on the Evanston campus, which are on the quarter system. (For transfer credit, courses taken during Summer Session are the equivalent of four quarter hours or three semester hours.)

### Numbering System

Three sets of characters denote all courses. The first set (three numbers) indicates the school and department or area of study, the second (a letter and two numbers) is the course number, and the third (one, two, or more numbers) usually indicates whether the course is part of a sequence. Special characters may identify certain groups of courses; for example, 15-week courses are designated as FW or TS. If courses carry less or more than one unit of credit, the number of units in parentheses follow the course title.

- 720-B06-0 Environmental Literacy
  7 = McCormick School
  20 = Department of Civil Engineering
  B06 = specific course
  0 = one-quarter course
- 610-B10-1,2 Landmarks in Rhetorical Theory
  6 = School of Speech
  10 = Department of Communication Studies
  B10 = specific course
  1,2 = two-quarter sequence
- 471-C69-FW Field Research and Methods of Data Collection (1.5)
  4 = College of Arts and Sciences
  71 = Department of Sociology
  C69 = specific course
  FW = 15-week course
  (1.5) = 1.5 units of credit

# College of Arts and Sciences

A liberal arts education in Northwestern's College of Arts and Sciences (CAS) cultivates intellectual skills and a depth of knowledge for a lifetime filled with change. Study in CAS combines broad exposure to the insights and methodologies of diverse disciplines with focused study in one or more areas. An emphasis on participatory learning prepares students to deal imaginatively with unforeseen challenges beyond their college years. Northwestern's strong undergraduate preprofessional schools offer liberal arts students unusual opportunities for specialized course work.

The College of Arts and Sciences, oldest of Northwestern's 13 schools, has stood at the center of the University's academic and intellectual life since 1851. The college faculty, consisting of more than 400 women and men, is dedicated to superior teaching informed by advanced research. All members of the faculty, including the most senior, regularly teach undergraduate students. Each year these students are offered a rich menu of choices for study: more than 2,000 undergraduate and graduate courses as well as tutorials, internships, laboratory rotations, and other individualized forms of instruction. With access to 25 departments and over a dozen interdisciplinary programs offering majors and minors, the college's 3,600 undergraduates and 1,200 graduate students enjoy a great diversity of choice. The college strives to open up new areas of discovery for students and to awaken them to fields and possibilities that they may never before have encountered.

An undergraduate liberal arts education in CAS emphasizes the ability to think rigorously and to communicate clearly and forcefully. Required course work in several disciplines provides a vivid account of the complexity of the world and a mastery of different ways of apprehending and solving problems. Foundational work shows how great minds from many backgrounds confronted fundamental issues and how social conditions have shaped those inquiries. Liberal education also develops a thoughtful sensitivity to human creativity and morality.

A liberal arts education equips students to take advantage of the diverse opportunities of a constantly evolving society. The ability to reason clearly, to extract the essential significance of large bodies of information, to apply general principles in new contexts, and to communicate effectively—these are skills required for success and advancement in professional schools, graduate programs, and occupations. A liberal education develops the qualities of mind needed by citizens in a democracy. CAS students often rise to positions of leadership after graduation, and one aim of the college is to prepare them to make decisions informed by knowledge, understanding, and thoughtfulness.

At Northwestern, faculty research enriches undergraduate learning. Our faculty members have achieved international reputations as scholars, and many CAS departments stand among the best in the nation. Students share in the excitement of discovery in the sciences, humanities, and social sciences through the intellectual energy professors bring to the classroom and through special projects developed by students under faculty guidance. Northwestern's outstanding library, research facilities, and professional schools support this stimulating pursuit.

## Academic Policies

### Program of Study for the Degree of Bachelor of Arts

CAS offers courses of study in the arts and sciences leading to the degree of bachelor of arts. Within a framework of requirements established by the faculty, students have extensive flexibility in structuring their academic programs.

Before graduation each student must demonstrate proficiency in writing and competence in a classical or modern foreign language, complete at least 45 quarter-courses, and fulfill the residence and grade requirements described below. First-year students complete two freshman seminars. Students take courses in each of the six major areas of intellectual

inquiry within the arts and sciences—areas defined by shared subject matter, sources of primary data, evaluative criteria, and modes of analysis—to acquire familiarity with a broad range of subjects and methods for approaching them. These general requirements are complemented by in-depth exploration of a major.

There is considerable latitude to fashion a personally rewarding and intellectually challenging course of study. Students who enter with sharply focused interests find that the college's limited admission programs offer immediate immersion in specialized work. Other students use the flexibility of the quarter system to pursue a variety of interests concurrently. A period of study abroad can complement many academic programs; students interested in such study are encouraged to explore the many possibilities early in their academic career.

CAS provides a large array of independent, small group, active learning experiences for its students: research and advanced study in special departmental seminars, independent study with a faculty member or in a laboratory, junior tutorials, and senior seminars. Honors study for seniors of exceptional academic ability provides the opportunity to pursue integrative and pathbreaking research. Departmental honors are awarded at graduation to those who complete their honors program with distinction.

Guidance in planning a coherent personal curriculum is available in several places. General advising is centered in the CAS Office of Studies, where faculty advisers are available throughout the year to discuss academic matters. They can answer questions about academic programs and discuss difficulties in courses, choices of major and career, and preparation for graduate and professional schools. Sophomores who have not declared a major are especially encouraged to seek advice from these advisers. Those unsure of where to turn with a question should begin in the Office of Studies; its staff will know where to direct queries they cannot handle themselves.

Each freshman is assigned a freshman adviser, a faculty member who, whenever possible, is in the student's area of general academic interest or associated with the student's living unit. Each CAS department and program has a corps of faculty advisers who advise undergraduates (including freshmen and sophomores) in their unit about courses, majors, and minors.

For various reasons, some CAS students will complete their graduation requirements in fewer than four years. Some transfer to the college from other schools in the University; others transfer to Northwestern from other institutions. Many freshmen enter with advanced placement and credit for work done before matriculation. All students pursuing abbreviated programs need to be particularly attentive to general education and major requirements.

## Requirements for the Degree of Bachelor of Arts

### *Residence and Grade Requirements*

Of the required 45 quarter-courses, the last 23 must be taken while students are enrolled as undergraduates at Northwestern. During the last three quarters preceding the granting of the BA degree, students must be enrolled in the College of Arts and Sciences.

### *Pass/No Credit Option*

Full-time students in CAS are permitted to enroll in a limited number of courses with the understanding that they will receive in place of a regular letter grade the notation P (pass) or N (no credit), neither of which counts in the student's grade point average. No more than one course per quarter and six courses in all may be taken under this P/N option. No more than one-fifth of the total courses taken at Northwestern and offered for graduation may have grades of P or D. Courses used to satisfy the distribution, foreign language, and freshman seminar requirements cannot be taken P/N.

While some other undergraduate schools of the University offer a Target Grade–P/N registration option, such registration is not available for courses offered by CAS. Special rules govern registrations by CAS students in courses of the undergraduate schools where this plan is available as well as by non-CAS students who transfer into CAS. Questions concerning this policy should be addressed to the Office of Studies.

Students must achieve a grade point average of C (2.0) or higher in courses offered to meet degree requirements. No work passed with a grade of D or P counts toward a major or minor (including any course prerequisite to a course required in the departmental unit or any related course), and a grade of C– or higher must be earned in the last

course in a sequence taken to fulfill the foreign language requirement. Transfer students must complete the equivalent of at least four one-quarter upperclass (C-level) courses at Northwestern in the department of their major.

In addition to and independent of the requirements set by the College of Arts and Sciences, all students must satisfy the University Enrollment Requirement (see Financial Regulations).

***Registration in Courses in Other Undergraduate Schools of the University and at Other Universities***

CAS students may take advantage of Northwestern's undergraduate preprofessional schools to take as many as 11 of their required quarter-courses; of those 11, up to 3 may be instruction in applied music. Dual registration in University College is included in this restriction. A student desiring to take more than 2 courses outside CAS in a given quarter must obtain the advance consent of the CAS Office of Studies.

Courses taken in University College can be counted toward the BA degree only if they are similar to those offered in the regular curricula of the Evanston undergraduate schools. This determination is made by the Office of Studies.

No credit is given for shop work, individual instruction in speech, correspondence courses, or course work in music education or physical education.

No more than 4 of the required 45 quarter-courses may come from the offerings of the programs of Aerospace Studies, Military Science, or Naval Science. *With the prior approval of the faculty,* qualified students may study abroad or undertake work at another institution in the summer. Students should consult with the Office of Studies concerning limitations on the amount of non-Northwestern credit that may be used towards the BA degree and with the Registrar's Office concerning limitations on the amount of such credit that may be used towards the University Enrollment Requirement.

***Freshman Seminar Requirement***

Freshman seminars, offered by nearly all departments in CAS, are small, discussion-oriented courses designed to develop basic intellectual skills: how to read critically, think logically, and communicate effectively, typically through the investigation of a specific theme or issue. Freshman seminars are limited to 15 students to encourage discussion, and each seminar requires considerable expository writing—usually a minimum of 15–20 typed pages per quarter. These seminars ordinarily supplement rather than replace standard introductory courses and usually do not provide the preparation necessary for advanced work in a departmental program.

Every student in the college is required to complete two freshman seminars in the freshman year. To ensure that class sizes are limited and that registrations are equally distributed, the college specifies the two quarters in which each student will take the seminars. P/N registration is not allowed in freshman seminars.

***Writing Proficiency Requirement***

The writing proficiency requirement has two parts: passing a writing proficiency examination (or having the exam waived on the basis of test scores) and writing satisfactorily in courses taken at Northwestern. Freshman seminar instructors make the initial evaluation of writing in courses. Students who do not write well on the exam, in their freshman seminars, or in other courses may be asked to take English A05 Expository Writing. Courses in expository writing and intermediate composition are available for all students who wish to increase their skill and confidence in writing.

***Foreign Language Requirement***

Before graduation students must demonstrate proficiency in a classical or modern foreign language equivalent to the work covered in a second-year, college-level course. Language proficiency may be demonstrated by achieving a score designated by the CAS Council on Language Instruction on a College Entrance Examination Board Advanced Placement Examination, by passing a proficiency examination administered at Northwestern during New Student Week and periodically thereafter through the school year (language departments may impose a limit on the number of times a proficiency examination may be taken), or by successfully completing course work designated by the Council on Language Instruction.

Students who believe they are proficient in reading, writing, listening, speaking, and the culture of a language not regularly taught at Northwestern

may petition the Council on Language Instruction for a proficiency examination in that language. Petitions are available in the Office of Studies and must be filed during a student's first quarter in CAS. In certain *extraordinary* cases of certified learning disability directly related to foreign language acquisition, the Council on Language Instruction has the authority to authorize a substitute for the proficiency requirement. The council will not, however, simply excuse a student from the foreign language requirement.

***Distribution Requirements***

To ensure breadth of education, CAS students must take two quarter-courses in each of the six distribution areas listed below. The list of courses that satisfy the distribution requirements is established by a CAS faculty committee. The list changes from year to year; a course must appear on the list for the year in which it was taken in order to satisfy these requirements. A current list is available in the CAS Office of Studies.

- I. Natural Sciences
  Courses in this area introduce methods of inquiry and fundamental concepts in the natural sciences.
- II. Formal Studies
  Courses in this area introduce concepts, methods, and use of formal rules of inference in mathematics, statistics, computer science, logic, linguistics, and cognate areas by showing how objects of thought and experience and their relationships can be analyzed in formal terms.
- III. Social and Behavioral Sciences
  Courses in this area introduce the theories, methods, and findings of empirical research on human behavior and its relation to social, cultural, economic, and political groups and institutions.
- IV. Historical Studies
  Courses in this area introduce the chronological development and historical relationships in cultural, social, political, economic, and military affairs in a broad temporal perspective.
- V. Values
  Courses in this area introduce the analysis of moral, social, and religious values and how they have developed.
- VI. Literature and Fine Arts
  Courses in this area foster understanding of how the attitudes, ideas, and values of individuals, groups, societies, or cultures are represented in their literature, arts, and creative activities.

As many as six of these distribution requirements may be satisfied by achieving sufficient scores on College Entrance Examination Board Advanced Placement or higher level International Baccalaureate examinations. A list of qualifying scores and tests as well as detailed information concerning the distribution requirements are available from the Office of Studies.

***Major Study Requirement***

All students must fulfill the requirements of a major, which must be declared by the end of the sophomore year. Majors are declared by meeting with the designated adviser in the department or program offering the major; at that meeting a course plan is developed and a Declaration of Major form is completed.

Students may pursue two or more majors by completing each department's major requirements. With limited exceptions in certain formal dual-major programs, the same course may not be applied to the major requirements of two departments. However, a course used as a major course in one department may also fulfill a course requirement for another major program.

A student may elect a major from among the following options:

- Departmental Major
  Each department offers one or more programs of specialization, which are described in detail immediately preceding the departmental course offerings in this catalog.
- Area or Interdisciplinary Major
  The college offers 13 interdisciplinary majors that apply the approaches of several departments to certain scientific, cultural, and political areas. These programs, described in the corresponding entries, are American studies, Asian studies, cognitive science, comparative literary studies, computing and information systems, drama, environmental sciences, geography, integrated science, international studies, mathematical methods in the social sciences, urban studies, and women's studies. American studies, integrated science, and mathematical methods in the social sciences are limited-admission majors that require a special application, as does the writing major in the English department. Geography, international studies, mathematical methods

in the social sciences, urban studies, and women's studies are available only as adjunct majors (that is, in conjunction with a second major).

- Ad Hoc Major
  Occasionally students with well-defined interests are led to programs of study that do not fit neatly into the mold of a traditional major. They may develop an ad hoc major by bringing together courses from various departments. Ad hoc majors must be approved by the CAS faculty's Curricular Review Committee. Ad hoc majors approved in recent years include the history of medicine, ethnomusicology, and American social dynamics; there is an established curriculum for the ad hoc major in neuroscience. For more information, see the assistant dean for curriculum in the Office of Studies.

## Special Opportunities

### *Junior Year Tutorials*

These tutorial classes for juniors, always with fewer than eight students, emphasize intense intellectual exchange and detailed mastery of texts and concepts. They develop critical skills, including research design if appropriate, through mutual criticism and practice in written and oral communication. Recent tutorials have included British Science Fiction (English), Masculinity and the Politics of Abortion (sociology), Philosophy of Language: The Question of Origins and Ends (philosophy), and The Life and Work of W. E. B. DuBois (history).

### *Senior Linkage Seminars*

In their senior year, undergraduates may take specially designed linkage seminars that approach social and work-related concerns through the eyes of an accomplished nonacademic professional with an affinity for the liberal arts and a gift for intellectual inquiry. These seminars link liberal education to professional issues, illustrating how theory and practice affect and enrich one another. In this way, they focus on the transition from the academic to the nonacademic world. Topics have included philosophy in the practice of medicine, the role of nonprofit organizations in American society, public policy in science and technology, and women and sexual violence. Linkage seminars are announced to CAS seniors before registration each quarter.

### *Undergraduate Seminars and Independent Study*

By departmental invitation, seniors may take C98 Undergraduate Seminar in one or more quarters, up to a maximum of four quarter-courses.

Seniors, as well as juniors with excellent records, may register for C99 Independent Study under the supervision of a faculty member. During the quarter before enrolling in C99, students must submit to the department for approval a detailed description of the work they will undertake and the basis for its evaluation. At the completion of the course, they also must submit an abstract of the completed work to the department, where the description and the abstract are filed.

Students may not register for more than two credits of C99 in a quarter. No more than nine quarters of C98 and C99 can be presented as credit for graduation. Certain independent study courses offered by some departments with course numbers different from C98 and C99 are also subject to these restrictions.

### *Honors*

Each major in the College of Arts and Sciences offers an honors program leading to the award, at graduation, of departmental honors to seniors with outstanding achievement in connection with a research project or other integrative type of work. Although the detailed criteria vary somewhat by major (and may be consulted under the listings of individual departments and programs), all share certain features.

Students recommended for departmental honors must have completed with distinction both such regular courses as may be required of them by their major and at least two quarters of C98 or C99 or their equivalent or D-level courses or some combination thereof. The honors project must result in a research report, thesis, or other tangible record; course work alone, such as completion of D-level courses, is not sufficient. Simple data collection, computer programming, analysis of data with canned programs, and summaries of primary or secondary sources are not alone bases for the award of departmental honors.

Each major has an undergraduate honors committee responsible for administering its honors program and for preparing the final recommendations for honors that are submitted in May to the CAS Committee on Superior Students and Honors. Students

are proposed for honors by the faculty adviser, who writes a letter describing and evaluating the student project. Additional evaluative letters giving independent and substantive judgments of the project must be submitted by faculty members unconnected with the student's project. The departmental honors committee reviews all nominations for departmental honors in a given year during spring quarter and takes a separate recorded vote on each candidate. Approved nominations are then forwarded to the Committee on Superior Students and Honors for final review.

***Minors***

Students may choose to pursue one of 40 minors or minor concentrations currently offered in CAS as well as the interschool Integrated Arts minor (see Other Undergraduate Programs). Specific minor requirements are given under the appropriate headings in this catalog. Completion of a minor is optional and not a degree requirement, and no more than one minor or minor concentration may be pursued and listed on a student's transcript.

***Concentrations in the School of Music and the School of Speech for CAS Students***

Students in CAS may elect to pursue a special concentration in music studies offered by the School of Music or one of four special concentrations offered by the School of Speech. These special curriculum concentrations, consisting of five to six courses, have limited enrollment and are available only to CAS students. More information is available at the CAS Office of Studies.

***Preprofessional Study***

CAS offers its students excellent preparation for subsequent training in professions such as law, medicine, and management. Each year many graduates pursue professional study in these areas. Other students enter the work force directly.

All majors can furnish suitable preparation for professional schools, provided appropriate courses are included in the student's course of study. However, no major is intended solely as preprofessional training. The college advisers in the Office of Studies help students design academic programs that combine the breadth of a liberal arts education with adequate preparation for further professional study. The Office of Studies has prepared pamphlets describing in detail the admission requirements of graduate professional schools and the ways in which those requirements can be met at Northwestern.

## Academic Options

### Combined Bachelor's and Master's Degree Programs

Exceptional undergraduates may be able to earn both a bachelor's degree and a master's degree in four years of study in the following departments: anthropology, art history, chemistry, classics, economics, French and Italian, geological sciences, Hispanic studies, linguistics, mathematics, political science, sociology, and statistics. Students are admitted to these programs only by invitation of the department and with the approval of the Graduate School. (See Academic Options in the Undergraduate Education section of this catalog.)

### Combined CAS–Medical School Program

The Honors Program in Medical Education (HPME) is designed for unusually gifted high school students who seek a career in medicine or medical science. It provides a plan whereby students entering Northwestern are admitted simultaneously to CAS and to the Medical School. HPME students then participate in a challenging program, with the first three years in undergraduate study and the last four years in the Medical School, thus reducing the period of formal training by at least one year.

Students in HPME must successfully complete 36 quarter-courses while in CAS and complete a University Enrollment Requirement of nine quarters. The course requirement includes 11 prescribed science courses. Selection of the remaining 25 courses depends on the curriculum chosen by the student. Options include completion of a BA degree, a senior concentration, or study abroad in a Northwestern-affiliated program.

Further information can be obtained from the premedical adviser in the Office of Studies.

### Combined CAS–School of Music Program

Students accepted into the combined CAS–School of Music program may simultaneously earn a BA degree from CAS and a BMus degree from the School of Music. They must complete all CAS degree requirements, including at least 30 CAS courses, as well

as all requirements for the bachelor of music degree in the School of Music, including at least 30 music courses. Fulfilling both CAS and School of Music requirements usually takes five years of full-time study, and a University Enrollment Requirement of 15 quarters is obligatory.

Participants in this combined program must be accepted by both the School of Music and CAS. The entrance requirements and structure of the program are currently undergoing revision; interested students should consult with the associate dean for undergraduate studies in CAS and the director of admissions in the School of Music for current information.

### Teaching Certification

Students enrolled in a number of departments of the College of Arts and Sciences may simultaneously pursue secondary teacher certification through the School of Education and Social Policy. Areas of certification are art, biological sciences, chemistry, economics with history, English, French, German, history, mathematics, physics, political science with history, sociology with history, and Spanish.

Majors in the certification areas who wish to be considered for teaching certification must apply, be admitted to, and complete all requirements of the Secondary Teaching Program as described in the School of Education and Social Policy section of this catalog. Application should be made with the Office of Student Affairs in the School of Education and Social Policy.

### Other Undergraduate Programs

Students in CAS may enroll in courses offered by the interschool Undergraduate Leadership Program as well as those offered by several other interschool programs administered by the college, including the Center for the Writing Arts, the Integrated Arts minor, and the International Studies adjunct major (see the Other Undergraduate Programs section of this catalog).

### Study Abroad

CAS students may study abroad, both in programs that are affiliated with Northwestern and those that are not. Prior approval is required in order to receive credit for any study abroad other than the summer programs in Mexico and Quebec operated by the Committee on Institutional Cooperation (consisting of the 11 Big Ten universities and the University of Chicago). Students who have studied abroad must return and be enrolled as full-time students in CAS for at least as many quarters as were spent abroad, even if all other requirements for graduation had been satisfied at an earlier time.

The philosophy of the college is that the best foreign study experiences combine strong academic programs with a significant opportunity for immersion in the culture of the host country. For that reason, CAS strongly encourages students who study abroad to do so for a full academic year. Complete information on study abroad is available from the University's Office of Study Abroad.

## General Studies

These interdivisional courses are open to all qualified students.

**401-B98-0 Student Organized Seminars** Students who desire to study topics in arts and sciences that are not covered in the college's course offerings may initiate their own courses under the supervision of sponsoring faculty members. Enrollment in these seminar courses is limited to 20 students. The student organizer or organizers must, in consultation with the faculty sponsor, prepare a plan for the seminar and submit it to the associate dean for undergraduate studies before the middle of the quarter preceding the quarter in which the seminar is held. The plan must include a topic description, a reading list, specification of the work that will be graded (such as term papers and written examinations), prerequisites, and the meeting schedule. The associate dean for undergraduate studies forwards proposals to the Curricular Review Committee of the college, which must review and approve all seminars to be offered. Students may enroll in only one Student Organized Seminar per quarter, and enrollment must be on the P/N basis. CAS students interested in organizing a seminar should consult the associate dean for undergraduate studies for further details.

**401-C50-0 Foreign Study** Registration for students participating in a Northwestern-affiliated foreign study program in England, France, Germany, Israel, Italy, Japan, the People's Republic of China, or Russia. Four units of P/N credit each term.

**401-C51-0 Foreign Study in Seville** Registration for the Northwestern/University of Seville Junior Year Program in Spain. Four units of P/N credit each term.

**401-C93-0 Chicago Field Studies Internship** (4 units) Full-time participant-observer experience in Chicago-area political, planning, and policy organizations; service, civic, and community institutions; groups committed to social change. Placement of students in responsible volunteer

positions; "real world" mode of inquiry complementing conventional campus-based and outside-observer approaches to understanding urban processes. Number of credits applicable toward the major, if any, determined by student's department. Prerequisite: consent of program director.

## African American Studies

The study of the African American experience has a very long and distinguished history in the United States. The field has developed exciting insights as well as firm intellectual and empirical foundations for the systematic study of the African American experience and, through such study, for a greater understanding of the larger American experience. From its beginnings, the field has been strongly interdisciplinary, bringing the perspectives of different disciplines to bear on understanding black life. The Department of African American Studies exemplifies these traditions and strengths, and through its courses provides students the opportunity to explore the richness and diversity of the African American experience in a meaningful and coherent way.

The primary focus of courses in the department is on blacks in the United States. At the same time, because of the scope and importance of the African diaspora throughout the New World, serious attention is also given to peoples of African descent in the Caribbean and in Latin America. Many courses in the department compare the black experience in one part of the New World with that in another as well as with that of other racial minorities in the New World. This broad study of the African American experience is one of the key features of the department, one that distinguishes it from similar departments in other institutions. Other major themes in the department's curriculum include the nature of colonization and its impact on the colonizer and on the colonized; racism and its effects on society as well as on scholarship; the importance of oral language, history, and tradition in the African American experience; the roots and development of African American music, literature, and religious styles; and analysis of key institutions such as the family.

African American studies provides good preparation for graduate work in the social sciences, the humanities, and the professions as well as for jobs and careers in a variety of fields. Education, law, journalism, urban planning, health-care delivery and administration, business, social work, and politics are only a few of the fields for which African American studies provides an excellent background. In addition, since considerable attention is being paid by scholars and political leaders to the Caribbean and Latin America as well as to blacks and other minorities in the United States, students of African American studies will enter a field that touches on issues of far-reaching national and international significance.

### Major in African American Studies

**Departmental courses**

***Core courses:*** B10-1, 2, B25, B36-1, 2

***Concentration:*** in addition to the core sequence, five courses selected from one of the following areas:

- Social and behavioral studies: C20 and four other courses, one to include data handling and analysis
- Historical and comparative studies: B45, C32, and three other courses
- Cultural studies of the black experience: C49 and four other courses

***Senior sequence:*** two-quarter sequence taken in the senior year: C90 and either C96 or C99.

**Related courses:** subject to approval of the department adviser, majors must take five courses offered by other departments at the B or C level, at least three of which are at the C level. Students are expected to choose related courses that develop the methodological skills and substantive focus appropriate to their areas of concentration.

### Minor in African American Studies

The minor in African American studies gives students a thorough exposure to contemporary scholarship concerning the African American experience.

**Minor course requirements (8 units)**

- Two foundation courses chosen from B10-1, 2, B25, B36-1, 2, B40
- Six additional courses in the department or approved by the department, four at the C level and one a history course chosen from B14-1, 2, C26, C32; History C01-1,2 or another approved history course

### Core Courses

**404-B10-1,2 Survey of African American Literature** Two-quarter sequence on the literature of blacks from slavery to freedom. Works of major writers and significant but unsung bards of the past.

**404-B25-0 African American Culture** Principal facets of African American culture, slavery to the present. Interconnections between African American culture and the sociopolitical context in which it developed. Role of African American culture in the larger American culture.

**404-B36-1,2 Introduction to African American Studies** **1.** Method, historical overview (Africa, slavery, rural, urban), social class, racism. **2.** Institutional development of politics, church, education, culture, women/family; historical and contemporary liberation struggle.

### Social and Behavioral Studies

**404-B30-0 The Civil Rights Movement** Interdisciplinary analysis of the civil rights movement, focusing on the period between the end of World War II and 1966. Opposition to the movement, competition among movement

organizations, radicalization, and the movement as a problem in historiography.

**225-C13-0 Development of African American Children and Families:Research and Social Policy** See Human Development and Social Policy in the School of Education and Social Policy section of this catalog.

**404-C15-0 Urban Education** Problems of urban education; special attention to prospects for reforming urban school systems.

**404-C20-0 The Social Meaning of Race** Race as a social concept and recurrent cause of differentiation in multiracial societies. Impact of race on social, cultural, economic, and political institutions. Discussion of prejudice, racism, and discrimination.

**471-C24-0 Social Structure in African American Communities** See Sociology.

**449-C27-0 Black American Politics in the United States** See Political Science.

## Historical and Comparative Studies

**404-B14-1,2 History of Racial Minorities in North America** Problems and experiences of racial minorities: blacks, Native Americans, Asian Americans, and Hispanic Americans. Comparative exploration of their relationships to each other and to the majority society. **1.** 1600–1865. **2.** 1865–1974.

**404-B45-0 Black Communities in Diaspora** Comparative exploration of social and cultural life in communities of African slaves and their descendants in the Caribbean, Latin America, Asia, and the United States. Common heritage and diverse developments.

**427-C01-1,2 Survey of African American History** See History.

**417-C21-0 African American Economic History** See Economics.

**404-C26-0 Making of the Caribbean Peoples** Destruction of Indian peoples and their culture. Era of slavery and slave trade. The colonizer and colonized. Plantation system, emancipation, church and state. Slave rebellions, era of independence.

**404-C32-0 Issues in African American Historiography** Research seminar. Use of primary and secondary sources for design and execution of a research project. Prerequisites: consent of instructor and B36-1,2 or two courses in American history.

## Cultural Studies of the Black Experience

**404-B40-0 Survey of African American Music** Development of black American music from Africa to the Americas. Secular and sacred works, styles, performance practices. Blues forms, jazz, ragtime, musicals, black composers, black-derived music of Latin America.

**404-B59-0 Introduction to African American Drama** Thematic and historical survey of African American drama. Sociopolitical context, thematic issues and styles, the aesthetic reflected in the work, impact on African American and general theater audiences.

**404-C38-0 Dostoevsky's Way** Impact of Dostoevsky's *Notes from the Underground* and *Crime and Punishment* on Wright's *Native Son,* Ellison's *Invisible Man,* and Faulkner's *Light in August.*

**404-C44-0 Black Presence in Faulkner** Centrality of black culture to the themes of violence, rites of passage, tradition, guilt, and the family in Faulkner's *The Sound and the Fury, Light in August, Absalom, Absalom!* and *Go Down, Moses.*

**404-C49-0 Black Families in Literature** Starting with James Baldwin's novel *Go Tell It on the Mountain* (1953), much of the most significant literature written by black American authors has had at its center a deep concern for the problems of family life, particular and even peculiar to African Americans living under the duress of racism.

**404-C60-0 The Art ofToni Morrison** Investigates all the published novels by Toni Morrison: *The Bluest Eye, Sula, Song of Solomon, Tar Baby,* and *Beloved.* The mythical powers of Morrison's art, her ability to haunt the reader's imagination with some of the most memorable characters in modern literature, and her evocative way of storytelling.

**404-C78-0 The Harlem Renaissance** African American political and social movements and cultural production in theater, music, visual arts, and literature from 1915 to 1930. Prerequisites: consent of instructor and B10-1,2 or another African American literature course.

**404-C79-0 African American Women Playwrights** Texts written from approximately 1916 to the present. Recuperation of biographical information, theatrical representations of the "folk" and of black feminism, anti-lynch and other propaganda plays, and development of analytical tools. Prerequisites: consent of instructor and B59 and/or other African American literature courses.

**404-C80-0 Topics in African American Studies** Advanced work on social, cultural, or historical topics: for example, images of black women in the diaspora, urban revolts of the 1960s, black feminist theory. May be repeated for credit with different topic.

## Courses for Advanced and Senior Students

**404-C90-0 Research Seminar in African American Studies** Methods of researching the African American experience. Identification of research problems; location, selection, and critique of relevant literature; data gathering and analysis; report writing. Topics vary.

**404-C96-0 Internship in African American Studies** Direct participation in the regular activities of a community organization in Evanston or Chicago. Analysis of

social and cultural institutions through field study and participant observation.

**404-C99-0 Independent Study** Open to advanced students with consent of the department.

## African and Asian Languages Program

The Program of African and Asian Languages (PAAL) offers an opportunity to explore through language study some of the fascinating cultures that are most vital for Americans to understand: those of Africa, China, Japan, Korea, and the Middle East. Students who combine study of one of PAAL's African or Asian languages with a major or strong background in such departments as history, economics, political science, or sociology will be well prepared for graduate and professional programs and a future career in international business, journalism, trade, law, or diplomacy. Even in the natural sciences there are now exchange programs in which knowledge of one of the non-Western languages is useful.

PAAL offers courses in Arabic, Chinese, Hebrew, Japanese, Korean, and Swahili. Other African languages can be made available. Any PAAL language can be taken to fulfill the CAS requirement of two years of foreign language study.

For programs in African and Asian studies of which the language offerings of PAAL are an integral part, see African studies, Asian studies, and Jewish studies. Opportunities for study abroad are available.

Undergraduates may take advanced language study through C99 registration. Work in the language laboratory is an integral part of some of the following courses.

### African Language Courses

**433-A05-1,2,3 Elementary Arabic** Three-course introduction to modern standard Arabic. Speaking, reading, and listening comprehension skills developed.

**433-A06-1,2,3 Intermediate Arabic** Grammar, reading of Arabic texts, oral communication in Arabic. Prerequisite: A05-3 or equivalent.

**433-B07-1,2,3 High Intermediate Arabic** Reading and discussion of Arabic writings relevant to students' interests and needs. Emphasis on writing skills. Prerequisite: A06-3 or equivalent.

**433-A21-1,2,3 Swahili I** Basic literacy and interactive proficiency, in cultural and historical context.

**433-A22-1,2,3 Swahili II** Development of literacy and interactive proficiency skills; introduction to verbal arts. In Swahili. Prerequisite: A21-3 or equivalent.

**433-B23-1,2,3 Introduction to Swahili Literature** Overview of Swahili oral verbal arts, classical literature, modern writing. In Swahili. Need not be taken in sequence. Prerequisite: A22-3 or equivalent.

**433-C99-0 Independent Study** For undergraduate students of any of the above languages who have advanced beyond the regular course offerings.

### Asian Language Courses

**433-A11-1,2,3 Elementary Chinese** Speaking, aural comprehension, reading, writing of basic vernacular Chinese. Both standard and simplified characters involving about 1,500 compounds. Accelerated section available for students with some oral proficiency but no literacy.

**433-A12-1,2,3 Intermediate Chinese** Conversation, aural comprehension, writing based on reading Chinese stories, poems, ballets, historical and cultural texts. Accelerated section available for students with some oral proficiency but no literacy. Prerequisite: A11-3 or equivalent.

**433-B13-1,2,3 Advanced Chinese** Readings from the works of contemporary Chinese writers. Discussion and writing based on the reading materials. Prerequisite: A12-3 or equivalent.

**433-A01-1,2,3 Elementary Hebrew** Understanding, speaking, reading, writing of mainly conversational Hebrew. Hebrew used as language of instruction. Drill in language laboratory.

**433-A02-1,2,3 Intermediate Hebrew** From language to literature: review of grammar; reading and discussing Hebrew literary works (prose and poetry) and newspaper articles. Compositions and oral presentations. Prerequisite: A01-3 or equivalent.

**433-B03-1,2 Advanced Hebrew** Reading Hebrew literature, some Biblical but mostly modern prose. Compositions and oral presentations. Prerequisite: A02-3 or equivalent.

**433-A15-1,2,3 Japanese I** Conversation, grammar, reading, writing for beginners. Issues of U.S.-Japan cross-cultural communication. Five class meetings a week plus language laboratory.

**433-A16-1,2,3 Japanese II** A comprehensive approach to conversation, grammar, reading, writing. Four class meetings a week. Prerequisite: A15-3 or equivalent.

**433-B17-1,2,3 Intermediate Japanese** Advanced readings in modern colloquial Japanese; prose essay, literary, and newspaper styles. Prerequisite: A16-3 or equivalent.

**433-C18-1,2,3 Advanced Japanese 1.** Advanced reading skills: comprehension, vocabulary acquisition, speed. Oral and written translation. **2.** Newspaper reading and developing oral/aural skills. **3.** Advanced writing skills, further reading, and oral/aural skill development. Prerequisite: B17-3 or equivalent.

**433-A25-1,2,3 Korean I** Three-course introduction to basic literacy and oral proficiency in Korean.

**433-A26-1,2,3 Korean II** Development of literacy and interactive proficiency skills. In Korean. Prerequisite: A25-3 or equivalent.

**433-C99-0 Independent Study** For undergraduate students of any of the above languages who have advanced beyond the regular course offerings.

## African Studies Program

In 1948, the distinguished scholar Melville J. Herskovits organized the Program of African Studies at Northwestern; a half-century later, the program remains a model at the forefront of Africanist study and research. Through sponsorship of multidisciplinary courses with African content, language training, and promotion of Africa-based study, the program supports and enlivens the undergraduate study of Africa while serving as the University's "headquarters" for formal and informal interaction among interested students, faculty, and visitors. Every year the program brings undergraduates studying Africa together with faculty and other experts in many areas of inquiry—across disciplinary boundaries and regional specializations—for lectures, seminars, workshops, conferences, and research programs. Northwestern's Melville J. Herskovits Library of African Studies, an unparalleled resource for Africanist study, attracts students and scholars from all over the world. Over the years, the program has remained in active contact with its counterparts in Africa and elsewhere, while expanding its role in the University and off-campus communities.

### Minor in African Studies

The minor in African studies approaches the study of African societies, cultures, histories, and arts across the disciplines—in the humanities, social sciences, and the professions. Students earning a bachelor's degree in CAS or another undergraduate school may complete a minor in African studies by merging a core of courses with African content with their major program of study. Undergraduates in all disciplines are welcome to participate formally or informally in the program's activities, which advance the training of Africa specialists at Northwestern and promote awareness of Africa in a wider context.

**Minor course requirements (6 units)**

- Six courses with African content from at least two departments. At least two of the six courses must be from the three-quarter sequence of History B55-1,2,3. Students are encouraged to develop a full-length research paper on an African topic, supervised by faculty with African interests. They may write this paper as part of a regularly offered class, an independent study course, or a senior honors program.
- Demonstrated competence in any African language or a European language other than English that is used in Africa (French or Portuguese) by completing the second year of language study or being certified by the appropriate language department. Professional school students whose curricula preclude meeting this requirement as well as students with proficiency in another CAS language may petition the program to count additional courses with African content toward the minor in lieu of fulfilling the language requirement as stipulated.
- Minimum of an overall B average in these courses. Courses taken for P/N are not counted toward the minor.

Students applying for the minor in African studies, conferred at the end of each spring quarter, must present records showing a minimum of five courses not double-counted in their major. Program staff encourage students to meet with them to initiate and monitor progress toward meeting the requirements.

## American Studies Program

The American Studies Program is an integrated interdisciplinary major involving faculty members from several departments. By drawing on a broad range of knowledge from the humanities and social sciences, the program examines the components of American culture and ways of integrating them. Students are allowed a wide-ranging yet disciplined exploration of problems that cross the boundaries of traditional academic fields. Freshmen and sophomores apply for admission to the major in the spring quarter. Because this selective program has more applicants than available space, admission depends in part on academic distinction and on demonstrated interest in American cultural studies.

### Major in American Studies

**Program courses:** all sophomore and junior majors must complete C01-1,2,3. Seniors must complete C90-1,2,3.

**Related courses:** 10 quarters at the B and C levels in those courses throughout the college comprising the general curriculum in American studies. These courses will be apportioned in a way that satisfies the interdisciplinary purpose of a major in American studies and expresses each student's explicit intellectual goals, but every major is normally expected to take History B10-1,2 or an approved equivalent as early as possible in his or her academic career.

### Courses Primarily for Freshmen and Sophomores

**418-B10-0 Topics in American Culture** Topics of interest to the American cultural analyst and historian: for example, early American symbols of heroism, the meaning of the frontier. Aimed at large general undergraduate enrollment. May be repeated for credit with consent of program director.

**418-B15-1,2 Humanistic Dimensions of Technological Change** Technological change in America, 1830–1920, and imaginative responses to this change. **1.** General survey. **2.** A significant aspect of American life (e.g., work) in relation to technological change. Prerequisite for B15-2: B15-1 or consent of instructor.

### Courses Primarily for Juniors and Seniors

**418-C01-1,2,3 Seminar for Majors** Yearlong sequences sharing a broad theme, integrating methods and materials from different disciplines. Change of instructor each quarter; change of theme every year. Limited to 20 students—majors only.

**418-C10-0 Studies in American Culture** Readings and discussions of topics in American cultural life: for example, law in 19th-century America; manners and morals in antebellum society. Limited enrollment with emphasis on student participation. Prerequisites vary (check with program director or in program office). May be repeated for credit with consent of program director.

**418-C90-1,2,3 Senior Project** Thesis, field study, or work of creative art. Required for honors.

**418-C99-0 Independent Study** Readings and conferences on special subjects for students pursuing their area of interest within the major.

## Anthropology

Anthropology studies humankind from a broad comparative and historical perspective: the biological evolution of the human species and aspects of the biology of living human populations, the comparative study of living primates, the origins of languages and cultures, the long-term development of human cultures over many millennia, and the social life of humans in groups—families, communities, and nations. Anthropologists attempt to describe specific cultural traditions, forms of social structures, languages, and specific transitions in human evolution and cultural history. They compare cultures and societies to assess what cultures are similar or different and why. Anthropology is at once a biological science, a social science, and one of the humanities.

Anthropology's breadth and its emphasis on biological and cultural change and cross-cultural comparison make it an ideal major for anyone seeking a solid liberal education as well as for those seeking careers in academic or applied anthropology or archaeology. It serves as an excellent background for students who plan to pursue specialized training in law, medicine, nursing, social work, education, conservation, international relations, or commerce. The world is an ever-smaller and more culturally mixed global community. Knowledge of the developmental processes that explain biological and cultural differences is relevant to a variety of careers. For example, prelaw students would profit from the cross-cultural study of conflict and conflict resolution; premedical students from courses in human evolution and population genetics as well as the cross-cultural study of health and disease.

The department has many strengths: (1) the application of evolutionary and other biological perspectives to the development of humankind; (2) North American, South American, Middle Eastern, and European prehistoric archaeology; (3) the study of African societies; (4) the anthropology of complex societies; (5) political economy; and (6) gender. The department is strong in basic theory and refinements of qualitative and quantitative (mathematical) analysis of anthropological data as well as ethnography. Two field schools, in archaeology and in cultural anthropology, provide practical proving grounds for classroom theorizing. All majors receive training and supervision in field research from our faculty.

### Major in Anthropology

Students are expected to complete a 16-course program (12 courses in anthropology and 4 in related fields) for a major in anthropology. The department's four required B-level courses provide background in the four major subfields of anthropology. C70 examines the philosophical and historical roots of the discipline. C62-1 and C88 introduce students to research design issues. Four additional C-level courses develop the student's intellectual maturity in the discipline. All seniors are required to take C98 and to prepare a senior thesis. This requirement provides students with an opportunity to conduct original research and, in the process, gain valuable analytic, critical thinking, and writing skills.

**Departmental courses**

- B11, B13, B14, and B15. Students with previous background in anthropology may petition to substitute a C-level course for a B-level requirement.
- C62-1 and C88. In the case of archaeology and cultural/linguistic students, an additional course in subfield methods is required (see C-level requirements below).
- C70
- Four additional C-level courses. These courses should be selected in consultation with an adviser. Normally, these courses are chosen from one of the three subfields listed below, but students may, after consultation with and consent of their adviser, develop a focus that bridges the subfields of anthropology (e.g., culture and technology, medical anthropology, the institutionalization of power).
  *Archaeology:* C22 *or* C25 and three courses chosen from C01, C02, C11, C21 (offered in summer), C29, C81, C84, C85, C90, C96 (offered in summer)
  *Biological anthropology:* four courses chosen from C06, C10, C12, C13, C17, C90
  *Cultural/linguistic anthropology:* C89 and three courses chosen from C10, C11, C20, C30, C32, C41, C47, C50, C54, C60, C76, C77, C83, C90, C92, C95
- C98 (senior year)

**Related courses:** subject to the approval of the department adviser, four courses—including at least two C-level courses—from other departments and programs. These courses should relate to the student's independent research work and strengthen the focus that guided the selection of C-level courses in anthropology.

## Minor in Anthropology

The minor in anthropology provides students in other fields with a framework to pursue a particular focus within the discipline. Such a focus might be within one of the subfields of anthropology (i.e., biological anthropology, archaeology, cultural anthropology, linguistic anthropology), in area studies (e.g., Africa, the Middle East, the United States), or in a specific topic (e.g., ethnicity, gender, the origins of the state, urban studies). To fulfill this goal, the minor in anthropology combines two of the four B-level courses required of majors in anthropology, one in the area of ethnography (B11 or B15) and one in the area of origins (B13 or B14) with five C-level courses that constitute a coherent focus. The B-level courses provide a foundation for pursuit of specialized topics.

Students pursuing the minor in anthropology must consult with the department's director of undergraduate studies to establish a program and be assigned a departmental adviser.

**Minor course requirements (7 units)**

- B11 *or* B15
- B13 *or* B14
- A coherent combination of five C-level courses in anthropology with a specific focus. Depending on the focus selected, a methods course may be required as one of the five C-level courses.

**Sample programs:** Students majoring in biological sciences but with an interest in ecology and behavior would build a coherent minor in biological anthropology by taking B11 or B15, B13, and a focused course selection such as C06, C10, C12, C13, and C83. Students majoring in history with an interest in pre- and early history would build a coherent minor in archaeology by taking B11 or B15, B14, and a focused course selection such as C01, C02, C22, C29, and C81. Students majoring in political science with an interest in noninstitutional or nongovernmental political processes would build a coherent minor in cultural anthropology by taking B13 or B14, B11, and a focused course selection such as C11, C20, C32, C41, and C47. Other programs for the minor in anthropology can be designed to meet a student's particular needs or interests.

*Note:* Students who are following the previous department curriculum should consult with the director of undergraduate studies.

## Four-Year BA/MA

The department offers a four-year BA/MA program in anthropology for outstanding undergraduate majors. Interested students should contact their adviser or the director of undergraduate studies and should see Four-Year Master's Programs in the Undergraduate Education section of this catalog.

## Honors in Anthropology

Students wishing to be considered for departmental honors should make inquiries no later than spring quarter of the junior year. In order to be eligible for honors, students must have a grade point average of 3.5 or above in anthropology courses. Enrollment is required in one quarter of C99 or an appropriate graduate-level course in addition to C98 (required for all majors). C99 should be taken before enrolling in C98. Students who meet these requirements and prepare an outstanding senior thesis will be awarded honors in anthropology. For more information, consult the director of undergraduate studies. See Honors under Academic Policies earlier in this section of the catalog.

## Courses Primarily for Freshmen and Sophomores

**403-A05-0 Fundamentals of Anthropology** Introduction to anthropology; the biological evolution of humankind; the evolution of culture; and the comparative study of existing or historically recorded societies.

**403-A12-0 New Directions in Archaeology** New frontiers in archaeological perspectives of historical events, public policy, historic preservation, and prehistoric interpretation.

**403-B11-0 Culture and Society** Introduction to the comparative study of culture, exploring different types of social organization, their evolutionary significance, and their economic and political correlates.

**403-B13-0 Human Origins** Emergence of human species through the process of organic evolution, emphasizing genetics, the fossil record, comparison with our nearest living relatives.

**403-B14-0 Culture Origins** The evolution of culture from its earliest beginnings through the development of urbanism and the state. Principles of archaeological research.

**403-B15-0 The Study of Culture through Language** The scope of linguistic anthropology, from the study of language as an end in itself to the investigation of cultures through the medium of human languages.

**403-B20-0 Evolution of Moral Systems** Critical examination of evolutionary theories of the origin and development of the human propensity to make moral judgments.

**403-B32-0 Myth and Symbolism** Introduction to different approaches to the interpretation of myth and symbolism, e.g., Freudian, functionalist, and structuralist.

## Courses Primarily for Juniors and Seniors

For C-level courses in anthropology, the prerequisite is sophomore or higher standing or one A- or B-level course unless a specific prerequisite is included in the description below. A student without the prerequisite occasionally

may be admitted to a course with the consent of the instructor.

**403-C01-0 Hunter-Gatherer Archaeology** Evolution and cultural history during the Pleistocene epoch. Interrelationship of biology, environment, and culture from earliest hominids through appearance of *Homo sapiens.* Prerequisite: B14 or equivalent.

**403-C02-0 Origins of Civilization** Comparative survey of prehistoric civilizations and systematic examination of the formative factors in their evolution. Prerequisite: B14 or equivalent.

**403-C06-0 Evolution of Life Histories** Strategies evolved by species for allocating metabolic resources between growth and reproduction, including gestation length, litter size, age at first reproduction, longevity.

**403-C10-0 Evolution and Culture** Introduction to the application of theory from evolutionary biology to cultural anthropology; principles of evolutionary biology; application of principles to human social behavior and culture. Prerequisite: B13 or equivalent.

**403-C11-0 The Indians of North America** Aboriginal cultures of northern Mexico, continental United States, Alaska, and Canada. Languages, art, and social, economic, and religious life.

**403-C12-0 Human Genetics** Introduction to quantitative approaches. Chromosomal variation, segregation analysis, genetics of disease, population genetics, and polygenic inheritance with applications to morphology, behavior, and disease. Prerequisites: B13; Biology B10.

**403-C13-0 Anthropological Population Genetics** Principles of population genetics applied to primates. Mathematical models, analyses of small populations, and interaction of social and genetic processes. Prerequisites: Mathematics A13 or equivalent, C12, or consent of instructor.

**403-C17-0 Human Evolution** Fossil record and reconstruction of phylogeny, morphological and behavioral adaptation of early hominids and forebears.

**403-C19-0 Theoretical Approaches in Archaeology** Introduction to theoretical approaches in archaeology; explanation of major cultural processes and events. Prerequisite: B14 or equivalent.

**403-C20-0 Peoples of Africa** A survey of the cultures of Africa and the significant similarities and differences among the indigenous societies of the continent. Prerequisite: B11.

**403-C21-0 Archaeological Field Methods** Practical training in basic methods and techniques at an excavation site; given with Summer Archaeology Field School.

**403-C22-0 Introductory Archaeological Methods** Quantitative and numerical approaches to the description and analysis of patterns in archaeological data, including typology, sequence ordering, and attribute analysis. Prerequisite: C01 or C02 or equivalent.

**403-C25-0 Archaeological Methods Laboratory** Analysis of archaeological methods (faunal, botanical, artifact, or soil analysis) with various techniques. May be repeated for credit.

**403-C29-0 Near Eastern Prehistory** The Levant and Mesopotamia, 9000–2400 B.C., from first domestication of plants and animals to earliest village communities and urban civilization in Mesopotamia. Prerequisite: B14 or equivalent.

**403-C30-0 Peoples of the World** Comparative ethnography of a regionally or historically associated group of cultures or a type of community defined in ecological, ideological, or other terms. May be repeated for credit.

**403-C32-0 Strategies of Marriage and Reproduction** Marriage and reproduction throughout the world, particularly the developing world and Africa. Conjugal strategies, fertility, contraception.

**403-C41-0 Economic Anthropology** Economic organization in small-scale, nonindustrialized communities. Traditional structures of primitive and peasant economies.

**403-C47-0 Political Anthropology** Cross-cultural study of political organization in stateless and state societies. The state, its origin, and changing role in developing countries.

**403-C50-0 Anthropology of Religion** The human relationship with the supernatural and action patterns accompanying beliefs. Comparison of nonliterate religions and historical religions.

**403-C54-0 Gender and Anthropology** Cross-cultural survey of women's roles from three perspectives; biosocial, sociocultural, politicoeconomic. Theory of gender inequality; emphasis on the third world.

**403-C60-0 Language and Culture** Relationship between language and culture; language as the vehicle of culture and as the manifestation of thought.

**403-C62-1,2,3 Quantitative Methods of Analysis 1, 2.** A broad range of classical statistical methods, univariate and multivariate, currently being applied to anthropological data. **3.** Recently developed distribution-free techniques, e.g., multidimensional scaling, entailment analysis. Prerequisite: graduate standing or consent of instructor.

**403-C70-0 Anthropology in Historical Perspective** Major schools of thought in social, archaeological, and biological anthropology over the last century. Prerequisite: B-level course in anthropology or consent of instructor.

**403-C76-0 Socialization** Cross-cultural study of the intergenerational transmission of culture; processes by which social groups pass on social tradition and behavior to succeeding generations. Prerequisite: B11, introductory psychology, or consent of instructor.

**403-C77-0 Psychological Anthropology** Contemporary approaches to cross-cultural behavior: ecocultural aspects of behavior development through maturation and socialization in human and nonhuman primates. Prerequisite: introductory survey courses in psychology or anthropology or consent of instructor.

**403-C81-0 North American Prehistory** Intensive study of cultural history of one or more areas of the continent from archaeological evidence.

**403-C83-0 Ecological Anthropology** Theory of interactions between organisms and their environments, with application to human populations.

**403-C84-0 Introduction to Zooarchaeology** Introduction to the study of animal bones from archaeological sites. Identification, sampling, quantification, hunting economies, domestication, and herding systems in complex societies. Prerequisites: B14, C01 or C02, or consent of instructor.

**403-C85-0 The Archaeology of State Societies** Origins and organization of prehistoric state societies. Comparison of political systems, elites, and regional economic organization in Old and New World. Prerequisite: C02 or equivalent.

**403-C88-0 Research Design** Introduction to fundamentals of research design; overview of major types of designs, data collection, and analysis strategies; managing and analyzing data from multiple sources. Prerequisite: C62-1 or consent of instructor.

**403-C89-0 Ethnographic Methods and Analysis** Descriptive, naturalistic study of the culture of human social groups. Data gathering through observation and interview. Data analysis for ethnographic reporting. Prerequisites: B11 and B15.

**403-C90-0 Topics in Anthropology** Advanced work in areas of developing interest and special significance. May be repeated for credit with different topic.

**403-C92-0 Urban Anthropology** Social and cultural context of urbanism. Contemporary problems of urban subcultures and rural-urban migration. Prerequisite: a basic social science course or consent of instructor.

**401-C93-0 Chicago Field Studies Internship** See General Studies.

**403-C95-0 Field Study in Anthropology** Ethnographic field experience in the United States (e.g., the Southwest) or abroad. Offered in conjunction with summer field schools for exceptional students. Prerequisite: consent of instructor.

**403-C96-0 Advanced Archaeological Field Methods** Complex excavation and survey procedures, topographic map-making, excavation drawing, soil description; offered in conjunction with the summer Archaeology Field School.

**403-C96-7 Junior Tutorial** Intensive work on a topic not normally offered.

**403-C98-0 Senior Seminar** Supervised group discussion of research in preparation of senior thesis. Required of all majors. Prerequisite: C88.

**403-C99-0 Independent Study** Open with consent of department to juniors and seniors who have completed with distinction at least two quarter-courses or equivalent in anthropology. Under direction of individual members of department.

### Related Courses in the School of Music

Musicology C23 Proseminar in Ethnomusicology
Musicology C26-1,2 Music of the World's Peoples

### Summer Field Schools

For additional information, contact the Department of Anthropology.

**Archaeology Field School:** Courses may include C21, C22, C25, and C96, some of which are also offered on the Evanston campus

**Ethnographic Field School in Cultural and Linguistic Anthropology:** C95

## Art History

Art history is the historical study, in the widest sense, of the production and use of architecture and the visual and decorative arts. It focuses on technical practices, aesthetic ideals, modes of pictorial representation, iconographies, changing economic conditions, and social functions within different cultures. The study of art history offers a firm factual and theoretical basis for further study of or work in various areas of cultural studies. It also offers sound training in writing and critical thinking for students who wish to pursue vocations both inside and outside the arts.

The department is particularly strong in the Western European tradition from prehistoric times to the present day. Interested undergraduates can choose from a wide range of courses that include surveys of Western and non-Western art as well as more specialized surveys and "special topics" courses in a variety of fields. An active program of extracurricular seminars, lectures, and field trips supplements the formal program of study.

Many undergraduate majors profit from participation in a Northwestern-affiliated study abroad program, thereby obtaining firsthand experience with another culture and its art. Upper-division undergraduate majors also are encouraged to supplement their regular programs by taking a museum studies course in preparation for an internship with a local museum or gallery. An undergraduate seminar (content varies) offered on a regular basis provides majors with an opportunity to study a specific topic in depth in a discussion format.

## Major in Art History

**Departmental courses**

- B10; B30 *or* B40; B20 *or* B50
- Nine C-level quarter-courses in art history (Classics C58 and C59 may also be counted). Students are expected to pursue a variety of approaches to the material of art history and to explore a diversity of the cultures and time periods covered by the department: ancient, medieval, Renaissance and baroque, modern, and non-Western art. The remaining C-level courses are to be chosen at students' discretion in consultation with the undergraduate adviser. Study abroad work approved by the director of undergraduate studies may be substituted for some departmental courses.

**Related courses:** Six B- and C-level related quarter-courses, of which at least one must be a studio course in art and the remainder chosen from one or more of the following departments and programs with the approval of the adviser: anthropology, art theory and practice, classics, comparative literary studies, English, European thought and culture, French and Italian, German, Hispanic studies, history, history of film, musicology, philosophy, religion, Slavic languages and literatures, and women's studies.

Sequence courses do not need to be taken in order; special topics courses may be repeated for credit with a change in topic.

## Minor in Art History

The minor in art history offers students a broad and systematic introduction to the interpretation and analysis of the visual arts. The introductory course focuses on conceptual approaches and the social context of art making. B-level courses are required in one of the two non-Western areas, Africa and Asia, and in one of the two arenas of Western art, America and Europe. Students must take three C-level courses approved by the director of undergraduate studies that reflect different approaches and periods represented in the department, at least one of which should be in a field other than modern art (19th and 20th centuries). The electives permit students to explore in greater detail some specific part of the general field.

**Minor course requirements (8 units)**

- B10; B20 *or* B40; B30 *or* B50
- Three C-level courses approved by the director of undergraduate studies
- Two art history electives, no more than one at the B level

## Four-Year BA/MA

The department offers a four-year BA/MA program in art history by invitation to outstanding undergraduate majors. Interested students should contact their adviser or department chair and should see Four-Year Master's Programs in the Undergraduate Education section of this catalog.

## Honors in Art History

Students may be nominated for honors in art history after completing the following prerequisites: successful completion of seminar work involving a research paper; a distinguished record in the major, normally a grade point average of 3.5 or above; and completion of a senior honors project, normally a senior thesis prepared in one or more quarters of C99 and presented to the departmental honors committee at the end of April of the senior year. For more information, consult the director of undergraduate studies. See Honors under Academic Policies earlier in this section of the catalog.

## Courses Primarily for Freshmen and Sophomores

**405-B10-0 Introduction to Visual Culture** Artworks in many media from varied cultures and time periods provide a range of conceptual, visual, and verbal skills essential to the description and analysis of visual forms.

**405-B20-0 Introduction to African Art** Thematic and historical survey of the major periods of art making in Africa; analysis of a few exemplary works.

**405-B30-0 Introduction to American Art** Arts and architecture of the Americas from their first emergence in the pre-Columbian period through the conquest and the 19th century to today.

**405-B40-0 Introduction to Asian Art** Primarily art of India, China, and Japan; selected major themes from early devotional imagery in India and the transfer of Indic religions to East Asia to European colonialism and its relationship to the study of Asia.

**405-B50-0 Introduction to European Art** Leading centers and artists of Europe from ancient Greece to the 20th century. Architecture, sculpture, painting, and graphic arts in relation to their social and cultural settings.

## Courses Primarily for Juniors and Seniors

**405-C10-1,2 Ancient Art** Painting, sculpture, architecture, and allied arts in the ancient world. **1.** Ancient Egypt and the ancient Near East. **2.** Greek art and architecture beginning with Minoan art and ending with art in the 5th century B.C.

**405-C19-0 Special Topics in Ancient Art** Content varies: for example, prehistoric art of Europe, including cave painting and megalithic construction; structuralist and other approaches to anthropological arts; text and image in the ancient world.

**405-C20-1,2 Medieval Art** Art and architecture in Europe during the Middle Ages. **1.** Early Christian and Byzantine. **2.** Carolingian and Romanesque.

**405-C29-0 Special Topics in Medieval Art** Content varies: for example, history of illuminated manuscripts.

**405-C30-1,2,3 Renaissance Art** Painting, sculpture, and allied arts in Europe from the late Middle Ages through the 16th century. **1.** The monastic style in Italy through the 15th century. **2.** The 16th century in Italy. **3.** France, the Netherlands, and Germany from the 14th to the 16th centuries.

**405-C39-0 Special Topics in Renaissance Art** Content varies (see also listings under C49): for example, the art of Hieronymus Bosch and Pieter Brueghel; the graphic arts in northern Europe from the 15th to the 17th centuries.

**405-C49-0 Special Topics in Baroque Art** Content varies (see also listings under C39): for example, French art of the 16th and 17th centuries.

**405-C50-1,2 19th-Century Art** A survey of European painting and sculpture from the late 18th through the end of the 19th centuries. **1.** Late 18th century to 1848. **2.** 1848–1900.

**405-C59-0 Special Topics in 19th-Century Art** Content varies: for example, the art of Georges Seurat.

**405-C60-1,2 20th-Century Art** The artist and the environment: a survey of European painting, sculpture, architecture, and design from the 1890s to the 1960s. **1.** Symbolism to constructivism. **2.** Berlin dada to the situationist international.

**405-C65-0 American Art** A survey of the visual arts in the United States from the 17th century to the present.

**405-C67-0 Special Topics in American Art** Content varies: for example, nationalism and internationalism in American art; the myth of America; the artist in American society; elite and popular visual traditions.

**405-C68-0 Special Topics in Modern Art and Performance** Advanced interdisciplinary study of the interrelated histories of visual and performance arts in the 20th century. Content varies: for example, American painting and dance; postmodern art and performance from the Judson Church to Pina Bausch. Prerequisites: B-level courses in two of the following areas—integrated arts, art history, theater; consent of instructor.

**405-C69-0 Special Topics in 20th-Century Art** Content varies: for example, American art with a French accent; totalitarian art.

**405-C70-0 Modern Architecture** Development of architecture from 1800 to the present.

**405-C78-0 Architecture and Urbanism of the World City in the 20th Century** Critical examination of the modern city as a socioeconomic system everywhere reproducible in our increasingly unified world. How Western architectural and urban patterns are transformed and non-Western patterns confronted.

**405-C79-0 Special Topics in Modern Architecture** Content varies: for example, Chicago architecture, including the work of Sullivan and Wright; Beaux-Arts architecture in Europe and America; modernism in architecture; American architecture from Thomas Jefferson to Frank Lloyd Wright.

**405-C82-0 Visual Culture of the Tang and Song Dynasty China** Survey of Chinese painting from the 7th to 12th centuries, focusing on moments of transition in painting theory and practice.

**405-C84-0 African American Art** Art of the African-descended cultures of North and South America and the Caribbean; what this art owes to its European context and African origins.

**405-C86-0 Art of Africa** Thematic and historical survey of the arts and architecture of Africa from the ancient periods (Nubian Egypt) to the present.

**405-C89-0 Special Topics in Non-Western Art** Content varies: for example, art and architecture of the ancient Maya; African architecture.

### Courses Primarily for Art History Majors

**405-C90-0 Undergraduate Seminar: Theories and Problems of Art History** Content varies: for example, the methods of cultural history.

**405-C94-0 Senior Linkage Seminars** Content varies: for example, prints and drawings (at the Art Institute of Chicago); the museum and its public.

**405-C95-0 Museums** Museum studies seminars. Power, politics, ethics: history of museums, their ethical basis, community responsibilities, educational prerogatives, future directions.

**405-C96-0 Internship in the Arts** Direct participation in the regular activities of an established arts organization in Evanston and the Chicago area, under the supervision of a faculty member. By petition, on a limited basis; may be taken only once.

**405-C99-0 Independent Study** Special projects in art history, involving reading and conferences and culminating in a paper. Open only to qualified seniors with consent of instructor. Required for departmental honors.

### Related Courses in Other Departments

Art Theory and Practice C20 Media and Process in Art
Classics C58 Roman Architecture
Classics C59 Topography of Imperial Rome
Comparative Literary Studies C75 Literature and the Arts

## Art Theory and Practice

The study of art involves the development of skills and techniques plus the stimulation of critical awareness, understanding, and appreciation of the visual arts. Philosophical questions raised in both theory and studio courses help students integrate and enrich their lives and perceptions. Nonmajors and majors share the unique experience offered by this diverse range of courses. Suggested introduction: survey course B70 or B72.

## Major in Art Theory and Practice

The major in art theory and practice plans a program of study in consultation with and subject to the approval of a department adviser. Areas of concentration are painting, printmaking, and the teaching of art. Specific requirements in each area are listed below. Qualified students may petition a department committee for exemption from one or more prerequisites.

### *Practice of Art—Painting Concentration*

**Departmental courses**

***Introductory courses (6):*** A20; A24; A25; B70 *or* B72; any two courses chosen from Art History B10, B20, B30, B40, B50

***Major courses (8):*** B22 *or* C20; B25; B40 *or* B50-1 *or* B50-2; C22-1; C22-2; C25-1 *or* C25-2; C31 *or* C32 *or* C33; plus one course chosen from those listed below under Art Criticism and the Tradition of Art

**Related courses:** five quarter-courses at the B and C levels chosen from one or more of the following departments with the approval of the adviser: anthropology, art history, classics, comparative literary studies, English, French and Italian, German, Hispanic studies, history, music, philosophy, Slavic languages and literatures

### *Practice of Art—Printmaking Concentration*

**Departmental courses**

***Introductory courses (6):*** A20; A24; A25; B70 *or* B72; any two courses chosen from Art History B10, B20, B30, B40, B50

***Major courses (8):*** B22 *or* C20; B25; C25-1 *or* C25-2; C31; C32; C33; plus one B- or C-level art history elective and one course chosen from those listed below under Art Criticism and the Tradition of Art

**Related courses:** same as for Practice of Art—Painting

### *Teaching of Art Concentration*

CAS students pursuing a major in art who also wish to be certified for secondary teaching must be admitted to the Secondary Teaching Program in the School of Education and Social Policy (SESP) and complete all requirements as outlined in the SESP section of this catalog. Students are urged to contact the Office of Student Affairs in SESP as early as possible in their academic career.

## Honors in Art Theory and Practice

Outstanding students may qualify for departmental honors in their senior year by enrolling in two consecutive or interrelated C99 or D99 courses in which they complete an approved studio project and related essay under the supervision of department faculty. See Honors under Academic Policies earlier in this section of the catalog.

## Courses Primarily for Undergraduates

An asterisk (*) preceding the course number indicates a lecture course open to all upperclass students and requiring no art skills or background unless otherwise noted.

### *Painting and Drawing*

**406-A20-0 Basic Painting and Composition**
Introduction to watercolor, oil, or acrylic painting techniques. Includes surface preparation, color mixing, composition. Emphasis on still life.

**406-A24-0 Essentials of Design** Principles of visual composition. Color theory; fundamentals of line, shape, texture, and value. Pictorial illusion; symbolic and narrative form. No previous studio experience necessary.

**406-A25-0 Basic Drawing** Problems in line, tonal value, and space. Drawing techniques and application to perception and invention. Relation of drawing to experience. No previous studio experience necessary.

**406-B22-0 Intermediate Painting** Still-life and figure painting. Problems in composition and content. Exploration of techniques with oil or acrylic paint. Prerequisite: A20 or acceptable substitute.

**406-B25-0 Intermediate Drawing** Modes of describing form; survey of traditional methods. Various techniques include charcoal, crayon, and ink. Prerequisite: A20, A25, or acceptable substitute.

**406-C20-0 Media and Process in Art** Use of various media to show the relation between content and process in art. Workshop demonstrations include visiting artists.

**406-C22-1,2 Advanced Painting** Problems in form and meaning. Painting concepts and objectives with emphasis on originality and development of skills and perception. Oil or acrylic. Prerequisites: junior or senior standing, B22 or equivalent.

**406-C25-1,2 Advanced Drawing** Studies in light and space in drawing with emphasis on development of drawing disciplines in relation to figure drawing from life. Problems in form and style in drawing. Prerequisite: B25 or equivalent.

### *Printmaking*

**406-C31-0 Relief Printmaking** The design and production of prints from wood, linoleum, and plastic surfaces; also collograph and monoprint techniques.

**406-C32-0 Intaglio** Printmaking with etching, engraving, aquatint, mezzotint, and drypoint.

**406-C33-0 Lithography** Design and production of prints in basic lithographic processes.

### *Sculpture*

**406-B40-0 Sculpture in Traditional Materials** Form-making with water clay modeling and plaster casting. Figurative and abstract work.

**406-C40-0 Sculpture in Metal and Plastic** Contemporary methods of metal fabrication with stock materials. Welding, brazing, and instruction in the use of power tools.

**406-C42-0 Process Sculpture and Environmental Art** New sculptural activities, including earth art, conceptual sculpture, and environmental work. Variety of materials and approaches; collective and individual projects.

### *Photography*

**406-B50-1,2 Basic Photography 1.** Extensive darkroom instruction focusing on high-quality processing of black-and-white film prints. Aesthetic problems; mastering techniques; some history. **2.** Further exploration of techniques: zone system, different papers, developers, and archival processing. Historical trends through slide lectures.

**406-C50-0 Photography:History, Concepts,and Ideas** Stylistic trends of contemporary photographic imagery. Photography's position in relation to other art forms. Lectures, lab work, and class discussion.

### *Art Criticism and the Tradition of Art*

***406-B70-0 Introduction to the Understanding of Art** Nonchronological examination of Western art from all periods, emphasizing critical perception of artistic intent and cultural context. Lecture and discussion. Visits to exhibitions.

***406-B72-0 Introduction to the Understanding of 20th-Century Art** Intuitive and artist-oriented approach to some major examples of modernist and postmodernist art; visual analysis and critical methods. Lecture and discussion.

***406-C72-0 Contemporary Criticism** Theoretical and visual background for the major ideas influencing present art criticism, focus on writing about current exhibitions and interviewing practicing artists.

### *Other Courses*

**406-C90-0 Special Topics in Art** Topics vary: for example, preparation of an art project under the guidance of visiting artists. May be repeated for credit with consent of department. Prerequisite: consent of department.

**406-C99-0 Independent Study** Special projects in the practice of art. Open to qualified seniors.

## Asian Studies Program

### Major in Asian Studies

On the recommendation of the Asian studies adviser, students who complete the following plan of study may apply for a major in Asian studies. Students must take 18 quarter-courses selected, in consultation with the adviser, from an approved list of Asian-related courses. The major should include an appropriate geographic or other focus and normally also at least six quarter-courses selected from each of three departmental clusters:

- Anthropology, economics, and political science
- History
- Literature, philosophy, and religion

With the adviser's consent, students may substitute up to six quarter-courses of language study in Arabic, Chinese, Hebrew, Japanese, or Korean. (Native-speaker proficiency does not count for course credit.) See the Program of African and Asian Languages for specific language offerings.

### Minor in Asian Studies

Students wishing to do some concentrated course work in Asian studies but not wishing a major in this field should consider the minor.

**Minor course requirements (8 units)**

Students may qualify for this minor by satisfactorily completing eight quarter-courses selected from an approved list of Asian-related courses, including at least two quarter-courses from each of three departmental clusters:

- Anthropology, economics, and political science
- History
- Literature, philosophy, and religion

Six such courses—including two from each cluster—will suffice for students who also complete satisfactorily two years of language study in Arabic, Chinese, Hebrew, Japanese, or Korean. (Native-speaker proficiency does not count for course credit.) Independent study courses and nonrepetitive special topic courses, such as Anthropology C90 and History C92, will normally count for credit toward the minor if they deal substantially with Asia. Students applying for a minor must present records showing a minimum of five courses not double-counted in their major.

Within the framework of the above requirements, students will normally be expected to organize their programs with emphasis on one main region or country of Asia. Students are encouraged to take courses on more than one country in Asia. Students are also encouraged to complete at least one quarter of research in their area of interest in the form of independent study. The Asian studies adviser will help students plan a program to meet their individual needs and interests.

For further information, contact the CAS Office of Studies.

## *Astronomy*

See Physics and Astronomy.

## *Biochemistry, Molecular Biology, and Cell Biology*

The Department of Biochemistry, Molecular Biology, and Cell Biology does not offer an undergraduate degree. See Biological Sciences, Undergraduate Program in, for a description of the major in biological sciences.

## Biological Sciences, Undergraduate Program in

The science of biology is the study of living organisms at all levels of complexity and in all their diversity. The Undergraduate Program in Biological Sciences draws particularly on two departments: biochemistry, molecular biology, and cell biology (BMBCB) and neurobiology and physiology (NBP). Additional opportunities in life sciences are available for students in a variety of departments: anthropology, biomedical engineering, chemistry, engineering sciences and applied mathematics, geological sciences, psychology, and communication sciences and disorders. The curriculum is intended to maximize students' access to offerings from these departments. The baccalaureate degree offered in CAS through the Undergraduate Program in Biological Sciences is the bachelor of arts with a major in biological sciences. No minor in biological sciences is offered.

### The Study of Biological Sciences

The goal of a baccalaureate degree program in biological sciences at a research university is to develop and enhance the intellectual and creative potential of life sciences students. To this end, the program includes the following components:

- A foundation in mathematics, chemistry, and physics
- A core curriculum offering an introduction to fundamental areas of biological science
- Areas of concentration that subsequently focus students' interests
- Opportunities to participate in research through the independent study program

### Major in Biological Sciences

Because biology is grounded in the principles of chemistry, mathematics, and physics, all majors must complete the courses listed under related courses below. During the freshman year, students usually complete A-level chemistry and most or all of the mathematics requirements. In the sophomore year, students start Chemistry B10-1 in the fall quarter concurrent with Biological Sciences B10-1. Physics should be completed by the end of the junior year.

**Program Courses**

***Core Curriculum:*** To set the stage for study in biological sciences at the advanced level, each major must complete Biological Sciences B10-1,2,3. These three courses taken in sequence address the central topics in contemporary biology with the goal of preparing students for further study in either the biological sciences or professional school. In this sequence, students are presented with a series of questions: What is the hypothesis? the concept? the principle? Finally, and very important: How do we test the hypothesis experimentally? To this end, the B-level core curriculum is augmented by a complementary laboratory sequence that provides biology students with an appreciation of the discipline as an experimental science.

The B10-1,2,3 sequence also serves the needs of preprofessionals majoring in other disciplines and those in specialized programs.

***Areas of Concentration:*** The continuing expansion of knowledge in biology makes it difficult to master all areas in a four-year curriculum. Thus, the junior and senior years are designed to permit students to explore in depth a focused area in the biological sciences that builds on the principles of the B-level core curriculum. To provide a variety of coherent pathways, five areas of concentration have been designed. In addition to the five courses specifically required for each concentration, each student must take three C-level life science elective courses approved by the adviser, at least two of which must be in a different concentration area or areas. The concentration will be noted on the transcript; only one concentration can be noted. Following are the five concentrations and a summary of their requirements.

*Molecular and Cell Biology*

- Biological Sciences C01, C15, C90, plus any *one* of C19, C33, C55, C91, C92, C93, C95
- Laboratory requirement: Biological Sciences C54

*Biochemistry and Biophysics*

- Biological Sciences C01; Chemistry C42-1; plus any *two* of Biological Sciences C22, C60, C61, C62
- Laboratory requirement: Biological Sciences C54

*Evolutionary Biology*

- Biological Sciences C42, C43; Anthropology C06; Geological Sciences C17
- Laboratory requirement: Biological Sciences C44

*Neurobiology*

- Biological Sciences C01, C02, C06, plus any *one* of C03, C04, C77
- Laboratory requirement: Biological Sciences C05, C08, or Psychology C21.

*Physiology*

- Biological Sciences C01, C25, plus *two* of C06, C56, Biomedical Engineering C02
- Laboratory Requirement: Biological Sciences C92

**Related courses**
All majors must complete the following foundational courses:
- Chemistry A01, A02, and A03 *or* A71 and A72
- Chemistry B10-1,2 *or* B12-1,2
- Mathematics B14-1,2 and either B14-3 *or* Statistics B02
- Physics A30-1,2,3 *or* A35-1,2,3

### Advising
Sophomores who declare a major in biological sciences are assigned to a specific faculty adviser. Juniors and seniors involved in independent study (C99) also have a specific research adviser.

### Research/Independent Study/Honors Program
This program offers students the unique opportunity to work on a research project in a faculty member's laboratory. It is recommended for all students who may wish to consider a career involving research. Students who have completed at least five quarters of course work and have attained a grade point average of 3.0 or higher in science and mathematics courses are eligible to apply for C99. A directory of research training faculty is available at the Undergraduate Program in Biological Sciences (UPBS) office. At least two weeks before the registration period for the quarter in which students begin a C99, an application form for independent study should be obtained from the UPBS office. Students visit the faculty members whose research areas are of interest and explore with them the possibility of doing research in their laboratories. By mutual agreement, a plan of study is proposed; the application/proposal is signed by the student and the faculty member. Students bring the completed, signed application to the UPBS office, where they are given a course authorization form to take to registration and a quarterly summary report that must be completed and returned to the UPBS office at the end of each quarter of C99. A biological sciences major's first two quarters of independent study are graded on the P/N option.

Students engaged in C99 research are encouraged to submit a senior thesis proposal by the beginning of their senior year. A faculty committee evaluates each proposal and either recommends or does not recommend that the student should proceed with the writing of a senior thesis. Students complete the laboratory work, data analysis, and writing of the thesis (literature survey, materials and methods, results, discussion) according to an established timetable.

Satisfactory completion of the thesis allows the faculty committee to recommend students for program honors and makes them eligible to compete for one of three awards given yearly for superior honors research. Completion of a senior thesis in the spring quarter enables students to use the spring quarter C99 as a C-level elective toward the major. Additionally, prior participation in C99 for two quarters is mandatory for the spring quarter of C99 to count as a C-level elective. In general, a research project leading to honors cannot be pursued outside C99 in a paid or unpaid job. The only exceptions are cases in which a student's supervisor is a participant in the UPBS honors program and an appropriate research/study plan has been approved by the honors coordinator. See Honors under Academic Policies earlier in this section of the catalog.

### Integrated Science Program
The Integrated Science Program (ISP) is a highly selective BA program in CAS (see Integrated Science Program). Students majoring in ISP who wish to complete a second major in biological sciences should fulfill the following requirements instead of those listed above. They may not substitute ISP C98 for any biology or chemistry course in the ISP curriculum and must take the following additional courses:
- Chemistry B12-2
- An appropriate laboratory course for the chosen concentration. (If the lab course is waived due to C99 or other research experience, another C-level biological sciences course must be taken in its place.)
- Two or three additional courses, as specified below for the indicated concentration:
  *Molecular and cell biology:* Biological Sciences C15, C90, C91
  *Biochemistry and biophysics:* two courses chosen from Biological Sciences C60, C61, C62
  *Evolutionary biology:* Biological Sciences C42, C43; Geological Sciences C17
  *Neurobiology:* Biological Sciences C03, C06
  *Physiology:* Biological Sciences C06, C25, C56

### Honors Program in Medical Education
C-level biological sciences course requirements for students also in the HPME Program consist of four core courses appropriate for each of the five department concentrations (not including the lab course, which is waived), plus two C-level electives.

### Premedical, Predental, and Preveterinary Students Majoring in Other Departments
Biological sciences requirements for most U.S. schools offering degrees in medicine, dentistry, and veterinary medicine are satisfied by either A10-1,2,3 or B10-1,2,3. Students with these career objectives usually begin such a sequence in their second year.

### The Teaching of Biological Sciences
CAS students pursuing a major in biological sciences who also wish to be certified for secondary teaching must be admitted to the Secondary Teaching Program in the School of Education and Social Policy (SESP) and complete all requirements as outlined in the SESP section of this catalog. Students are urged to contact the Office of Student Affairs in SESP as early as possible in their academic career.

## Courses Primarily for Undergraduates

**409-A03-0 Diversity of Life** Comparative survey of organisms, emphasizing adaptation and phylogenetic relationships. No credit while or after taking any part of the B10-1,2,3 sequence.

**409-A10-1 Biology:Genetics and Biochemistry** Principles of genetics and biochemistry and their application. Laboratory. Chemistry A01 recommended. No credit while or after taking any part of the B10-1,2,3 sequence.

**409-A10-2 Biology:Molecular and Cellular Biology** How genes direct synthesis of proteins; how proteins generate a cellular phenotype. Laboratory. Prerequisite: A10-1. No credit while or after taking B10-2 or B10-3.

**409-A10-3 Biology:Physiology and Evolution** How cells are organized into tissues; how tissues function. Selection, macroevolution, and their central role in our understanding of biology. Laboratory. Prerequisite: A10-2. No credit while or after taking B10-2 or B10-3.

**409-A24-0 Biological Clocks** Daily and annual biological rhythms, their mechanisms, and their effects on health, performance, and society. Scientific method emphasized. No credit while or after taking any part of the B10-1,2,3 sequence.

**409-A60-0 Human Reproduction** Basic biology of reproduction; relation between hormones, emotions, intelligence, and behavior; related policy issues. No credit while or after taking any part of the B10-1,2,3 sequence.

**409-A63-0 Human Biology** Principles of human biology; function of the 10 major organ systems of the body and how they are currently understood. No credit while or after taking any part of the A10-1,2,3 or B10-1,2,3 sequences.

**409-A64-0 Genetics and People** Principles of inheritance with emphasis on human characteristics and the interaction of genetics and society. Credit not allowed for both A64 and A70. No credit while or after taking any part of the B10-1,2,3 sequence.

**409-A70-0 Concepts of Biology** Cellular organization, energy conversion, genetics, reproduction, evolution. Credit not allowed for both A70 and either A80 or A90. No credit while or after taking any part of the B10-1,2,3 sequence.

**409-A80-0 Biology at the Molecular Level** The microworld of biological molecules; the diverse roles that they play in the lives of cells. Credit not allowed for both A80 and either A70 or A90. No credit while or after taking any part of the B10-1,2,3 sequence.

**409-A90-0 Characteristics of Living Organisms** Rigorous introduction to biology as an experimental science. Laboratory. Prerequisite: consent of instructor. Credit not allowed for both A90 and A70 or A80. No credit while or after taking any part of the B10-1,2,3 sequence.

**409-A91-0 Evolution** Major evolutionary principles. No credit while or after taking any part of the B10-1,2,3 sequence.

**409-B04-0 Environmental Biology** Underlying biological principles necessary to make informed decisions about environmental issues. Laboratory. Prerequisites: A70, A90, or B10-1; Mathematics B14-1,2; Chemistry B04; Physics A30-1,2; one course in statistics.

**409-B10-1 Genetics and Evolutionary Biology** Transmission and demic genetics; evolutionary biology. Laboratory. Prerequisites: Mathematics B14-1,2; Chemistry A01, A02, and A03 *or* A71 and A72.

**409-B10-2 Biochemistry and Molecular Biology** Biochemical and molecular biology. Laboratory. Prerequisites: B10-1; Chemistry B10-1; concurrent registration in Chemistry B10-2.

**409-B10-3 Physiology and Cell Biology** Cell biology and systems physiology. Laboratory. Prerequisite: B10-2.

**409-C01-0 Biochemistry** Major areas and principles of biochemical processes at the molecular level; structure, metabolism, energetics, and control mechanisms. Prerequisites: B10-1,2,3; Chemistry B10-1.

**409-C02-0 Fundamentals of Neurobiology** Cellular and biochemical approaches to the nervous system, focusing on neuron structure and function; mechanisms underlying cell-to-cell communication. Prerequisites: B10-3; Physics A30-2.

**409-C03-0 Molecular Neurobiology** Mechanisms of signal transduction and synaptic plasticity; basic neurochemistry. Prerequisites: B10-3, C02.

**409-C04-0 Developmental Neurobiology** Cellular aspects of nervous system development; relationship between structure and function during development. Prerequisites: B10-3, C02.

**409-C05-0 Neurobiology Laboratory** Hands-on experience in the performance of classical experiments in cellular neurophysiology. Laboratory course for students of neurobiology. C02 strongly recommended.

**409-C06-0 Central Nervous System Physiology** Integrative approach toward understanding functioning of mammalian central nervous system. Prerequisite: B10-3.

**409-C08-0 Neuroanatomy Laboratory** Organization and morphology of the vertebrate central nervous system. Prerequisite: B10-3.

**409-C09-0 ISP Biochemistry and Cell Biology** Biochemistry, including intermediary metabolism and macromolecules; molecular biology; cellular genetics. Laboratory. Prerequisites: ISP enrollment; A70 or equivalent; Chemistry B12-1.

**409-C10-0 ISP Quantitative Biochemistry and Molecular Biology** Protein interaction with small molecules, location of genetic markers, X-ray diffraction

studies of DNA fibers, protein tertiary structure determination. Prerequisite: C09.

**409-C11-0 ISP Neurobiology** Detailed look at membrane properties of single neurons and synaptic transmission. Mechanisms of basic sensory and motor processes in the brain. Prerequisite: C09.

**409-C14-0 Mind and Brain** Neural transmission; effects of endogenous substances and exogenous drugs; how neural dysfunction can translate into cognitive abnormality. Prerequisite: A10-3, A70, A90, or B10-3.

**409-C15-0 Cell Biology** Relationship of shape, structural dynamics, and function with the cellular state and gene expression; chromosomal and cellular structure; cell-to-cell communication. Prerequisite: B10-3.

**409-C19-0 Biology of Animal Viruses** Virus structure, synthesis of viral nucleic acids and proteins, the interaction of the viral and cellular genomes, structural and functional alteration of virus infected cells. Prerequisite: B10-3.

**409-C20-0 Behavioral Ecology Seminar** Evolutionary study of animal behavior, emphasizing theory but using field data to test or illustrate aspects of theory. Prerequisites: B10-1 and consent of instructor.

**409-C22-0 Biochemistry of Macromolecular Complexes** Structure and behavior of membranes and complexes that function in association with membranes. Prerequisite: C01.

**409-C25-0 Animal Physiology** Physiological principles and mechanisms responsible for the ability of animals to regulate variables in the steady state and to survive in the face of alterations in the external environment. Prerequisite: B10-3.

**409-C33-0 Microbial Cell and Molecular Biology** Structure, growth, metabolism, and genetics of prokaryotes. Computer-based analyses. Prerequisite: B10-3.

**409-C40-0 Biological Aspects of Disease** Cellular response to injury; biology of cancer, including molecular and genetic aspects; inflammation and immunity; genetic basis of human disease; and developmental pathology. Prerequisite: B10-3.

**409-C42-0 Evolutionary Processes Seminar** Natural selection as a predictive process. Prerequisites: B10-1 and consent of instructor.

**409-C43-0 Phylogenetics** Current concepts of evolutionary biology as background for an understanding of systematics and phylogeny reconstruction. Prerequisites: B10-1,2 and consent of program.

**409-C44-0 Evolutionary Morphology of Vertebrates Laboratory** Vertebrate phylogeny illustrated via comparative morphology; anatomical/functional consideration of the musculoskeletal and other selected systems. Prerequisites: B10-1,2 and consent of program.

**409-C45-0 Topics in Evolutionary Biology** Topics vary, but always deal with phylogenetic techniques and/or the biology of a major group of organisms. Laboratory. May be repeated for credit with different topic. Prerequisites: B10-1,2.

**409-C54-0 Experimental Techniques in Biochemistry and Molecular Biology** Laboratory course in molecular and biochemical experimentation, using microorganisms to probe fundamental problems in biology. Prerequisite: B10-3.

**409-C55-0 Immunobiology** Nature of host resistance; characteristics of antigens, antibodies; basis of immune response; hypersensitivity; specific immunologic paralysis and transplantation. Prerequisite: B10-3.

**409-C56-0 Vertebrate Endocrinology** Physiology and biochemistry of hormones and glands of internal secretion in vertebrates; hormone structure, measurement, function, and interrelationship among endocrine glands. Prerequisite: B10-3.

**409-C60-0 Biophysics of Living Organisms** Physical principles involved in functions of living organisms; how physical methodology contributes to understanding biological functions. Prerequisites: B10-3; Physics A30-1,2; Mathematics B14-1,2.

**409-C61-0 Biophysics of Macromolecules** Structure and function of biological macromolecules; methods in molecular biophysics. Topics include X-ray crystallography and NMR methods for structure and dynamics. Prerequisites: Chemistry B10-2; Mathematics B14-2; Physics A30-3.

**409-C62-0 Biophysics of Macromolecular Systems** Biophysics of macromolecular assemblies, organelles, and cells. Topics include molecular motors and signal transduction assemblies. Prerequisites: Chemistry B10-2; Mathematics B14-2; Physics A30-1,2.

**409-C77-0 Sensory Neurobiology** Physiological process in sensory receptor cells; chemical senses, vision, hearing, and lateral line organs; analysis of specialized sensory systems. Prerequisite: B10-3.

**409-C89-0 Biology of Reproduction Seminar** Molecular aspects of gametogenesis and fertilization; intercellular communication in testes; signal transduction/receptors involved in fertilization. Prerequisites: B10-3 or C09 and consent of instructor.

**409-C90-0 Molecular Biology** Nucleic acid structure; cell and virus genetics; DNA mutation, repair, recombination, replication, restriction and modification; translation; lysogeny; recombinant DNA technology. Prerequisite: B10-3.

**409-C91-0 Eukaryotic Regulatory Mechanisms Seminar** Control of vertebrate gene expression in organisms by the external environment via organismic signal transduction pathways and by intrinsic developmental mechanisms. Prerequisites: B10-1,2,3; C90.

**409-C92-0 Developmental Biology** Processes that result in spatial arrangements of cells from gametogenesis to the differentiation of specialized cell types; cytodifferentiation, mechanisms of morphogenesis and pattern formation. Laboratory. Prerequisite: B10-3.

**409-C93-0 Molecular Biology of Human Disease Seminar** Use of biochemical, cellular, and molecular biology to elucidate contemporary problems in biomedical research. Prerequisites: B10-3, C01, C15, C90.

**409-C95-0 Molecular Genetics** How molecular genetics is used to study biological problems, using examples from the cell biology of yeast, development of fruit flies, and genetic diseases of humans. Prerequisites: C15, C90.

**409-C98-0 Undergraduate Research Seminar** Advanced work for superior students through supervised reading, research, and discussion. Prerequisite: consent of faculty supervisor and program.

**409-C99-0 Independent Research** Supervised individual research open only to juniors and seniors meeting specified requirements. Prerequisite: consent of faculty research supervisor and program.

## Business Institutions Program

The Program in Business Institutions approaches the study of business through a thoughtful investigation of the cultural, political, philosophical, literary, and social consequences of business institutions. Therefore, business institutions is not intended to constitute a narrowly conceived preprofessional training or to function as a business concentration within any single departmental major. This program is instead conceived as a means to a broad, multidisciplinary perspective on a significant area of inquiry in late 20th-century society. Students who wish to pursue the minor in business institutions should be open to inquiries grounded in the intellectual approaches of many disciplines.

### Minor in Business Institutions

The minor in business institutions requires the successful completion with a grade of C– or above of eight courses: three required core courses and five elective courses. The program director may approve a course offered in a particular year as a substitution for an elective course when the syllabus demonstrates a business institutions emphasis.

Students interested in the minor in business institutions should consult with a program adviser. Information is available in the CAS Office of Studies and the program office, University Hall, room 001. Students applying for the minor in business institutions must present records showing a minimum of five courses not double-counted in their major. Grades of P/N are not accepted.

**Minor course requirements (8 units)**

***Core courses***

- Economics B01 and B02 (which together count as one business institutions core requirement) *or* C10-1
- Economics C34 or Political Science C75
- Sociology C02

***Electives:*** five courses chosen from Anthropology C41; Business Institutions C92; Economics C05, C07, C08, C09, C23, C39, C49, C50, C55; History C67, C91; Philosophy B60; Political Science C61, C71, C72, C73; Sociology B15, C12, C15, C16, C31, C32, C76

### Course

**493-C92-0 Business Institutions Program Internship Seminar** Allows students to relate the scholarship concerning an aspect of corporate culture to experience gained from a previously completed summer internship. Prerequisites: completion of business institutions core courses and consent of instructor.

## Chemistry

Chemistry is the study of molecular structure, chemical reactions, and the molecular basis of solids, liquids, and gases. The broad applicability of phenomena and rigorous methodology of chemistry provide a wide range of career options for chemistry majors. Training in chemistry blends descriptive, conceptual, and mathematical elements in both lectures and laboratory work. While developing chemical knowledge is essential, the progressive honing of analytical abilities is equally important.

The chemistry department offers courses carefully designed to provide a rigorous introduction to chemistry for science or nonscience students. Additional courses provide several chemistry program options and serve the needs of Northwestern's engineering, biology, and medical programs. The chemistry faculty conducts vigorous, original research that includes undergraduates, graduate students, and visiting scholars from around the world. This environment, i.e., modern instrumentation, seminars, colloquia, and informal contacts, invigorates the educational process and provides exciting opportunities for undergraduates.

The department offers programs to meet the needs of students with diverse career objectives, including professional chemistry, medicine, and teaching.

### Major in Chemistry

The major is recommended for students planning careers in chemistry. It is suitable preparation for graduate study in chemistry and for those seeking positions as professional chemists. Only this program qualifies students for certification as a professional chemist by the American Chemical Society.

**Departmental courses:** A01; A02; A03 *or* A71; A72; B10-1,2,3 or B12-1,2,3; B15; C29; C33; C35; C42-1,2,3; C45; C61

**Related courses:** Mathematics B14-1,2,3 and B15 (the accelerated mathematics courses B90-1,2 or B91-1,2 also satisfy this requirement); Physics A25-1,2,3 or A35-1,2,3 or A90-1,2,3

### *Chemistry Program with Biochemistry Emphasis*

This program is designed for students who wish to emphasize the biochemical aspects of chemistry. For example, this program is suitable preparation for medical school or for advanced study in fields that require a strong background in chemistry. Three courses from the regular chemistry program (C35, C61, and B15 or C45) are replaced by Biological Sciences B10-1,2 and one of the following: Chemistry C97, D14; Biological Sciences C01, C22, C50, C54, C90.

## Minor in Chemistry

The minor in chemistry allows majors in other fields to complete a significant portion of the course work required for a chemistry major. It permits the flexible selection of course work from the traditional subdisciplines of organic, inorganic, physical, and analytical chemistry.

Minors must obtain permission from the department to register in B12-1,2,3, B15, and C35. Majors have priority for registration in these courses, which may have limited enrollments, and in C99.

**Basic courses:** A03 or A72 or equivalent (C-level chemistry courses have additional chemistry, physics, and mathematics prerequisites)

**Minor course requirements (6 units):** six B- or C-level chemistry courses (exclusive of B01, B02, B04, and C99)

**Sample programs:** Life science majors and premedical students are advised to take B10-1,2,3 or B12-1,2,3, C-43, and two additional courses. Physical science majors should take C42-1,2,3, C45, and two additional courses. Students with interests in materials science, geological science, environmental science, or chemical engineering should take B10-1,2, C35, C43 and two additional courses. Other programs for the minor can be designed to suit the needs of individual students.

## Four-Year BA/MS

Students who have done outstanding work during their first three years and who have a professional interest in chemistry or biochemistry are eligible to apply for the four-year BA/MS program. Applications should be made during the spring quarter of the junior year. By the end of three years, the applicant should have completed all the C-level chemistry courses, all or nearly all CAS requirements, and one quarter of independent study. To fulfill the MS requirements, students must take nine graduate courses, including four chemistry courses selected from a list approved by the department and at least 3 units of independent study. None of these nine courses can be used to fulfill any specific undergraduate CAS or major course requirement. See Four-Year Master's Programs in the Undergraduate Education section of this catalog and consult a department adviser.

## Integrated Science Program

The Integrated Science Program (ISP) is a highly selective BA program in CAS (see Integrated Science Program). Students majoring in ISP who wish to complete a second major in chemistry must take the courses listed under one of the following options.

**Chemistry option:** B12-2,3, B15, C29, C33, C35, C45, C61

**Biochemistry option:** B12-2,3, C29, C33; B15 *or* C45 (ISP C98 may not be substituted for Biological Sciences C01, C09, or C10)

**Program in the teaching of chemistry:** B12-2, C29, C33, three B- or C-level chemistry electives

## Honors in Chemistry

Seniors who have done outstanding work in the classroom and research laboratory are eligible for graduation with honors in chemistry. A student who is recommended must have completed the sequence of courses required by the department with a grade point average of 3.3 or above in chemistry and at least two quarters of either C98 or C99 during which the student was engaged in original research. A written report of research activities along with a strong recommendation from the student's research adviser is also necessary. For more information consult the director of undergraduate studies. See Honors under Academic Policies earlier in this section of the catalog.

## The Teaching of Chemistry

CAS students pursuing a major in chemistry who also wish to be certified for secondary teaching must be admitted to the Secondary Teaching Program in the School of Education and Social Policy (SESP) and complete all requirements as outlined in the SESP section of this catalog. Students are urged to contact the Office of Student Affairs in SESP as early as possible in their academic career.

## Advanced Placement

Entering students seeking advanced placement will be advised to register for Chemistry A71, B10, or B12 according to their score on either the College Board advanced placement chemistry examination or the department chemistry placement examination.

## Courses Primarily for Freshmen and Sophomores

**411-A01-0 General Chemistry** Descriptive chemistry, elements and compounds; basic chemical calculations, mole problems, stoichiometry, and solution concentrations; gas laws; thermochemistry; quantum theory and electronic structure of atoms; periodic properties of the elements; nuclear chemistry; chemical bonding.

**411-A02-0 General Inorganic Chemistry** Descriptive chemistry, inorganic reactions; chemical bonding; condensed phases; introduction to chemical equilibria; phase equilibria; solutions and colligative properties; metal complexes. Prerequisite: A01 (C– or better) or consent of department.

**411-A03-0 General Physical Chemistry** Chemical equilibrium; equilibria in aqueous solution, thermodynamics; chemical kinetics; electrochemistry and oxidation-reduction reactions; solid-state chemistry; industrial chemical processes. A grade of C– or better in A03 required to enroll for any higher-level chemistry course. Prerequisites: A02 (C– or better) or consent of department; Mathematics B14-1.

**411-A71-0 Accelerated General Inorganic Chemistry** Review of mole problems and stoichiometry; descriptive chemistry, elements, compounds, and inorganic reactions; gas laws; phase equilibria and colligative properties; chemical equilibrium; aqueous equilibria; topics in chemical bonding and molecular structure. Prerequisite: placement by the department through department placement exam.

**411-A72-0 Accelerated General Physical Chemistry** Thermodynamics and equilibrium; chemical kinetics and mechanism; electrochemistry; electronic structure of the atom and quantum theory; advanced topics in chemical bonding; coordination compounds; solid-state chemistry; nuclear chemistry. Prerequisites: A71 (C– or better); Mathematics B14-1.

**411-B01-0 Chemistry of Nature and Culture** Chemistry for the nonscientist. Chemicals commonly encountered in everyday life. With laboratory.

**411-B02-0 Color Science** Science necessary to understand color. For students with majors not in the physical or biological sciences.

**411-B04-0 Environmental Chemistry** The chemistry of the environment. Air, water, and soil; effects of pollution, heating, nuclear emissions, toxicity, and remediation. Laboratory. Primarily for environmental science majors but open to all qualified students. Prerequisites: A01, A02, A03 or A71, A72.

**411-B10-1,2,3 Organic Chemistry 1.** Basic concepts of structure, stereochemistry, and reactivity of organic compounds. The chemistry of hydrocarbons and alcohols. No P/N registration. Prerequisite: A03 or A72 (C– or better). **2.** The chemistry of aromatic, carbonyl, and nitrogen compounds; characterization of organic substances by chemical and spectral methods; reaction mechanisms. With laboratory. No P/N registration. Prerequisite: B10-1 (C– or better). **3.** The chemistry of polyfunctional compounds of biological and medicinal interest. Modern organic synthesis, bioorganic chemistry, and recent developments in organic chemistry. With laboratory. No P/N registration. Prerequisite: B10-2 (C– or better).

**411-B12-1,2,3 Organic Chemistry** Primarily for chemistry majors and students in ISP. Similar to B10-1,2,3 except with laboratory in the first and second quarters. No P/N registration. Prerequisites: A72 or A03 (C– or better) and consent of department, enrollment in ISP, or department placement.

**411-B15-0 Organic Synthesis Laboratory** A laboratory course in modern methods of synthesis, separation, and spectroscopic characterization of organic compounds. Included are organization, access, and use of chemical information. Prerequisite: B10-3 or B12-3 (students may take B12-3 concurrently).

## Courses Primarily for Juniors and Seniors

**411-C29-0 Analytical Chemistry with Laboratory** Principles and applications of analytical methods with emphasis on chromatography and electrochemistry. With laboratory. No P/N registration. Prerequisites: C42-1, C42-2, or C43 (students may take C43 concurrently).

**411-C33-0 Inorganic Chemistry** Descriptive chemistry of some important elements. Current concepts and models of chemical bonding. Prerequisites: 2 units of B- or C-level chemistry.

**411-C35-0 Inorganic Synthesis Laboratory** Laboratory course in modern methods synthesis, separation, and spectroscopic characterization of inorganic compounds. Introduction to current topics in inorganic chemical research. Prerequisites: B12-3 or B10-3, C33 (students may take C33 concurrently).

**411-C42-1 Thermodynamics** Laws of applications of thermodynamics. Thermochemistry, chemical potentials, solution thermodynamics, nonideal gases. Prerequisites: A03 or A72 (C or better); Mathematics B14-3; Physics A35-1,2 (students may take Physics A35-2 concurrently).

**411-C42-2 Quantum Mechanics and Spectroscopy** Quantum mechanics with emphasis on atomic and molecular electronic structure. Electronic, vibrational, rotational, and magnetic resonance spectroscopy. Prerequisites: Mathematics B14-3 (B15 recommended); Physics A35-1,2.

**411-C42-3 Kinetics and Statistical Thermodynamics** Chemical kinetics, including experimental techniques and theories of rate processes. Statistical mechanics, including Boltzmann distribution, partition functions, and applications to thermodynamics. Prerequisites: C42-1,2.

**411-C43-0 Kinetics and Spectroscopy** Chemical kinetics, including experimental techniques and elementary theory. Ultraviolet, visible, infrared, and magnetic resonance spectroscopy. For nonmajors. Prerequisites: C42-1 or Physics A35-1,2; Mathematics B14-3.

**411-C45-0 Spectroscopy Laboratory** Experiments on modern spectroscopic methods and data analysis. Prerequisite: C42-2 (students may take C42-2 concurrently).

**411-C48-0 Physical Chemistry for ISP** Gas laws and properties; kinetic theory; first, second, and third laws; phase equilibria; kinetics. Prerequisites: ISP enrollment; A72; Mathematics B91-1,2,3; or consent of department.

**411-C61-0 Advanced Laboratory** Advanced laboratory in analytical and physical chemistry. Prerequisites: C29, C42-1,2, C45.

**411-C80-0 Cooperative Chemistry Education** Participation in approved industrial work experience away from the campus. No credit; no tuition. Prerequisite: consent of department.

**411-C97-0 Medicinal Chemistry:The Organic Chemistry of Drug Design and Action** Introduction to principles of drug design and mechanisms of drug action from a chemical viewpoint. Historical introduction, drug design and development, receptors, enzymes and enzyme inhibitors, DNA, drug metabolism, and prodrugs. Prerequisites: B10-3, B12-3, or consent of instructor.

**411-C98-0 Undergraduate Seminar** Advanced work for superior students through supervised reading, research, and discussion. Prerequisite: consent of department.

**411-C99-0 Independent Study** Faculty-directed research. Prerequisite: consent of department.

## Classics

Classics is the multidisciplinary study of Greek and Roman civilization. The chief purpose of the undergraduate programs is to elucidate the classical foundations of our culture and to sharpen the abilities that grow from the study of the classical languages, literature, and history. The department also offers MA and PhD programs that prepare scholars for a career in teaching and research.

The classics programs at Northwestern are strong in history and literature. Complemented by resources in the Department of Philosophy, the department also is well qualified to offer undergraduate and graduate programs in Greek philosophy. A major commitment to classical studies is evident in the holdings of the University Library, which provides extensive research opportunities to classics undergraduate and graduate students.

The Department of Classics offers a major in classics and minor concentrations in Latin and in Greek. CAS students pursuing a major in classic who also wish to be certified for secondary teaching must be admitted to the Secondary Teaching Program in the School of Education and Social Policy (SESP) and complete all requirements as outlined in the SESP section of this catalog. Students are urged to contact the Office of Student Affairs in SESP as early as possible in their academic career.

Additional information about classics programs and courses may be obtained from the department's Web site <http://www2.mmlc.nwu.edu/classics/> or on request from the department office.

### Major in Classics

The major in classics, with emphasis in Latin or Greek, provides extensive contact with classical literature in the original language and a broad knowledge of the classical world and its place in the Western tradition. Requirements for the classics major can be satisfied by 18 or 19 courses, evenly divided between language courses (413 in Latin; 415 in Greek) and courses with readings in English (414). A classics major is a viable option even for students enrolling at Northwestern with little or no language background.

**Departmental courses**

***Basic courses:*** Latin B01-1,2,3 or Greek B01-1,2,3; Classics B10, B11, B12.

***Major courses***

- Six C-level Latin or Greek courses in any combination or three C-level courses in one language and four at any level in the other language
- Three B-level classics 414 courses in English (With departmental approval, related B-level courses outside the department may be used to fulfill this requirement.)
- Three C-level classics 414 courses (With departmental approval, related C-level courses outside the department may be used to fulfill this requirement.)

### Minor Concentrations in Classics

Classics offers two minor concentrations designed to provide a solid foundation in language, literature, history, and culture and to complement specialization in any other discipline. Each concentration calls for six quarters of Greek or Latin and three approved C-level classics courses. Students planning to minor in classics should meet with a departmental adviser.

#### *Latin*

**Prerequisites:** Latin A01-1,2,3 or equivalent

**Minor course requirements (6 units)**

- Latin B01-1,2,3
- Three C-level classics 414 courses approved by the department

#### *Greek*

**Prerequisites:** Greek A01-1,2,3 or equivalent

**Minor course requirements (6 units)**

- Greek B01-1,2,3
- Three C-level classics 414 courses approved by the department

### Study Abroad

Qualified majors have the opportunity to attend the Intercollegiate Center for Classical Studies at Rome during their junior or senior year. Students interested in this program or similar opportunities in Greece should consult the department chair.

### Four-Year BA/MA

Students with a strong background may apply for a two-degree program that can be completed in four years. This is ideal for students interested in continued graduate studies in any of several fields. It also serves to prepare highly qualified secondary school teachers of classics, for whom there is a renewed demand. See Four-Year Master's Programs in the Undergraduate Education section of this catalog and consult a department adviser.

### Honors in Classics

Outstanding seniors in classics are encouraged to prepare an honors thesis based on two or more quarters of C99. Successful completion of this project entitles the candidate to nomination for honors in classics. For more information, consult the director of undergraduate studies. See Honors under Academic Policies earlier in this section of the catalog.

### Courses in Latin

**413-A01-1,2,3 Elementary Latin** Classical Latin vocabulary, grammar, and syntax with graded readings for translation. Four class meetings a week.

**413-A11-0 Introduction to Latin** Basic Latin texts and essential Latin vocabulary, grammar, and syntax. Students receiving outstanding grades are eligible for Latin A01 credit.

**413-A50-0 Intermediate Latin Review** Intensive review of Latin grammar and forms; readings from Latin prose and poetry. Prerequisite: department placement.

**413-B01-1,2,3 Introduction to Latin Literature** Grammar and vocabulary review. Readings in Catullus, Horace, and other selected comedy and prose authors; emphasis on literary analysis. Prerequisite: A01 or department placement.

**413-C10-0 Readings in Latin Literature** Authors and topics arranged in a three-year cycle. Authors include Plautus, Terence, Lucretius, Cicero, Virgil, Horace, Ovid, and Tacitus. Prerequisite: B01 or equivalent.

**413-C99-0 Independent Study** For advanced students approved by the department, individual programs under the direction of a department member.

### Courses in Greek

**415-A01-1,2,3 Elementary Greek** Vocabulary, forms, and syntax of the Homeric dialect of ancient Greek, using Homer's *Iliad* as the basic text.

**415-B01-1,2,3 Introduction to Greek Literature** Review of basic grammar and vocabulary. Representative selections from Greek authors in their historical and cultural context. **1.** Epic. **2.** Drama. **3.** History, philosophy. Prerequisite: A01 or equivalent.

**415-C01-0 Readings in Greek Literature** Authors and topics arranged in a three-year cycle. Authors include Homer, Pindar, Herodotus, Thucydides, and Plato. Prerequisite: B01 or equivalent.

**415-C99-0 Independent Study** For advanced students approved by the department, individual programs under the direction of a department member.

### Courses with Readings in English

These courses offer an understanding of classical culture and its influence in history, literature, and art. There are no prerequisites in Greek or Latin.

**414-A10-0 Scientific Vocabulary through Classical Roots** Greek and Latin etymology in the vocabulary of the sciences. Designed primarily for science or medical students. Self-paced independent study.

**414-B10-0 Early Western Civilization** Comparative study of early Greek and Hebrew cultures against the background of other civilizations of the ancient Near East.

**414-B11-0 Classical Greece** Political, social, and intellectual culture of Greece in the 5th and 4th centuries B.C.

**414-B12-0 Roman Civilization** Development and character of the Roman Republic and Empire, emphasizing political and social institutions. Roman origins of Europe's politics, religion, literature, and ideas.

**414-B40-1,2 The Literary Achievement of Greece and Rome 1.** Homer and Hellenism: the *Iliad*, the *Odyssey*, and their early influence. **2.** Hellenistic and Roman humanism; new values in comedy, Virgil's *Aeneid*, satire.

**414-B44-0 The Ancient Novel** Critical approach to the origins of the genre of the novel through works by ancient Greek and Latin authors.

**414-B50-0 Introduction to Greek Philosophy** Survey of pre-Socratic philosophy, Plato, and Aristotle.

**414-B60-0 Classical Mythology** Stories of gods and heroes as reflections of the structure and attitudes of Greek and Roman society and as changing models for human behavior.

**414-C21-1,2,3 Roman History** Politics, economics, and society. **1.** The Republic, from the founding of Rome to the accession of Augustus (753–31 B.C.). **2.** The early Empire, from Augustus to the accession of Marcus Aurelius (31 B.C.–180 A.D.) **3.** Later Roman Empire, from Marcus Aurelius to the death of Constantine (180–337 A.D.).

**414-C30-0 Ancient Economy** Preindustrial Mediterranean economies of ancient Greece and Rome. Farming,

transportation, settlement patterns, capitalism and trade, slavery; ends with a rustic Roman banquet.

**414-C42-0 Early European Medicine** Greco-Roman origins of European medical thought from the cult of Asclepius to Galen; emphasis on ethical ideas, strengths, and weaknesses of Greek science.

**414-C45-0 Greek Tragedy** Readings in the plays of Aeschylus, Sophocles, and Euripides; emphasis on social and institutional contexts of Greek theater and its influence on Western drama.

**414-C48-0 Roman Comedy** Readings in the plays of Plautus and Terence: focus on dramatic and linguistic style in Roman comedy.

**414-C58-0 Roman Architecture** Architecture and urbanization, 700 B.C.–337 A.D. Important sites outside Rome: Pompeii, Herculaneum, Baalbek, Jerash, Palmyra, and Lepcis Magna.

**414-C59-0 Topography of Imperial Rome** Covers the period of Rome's maximum ancient development, the reign of the Emperor Constantine. Presented alternate years with C58.

**414-C90-0 Topics in Greco-Roman Civilization** Content varies; may be repeated for credit with different topic. Recent topics include music and the city; the origins of democracy; written voices; Herodotus and the invention of history.

### Related Courses in Other Departments

Art History C10-2 Ancient Art: Greek Art
Comparative Literary Studies B01-1 Western European Literature
Philosophy B65 Introduction to the Philosophy of Law
Philosophy C20 Studies in Ancient Philosophy
Political Science C01 Classical Political Theory

## Cognitive Science Program

Cognitive science is the scientific study of the mind with the goal of understanding the nature of thought. Students learn the ways in which converging sources of evidence may be integrated to discover the mechanisms underlying the complex, adaptive properties of human cognition. Areas covered include current methods in cognitive psychology, linguistics, artificial intelligence, and neuroscience (human and animal research). A junior proseminar focuses on ongoing research in the field by Northwestern faculty. Qualified seniors will be invited to take a senior honors seminar to engage in independent research under the guidance of department faculty and to write a senior thesis.

For additional information about the Program in Cognitive Science, see the program director.

### Major in Cognitive Science

**Program courses**

***Introductory courses (3):*** B07, B10, B11

***Basic requirements (3):*** Computer Science A10 *or* A11; Psychology B01, B05

***Intermediate requirements (3):*** Linguistics B05 *or* B06 *or* B07 and two courses chosen from Psychology B12, B28; Computer Science C48; Communication Sciences and Disorders B02, C01

***Advanced requirement (1):*** C66 (should be taken in the junior year)

***Advanced electives (6):*** six courses chosen from four areas; at least three must be in one area (major emphasis) and at least two must be outside of that area. Other C- and D-level courses not listed below may be substituted for advanced electives with consent of the cognitive science adviser. It is strongly advised that students pursue independent study (C99) in one of the departments listed below. This course may count as an advanced elective. Asterisks (*) denote courses required for major emphasis in that area.

- *Anthropology:* C60, C89, C90, C95 *or* E95, D71
- *Artificial intelligence:* Computer Science C25-1*, C25-2, C37, C44, D32, D37-1,2
- *Cognitive psychology:* Psychology C11, C14, C24, C27-1,2, C33, C34, C35, C60, C62, D60
- *Cognitive neuroscience:* Biological Science B10-3*, C02, C03, C04, C06, C08-3*, C77; Psychology C12-2, C21
- *Learning sciences:* C01, C21, D01, D22, D23, D29, D39, D50, D51
- *Linguistics:* C05, C06, C09, C16, C19, C29, C46, C71
- *Philosophy:* C25, C27

*Note:* Cognitive science majors who wish to double major must show a minimum of 11 courses not double-counted in any other major(s). Cognitive science majors seeking a minor in another discipline cannot double-count for that minor any courses used to meet the major requirements in cognitive science.

### Minor in Cognitive Science

The minor in cognitive science gives a broad foundation in this interdisciplinary field, encompassing cognitive psychology, linguistics, artificial intelligence, neuroscience, and related disciplines. Introductory courses survey basic phenomena and approaches; methods courses impart the core methods of cognitive science; elective courses allow students to pursue more advanced study in particular disciplines.

**Minor course requirements (8 units)**

- Introductory courses: two courses chosen from B07, B10, B11
- Methods courses: two courses chosen from Psychology B01, B05; Computer Science A10, A11

• Electives (4): Four courses chosen from at least two areas; at least three must be C level and at least three must be outside the major. For available areas, see the advanced electives for the major. Courses listed below are required if that area is chosen.
*Artificial Intelligence:* Computer Science C48
*Cognitive Psychology:* Psychology B28
*Cognitive Neuroscience:* Biological Sciences B10-3
*Learning Sciences:* C01
*Linguistics:* B05 or B06 or B07

*Note:* Courses used to meet the requirements for the minor in cognitive science cannot be used to meet the requirements for any major in the college.

### Courses

**452-B07-0 Introduction to Cognitive Modeling**
Introduction to artificial intelligence and cognitive science from a nontechnical perspective. Fundamental questions concerning thinking, beliefs, language understanding, education, and creativity.

**452-B10-0 Introduction to Cognitive Science: Language,Vision,and Memory** Scientific study of human cognition with an emphasis on vision, language, and memory.

**452-B11-0 Introduction to Cognitive Science:Learning,Representation,and Reasoning** Interdisciplinary study of the nature of the mind with emphasis on learning, representation, and reasoning.

**452-C66-0 Cognitive Science Proseminar** New and ongoing research in the field by Northwestern faculty. Prerequisite: consent of instructor.

**452-C98-1,2 Senior Honors Seminar** Independent research for a senior thesis under the direction of department faculty. By invitation only.

## Comparative Literary Studies Program

Comparative literary studies is an interdepartmental, interdisciplinary program for the study of literature across national and linguistic lines and within its historical and cultural contexts. Drawing on faculty from the various literature departments and related disciplines (such as art history and philosophy), the program reflects the belief that literature is truly an international activity best understood within the larger context of other literatures and other cultural activities. Whereas specific national literature majors encourage students to trace the development of a single tradition, comparative literature juxtaposes literatures of several cultures in a variety of ways: for example, by period, epoch, cultural milieu, or any of the larger questions raised by the very existence of literature as a way of representing and interpreting the world. Thus, the program enables students not only to read texts critically but also to reflect upon the theories and methods that have guided literary study in the past and in the present.

The Program in Comparative Literary Studies offers an undergraduate major and a graduate program leading to the PhD degree.

### Major in Comparative Literary Studies

The major in comparative literary studies includes a core curriculum and electives that make up a concentration. The core curriculum consists of eight courses common to all majors that introduce basic texts, methods, and theoretical models of the discipline. Students consult with an undergraduate adviser to plan an eight-elective concentration.

Each concentration exemplifies an important orientation of comparative literary studies. Concentrations are generally organized according to three broadly defined fields: language and literature (focus on particular literary traditions); world literature (exploration of a broader range of literatures, particularly non-Western); and literature and theory (integration of a study of literature with work in related disciplines).

During the spring quarter of the junior year, comparative literary studies majors submit written proposals to the program adviser explaining in detail the concentration chosen and how the requirements will be fulfilled. Majors in study abroad programs during their their junior year should submit their proposal before leaving Northwestern. Majors may preregister each quarter during the week preceding general preregistration. Additional information may be obtained from the program office.

**Program courses**

***Core courses (8)***
• B01-1,2; B02; B80
• Two courses at the B level or above in a literature other than English in the original language; if literature is not taught at the B level in the original language, at least three years of the language and corresponding courses in the literature in translation, which can be concentration electives
• C01, C02, or C03
• C98

***Concentration (8):*** Eight courses organized according to an individual concentration drawn from the following categories:
• B- or C-level courses in literature in the original language
• C-level courses in literature in translation
• C-level courses in disciplines related to literary studies (for example, art history, film studies, history, philosophy, women's studies)

Students must take at least one course in Western literature before 1750 and at least one course in a non-Western literature. At least five electives must be at the C level or higher.

The principle for the construction of a concentration is precisely that it *concentrates* the student's interests into

a coherent and recognizable program of study. Examples of individual concentrations:

- Regionally defined or "national" literatures (African [including anglophone and/or francophone], American, Chinese, English, French, German, Italian, Japanese, Latin American, Spanish [peninsular])
- Epochs of literature (medieval, Renaissance, romanticism, modernism)
- Genres (novel, drama, lyric)
- Literature and another discipline (anthropology, art history, film, history, intellectual history, philosophy, theater)

### Double Major

Majors in comparative literary studies must show a minimum of 12 courses not double-counted in any other major(s).

### Honors in Comparative Literary Studies

Students may qualify for honors with a grade point average of 3.3 or above in the major. They must take C-97, which can also count as one of the eight courses in their concentration. In addition, students must take 1 or 2 units of C99 beyond the regular course requirements of the major, and they must write an honors thesis of 25–30 pages. The paper will be evaluated by the director of the independent study and a second reader appointed by the comparative literary studies director of undergraduate studies. Students who wish to pursue honors must declare their intention to do so by the end of the junior year. For more information, consult the director of undergraduate studies. See Honors under Academic Policies earlier in this section of the catalog.

### Preparation for Graduate Study

While it is possible to complete the Northwestern BA in comparative literary studies with only two B-level courses in one language other than English, most PhD programs in comparative literature require significant mastery of at least two languages in addition to English.

### Study Abroad

The Program in Comparative Literary Studies encourages all majors who qualify to consider a year of study abroad during the junior year.

### Courses Primarily for Freshmen and Sophomores

**416-B01-1,2 Western European Literature: Tradition and Transformation** A two-quarter sequence interweaving selected classics of the Western European literary tradition from Homer and Genesis forward with modern transformations of traditional themes.

**416-B02-0 Practices of Reading** Introduction to fundamental skills and problems of close reading, with special focus on the "conflict of interpretations" between competing practices of reading.

**416-B03-0 Introduction to Comedy** Survey of comic drama from Aristophanes to the present day.

**416-B05-0 Introduction to Modern Drama** Survey of principal dramatic movements since Ibsen.

**416-B06-0 European Fiction since 1900** Reading in translation of some important works written in continental languages during the present century, by writers such as Dostoevsky, Mann, Kafka, Rilke, Sartre, Camus.

**416-B10-0 The Bible as Literature** Selected books of the Hebrew Bible and New Testament studied from a literary perspective; issues of plot, character, genre, narrative strategy, and theories of interpretation.

**416-B13-0 Introduction to Fiction** Fictional modes such as the novella, the short story, and the novel. May be repeated for credit with different topic.

**416-B71-1,2,3,4 Japanese Literature in Translation** A set of four courses surveying Japanese literature from the eighth century to the present.

**416-B74-1,2,3 Introduction to Chinese Literature** Survey of Chinese poetry and fiction from the fifth century B.C. to the present.

**416-B75-0 Arabic Literature in Translation** Introduction to Arabic literary background; survey of literary genres from the pre-Islamic period to the present.

**416-B76-0 African Literature in Translation** Continental African literature. Content varies. May be repeated for credit with different topic.

**416-B78-0 Modern Hebrew Literature in Translation** Introduction to the main works of contemporary Israeli writers.

**416-B79-0 Modern Jewish Literature** A study of modern European, American, and Israeli Jewish literature in its historical context.

**416-B80-0 Interpreting Culture** Introduction to the theory and practice of interpreting "cultural texts," the literary and other texts through which human culture imposes structures of meaning on the world.

### Courses Primarily for Juniors and Seniors

Comparative literary studies and language majors will read the texts and be tested in their language or area of expertise whenever the course material allows.

**416-C01-0 Writing in Society** Studies in relations between literature and society through a series of theoretical readings in the sociology of literature, juxtaposed with literary examples from different societies.

**416-C02-0 Language in the Text** Close reading of exemplary literary and theoretical texts with a focus on the relationship between the meaning of texts and the linguistic devices that produce meaning: that is, on the tension between what a text means and how it means.

**416-C03-0 Literature in History** Studies in the historicity of literature, with attention to the development of literary kinds over time and to the historical circumstances in which literature is produced.

**416-C10-0 Studies in Literary Genres** Selected literary genres, such as epic, pastoral, autobiography, comedy, satire, the essay. May be repeated for credit with different topic.

**416-C12-0 Studies in Drama** Content varies. May be repeated for credit with different topic.

**416-C13-0 Studies in Fiction** Content varies. May be repeated for credit with different topic.

**416-C21-0 Medieval Epic and Romance** Major forms of medieval narrative from heroic saga to courtly romance.

**416-C24-0 Backgrounds of Medieval Literature** Intellectual background of medieval literature, with special emphasis on the interpretations of Plato and Aristotle by late classical and scholastic philosophers.

**416-C62-1,2,3 Modern Drama 1.** Major developments from the late 19th century to the end of World War I. **2.** 1920s–1950s. **3.** From absurdist theater to the present.

**416-C65-0 The Avant-Garde** Nature, origins, and development of the avant-garde movements in Europe, North America, and Latin America since the early 20th century.

**416-C75-0 Literature and the Arts** Differences and similarities of literature and the visual arts and/or music. Content varies. May be repeated for credit with different topic.

**416-C82-1,2,3 History of Literary Criticism 1.** Changing concepts of mimesis, genre, and style, from Plato to the Renaissance. **2.** The emergence of neoclassical theories in France and England and their replacement by romantic theories in England and Germany. **3.** Major themes and movements in 20th-century criticism.

**416-C83-0 Special Topics in Theory** For students with previous study of criticism and literary theory. Content varies. May be repeated for credit with different topic.

**416-C90-0 Topics in Comparative Literature** Content varies: for example, problems of literary translation, literature and psychoanalysis. May be repeated for credit with different topic.

**416-C97-1,2,3 Literary Studies Colloquium** Yearlong course carrying 1 unit of credit, organized around a particular problem in the study of literature; presentations by distinguished visitors and Northwestern faculty. Preparation and follow-up for each presentation. Prerequisite: consent of department.

**416-C98-0 Senior Seminar** Variable topics and reading lists to develop work undertaken in earlier courses in a setting that introduces the active give-and-take of current intellectual debates. Required of senior majors in comparative literary studies. Prerequisite: consent of the program adviser.

**416-C99-0 Independent Study** (1–3 units)

### Related Courses in Other Departments

The following courses in literature in translation are from other department listings, which should be consulted for fuller descriptions.

Classics B40-1,2 The Literary Achievement of Greece and Rome
German B10-1,2 German Literature in Translation
German B12 Introduction to German Culture and Literature
German B20 The German Film
German B40 The Theme of Faust through the Ages
German B61 Turn-of-the-Century Vienna: In Search of New Values
German B62 Berlin: The Golden ’20s
German C14 German Contributions to World Literature
Italian B75 Dante’s *Divine Comedy*
Italian C80 Topics in Italian Cinema
Portuguese C97 Topics in Luso-Brazilian Culture and Civilization
Slavic Languages and Literatures B10-1,2,3 Introduction to Russian Literature
Slavic Languages and Literatures C10 Tolstoy
Slavic Languages and Literatures C11 Dostoevsky
Slavic Languages and Literatures C18 19th-Century Russian Comedy and Satire
Spanish B23 Cervantes
Spanish B43 Contemporary Spanish-American Prose Fiction
Spanish C96 Topics in Spanish Culture and Civilization
Spanish C97 Topics in Latin American Culture and Civilization

## Computing and Information Systems Program

The Program in Computing and Information Systems offers students in CAS the opportunity to study computer science within the context of the college’s focus on liberal arts and sciences, as distinct from the engineering context offered by the Department of Computer Science in the McCormick School of Engineering and Applied Science. Faculty and courses for the program are drawn from the McCormick department. Courses and research in the department address the underlying theories, enabling technologies, and applications of modern computer science. There is a strong focus on the design, implementation, and evaluation of software systems, including interactive, distributed multimedia, artificial intelligence, robotics, and database systems. Research in the department is highly

interdisciplinary, including important links with the Cognitive Science Program and the Department of Psychology in CAS as well as the Department of Learning Sciences in the School of Education and Social Policy. Undergraduates are encouraged to join ongoing research projects within the department. For more information on the Department of Computer Science and its course offerings, see the McCormick School section of this catalog.

The major in computing and information systems is highly flexible, emphasizing the interdisciplinary study and project work that are critical in a field as rapidly changing as computer science. The specific courses to be taken are largely determined by the goals and interests of individual students. The major includes a two-quarter capstone project that helps integrate the skills and knowledge acquired in course work.

Computing facilities available to students in the program are extensive. The campus, including all dormitories, is completely networked. All students have full Internet access. E-mail, Web sites, and other computer-based communication resources are extensively used within the program to foster a sense of community and facilitate communication among students and faculty beyond the classroom. The program also draws on the facilities and staff of the Institute for the Learning Sciences, an interdisciplinary research and development center dedicated to building innovative, multimedia-intensive educational software.

### Major in Computing and Information Systems

For requirements in mathematics, see related courses below.

**Program courses**

***Introductory sequence:*** Computer Science A11, B11, and C11. Students without prior programming experience may wish to take A10 before A11.

***Intermediate and advanced courses:*** eight courses chosen from Computer Science B30 and C10 through C99

***Additional advanced technical courses:*** two courses chosen from Computer Science C10 through C99; Mathematics B15, B21, C08, C10, C13, C35, C37-1,2,3; Electrical and Computer Engineering B01, B05, C13, C28, C58, C61, C62 (See the program director for up-to-date information on suitable courses in this category.)

***Advanced electives:*** Two courses chosen with the consent of the student's adviser. Examples of appropriate courses include advanced courses in computer science; social sciences such as psychology, economics, or learning sciences; mathematics; natural sciences such as biology, chemistry, or physics; or other disciplines such as radio/television/film, journalism, or music.

***Project courses:*** Two courses requiring substantial project work (e.g., Computer Science C94 or C99). The project or projects developed in these courses must be approved by the student's adviser as well as the course instructor in order to fulfill the program requirements.

**Related courses:** Mathematics B14-1,2,3, B17, and C30-1 or equivalent.

### Integrated Science Program

The Integrated Science Program (ISP) is a highly selective program in CAS. Students majoring in ISP may complete a second major in computing and information systems through a curriculum tailored specifically to their needs.

**Program courses**

***Introductory sequence:*** Computer Science A11, B11, C11

***Intermediate and advanced courses:*** seven courses chosen from Computer Science C10 through C95

***Project courses:*** two quarters of ISP C98 or two quarters of Computer Science C99. Projects developed in these courses must be approved by the student's advisers in both ISP and the computing and information systems program in order to fulfill the program requirements.

### Minor in Computing and Information Systems

The program offers a minor in computing and information systems for students who wish to develop a strong competence in computer science while majoring in another area. Students choosing this minor are expected to have completed Mathematics B14-1,2,3 and B17, which are prerequisites for most computer science courses.

**Minor course requirements (9 units)**

- *Introductory sequence:* Computer Science A11, B11, and C11. Students without prior programming experience may wish to take A10 before A11.
- *Intermediate and advanced courses:* six courses chosen from Computer Science B30 and C10 through C99

## Drama Program

The Program in Drama offers undergraduates the opportunity to combine the study of dramatic literature in classics, comparative literary studies, English, and modern language courses with performance studies and theater courses in the School of Speech. Recognizing the uniqueness of drama among literary genres as a performing art, it seeks to develop an understanding and appreciation of dramatic literature informed by the study of acting, interpretation, playwriting, or directing. The program is not intended for students interested in professional performance but is directed rather toward those who wish to bring to the study of dramatic history and criticism a developed awareness of the problems and techniques involved in bringing a dramatic text to full life. Major

requirements ensure a balance of historical, literary, and theatrical approaches to drama; they are flexible enough to allow for special interests and concentrations, including the study of non-English drama in the original language. All students electing this major must work out a long-range plan of study with the program's director.

### Major in Drama

**Program courses**

***Introductory courses:*** 2 units from each of the following sets of courses, one from CAS and one from the School of Speech:

- *CAS:* Comparative Literary Studies B03; English B12; Integrated Arts B91-1
- *Speech:* Performance Studies A03, B10-3; Theatre A40-1,2, A43

***Major courses:*** 12 courses with a minimum of 9 C-level courses; to maintain a balance between literary and theatrical approaches to the study of drama, no more than 7 courses should be from one school and they must be distributed as follows:

- At least 6 units in the history and criticism of drama, including 3 units in drama before 1850 (but not all in Shakespeare) and 2 units in drama after 1850. Eligible courses include African American Studies B59; Classics B40-2, C45; Comparative Literary Studies B05, C12, C62-1,2,3; English C12, C32, C34-1,2, C39, C42; French B72, C30; German C24; Hispanic Studies C21, C42; Slavic Languages and Literatures C69; Theatre B44-1,2, C45-1,2,3, C65, C66, C67, C68
- At least 3 units in performance practices: French C90; Integrated Arts C90-1; Performance Studies B24, C09-2, C18, C24-1,2; Theatre B43-1,2,3, C40-1,2, C41-1,2,3, C46-1,2
- One unit in an advanced seminar, normally a D-level course approved by the program director

**Related courses:** 4 units at the B or C level in subjects related to the study of drama, approved by the program director. Applicable areas include aesthetics, criticism, cultural and intellectual history, humanities, literature, teaching of dramatics.

### Honors

Seniors with distinguished records in major courses who wish to be candidates for honors in the program do so by completing an independent project. This project is normally based on work done in the required D-level seminar and a subsequent unit of C99. Interested students should consult with the program director in the spring quarter of the junior year. See Honors under Academic Policies earlier in this section of the catalog.

### Course

**420-C99-0 Independent Study in Drama** For senior drama majors who have completed the required seminar and wish to undertake a project in candidacy for honors in drama. Prerequisite: approval of program director.

## Economics

The program in economics enables students to understand the basic concepts, theories, and techniques of economics as they apply to economic problems and policies. These may focus on macroeconomics, applied microeconomics, quantitative economics, or economic history. Whatever courses students take, they will become familiar with the way economists think about problems and devise solutions to them. Although the program does not offer specialized professional training in economics, it is an excellent preparation for graduate work in economics, the study of law, or a career in business or government. Students should consult a department adviser about elective courses to fit their needs.

### Major in Economics

The introductory courses B01 and B02 must be taken first and in that order. Statistics B10 and Mathematics B14-1 should also be taken early in the program; the former is a prerequisite of Economics B81 and the latter of C10-1. B81 and the intermediate theory courses should be completed before C-level electives are taken. Although only Mathematics B14-1 is required, some C-level electives may require Mathematics B14-2 or B14-3, both of which majors are strongly urged to take.

**Departmental courses**

***Introductory courses:*** B01, B02, B81

***Intermediate theory courses:*** C10-1, C10-2, C11-1

***Elective courses:*** six additional C-level courses

**Related courses:** Mathematics B14-1, Statistics B10, and three additional courses in the social sciences, mathematics, or statistics, no more than one at the A level. Economics B60 may be taken in partial fulfillment of this requirement.

### Minor in Economics

The minor offers training in economic theory through the intermediate level, instruction in quantitative methods of econometrics, and opportunity for advanced elective work in students' areas of interest. The introductory and intermediate courses are the same as those in the major, except that only two of the intermediate theory courses are required (C10-1 and C10-2 or C11-1). As in the major, Mathematics B14-1 and Statistics B10 must be taken early in the program because they are prerequisites for required courses.

**Minor course requirements (8 units)**
- Introductory courses (3): B01, B02, B81
- Intermediate theory courses (2): C10-1 and C10-2 *or* C11-1
- Elective courses (3): Three additional C-level courses

## Four-Year BA/MA

The department offers a four-year BA/MA for outstanding students in economics. Graduate-level courses in economic theory are required. Interested students should consult the director of undergraduate studies in their sophomore year and should see Four-Year Master's Programs in the Undergraduate Education section of this catalog.

## Honors in Economics

By invitation only, superior students in economics may pursue departmental honors by completing, in addition to the regular requirements of the major, one of the following three options: (1) C98-1,2; (2) two quarters of C99; or (3) two D-level field courses in economics. Under each option, candidates must submit an honors thesis presenting original research. Interested students should consult with the director of undergraduate studies. See Honors under Academic Policies earlier in this section of the catalog.

## The Teaching of Economics

CAS students pursuing a major in economics who also wish to be certified for secondary teaching must be admitted to the Secondary Teaching Program in the School of Education and Social Policy (SESP) and complete all requirements as outlined in the SESP section of this catalog. Students are urged to contact the Office of Student Affairs in SESP as early as possible in their academic career.

## Courses Primarily for Freshmen and Sophomores

**417-B01-0 Introduction to Macroeconomics** Scarcity and choice; elements of demand and supply, determinants of aggregate output, employment, inflation, growth, and balance of payments.

**417-B02-0 Introduction to Microeconomics** Consumers' and producers' influence on structure of output and prices and distribution of income. Social efficiency in resource allocation. Government impact on allocative efficiency and distributive equity. Prerequisite: B01.

**417-B13-0 Economics of Gender** Analysis of gender differences in employment and earnings. Family, labor market, discrimination, segregation, historical and international conditions, and antidiscrimination legislation.

**417-B60-0 Accounting and Business Finance** Accounting and managerial finance, including the principles of accounting, the elementary concepts of the theory of capital and its relationship to the objectives and problems of managing the firm. Prerequisites: B01, B02, or consent of instructor.

**417-B81-0 Introduction to Applied Econometrics** Estimation and analysis of a variety of empirical econometric models. Descriptive statistics, univariate regression, multiple regression, simultaneous equations, and forecasting. Prerequisite: Statistics B10 or equivalent.

## Courses Primarily for Sophomores, Juniors, and Seniors

**Prerequisites:** B01, B02, and B81 are normally required for C-level courses, except that C10-1 and C11-1 may be taken before or concurrently with B81. Additional prerequisites are indicated for specific courses. Prerequisites may vary somewhat, depending on the instructor.

**417-C05-0 Comparative Economic Systems** Development of welfare capitalism, market socialism, and centrally planned socialism and the problems confronting them in the contemporary world.

**417-C06-1,2 International Economics 1.** International and interregional trade. Factors influencing trade in goods and services between areas. Reasons for and effects of impediments to trade, such as transport costs, tariffs, quotas, and voluntary export restrictions. Prerequisites: C10-1; Mathematics B14-1. **2.** International finance. Determination of exchange rates, balance of payments, and international asset flows and prices; international transmission of macroeconomic disturbances. Prerequisites: C10-1 and C11-1.

**417-C07-0 Economics of Medical Care** Effects of medical care on health; health insurance and public and private demand for medical care; the market for medical care; efficient organization and regulation of hospitals and physicians.

**417-C08-0 Money and Banking** Nature of money and bank credit. Development, functions, and operation of monetary standards and credit systems. Banking and credit policies; price levels. Interrelationships of domestic and foreign monetary systems. Prerequisites: C10-1, C11-1; Mathematics B14-1.

**417-C09-0 Elements of Public Finance** Theory and practice of public finance. Welfare aspects of taxation and public expenditure decisions. Budgeting, public investment, external costs and benefits, and public debt. Prerequisites: C10-1; Mathematics B14-1.

**417-C10-1,2 Microeconomics 1.** Consumer behavior and the theory of demand; production, cost, supply functions; choices under uncertainty, insurance; competitive equilibrium; subsidies, taxes, price controls; monopoly and monopsony. Prerequisite: Mathematics B14-1. **2.** Price discrimination and public utility pricing; monopolistic competition, oligopoly, duopoly models; game theory; factor demands; general equilibrium theory and welfare

economics; information theory; externalities and public goods. Prerequisite: C10-1.

**417-C11-1,2 Macroeconomics 1.** Macroeconomics and monetary policy. Behavior of economy as a whole. Income, inflation, unemployment, and growth; consumption, investment, and rate of interest; monetary and fiscal policy. **2.** Advanced macroeconomics. Microeconomic foundations of aggregate demand and supply; consumption, investment, money demand and supply; labor-market behavior; rational expectations. Prerequisites: B81 or equivalent, C11-1, Mathematics B14-1,2.

**417-C15-0 Topics in Economic History** Topics vary: for example, the decline of European feudalism, Malthusianism, convertibility and free trade, constant wage shares during growth, the origins of the welfare state. Prerequisites: C10-1, C11-1.

**417-C17-0 Population and Economic Growth** Role of population growth in the process of economic growth; the effect of changes in economic conditions on the growth of population.

**417-C18-0 History of Economic Thought** Development of economic thought from the advent of the mercantilists to the formation of current schools of economics. Prerequisites: C10-1, C11-1.

**417-C21-0 African American Economic History** Economic experiences of African Americans as slaves and free people in the pre–Civil War period and in post–Civil War agriculture. South-north migration, urbanization, civil rights movements, and global economic competition.

**417-C23-1,2 Economic History of the United States** Economic development of the United States with emphasis on changing structure and performance of the economy. **1.** Colonial period to 1865. **2.** 1865 to the present.

**417-C24-0 Western Economic History** Western European developments, 1750 to the present: demographic, technical, social, and economic change. Prerequisites: C10-1, C11-1.

**417-C25-0 Economic Development** Structure, performance, and problems of developing economies in the third world—Africa, Asia, and Latin America. Prerequisites: C10-1, C11-1.

**417-C26-0 Economic Development in Africa** Economic change in sub-Saharan Africa, emphasizing current issues and policies in their historical contexts. Agriculture and rural development, industrialization, and international economic relations.

**417-C30-0 Economic Analysis and the Social Sciences** Relationship between economics and the other social sciences. The economic analysis of "noneconomic" topics; economic insights of other social sciences. Prerequisites: C10-1, C11-1, Mathematics B14-1,2.

**417-C34-0 Business and Government** Survey of the functions, origins, and evolution of government control over business decisions in the American economy. Special emphasis on the modern structure of government regulation with attention to remote origins.

**417-C36-0 Analytic Methods for Public Policy Analysis** Formulation of objectives, structuring decision problems, choices under uncertainty, interactive decisions, and the impact of organizational structure on project outcomes. Prerequisites: C10-1, C11-1, Mathematics B14-1.

**417-C37-0 Economics of State and Local Governments** Economic functions and financing of state and local governments in theory and practice; costs and demands for local public services; role of government finance in urban and regional growth. Prerequisites: C10-1, C11-1, Mathematics B14-1.

**417-C38-0 Theories of Income Distribution** Issues of economic equity and the distribution of economic resources. Alternative models of a just economic distribution, analysis of existing U.S. income distribution and its underlying causes, analysis of government policies designed to redistribute income. Prerequisite: C10-1.

**417-C39-0 Labor Economics** Survey of economic problems growing out of employment relationships; theories and processes of wage and employment determination, income distribution, and the role of trade unions and issues of economic security. Prerequisites: C10-1, C11-1, Mathematics B14-1,2.

**417-C49-0 Industrial Economics** Price and efficiency performance of American industries representative of various types of market structures and practices. Prerequisites: C10-1, Mathematics B14-1,2.

**417-C50-0 Monopoly, Competition,and Public Policy** Present public policy and unsettled issues with respect to structure and practices of industrial markets; concentration, vertical integration, and forms and effectiveness of competition. Prerequisites: C10-1, Mathematics B14-1,2.

**417-C53-0 Urban and Regional Economics** Influence of various factors on spatial distribution of economic activity. Consideration of methods for analyzing economic structure of urban areas.

**417-C54-0 Issues in Urban Economics** Applications of economic analysis to specific problems of urban areas, such as housing markets, zoning restrictions, and racial patterns of employment and housing. Prerequisites: C10-1, Mathematics B14-1,2.

**417-C55-0 Transportation Economics and Public Policy** The demand for alternative modes by passengers and shippers. Cost of providing transportation, competition, regulation, optimal pricing, subsidies, congestion pricing, and urban transit. Prerequisites: C10-1, Mathematics B14-1.

**417-C60-0 Foundations of Corporate Finance Theory** How corporations allocate resources over time as facilitated by capital markets. Theory of asset evaluation, economic analysis of uncertainty, and capital budgeting and capital structure decisions. Prerequisites: C10-1, C11-1, Mathematics B14-1,2.

**417-C70-0 Environmental and Natural Resource Economics** Externalities and the role of property rights, pollution, waste disposal, common property problems, renewable resource management, nonrenewable resource use and depletion, recyclable resources, water allocation, and management of public lands. Prerequisites: C10-1, Mathematics B14-1.

**417-C80-1,2 Introduction to Mathematical Economics** **1.** Noncooperative game theory, with applications to industrial organization, auctions, and theories of the firm. Prerequisites: C10-1, C11-1, Mathematics B14-2. **2.** Cooperative and noncooperative game theory, and decision making under uncertainty. Prerequisite: C80-1 or consent of instructor.

**417-C81-1,2 Introduction to Econometrics** **1.** Probability and distribution theory, statistical inference, simple and multiple regression, specification error and multicollinearity, heteroskedasticity and serial correlation, measurement error, dummy variables. Prerequisites: B81, C10-1, C11-1, Mathematics B14-1,2. **2.** Hypothesis testing, estimation with deficient data, distributed lags, panel data, simultaneous equation systems, limited dependent variables. Prerequisite: C81-1.

**417-C82-0 Welfare Economics and Social Choice** Rigorous analysis of the classical problems of welfare economics. Efficiency of competitive equilibrium, social versus private costs, norms for evaluating economic systems, social rankings, and social welfare functions. Prerequisites: C10-1, C11-1, Mathematics B14-1,2.

**417-C83-0 Economic Forecasting** Techniques for making and evaluating economic and business forecasts, including univariate regressions, autoregressive and ARMA models, vector autoregressive models, and structural econometric models. Prerequisite: B81.

**417-C95-0 Junior Seminar** Small seminars led by different department members on their special interests. Advanced work through supervised reading, research, or discussion. Prerequisites: C10-1, C11-1, Mathematics B14-1,2.

**417-C98-1,2 Senior Honors Seminar** For students of superior ability. Original research on a topic of interest to the student, culminating in a senior honors thesis. By department invitation only. Grade of K given in C98-1. Prerequisites: C10-1, C11-1, Mathematics B14-1,2, at least four C-level economics electives.

**417-C99-0 Independent Study** Advanced work through reading, research, and discussion in areas of particular interest to the student. Project to be decided by mutual agreement with a faculty member.

### Related Course

**403-C41-0 Economic Anthropology**
This course can be taken in partial fulfillment of the six elective requirements in economics. See Anthropology.

## English

Perhaps the most striking thing about the study of English literature today is how varied it is. While some scholars and teachers emphasize the formal qualities of literary works, others address such questions as what counts as "literary" and the relationship of literature to society. The particular kinds of texts they examine also vary a good deal, as do their assumptions, methods, and emphases. The unity underlying this variety is a common emphasis on close reading and careful analysis of the written word. The English department's curriculum reflects this variety and unity, and it offers a major that enables each student to pursue a particular area of interest within a broader understanding of the sweep of literary history and the range of literary study. The department also offers students disciplined training in the writing of verse and fiction. Virtually all of its courses also include practice in the writing of clear, concise, and persuasive expository prose. Rigorous training in thinking and writing is valuable for any career that an undergraduate may ultimately pursue and makes English an attractive major for students preparing for careers in medicine, law, and business, as well as in the teaching of English at all levels.

The department takes pride in the diversity of perspectives afforded by its courses. In addition to teaching classes in the department, English faculty contribute substantially to the course offerings in theater and drama, comparative literary studies, and American studies.

The University Library is a valuable resource for the advanced study of British and American literature, maintaining notable collections and databases in 19th- and 20th-century materials, especially modern "little" magazines. English majors also often profit from University programs for foreign study, particularly at the University of Sussex in England.

### Majors in English

A complete description of undergraduate English major programs can be obtained from the department office and from the departmental Web page <www.english.nwu.edu>. Detailed descriptions of courses offered each quarter are published in "English Notes," available from the department office three times a year in advance of registration. In addition, a tentative list of course offerings for the following year is available each spring. Writing courses

(B06, B07) and other courses whose content varies may be repeated, but only with consent of the department.

### *English and American Literature*

**Departmental courses**

***Introductory courses:*** B10, followed by B98

***Major courses:*** 11 courses

- Five courses within a designated concentration:
  1. new world and postcolonial literature
  2. medieval literature
  3. British literature, 1500–1660 plus Milton
  4. Restoration and 18th-century British literature
  5. 19th-century British literature, including Romantic literature
  6. 20th-century literature in English
  7. American literature
  8. literary criticism and theory
  9. literature and culture
  10. literature and gender
  11. poetry
  12. drama
  13. fiction
- Six courses outside the concentration
- Nine courses at the C level or above
- At least nine English department courses, literature courses offered by the Department of African American Studies, or courses taught by members of the English department through other departments or programs and that deal substantially with literary works originally written in English (i.e., not in English translation)
- At least three of these courses must deal substantially with texts written before 1798 and at least three with texts written after 1798
- At least one course in American literature
- At least one course in literary criticism or theory

**Related courses:** At least two quarter-courses in fields outside of literature and related to the student's concentration. Specific listings are available in the department office and on the departmental Web page <www.english.nwu.edu>.

*Note:* Requirements for different concentrations vary. For more information, consult with the department office, University Hall, room 215, or the departmental Web page.

### *English Major in Writing*

Students majoring in English may apply to the major in writing. Admission to the writing major is competitive, and the overall configuration of courses in the writing major is somewhat different from the literature major. The writing major includes the writing of poetry and fiction, but it is not restricted to "creative writing" alone. A required course in prose style and argument encourages students to focus on discursive forms, while a strong literature component and a course in cultural criticism further situate the writing done in the practical workshop courses in poetry and fiction within a context of general literacy.

Students may apply for admission to the writing major through the department office in the early spring of each year.

**Departmental courses**

***Introductory courses:*** B10, B06, B07

***Major courses***

- One yearlong practice and theory sequence: C93-FW,TS or C94-FW,TS
- C92 and C95
- Five literature courses, at least two of which must deal with works written before 1798 and at least two with works written after 1798

*Note:* C-level writing courses will satisfy the major requirement in the literary criticism and theory concentration. Other major requirements apply.

**Related courses:** Two courses in fields outside of literature selected with the advice and consent of the student's writing major adviser. Recommended are those courses that provide a broad historical background for the study of literature.

## Minor in English

The minor in English offers students experience in reading literary texts and writing critical analyses. Two courses in literature before the 19th century are required to ensure historical perspective. Students pursuing the minor will be permitted to preregister in the department after declared English majors.

**Minor course requirements (7 or 8 units)**

- Two or three B-level courses: B10 followed by B98 *or* B06 and B07
- Five C-level courses, at least two of which must deal with literature written before 1798 and at least two with literature written after 1798; one course may be in comparative literary studies

## Honors in English

Literature majors who wish to earn honors may apply during the spring of their junior year for admission to the two-quarter honors seminar, C98-1,2, which meets the following fall and winter quarters. Each student in the seminar is expected to produce an honors essay. Under the direction of the department honors coordinator, students in C98 discuss their work and issues of common interest, at the same time receiving individual advice on their particular topics from faculty members with expertise in relevant areas. The aim is to foster intellectual community among the department's most ambitious students while encouraging outstanding independent work. Admission to

the seminar is competitive; a grade point average of 3.4 or above and a description of a likely topic are among the requirements. Students interested in honors through the writing major should consult with the director of the program. See Honors under Academic Policies earlier in this section of the catalog.

### The Teaching of English

CAS students pursuing a major in English who also wish to be certified for secondary teaching must be admitted to the Secondary Teaching Program in the School of Education and Social Policy (SESP) and complete all requirements as outlined in the SESP section of this catalog. Students are urged to contact the Office of Student Affairs in SESP as early as possible in their academic career.

### Related Programs

Department of English courses are used in the American studies, comparative literary studies, and drama programs. Students also may pursue creative writing in courses offered by the writing arts program.

### Courses Primarily for Freshmen and Sophomores

**419-A05-0 Expository Writing** Emphasizes all phases of the composition process (gathering and analyzing material, drafting, revising, and editing), research methods, and critical thinking (analysis, argument). Careful review of student papers and reports.

**419-A06-1,2 Writing in Special Contexts** An introduction to expository writing that is paired with a course in another discipline. Emphasizes the composition process, research methods, and critical thinking. Careful review of student papers and reports.

**419-B05-0 Intermediate Composition** Expository writing at an intermediate level. Emphasis on techniques for writing clearly, precisely, and persuasively.

*Prospective writing majors take both B06 and B07.*

**419-B06-0 Reading and Writing Poetry** Forms and techniques of verse.

**419-B07-0 Reading and Writing Fiction** Forms and techniques of fiction.

**404-B10-1,2 Survey of African American Literature** See African American Studies.

**419-B10-0 English Literary Traditions** Chronological survey of the common history and traditions of English literature from the Middle Ages to the 20th century in its cultural contexts, emphasizing earlier periods.

**419-B11-0 Introduction to Poetry** Elements of lyric and narrative poetry—diction, imagery, metrics, plot—with emphasis on the ways these can create meaning and elicit response.

**419-B12-0 Introduction to Drama** Fundamental elements of drama as perceived in performance. How a play communicates from text to stage and from stage to audience, through analysis of representative early and modern plays. Prerequisite for drama major.

**419-B13-0 Introduction to Fiction** Major 19th- and 20th-century fiction examined to define the genre (novel or short story) and distinguish between its conventional and experimental modes.

**419-B34-0 Introduction to Shakespeare** Representative Shakespearean plays.

**404-B59-0 Introduction to African American Drama** See African American Studies.

**419-B60-0 Introduction to 20th-Century British Literature** Principal writers and works since World War I.

**419-B70-1,2 Introduction to American Literature** Representative writers and works of American literature in cultural context, including history, art, and other extraliterary forms. **1.** Puritans to *Moby Dick*. **2.** Mid-19th century to 1900.

**419-B73-0 Introduction to 20th-Century American Literature** Principal writers and works since World War I.

**419-B98-0 Introductory Seminar in Reading and Interpretation** Practice in close reading and analysis of literature in relation to important critical issues and perspectives in literary study. Prerequisite: B10 (may be taken concurrently).

### Courses Primarily for Juniors and Seniors

**486-C01-0 The Art of Fiction** See Writing Arts.

**419-C02-0 History of the English Language** The English language from the earliest times to today. Examples from Old English, Middle English, and Early Modern English literature.

**486-C02-0 The Art of Poetry** See Writing Arts.

**486-C03-0 The Art of Expository Prose** See Writing Arts.

**419-C04-0 Practical Rhetoric** The theory of writing and of skills that underlie good writing. Intended to meet the special problems of teachers in secondary schools and universities.

**419-C05-0 Advanced Composition** For students with previous formal training in composition; admission by consent of department.

**419-C07-0 Advanced Creative Writing:Fiction** For students with previous formal training in creative writing who are not writing majors; admission by consent of department.

**419-C10-0 Studies in Literary Genres** Content varies: for example, satire, biography, comedy. May be repeated with consent of department.

**419-C11-0 Studies in Poetry** Such elements of poems as diction, imagery, rhythm, structure; how they work with the subject matter to determine the individual poem, and how they guide interpretation of the poem.

**419-C12-0 Studies in Drama** Content varies: for example, Ibsen, Shaw, and Pirandello; women and modern drama. May be repeated for credit with consent of department.

**419-C13-0 Studies in Fiction** Content varies: for example, the subversive hero in 20th-century literature, experiments in modern literature. May be repeated for credit with consent of department.

**419-C20-0 Medieval English Literature** Representative works in their intellectual and cultural contexts.

**419-C21-1,2 Old English 1.** The Old English language and readings in prose and poetry. **2.** *Beowulf* and other poetry. Prerequisite for C21-2: C21-1.

**419-C23-1,2 Chaucer 1.** *The Canterbury Tales.* **2.** *Troilus and Criseyde* and other works.

**419-C24-0 Studies in Medieval Literature** Content varies: for example, courtly romance, poems in manuscripts, Arthurian tradition, women in medieval culture.

**419-C31-0 Renaissance Poetry** English poetry from the Elizabethan period to 1660, including such writers as Wyatt, Jonson, Donne, Herbert, and the Cavalier poets.

**419-C32-0 Renaissance Drama** English plays of the Tudor, Elizabethan, and Jacobean periods, including such writers as Marlowe, Jonson, Beaumont and Fletcher, Webster, Middleton, and Ford.

**419-C33-0 Spenser** Spenser's major poetry, with emphasis on *The Faerie Queene.*

**419-C34-1,2 Shakespeare 1.** Principal plays up to 1600. **2.** Principal plays after 1600.

**419-C35-0 Milton** Milton's poetry, with those parts of his prose that illuminate his poetical and intellectual development.

**419-C38-0 Studies in Renaissance Literature** Content varies: for example, Marvell, Herbert, and Vaughan.

**419-C39-0 Special Topics in Shakespeare** Content varies: for example, late comedies and romances, illusion and the social order, Shakespeare in film.

**419-C40-0 Restoration and 18th-Century Literature** Representative works in their intellectual and cultural contexts.

**419-C41-0 Restoration and 18th-Century Poetry** Dryden, Pope, and other poets of the period 1660–1744.

**419-C42-0 Restoration and 18th-Century Drama** English drama from 1660 to the end of the 18th century.

**419-C43-0 18th-Century Prose** Johnson, Swift, Gibbon, Burke, Wollstonecraft, and other nonfiction prose writers.

**404-C44-0 Black Presence in Faulkner** See African American Studies.

**419-C44-0 18th-Century Fiction** Defoe, Richardson, Smollett, Fielding, Sterne, Burney, Radcliffe, and Austen.

**419-C48-0 Studies in Restoration and 18th-Century Literature** Content varies: for example, biography and autobiography, literary careers, literature and social criticism.

**404-C49-0 Black Families in Literature** See African American Studies.

**419-C50-0 19th-Century British Literature** Representative works in their intellectual and cultural contexts.

**419-C51-0 Romantic Poetry** Blake, Wordsworth, Coleridge, Byron, Shelley, and Keats.

**419-C53-0 Studies in Romantic Literature** Content varies: for example, Blake: poet and painter; romanticism and revolution; Byron and the Byronic.

**419-C56-0 Victorian Poetry** The principal British poets from Tennyson to Hopkins, with attention to cultural context and developments in form.

**419-C57-0 19th-Century British Fiction** Important and representative novels written between 1800 and 1900.

**419-C58-0 Dickens** Representative major works of Charles Dickens.

**419-C59-0 Studies in Victorian Literature** Content varies: for example, Victorian autobiography, novels of the Brontë sisters, painting and Victorian literature.

**419-C60-0 20th-Century British and American Literature** Representative works in their intellectual and cultural contexts.

**419-C61-1,2,3 20th-Century Poetry 1.** Major British poets such as Yeats, Eliot, Auden. **2.** Major American poets from Frost and Robinson to Crane. **3.** British and American poetry since World War II.

**416-C62-1,2,3 Modern Drama** See Comparative Literary Studies.

**419-C63-1,2 20th-Century Fiction 1.** British writers such as Conrad, Ford, Forster, Greene, Huxley, Lawrence, Waugh, and Woolf. **2.** American writers such as James, Hemingway, Fitzgerald, Faulkner, and West.

**419-C65-0 Studies in Postcolonial Literature** Themes, antecedents, and contexts of selected literature produced in societies now emerging from colonial rule: for example, autobiography, initiation narratives, magical realism, Walcott, Rushdie.

**419-C66-0 Studies in African American Literature** Content varies: for example, black women's fiction; the slave narrative in modern African American fiction;

the Harlem renaissance; vernacular theories of African American literature.

**419-C67-0 Postwar British Fiction** Representative British novels since 1945, including such writers as Orwell, Greene, and Waugh.

**419-C68-0 Studies in 20th-Century Literature** Content varies: for example, boundaries of modernism (Kafka, Joyce, Nabokov), Forster, Cather.

**419-C69-0 Studies in African Literature** Twentieth-century African literature in English.

**419-C70-0 American Literature before 1914** Intellectual and cultural contexts of American literature from the Puritans to 1914. Such writers as Bradford, Edwards, Franklin, Emerson, Thoreau, Fuller, and Henry Adams.

**419-C71-0 American Novel** Writers such as Cooper, Alcott, Chopin, Hawthorne, Melville, Poe, Twain, James, Howells, Crane, Dreiser, and Wharton.

**419-C72-0 American Poetry** Writers such as Bradstreet, Freneau, Bryant, Poe, Whitman, Dickinson, Robinson, and Frost.

**419-C78-0 Studies in American Literature** Content varies: for example, radicalism in American literature, Twain, cultural imagination of turn-of-the-century America.

**416-C82-1,2,3 History of Literary Criticism** See Comparative Literary Studies.

**416-C83-0 Special Topics in Theory** See Comparative Literary Studies.

**419-C85-0 Topics in Combined Studies** Special topics in literature and related disciplines. Content varies: for example, opera and literature, mythology and the arts.

**419-C86-0 Studies in Literature and Film** Content varies; comparison of representative films and literary works with emphasis on aesthetic principles and social and historical contexts they share.

**419-C92-0 The Situation of Writing** Literary and cultural contexts of writing; the competing claims of tradition and innovation; current literary ideologies; the relation of writer to audience and marketplace. Prerequisite: admission to writing major.

**419-C93-FW,TS Theory and Practice of Poetry** (1.5 units each) Sequence of two 15-week courses. **1.** Theory of prosody, including the major form of poetry in English (accentual-syllabic verse) and minor forms (accentual, syllabic, and free verse). **2.** Intensive writing practice culminating in the production of a long poem. Prerequisite: admission to sequence or writing major.

**419-C94-FW,TS Theory and Practice of Fiction** (1.5 units each) Sequence of two 15-week courses. **1.** Tenets of fictional realism and its substitutes, with practice in different applications of plot, narrative technique, and point of view. **2.** Culminates in the writing of a novella. Prerequisite: admission to sequence or writing major.

**419-C95-0 Fundamentals of Prose** The techniques of prose for writing majors. How syntax, diction, special vocabularies, and methods of argument and analysis contribute to tone and expression.

**419-C98-1,2 Honors Seminar** For seniors preparing an honors essay. Students pursue individual topics with careful guidance while meeting collectively to discuss common issues and present their works-in-progress. Admission by application. K grade given pending completion of essay.

**419-C99-0 Independent Study** Reading, writing, and conferences on special subjects for senior majors with excellent records. May be elected three quarters but only one unit at a time. Prerequisite: consent of instructor or director of writing major.

## Environmental Sciences Program

A major challenge facing our species is to learn to understand and coexist with the natural environment. The environmental sciences major is designed to provide students with an understanding of the physical environment and the relations of humans to it. Environmental science necessarily differs from the more traditional divisions of scientific inquiry. The intellectual approach is that of synthesis, where the focus is concentrated on the integration of knowledge rather than on further refinement of knowledge within a particular scientific field. Also, the concern for translating theory into practice requires a strong association with engineering. With this approach, environmental sciences provides a mechanism for motivated students to work in a multidisciplinary framework with a common theme.

The major gives students the expertise to address issues of environmental concern from a scientific basis, such as energy options, environmental law, the relation of society and resources, and health problems of air and water pollution. It provides a background for employment in environmentally oriented firms or for graduate study in any of several different environmental science disciplines as well as an exceptional preprofessional experience for students interested in law or business.

### Major in Environmental Sciences

The major is rigorous but reasonably flexible. It requires a basic grounding in the sciences and mathematics, a core curriculum that introduces students to environmental problems, courses that consider society's impact on the environment, and a series of advanced courses tailored to each student's interest. This is capped by a senior seminar where students conduct environmental research and present their results.

For a double major and to determine the grade point average in the environmental sciences major, the

Foundations in Science and Mathematics courses are not considered major courses but rather courses related to the major.

**Program Courses**

***Foundations in Science and Mathematics:*** Basic science and mathematics courses are necessary to understand the environmental sciences; all the courses in chemistry, mathematics, physics, and biological sciences listed under related courses below are required for the major.

***Core Curriculum:*** Physical systems of the environment are emphasized in the core courses; any three of the following are required for the major:

- Biological Sciences A91 Evolution
- Biological Sciences B04 Environmental Biology
- Chemistry B04 Environmental Chemistry
- Environmental Sciences B35 Atmosphere and Climate
- Geological Sciences B01 The Skin of the Earth
- Geological Sciences B04 Environmental Geology
- Political Science B04 Politics and Nature

***Environment and Society:*** Society's place in and interaction with the environment is treated in social science courses; any two of the following are required for the major:

- Anthropology C83 Ecological Anthropology
- Economics C70 Environmental and Natural Resource Economics
- Geography C28 The Human Use of the Earth
- Political Science C71 Environmental Politics
- Sociology C12 Social Basis of Environmental Change

***Advanced Studies:*** The following courses focus on developing skills for detailed understanding of specific environmental issues described in the core curriculum and preparing students for research; any four courses with no more than two from one department are required for the major; Environmental Sciences C98-1,2 is required of all majors.

- Biological Sciences C20 Behavioral Ecology Seminar
- Chemistry C29 Analytical Chemistry with Laboratory
- Chemistry C42-1 Thermodynamics
- Geography C43 Geographic Information Systems
- Geological Sciences C01 Environmental Biogeochemistry
- Geological Sciences C12 The Earth's Changing Climate
- Geological Sciences C17 Paleobiology
- Geological Sciences C18 Stable Isotope Geochemistry
- Civil Engineering C58 Airphoto Interpretation
- Civil Engineering C59 Hazardous Waste Management
- Civil Engineering C60 Environmental Impact Evaluation
- Civil Engineering C61 Public Health Engineering
- Civil Engineering C63 Community Air Pollution
- Civil Engineering C66 Ecosystems and Ecotoxicology
- Civil Engineering C67 Aquatic Chemistry

***Senior seminar***

- Environmental Sciences C98-1,2 Environmental Research Seminar (required of all majors)

**Related Courses**

The following foundations in science and mathematics are required for the major:

- Biological Sciences A70 Concepts of Biology *or* A90 Characteristics of Living Organisms *or* B10-1 Genetics and Evolutionary Biology
- Chemistry A01 General Chemistry
- Chemistry A02 General Inorganic Chemistry
- Chemistry A03 General Physical Chemistry
- Chemistry B10-1 Organic Chemistry
- Mathematics B14-1,2,3 Calculus
- Physics A35-1,2 General Physics or A30-1,2 College Physics

## Integrated Science Program

The Integrated Science Program is a highly selective BA program in CAS (see Integrated Science Program). Students majoring in ISP who wish to complete a second major in environmental sciences should fulfill the following requirements instead of those listed above. They may not substitute ISP C98 or Environmental Sciences C98 for the ISP-required course Mathematics C91-2 and must take the following additional courses:

- Geological Sciences B01
- Biological Sciences A91 or Environmental Sciences B37
- Two of the following courses: Environmental Sciences B35, B36; Geography B11; Geological Sciences B04
- Two courses listed under Environment and Society above
- Two courses, not in the same department, from those listed under Advanced Studies above, except Chemistry C42-1
- Students may take the two quarters of Environmental Sciences C98 instead of ISP C98

## Advising and Course Selection

As soon as students have declared a major in environmental sciences, they should consult with the environmental sciences adviser to plan their programs. They should try to complete the foundations in science and mathematics courses by the end of their sophomore year.

Premedical students and students interested in advanced study in environmental biology are advised to take the B-level sequence in biological sciences and one or two additional quarters of organic chemistry.

## Core Courses

**422-B35-0 Atmosphere and Climate** Nature and composition of the atmosphere, principles of atmospheric motion; frontogenesis; precipitation processes; global patterns of climate and climatic change. Prerequisite: Mathematics B14-3 or equivalent.

**422-B37-0 Ecology and Environment** Principles of ecology with an emphasis on environmental factors and problems. Growth and regulation of populations. Community

ecology, extinction, habitat fragmentation. Population genetics in an ecological context. Prerequisites: Biological Sciences B10-1; Chemistry A03; Mathematics B14-3. Two Saturday field trips required.

### Other Courses

**422-C90-0 Internship in Environmental Sciences (1–2 credits)** Participation in off-campus research activities of public and private environmental organizations under the supervision of faculty. Prerequisite: junior or senior standing and consent of program director.

**422-C98-1,2 Environmental Research Seminar** Independent research directed by environmental sciences faculty. Research design and scientific communication. Prerequisite: senior standing. Open only to majors.

## European Thought and Culture

The series of courses Patterns of European Thought and Culture is a joint enterprise of faculty in classics, the modern language and literature departments, art history, history, music, philosophy, and religion. Through a study of the forms and values of particular ages in their historical context, the courses aim at tracing patterns of social and cultural representation that are shared by different European societies and give to the different eras of European history their temporal boundaries. The courses are frequently team-taught by faculty from different disciplines. The courses meet various distribution requirements in the areas of historical studies, values, and literature and fine arts, but any combination of six may be used to meet all the requirements in those three areas.

### Courses

**414-B10-0 Early Western Civilization** See Classics.

**414-B11-0 Classical Greece** See Classics.

**414-B12-0 Roman Civilization** See Classics.

**430-B13-0 The Middle Ages** Introduction to the distinctive institutions, political and spiritual horizons, and aesthetic expressions of medieval culture, with special emphasis on the 12th and 13th centuries.

**430-B14-0 The Renaissance** Introduction to some themes associated with the Renaissance, principally humanism, the invention of printing, the discovery of the Americas, the Copernican revolution, the Reformation and Counter-Reformation, and more generally, radically new ways of conceiving the self and its relation to social orders.

**430-B15-0 The Birth of Modernity (1550–1720)** Introduction to the social, political, and intellectual history of Europe from 1580 to 1720, with special emphasis on the change from medieval monarchy to the modern nation state and on the origins of modern philosophy and natural science.

**430-B16-0 The Age of Enlightenment** Introduction to European scientific and philosophical thought in the 18th century, with special emphasis on natural philosophy and evolving concepts of gender and race.

**430-B17-0 The Romantic Period** Introduction to the romantic movement and the radical shift it introduced to traditional concepts of the self, with special emphasis on philosophy, lyric poetry, and music as dominant cultural forms of this period.

**430-B18-0 Modern Culture:The 19th Century** Survey of 19th-century culture with special emphasis on the political and social consequences of the French Revolution, the industrial revolution, and the emergence of the novel as the most characteristic form of artistic expression.

**430-B19-0 Modern Culture:The 20th Century** Survey of the relationship between history, thought, literature, and the fine arts in the 20th century, with special emphasis on the massive revaluation of traditional norms in modernism, the political implications of philosophic movements (Nietzsche, existentialism), and the impact of mass phenomena (wars, revolution, urban life) on modern experience.

## French and Italian

Studies in French or Italian provide insight into the language, thought, and character of cultures different from our own. Such knowledge builds an awareness of our own society's diversity and the ways it resembles and differs from others. As the merging of domestic and international events increasingly affects the material and intellectual life of every individual, the ability to communicate with other peoples assumes vital importance. Whether a student is planning a career in teaching, government, science, the professions, or business, the study of a foreign language, literature, and culture is a wise option in a university education.

Programs in the department are varied. Language courses, from the elementary through the graduate levels, develop communication skills that allow students to function at ease with foreign texts or in a foreign environment. Courses in literature and civilization not only broaden and deepen insights into the thought and writing of another culture; they also train students to think independently, to organize and analyze materials thoughtfully, and to discuss ideas effectively.

There is a minor in French, a major in French studies, a minor and a major in Italian, and MA and PhD programs in both languages. These may be supplemented by foreign study, which allows students to increase their knowledge of a foreign language and society while continuing university work abroad in a variety of fields. It is not necessary to be a major to participate in these programs. An excellent library, modern audiovisual resources, and a learned faculty (of which nearly one-half are native speakers) further strengthen studies in French and Italian.

## *French*

### Major in French

The program for majors in French studies consists of 17 quarter-courses; at least 12 must be at the C level. Courses at the A level do not count toward the major. Students may count up to five B-level courses toward the major. Of the 17 courses, up to two may be French department courses taught in English. At least two of the C-level courses must be on literature and culture before 1800. All majors must take 2 units of senior seminar, C96 and C97.

Students returning from a study abroad program in France will receive up to eight credits if the content of the courses taken abroad relates in a substantive way to some aspect of French or Francophone culture. All returning students must take 2 units of senior seminar.

### Minor in French

The goal of the minor in French is to give students a solid grounding and good fluency in the French language and to provide a basic familiarity with important aspects of French culture and society. Together these accomplishments will enable students to pursue their interests in French and in countries where French is used.

The minor is designed for students who have a strong interest in French but cannot fulfill the requirements of the French major, either because their knowledge of French was nonexistent or elementary when they came to Northwestern or because they are also engaged in another major with requirements that preclude pursuing a second major. Except for one possible course at the C level, all courses are conducted in French, with class discussion and papers also in French.

Students choosing to minor in French are assumed to have completed either A21 or A23 or the equivalent.

**Minor course requirements (9 units)**

- Four B-level courses: two chosen from B01, B02, B03, B04; two chosen from B10, B71, B72, B80, B82
- Five C-level courses: two or three chosen from C02-1,2, C03, C05, C09, C91-1,2; two or three other courses in literature or civilization, one of which may be a French department course taught in English. C90 may be counted either as a language course or as literature or civilization course.

Students returning from a study abroad program must enroll in at least one C-level course in the department.

### Four-Year BA/MA

The department offers a four-year BA/MA program in French for outstanding undergraduate majors. Interested students should consult with the department chair and should refer to Four-Year Master's Programs in the Undergraduate Education section of this catalog.

### Honors in French

Students who have a grade point average of 3.4 or higher in the major and are interested in writing an honors thesis should declare their intention of doing honors work no later than the spring quarter of their junior year. They also should consult with the director of undergraduate studies. The honors project is produced through one or two quarters of C99. It can build on previous work done in a C-level course or, with consent of the instructor, in a graduate seminar. These courses will count toward the 17 required credits for the major. See Honors under Academic Policies earlier in this section of the catalog.

### The Teaching of French

CAS students pursuing a major in French who also wish to be certified for secondary teaching must be admitted to the Secondary Teaching Program in the School of Education and Social Policy (SESP) and complete all requirements as outlined in the SESP section of this catalog. Students are urged to contact the Office of Student Affairs in SESP as early as possible in their academic career.

### Courses Primarily for Undergraduates

**455-A11-1,2,3 First-Year French** Conversation, grammar, reading, writing for beginners. Five class meetings a week.

**455-A15-1,2 Accelerated First-Year French** For students with some previous experience in French. Review and development of skills in speaking, understanding, and reading as preparation for work at the second-year level. Four class meetings a week. Prerequisite: department placement.

**455-A21-1,2,3 Second-Year French** Grammar review, conversation, reading, writing. Four class meetings a week. Prerequisite: A11 or A15.

**455-A23-0 Second-Year French: Individualized Instruction** Intermediate French in a format allowing students a choice of skill concentrations and learning paces. Credit possible for up to three quarters. Prerequisite: department placement.

**455-A27-1,2,3 Second-Year French for Reading** Designed to develop skill in reading prose, drama, and poetry texts through discussion and translation. Grammar review. Preserves previously acquired oral skills. Prerequisite: A11, A15, or department placement.

**455-B01-0 Introduction to French Studies** Development of fluency, accuracy, and creativity in speaking, comprehension, reading, and writing French; introduction to social, cultural, and literary topics. May not be repeated for credit.

**455-B02-0 Writing Workshop** Practical study of French grammar and structure; students develop and improve writing skills through practice in preparing short compositions. Prerequisite: CAS proficiency in French or equivalent.

**455-B03-0 Oral Workshop** Practical course to increase listening comprehension, build vocabulary and idiom use, and enhance communication skills. Three hours per week.

**455-B04-0 Advanced Intermediate Conversation** Increases listening comprehension, builds vocabulary, and enhances communication skills through extensive use of French television broadcasts and class presentations. Prerequisite: B02 and B03 or consent of instructor.

**455-B10-0 Introduction to French Literature** Study of texts illustrating various genres from the 16th century to the present such as poetry, drama, fairy tale, novel, autobiography. Prerequisite: department placement, AP score of 5, or B02.

**455-B71-0 Introduction to the French Novel** Fundamental concepts and significant achievements of the French novel. Representative novels chosen from writers of the 17th to the 20th centuries. In French. Prerequisites: B02 and B03 or consent of instructor.

**455-B72-0 Introduction to French Theater** Basic concepts and representative works of the French theater with emphasis on the 17th and 20th centuries. Principles of tragedy and comedy; contemporary developments. In French. Prerequisites: B02 and B03 or consent of instructor.

**455-B80-0 French Cultural Studies:Historical France** Major cultural and intellectual problems of France from a historical perspective, such as France in the 19th century, history of gender, rise of the bourgeoisie. Prerequisites: B02 and B03 or consent of instructor.

**455-B82-0 French Cultural Studies:Contemporary France** Major cultural and intellectual problems of contemporary France, such as the Occupation, the Algerian War, racism and immigration, ethnicity and social relations, role of the intellectual, role of France in a unified Europe. Prerequisites: B02 and B03 or consent of instructor.

### Courses with Reading and Discussion in English

No prerequisite in French; readings, discussions, papers, and exams in English.

**455-B76-0 Culture and Autobiography** Autobiography as a literary genre examining culture, race, and gender identity from a subjective perspective.

**455-B77-0 The Literature of Existentialism** Existentialism in its literary, philosophical, and cultural manifestations.

**455-B78-0 From Novel to Film** Conceptual, aesthetic, and cultural dimensions of selected 19th- and 20th-century French novels and their screen adaptations.

**455-C72-0 Medieval Movies** Films representing medieval and Renaissance culture; films that a medieval viewer would have understood.

**455-C74-0 French Feminist Fiction** Feminist poetry, prose, and experimental texts.

**455-C76-0 Feminist Theory** Introduction to fundamental theoretical texts and basic tenets of contemporary feminist theory.

**455-C78-0 Contemporary Theory** Introduction to some major trends in contemporary French theory and the way they have influenced literary studies in the U.S.

### Courses with Prerequisites in French

Students taking these courses are assumed to have completed at least three B-level courses in French, including B10, unless otherwise stated.

**455-C02-1,2 Advanced Grammar and Composition** Grammar, vocabulary, and discourse features related to a particular linguistic function (such as narrating, describing, persuading) and writing practice to synthesize these elements. Prerequisite for C02-1: B02 or consent of instructor. Prerequisite for C02-2: C02-1.

**455-C03-0 Advanced Conversation** Free oral practice based on short readings and spontaneous scenarios. No formal grammar or composition. Language laboratory required. Prerequisite: C02 or consent of instructor.

**455-C05-0 French Phonetics** Study of syllabic division, intonation, rhythm, accent, linking, vowels, consonants. Practical exercises to improve pronunciation.

**455-C09-0 French in Commerce and Industry** Introduction to fundamentals of the French business world in historic, economic, social, and political context. Acquisition of language skills for communication in commerce and business. Prerequisite: C02-1 or consent of instructor.

**455-C10-0 Medieval French Song** Songs of the troubadours; songs of courtly love, social and political songs, women's songs. Study of musical setting and performance. No musical training required.

**455-C12-0 Medieval Heroic Narratives** Epics such as the *Song of Roland,* romances such as *The Story of the Grail.* Texts read in modern French versions.

**455-C20-0 On the Threshold of Modernity:Rabelais and Montaigne** Transition from the Middle Ages to modernity in two major 16th-century artists: Rabelais and optimistic faith in human potential, Montaigne and profound skepticism. In-depth reading of works that speak to the modern condition.

**455-C30-0 Classical Theater and Society** Major dramatic writers of the 17th century, including Corneille, Molière, and Racine, and the social and historical context in which their plays were written and performed.

**455-C35-0 The Literature and Thought of the 17th Century** Major works of poetry, prose, and drama of the 17th century in historical and social context; content varies and may include Descartes, Pascal, Corneille, Racine, Molière, La Fontaine, La Fayette, and others.

**455-C40-0 Sexual Politics in the Ancien Régime** Literary, intellectual, and political role of women in view of the debates generated by the issues of women's power in the public sphere before and during the French Revolution.

**455-C45-0 La Philosophie des Lumières** Enlightenment thought in philosophical and literary works by Montesquieu, Voltaire, Diderot, and Rousseau, emphasizing political thought, materialism, ethics, and aesthetics.

**455-C50-0 The Rhetoric of Romanticism and of Realism** Representations of 19th-century France, primarily through literary texts; historical and cultural contexts of French romanticism and realism.

**455-C55-0 The Invention of Modernity** Study of the origins of modernity in the 19th century, addressing such issues as the rise of mass culture, urbanization, and the beginnings of consumer society.

**455-C60-0 From Modernism to Postmodernism: Experiments in Narrative Form** Crises and reinventions of French prose from the modernist moment of the early 20th century through the ambiguities of "engaged" literature of the 1930s to postmodernism.

**455-C62-0 The French Avant-Garde** Literary and cultural experiments of the various French avant-garde movements, from dada and surrealism to the theater of the absurd and new wave cinema.

**455-C66-0 Francophone Literature of Africa and the Caribbean** Literary traditions of north and sub-Saharan Africa, the Caribbean, and the Indian Ocean. Historical and cultural contexts of literary production; role of oral traditions in the emergence of intellectual and literary movements.

**455-C80-0 Political and Social Thought in France** An inquiry into the major French political and social trends from the *ancien régime* to the 20th century. The intellectual and cultural framework for study of French political life.

**455-C82-0 Literature and Exoticism** Various modalities of the rhetoric of exoticism throughout the history of French literature and in popular culture.

**455-C84-0 Women Writing in French** Female-authored texts analyzed in relation to their respective social, cultural, political, and historical contexts.

**455-C90-0 Topics in Culture** Study of various topics, issues, and questions in French and francophone culture. Content varies: for example, French and francophone cinema, the intellectual in France. May be repeated for credit with different topic. May have language prerequisite.

**455-C91-1,2 Theory and Practice of Translation** Intensive, advanced, two-quarter course integrates previously acquired skills through the comparative study and translation of English and French. Culminates in individual translation project in second half of second quarter.

**455-C96-0 Contemporary French Thought** An examination of different perspectives and paradigms for understanding literature and culture.

**455-C97-0 Studies in Literature and Culture** In-depth research and analysis of a problem or topic concerning cultural representation.

**455-C99-0 Independent Study** Independent reading and research. Topics arranged through consultation with an instructor and approval of the department.

## *Italian*

### Major in Italian

Courses indicated as a prerequisite for an advanced course may not be taken for credit after the advanced course is completed.

**Departmental courses**

***Introductory courses:*** B01, B02, B03

***Major courses:*** at least two courses chosen from C01, C02, C03; five credits of other C-level Italian literature and culture courses, one of which must be on Dante; one course on literary theory as approved by the director of undergraduate studies, possibly Comparative Literary Studies B02, English B06, B07, C80, or C92. No more than one credit of C99 except with departmental honors. Of the seven required C-level courses, up to four may be approved study abroad courses; no more than two may be courses given in English.

**Related courses:** Students choose one of the three following options)

- Language: 5 units in French, German, Greek, Hebrew, Latin, Russian, or Spanish, including at least 2 units at the B level
- Literature: 5 units of B- and C-level work in literature other than Italian, including literature in translation; at least 2 units must be at the C level
- Culture: 5 units in courses pertinent to Italy in art history, classics, European thought and culture, history, linguistics, music, philosophy, or political science; the choice of related courses in culture must be approved by the major adviser (with departmental approval, students may take as many related courses abroad as they wish)

### Minor in Italian

The minor in Italian is designed to give students a solid proficiency in the language and significant knowledge of the literature and culture of Italy that will complement a variety of major studies in the University.

Students choosing to minor in Italian are assumed to have completed A02-3 or equivalent.

**Minor course requirements (8 units)**
- Two courses chosen from B01, B02, B03
- Two courses chosen from C01, C02, C03
- Four additional courses in Italian literature and culture, at least two offered in Italian, at least two at the C level. With the consent of the director of undergraduate studies, one of these courses may be taken in another department.

No more than three of the required courses for the minor may be approved study abroad credit.

### Courses Primarily for Undergraduates

**457-A01-1,2,3 Elementary Italian** Pronunciation, grammar, composition, reading, and conversation. Drill in language laboratory. Five class meetings a week.

**457-A02-1,2,3 Intermediate Italian** Grammar review, conversation, composition, and readings in modern prose and drama. Four class meetings a week. Prerequisite: A01 or 2 units of Italian.

**457-A33/A34-1,2,3 Intensive Italian** Beginning course designed to complete the work of A01 and A02 in one year. Students must enroll concurrently in A33 and A34, for which they receive two credits per quarter. Five class meetings a week.

**457-B01-0 Italian through Media:Composition and Conversation** Issues from Italian media; frequent oral and written reports: for example, America in Italian media, advertising, immigration, youth culture. Grammar review. Produce newspaper or newscast at end of quarter.

**457-B02-0 The Culture of Regional Italy:Conversation** Major authors and cultural movements throughout Italian history, emphasizing regional differences: cooking and folklore, poetry, city planning, theater, film. Some grammar; spoken Italian emphasized.

**457-B03-0 Culture of Unified Italy:Composition** Idea of unified Italy in literature and culture. Nationalism in poets from Dante to Leopardi; government; influence of television on language; opera; education and childhood. Some grammar; written Italian emphasized.

### Courses with Reading and Discussion in English

No prerequisite in Italian.

**457-B75-0 Dante's *Divine Comedy*** Introduction to the *Divine Comedy*, its artistic and intellectual achievement, and its cultural and historical content.

**457-C75-0 Topics in Italian Culture** Content varies: for example, arts and letters in Renaissance Florence, Italian opera, fascism and culture. Prerequisite: consent of instructor.

**457-C80-0 Topics in Italian Cinema** Introduction to major Italian filmmakers and cinematic trends.

### Courses with Prerequisite in Italian

Prerequisite: B01, B02, B03, or equivalent.

**457-C01-0 Advanced Writing Workshop** Analysis of grammar and syntax. Intensive work in composition and translation.

**457-C02-0 Literary Traditions and National Identity** Selective survey of the Italian literary tradition, 1300 to the present. Theme of national identity, techniques of textual analysis.

**457-C03-0 Modern Italian Cultural Studies** Culture of Italy from World War II to the present. Novels, films, popular culture. Content varies; may be repeated for credit with different topic. Sometimes given in English; consult department for details.

**457-C10-1,2,3 Studies in Dante** Interpretations of the *Divina Commedia*, the *Vita Nuova*, and selections from other works.

**457-C20-0 Topics in Renaissance Literature** Content varies: for example, epic poems of Ariosto and Tasso, drama, Machiavelli and Italian humanism.

**457-C50-0 Topics in 19th-Century Literature** Content varies: for example, romantic prose and poetry, Verga and Italian realism.

**457-C60-0 Topics in 20th-Century Literature** Content varies: for example, prose fiction of Pavese, Svevo, Moravia; theater of Pirandello, D'Annunzio, Betti; poetry of Ungaretti, Quasimodo, Montale.

**457-C99-0 Independent Study** Independent reading under supervision (consult department chair).

## Geography Program

The Program in Geography offers three types of courses to students who seek a knowledge of the physical earth and its various modes of human occupance. Introductory courses develop global perspectives on environments that are relevant to many social and physical science fields. Courses in regional geography present a unique way of understanding how nature and culture have interacted over time to give character to specific places or regions. Advanced courses focus on the concepts and techniques of professional geography, especially on the construction of maps and on the uses of maps in solving geographical problems.

Programs of study may lead to a major or a minor in geography. In addition to the following requirements, students majoring in geography also must complete a major in a related social or natural science field.

### Major in Geography

**Program courses:** Geography B10 or Environmental Sciences B35; Geography C41; and four additional geography courses, at least three of which must be at the C level, including 1 unit of research (C98 or C99)

**Related courses:** Mathematics B14-1,2; Economics B01, B02; Statistics B10 or equivalent.

### Minor in Geography

The minor in geography supplements the academic programs of students who major in related social and natural sciences by training them in the theory and method of geographical analysis. In addition to the courses listed below, students choosing to minor in geography must complete Mathematics B14-1,2 or equivalent.

**Minor course requirements (7 units)**

- Statistics B10
- Geography B10 or Environmental Sciences B35
- Geography C41
- Four additional courses, at least three at the C level; one may be taken in a department or program other than geography on the recommendation of the geography program adviser

### Introductory Courses

**421-B10-0 The Natural Environment** Introduction to the physical elements of geography. Major local and global atmospheric processes producing weather and climate. Study of the earth-shaping forces that give rise to the geography of landform features.

**421-B11-0 World Biogeography** Geography of the world's major ecosystems based on the global climate model. Physical processes of soil formation and vegetation development in various ecosystems. Human impacts on natural systems resulting from past and present land-use practices.

### Regional Geography

**421-C13-0 North America** Detailed study of the regional geography of the United States and Canada. The regional distribution of landform types. Patterns of culture, history, and economic development that underlie the distribution of distinctive lifeways in the two countries.

### Advanced Courses

**421-C28-0 The Human Use of the Earth** Geography of the earth's natural environments as modified by human agency. Natural versus anthropogenic environmental change. Processes of habitat alteration in hunter-gatherer societies. Impacts of modern agriculture and forestry.

**421-C41-0 Principles of Cartography** Design, construction, and use of thematic maps for effective presentation of spatial data. Typography and symbolization. Coordinate systems and map projections. Prerequisite: Mathematics B14-1.

**421-C42-0 Map Production Techniques** Advanced techniques for constructing publication-quality maps. Compilation from multiple sources, scribing, and negative construction. Photographic methods, peel coats. Prerequisite: C41.

**421-C43-0 Geographic Information Systems** Methods and techniques of digital cartography; encoding and analysis of spatial information; applications to archaeology, environmental sciences, and business geographics. Prerequisite: C41.

**421-C98-0 Undergraduate Seminar** Advanced work through readings, research, and discussion. Open only to undergraduate majors. Prerequisite: consent of department.

**421-C99-0 Independent Study** Independent research projects. Open to qualified advanced students by consent of department.

## Geological Sciences

The geological sciences use diverse and interdisciplinary approaches to the study of complex physical, chemical, and biological processes occurring on and within the earth. The undergraduate program combines fundamental background in mathematics, physics, and chemistry with courses applying these techniques to geological problems. Undergraduates are encouraged to select individual programs reflecting their scientific interests and career goals, whether graduate study in the earth sciences, professional employment, or advanced study in areas such as management or law.

Undergraduates are involved in the full spectrum of departmental activities beyond class work: research, seminars, field trips, and social functions. The resulting educational environment offers unusual opportunities for motivated and interested students.

### Major in Geological Sciences

**Departmental courses:** B01, B02, and four C-level courses.

**Related courses**

- Chemistry A01, A02, A03; *or* A71, A72
- Mathematics B14-1,2,3, B15, B17, B21
- Physics A35-1,2,3 *or* A90-1,2,3

Mathematics, chemistry, and physics are prerequisites for B- and C-level courses and should be taken at the earliest opportunity.

### Minor in Geological Sciences

The minor in geological sciences offers students in any major a flexible path to improved knowledge of Earth, its processes and, more generally, Earth system science. Students select paths with advice from faculty that emphasize such fields as physical geology, geochemistry, geophysics, or a combination of these.

**Minor course requirements (6 units)**

- B01, B02
- Four other geological sciences courses at the B or C level; three of the four must be at the C level. C98 and C99 will not be credited toward the minor.

**Note:** Most B- and C-level courses in geological sciences have prerequisites in other disciplines and/or in geological sciences. Students should consult the course descriptions in this catalog for details.

### Honors in Geological Sciences

Graduation with honors in geological sciences requires completion of a research project. For more information, consult the director of undergraduate studies. See Honors under Academic Policies earlier in this section of the catalog.

### Four-Year BA/MS

Students with a professional interest in the earth sciences and a grade point average of 3.5 or above may be eligible for the four-year BA/MS honors program offered by the Department of Geological Sciences. The department only recommends students for this program; final approval is made by the Graduate School. Students may apply for this program in the spring quarter of their junior year; by the end of that year, applicants should complete all courses required for the major in geological sciences and all (or nearly all) the CAS BA requirements. See Four-Year Master's Programs in the Undergraduate Education section of this catalog and consult with a department adviser.

To fulfill the MS requirements, students must complete

- 12 courses approved by the student's advisory committee and bearing graduate credit in science or engineering (Mathematics B21, Chemistry C42-1, and the four C-level courses taken for the BA may be counted)
- a final independent research report (not necessarily a formal thesis)

### Integrated Science Program

The Integrated Science Program (ISP) is a highly selective BA program within CAS. Students majoring in ISP who wish also to complete a major in geological sciences must take B01 and three C-level courses in addition to C15. These requirements replace the usual major requirements noted above.

### Courses Primarily for Freshmen and Sophomores

**423-A01-0 Earth Processes and Products** Minerals, rocks, and structures of the earth's crust, changes wrought through geologic time. Lectures, laboratory; weekend field trip.

**423-A06-0 The Ocean,the Atmosphere, and Our Climate** Physical, chemical, and geological oceanography; emphasis on interactions with the atmosphere and the role of the world ocean in the earth's climate. Lectures and discussion.

**423-A07-0 Plate Tectonics** Drift of continents and spreading of sea floor; pattern of motions; relation to earthquakes, volcanism, mountains, and the earth's interior. Lectures and discussion.

**423-A10-0 The Earth As a Planet** Origin of the solar system, accretion and differentiation of the earth, early history of the moon, abundance of elements, geologic time. Lectures and discussion.

**423-A11-0 Global Environmental Change** Natural and human causes of change and environmental changes on land, in waters, and in the atmosphere. The earth system on long and short timescales. Lectures and discussion.

**423-B01-0 The Skin of the Earth** Weathering, sedimentation, glaciation, mountain building, deformational features, metamorphism, volcanism, and historical geology. Field trip. Prerequisite: Chemistry A03, Mathematics B14-1, or equivalent.

**423-B02-0 The Body of the Earth** The earth as a planet: origin, composition, and evolution of the solar system and the earth; internal structure of the earth; plate tectonics. Prerequisite: Mathematics B14-2, Physics A35-1, Chemistry A03, or equivalent.

**423-B03-0 Minerals,Natural Solids,and Rocks** Rock-forming minerals, natural solids, crystal structure, and their formation. Main rock-forming processes, mineral assemblages, and conditions for formation of crust and mantle. Prerequisite: Chemistry A02 or A71, Physics A35-1, or equivalent.

**423-B04-0 Environmental Geology** Hazardous earth processes, human interaction with the environment, problems of resource availability and use. Laboratory and one-day field trip. Prerequisites: Mathematics B14-2, Chemistry A03.

**423-B88-0 Earth in Science and Art** Major ideas and discoveries behind our understanding of the earth and its environment. Similarities and differences between the views of the earth in science and pictorial art. Prerequisite: one college-level course in physics, chemistry, or geological sciences, or consent of instructor.

### Courses Primarily for Juniors and Seniors

**423-C01-0 Environmental Biogeochemistry** Surficial processes and their geological and biological driving forces (atmosphere-land-water interactions, weathering, geochemical transport, sedimentation). Biogeochemical cycles and their role in the global environment. Prerequisite: B01, B02, or B04.

**423-C03-0 Hydrogeology** Transport and storage of water on the earth. Hydrostatics, hydrodynamics, flow models, infiltration, permeability, erosion, sediment transport, sediment dewatering, climate and sea-level changes, resource limitations, and pollution. Prerequisites: B01, Mathematics B15, Physics A35-1,2,3, or consent of instructor.

**423-C04-0 Coastal Processes** Competition between motions of water, beach, sediments, and crust. Waves,

currents, tides. Sediment transport, beach evolution, cliff erosion, sea-level change, coastline and landform development. Processes in Lake Michigan. Prerequisites: B01, Mathematics B15, Physics A35-1,2,3, or consent of instructor.

**423-C07-0 Tectonics and Structural Geology** Deformation of rock masses: strain, fracture, slip, stress, and rheologic regimes; rock structures; folds, faults, foliations; seismic parameters in tectonic studies; orogenic belts and their tectonic evolution. Lectures and lab. Prerequisites: B01, Mathematics B17, Physics A35-1, or equivalent.

**423-C09-0 Reflection Seismology** Acquisition, processing, and interpretation of reflection seismograms. Hydrocarbon prospecting, structural geology, tectonics, stratigraphy, and deep continental reflection profiling. Prerequisites: Mathematics B14-3, Physics A35-1, or consent of instructor.

**423-C12-0 The Earth's Changing Climate** The physics of climate and climate change; methods of study of past climates of the earth. The climate from the Cretaceous to the present.

**423-C13-0 Sedimentary Geology** Sedimentary rocks; stratigraphy; local, regional and global correlation. Ancient depositional systems; facies analysis in context of tectonic, eustatic, and climatic controls on deposition. Prerequisite: B01 or equivalent.

**423-C15-0 Physics of the Earth for ISP** Solid earth geophysics: the earth's gravity field, the earth's magnetic field, interior of the earth, heat flow, elementary wave propagation, plate tectonics. Prerequisite: second-year standing in ISP or comparable background in mathematics and physics.

**423-C16-0 Sedimentary Geochemistry** Formation and diagenesis of carbonate, geochemistry of organic matter, petroleum formation, evaporite precipitation, paleoenvironmental reconstruction, isotope, organic, and trace and major element geochemistry. Prerequisites: B01, C13, Chemistry A03, or equivalent.

**423-C17-0 Paleobiology** Major fossil groups; origin and evolution of life; speciation and mass extinction; evolution of communities and ecosystems. Application of paleobiologic methods to paleoenvironmental reconstruction. Prerequisites: A01, A06, or A11; Biological Sciences A03 or B10-1; or consent of instructor.

**423-C18-0 Stable Isotope Geochemistry** Fractionation and distribution of stable isotopes (C,H,N,O,S) in the biosphere, hydrosphere, atmosphere, and geosphere; isotopic biogeochemistry, environmental problems and global climate change. Prerequisites: B01 or B04, C01, C16.

**423-C19-0 Field Problems in Sedimentary Geology** Field methods in stratigraphy and sedimentology; interpretation of depositional systems and development of facies models based on field observations. Continuation of C13; 2½-week field trip to Colorado and Utah in early to mid-September, returning in time for beginning of fall classes. Prerequisite: C13.

**423-C24-0 Seismology and Earth Structure** Elastic theory, seismic waves, seismometers and seismograms, ray paths, travel times; internal structure of the earth; earthquakes: location, characteristics, mechanism, and relation to plate motions. Prerequisites: Mathematics B21, Physics A35-2.

**423-C25-0 Global Tectonics** Kinematics of plate tectonics. Geometry, determination, and description of plate motions. Paleomagnetism, marine magnetism, and hot spots. History of ocean basins and mountain building processes. Prerequisites: B02, Mathematics B17, Physics A35-2.

**423-C27-0 Chemical Processes in the Earth's Crust** Fundamental principles of multiphase equilibria and solution chemistry; fluid-rock interactions in the earth's crust; hydrothermal ore deposits, geothermal systems, metamorphism. Prerequisites: B01 and Chemistry A03 or A72.

**423-C28-0 Geophysical Data Processing** Analysis of seismic and other geophysical data. Sampling, windowing, discrete and fast Fourier transforms, z-transforms, deconvolution, filtering, and inverse methods. Prerequisite: Mathematics B21.

**423-C29-0 Tectonophysics** Quantitative kinematics of distributed deformation within plate boundary zones; gravity field and geoid; principle of isostasy; flexure of the crust and lithosphere. Prerequisites: Mathematics B21 and Physics A35-2 or consent of instructor.

**423-C50-0 Physics and Thermochemistry of the Earth's Interior** Finite strain theory, solid solution thermodynamics, phase transitions, subduction zone processes, seismic velocity structures, mineral equations of state. Prerequisites: Chemistry A03, Physics A35-1, Mathematics B14-3.

**423-C98-0 Undergraduate Seminar** Opportunity for advanced work through supervised reading, research, and discussion. Open only by invitation of the department.

**423-C99-0 Independent Study** Special problems under direct supervision of one or more members of staff. Comprehensive report and examination required. Open with consent of department to juniors and seniors who have completed a field of concentration in the department.

## German

The Department of German offers courses in three separate tracks, giving students a choice in satisfying their educational needs or interests. Courses are designed to

- offer students who select German to fulfill the college language requirement and those who wish to acquire a basic knowledge of the language an opportunity to read modern German prose and to express themselves in German

- educate majors in German language and literature or German studies, German minors, and prospective teachers in all aspects of German language, literature, and culture with an emphasis on the "modern" period (from the 18th century to the present)
- provide a basis for the understanding of the intellectual and cultural life of Germany for students who are not proficient in German

## Majors in German

Courses indicated as a prerequisite for an advanced course may not be taken for credit after the advanced course. Students returning from a study abroad program in their junior year must enroll in three C-level quarter-courses in the department.

### *German Language and Literature*

**Departmental courses**

- Four quarter-courses in the German language, two at the B and two at the C level, chosen from B05, B08, C91
- Three quarters of B01-1,2,3,4 *or* B04 and two quarters of B01-1,2,3,4
- Three quarters of C10-1,2,3,4
- Three quarters of C29 and/or C32

*Note:* Students may substitute a C-level criticism course for one C-level literature and culture requirement.

**Related courses:** Students choose one of the following options with the consent of the director of undergraduate studies

- Five quarter-courses, at least two at the C level, in the humanities or social sciences in topics pertinent to German or to the study of language and literature in general
- Five quarter-courses in another foreign language, including at least three at the B level or higher

### *German Studies*

This program offers students the opportunity to study German life and culture in the broadest sense, including language, geography, institutions, politics, economics, social and intellectual history, literature, and music. Since the program was designed to prepare the German studies student for a career in government service or for graduate study in international economics, management, trade, or law, a secondary concentration in economics, political science, history, or a combination thereof is highly recommended.

Students pursuing a second major in addition to German studies must select a concentration in an area distinct from that second major; for example, a double major in German studies and economics must select a German studies concentration in a field other than economics. Courses required for either major may be counted in one major only.

**Departmental courses**

- Four quarter-courses in the German language: C80, C91, and two courses chosen from B05, B08, and B80
- Two quarters of B01-1,2,3,4 *or* B04 and one quarter of B01-1,2,3,4
- Three quarters of C10-1,2,3,4
- Two quarters of C32

**Related courses**

- Two quarter-courses chosen, with consent of the director of undergraduate studies, from German B33-2, B50, History C44-1, C44-2, C49

**Secondary concentration:** five quarter-courses pertinent to German, at least two at the C level; must be approved by director of undergraduate studies

## Minor in German

The minor in German is designed to give students a solid language proficiency at the upper level and to provide significant knowledge of German culture. Students returning from a study abroad program in their junior year must enroll in one C-level quarter-course in the department.

For more information, consult the department's director of undergraduate studies.

**Minor course requirements (8 units)**

- Four quarter-courses in German language: B05; one course chosen from B03, B08, B80; two quarters of C80 and/or C91
- Four quarter-courses in German literature and culture: two quarters of B01-1,2,3,4 *or* B04 and one quarter of B01-1,2,3,4; two quarters chosen from C10-1,2,3,4 and C32

## Honors in German

Superior students majoring in German language and literature or German studies may qualify for departmental honors by completing (a) two quarters of C98 or C99, (b) two quarters of D-level courses, or (c) one quarter of C98 or C99 and one quarter of a D-level course. In addition, they must present a research paper at the end of their second quarter of honors study. Interested students should consult with the department's director of undergraduate studies. See Honors under Academic Policies earlier in this section of the catalog.

## The Teaching of German

CAS students pursuing a major in German who also wish to be certified for secondary teaching must be admitted to the Secondary Teaching Program in the School of Education and Social Policy (SESP) and complete all requirements as outlined in the SESP section of this catalog. Students are urged to contact the Office of Student Affairs in SESP as early as possible in their academic career.

## Language Courses

**425-A01-1,2,3 Elementary German** German language and culture. Understanding, speaking, reading, and writing of German.

**425-A02-1,2,3 Intermediate German** German language and culture. Understanding, speaking, reading, and writing of German continued. Prerequisite: A01-3 or equivalent.

**425-A05-0 German for Research** (0 units) Introduction to the translation of scholarly and scientific German texts. No prerequisites in the language.

**425-B03-0 Intermediate Conversation** Practical training in communication skills with sole emphasis on listening comprehension and speaking. May be repeated for credit with different materials. Prerequisite: A02-1 or equivalent.

**425-B04-0 Foundations of Literary Study** Bridges the gap between intermediate language courses and B- and C-level literary and cultural offerings. Emphasizes skills needed to work with literary, philosophical, and historical texts. May not be repeated for credit. Prerequisite: A02-3 or AP score of 3 or consent of instructor.

**425-B05-0 Intermediate Grammar and Composition** Practice in the writing of short essays; German grammar and structure. May be repeated for credit with different materials. Prerequisite: A02-3 or equivalent.

**425-B08-0 German through Reading News Periodicals** Articles of current interest in German newspapers, read and discussed in German, with regular compositions. May be repeated for credit with different materials. Prerequisite: A02-3 or equivalent.

**425-B80-0 German in Commerce and Industry** German language study oriented toward business and economics. Prerequisites: B-level courses in German or equivalent.

**425-C80-0 Advanced German in Commerce and Industry** Advanced German language study oriented toward business and economics. May be repeated for credit with different materials. Prerequisite: B80 or equivalent.

**425-C91-0 Topics in Language** Special topics in German language: for example, advanced grammar and composition; translation; advanced translation; stylistics; advanced conversation. May be repeated for credit with different topic.

## Courses in Literature and Culture with Prerequisites in German

**425-B01-1,2,3,4 Introduction to German Literature** Works from the 18th century to the present. Readings, lectures, and discussions in German.

**425-B15-0 Special Studies in German Literature and Culture** Studies of a major author, a prominent theme in German literature or culture, a movement, or a genre. May be repeated for credit with different topic. Prerequisite: A02-3 or equivalent.

**425-C10-1,2,3,4 Epochs of German Culture** Thought, literature, arts, and music of four epochs of German history in their sociopolitical contexts. **1.** Age of reason and revolution. **2.** Myths and monumentalism. **3.** German literature and politics, 1900–45. **4.** German literature and politics after 1945. Prerequisites: B-level courses in German or equivalent.

**425-C29-0 Topics in Literature** Readings and discussions of topics in German literature, as announced annually. May be repeated for credit with different topic.

**425-C32-0 Topics in German Studies** In-depth study of pivotal periods in German culture, as announced annually. May be repeated for credit with different topic.

**425-C98-0 Undergraduate Seminar** (1–3 units) Advanced work through supervised reading, research, and discussion.

**425-C99-0 Independent Study** Open to outstanding German majors with senior standing.

## Courses with Reading and Discussion in English

No prerequisite in German required.

**416-B06-0 European Fiction since 1900** See Comparative Literary Studies.

**425-B10-1,2,3 German Literature in Translation** **1.** Drama **2.** The novella. **3.** The novel.

**425-B12-0 Introduction to German Culture and Literature** Topics vary: for example, the fairy tale, Germanic mythology. May be repeated for credit with different topic.

**425-B20-0 The German Film** Topics vary: for example, the pioneer film, "new" German cinema. May be repeated for credit with different topic.

**425-B33-1,2 German History and Culture** German cultural, political, and intellectual history, from its origins to the present. **1.** Reformation to founding of the Empire. **2.** Imperial Germany to the present.

**425-B40-0 The Theme of Faust through the Ages** Faust theme in literature and music through shifting intellectual and social climates from the 16th century to the present.

**425-B50-0 Introduction to Contemporary Germany** German political, social, and cultural scene after 1945. May be repeated for credit with different readings.

**425-B61-0 Turn-of-the-Century Vienna: In Search of New Values** Literature and thought of fin de siècle Vienna and its impact on the modern consciousness. Fiction, poetry, essays, plays by Freud, Schnitzler, Wittgenstein, Hofmannsthal, Musil, Karl Kraus, Schoenberg.

**425-B62-0 Berlin: The Golden '20s** Literature, philosophy, fine arts, and architecture of the Weimar Republic (1918–33) as expressions of its intellectual debates and

social upheavals. Remarque, Piscator, Mann, Spengler, the Bauhaus.

**425-C14-0 German Contributions to World Literature** Topics vary: for example, Rilke's poetry; Nietzsche's influence on literature: Thomas Mann; Hesse, the German novel, and the mystic tradition; German intellectual history. May be repeated for credit with different topic.

**425-C24-0 Modern German Drama** From the perspective of the stage as a "moral institution," plays by authors ranging from Heinrich von Kleist to Peter Weiss.

## *Greek*

See Classics.

# Hispanic Studies

Spanish is spoken over a wider territory than the other Romance languages, in countries of all three worlds. In the United States, it constitutes the second language, particularly in large urban areas like Chicago and in the Southwest.

In addition to its obvious practical value, the study of Spanish is of cultural and aesthetic value. When Spain was the most important power in Europe, such authors as Cervantes and such painters as El Greco and Velázquez contributed to the treasure of human achievement on a par with Shakespeare and Michelangelo. Goya and Galdós in the 19th century and Picasso, García Lorca, Ortega y Gasset, and Unamuno in the 20th demonstrate that Spanish culture is still vital today. Spanish culture spread to the New World where, during the colonial and nationalization periods, literature vividly reflected Latin America's struggle to attain its rightful place under the sun. Today, with the appearance of the Nobel prize winners Miguel Angel Asturias, Gabriel García Marquez, Gabriela Mistral, Pablo Neruda, Octavio Paz, and many others, Latin American literature has assumed an outstanding role in the development of more sophisticated and universal literary techniques.

With the belief that in this ever more enlightened and cosmopolitan world all students should be familiar with another language and civilization, the department, by means of three optional programs of study, prepares majors to graduate with linguistic competence and a wide background in Spanish and Latin American literature. To achieve this goal, Spanish is offered on all levels. In the A-level courses emphasis is placed on reading, speaking, and understanding Spanish. The B-level courses are designed to solidify students' knowledge of the language and to introduce them to Spanish and Latin American literature. One series of C-level courses provides advanced training in the language; other C-level courses provide a more detailed analysis of cultural and literary movements, including all periods of both Spanish and Latin American literature and thought. Able undergraduates are eligible to take D-level (graduate) courses. Undergraduate majors are encouraged to enrich their work in Spanish by studying other languages and literatures and other fields in the humanities. The department regularly offers two years of work in Portuguese. All students who are competent in Spanish (not only majors) are encouraged to take part in the Northwestern/University of Seville Junior Year Program in Spain or in the summer program in Mexico sponsored by the Committee on Institutional Cooperation (CIC), the academic consortium of the Big Ten universities and the University of Chicago.

The department also offers a full program of graduate studies leading to the MA and PhD degrees.

## *Spanish*

### Majors in Spanish

Courses indicated as a prerequisite for an advanced course may not be taken for credit after the advanced course is completed.

#### *Language and Literature*

**Departmental courses**

***Basic courses:*** three quarter-courses chosen from B01-1,2,3 and B02-1,2,3; one quarter of B03-1,2,3

***Major courses***

- C02 *or* C03; C23; C50 *or* C51; C80,
- Five C-level quarter-courses in Spanish or Latin American literature, including at least one course in each of the following areas:
  Spanish literature before 1700 (in addition to C23)
  Modern Spanish literature
  Latin American literature

  One C-level course in comparative literary studies taught by a member of the department may be substituted for one C-level requirement in Spanish or Latin American literature; Linguistics B07 is strongly recommended.

***Foreign study:*** All majors are encouraged to spend at least one quarter studying in a Spanish-speaking country

**Related courses:** five quarter-courses, constituting a coherent pattern of study, chosen from other departments or programs with the approval of a department adviser; the study of another foreign language is encouraged.

#### *Latin American Studies*

**Departmental courses**

***Basic courses:*** one quarter of B01-1,2,3; three quarters of B02-1,2,3; one quarter of B03-1,2,3

***Major courses***

- C02 *or* C03; C23; C40; C41; C43 *or* C44; C51; C90 *or* C99
- Four quarter-courses relating specifically to Latin America chosen from history, linguistics, political science, or other departments or programs; a year of Portuguese is recommended.

**Foreign study:** All majors are encouraged to spend at least one quarter studying in a Latin American country.

**Related courses:** Same as for language and literature. For alternatives, see Latin American and Caribbean studies program.

## Minor Concentrations in Hispanic Studies

Requirements for the minor concentrations in Hispanic studies can be met by equivalent courses taken in the Northwestern program in Seville, the CIC program in Mexico, or other approved study abroad programs. Also see Latin American and Caribbean Studies.

### *Hispanic Culture and Civilization*

The minor concentration in the culture and civilization of Spain provides students the opportunity to study a foreign culture. This minor is for students planning careers in business, law, medicine, and service professions or preparing for advanced degree programs in which the knowledge of Spanish culture is useful.

**Prerequisite:** A02-3 or equivalent

**Minor course requirements (8 units)**

- B01-1,2,3 *or* B02-1,2,3; one quarter of B03-1,2,3; C50
- Three C-level Hispanic studies courses on Spain or Latin America; may be given by other departments when approved by the Department of Hispanic Studies

### *Spanish Language*

The minor concentration in Spanish language provides students the opportunity to achieve advanced competence and facility in the Spanish language. This minor is for students planning careers in business, law, medicine, and service professions or preparing for advanced degree programs in which the knowledge of the Spanish language is useful.

**Prerequisite:** Spanish A02-3 or equivalent

**Minor course requirements (8 units)**

- B03-1,2,3; C02; C03 (the B03-1,2,3 sequence is a prerequisite for C02 and C03)
- Two quarters of B01-1,2,3 *or* B02-1,2,3
- One C-level Hispanic studies course in the history of the language or in literature taught in Spanish

## Four-Year BA/MA

The department offers a four-year BA/MA program in Spanish for outstanding undergraduate majors. Interested students should consult the department chair and should see Four-Year Master's Programs in the Undergraduate Education section of this catalog.

## Honors in Hispanic Studies

Seniors with a grade point average of 3.3 overall and 3.5 or above in any of the major programs in Hispanic studies may qualify for departmental honors by taking two quarters of C99 (or in some cases a quarter of C99 and a D-level seminar) and writing a substantial research paper. They should identify a prospective faculty adviser as soon as they are admitted to the program. During the first quarter of C99, students work with a professor of their choice to prepare a bibliography and do the reading and research for an honors paper. In the second quarter of C99, they organize the research results and write the paper. See Honors under Academic Policies earlier in this section of the catalog.

## The Teaching of Spanish

CAS students pursuing a major in Spanish who also wish to be certified for secondary teaching must be admitted to the Secondary Teaching Program in the School of Education and Social Policy (SESP) and complete all requirements as outlined in the SESP section of this catalog. Students are urged to contact the Office of Student Affairs in SESP as early as possible in their academic career.

## Courses Primarily for Undergraduates

**463-A01-1,2,3 Elementary Spanish** Pronunciation, grammar, translation, and easy conversation. Five class meetings a week. Drill in language laboratory.

**463-A02-1,2,3 Intermediate Spanish** Grammar review, conversation, composition, and readings in modern prose and drama. Four class meetings a week. Prerequisite: A01 or 2 units of Spanish.

**463-A15-1,2 Accelerated First-Year Spanish** For students with some previous experience in Spanish. Pronunciation, grammar, and easy conversation. Four classes per week plus one hour in the language laboratory. Prerequisite: department placement.

**463-B01-1,2,3 Introduction to the Literature and Civilization of Spain** Main currents of Spanish literature and culture. **1.** 19th and 20th centuries. **2.** 16th and 17th centuries. **3.** Middle Ages. Prerequisite: A02 or 4 units of Spanish.

**463-B02-1,2,3 Introduction to the Literature and Civilization of Latin America** Main currents of Latin American literature and culture. **1.** From *modernismo* to the present. **2.** From the 17th century to 1888. **3.** Indigenous literatures of Latin America and from Columbus to Ercilla. Prerequisite: A02 or 4 units of Spanish.

**463-B03-1,2,3 Intermediate Conversation and Composition** Prerequisite: A02 or 4 units of Spanish.

## Courses with Reading and Discussion in English

**463-B10-0 The Literature of Spain** A study of major works of Spanish literature of significance to the European tradition: from the late Middle Ages to the present.

**463-B11-0 Survey of Latin American Literature** Representative works of Latin American literature from Columbus to the present.

**463-B23-0 Cervantes** *Don Quixote* and selected novels in translation.

**463-B43-0 Contemporary Spanish American Prose Fiction** Selected works in English translation of 20th-century Spanish American authors.

**463-C96-0 Topics in Spanish Culture and Civilization** Lectures, readings, discussions, and papers on specific topics in Spanish culture and civilization as announced annually.

**463-C97-0 Topics in Latin American Culture and Civilization** Lectures, readings, discussions, and papers on specific topics in Latin American culture and civilization.

**463-C98-0 Topics in Literature** Content varies: for example, single author (Borges, Cela, García Marquez, Galdós, Lorca), the picaresque novel, voices of women in colonial Latin America. May be repeated for credit with different topic.

### Courses with Prerequisite in Spanish

Prerequisite for these courses is B01 or its equivalent.

**463-C02-0 Advanced Grammar** Thorough study of grammar and syntax for majors and prospective teachers. Prerequisite: B03.

**463-C03-0 Advanced Conversation** For advanced students and prospective teachers. Prerequisite: B03.

**463-C04-1,2 Topics in Language** Advanced topics focus on teaching high school and college Spanish. **1.** Methodology. **2.** Grammar and syntax. Prerequisite: B03 or the equivalent.

**463-C05-0 History of the Iberian Languages** Phonology, syntax, morphology, semantics of old Castilian as it evolved from Latin. Portuguese and Catalan. Historical development of Spanish from the Middle Ages through the colonization of America.

**463-C06-0 Introduction to Catalan Language and Literature** Pronunciation and grammar for reading knowledge of Catalan; readings in major works of Catalan literature.

**463-C10-0 Medieval Literature** Masterpieces of Spanish literature from the *Poema de Mío Cid* to the *Celestina.*

**463-C20-0 Golden Age Poetry and Prose, Excluding Cervantes** Development of the Italian school of poetry, mysticism, Gongorism, and the picaresque novel.

**463-C21-0 Golden Age Drama** Antecedents and development of drama of the Golden Age.

**463-C23-0 Cervantes** The works of Cervantes, especially *Don Quixote.*

**463-C30-0 History of Ideas in Modern Spain** Spanish thought since the 18th century, in relation to main trends in the rest of Europe.

**463-C31-0 The Romantic Movement** Origin and development of romanticism in Spain.

**463-C32-0 The Novel of the 19th Century** Development of the novel from Férnan Caballero to Blasco Ibáñez.

**463-C33-0 Literature and Society in 20th-Century Spain** How literature gives shape to the social institutions and historical events that circumscribe the reality of 20th-century Spain.

**463-C34-0 Modern Poetry** Reading, analysis, discussion of major modern Spanish poets.

**463-C35-0 Literature of Post–Civil War Spain** Trends and tendencies in contemporary Spanish literature. Prerequisite: B01 or equivalent.

**463-C40-0 Latin American Literature and Civilization before 1888** The colonial period and the 19th century.

**463-C41-0 The Modernist Movement in Latin American Literature** Spanish American literature from 1888 to about 1920. The modernist movement.

**463-C42-0 Latin American Drama** Spanish American drama of the 19th and 20th centuries.

**463-C43-0 The Avant-Garde and Regionalism in Latin American Literature** Latin American literature from about 1915 to 1950.

**463-C44-0 Contemporary Latin American Literature** Latin American literature from 1950 to the present.

**463-C50-0 Spanish Culture and Civilization** Historical and social backgrounds of Spanish civilization.

**463-C51-0 Latin American Culture and Civilization** Historical and social backgrounds of Latin American civilization.

**463-C80-0 Critical Analysis** Detailed examination of representative selections from Hispanic writers. Critical analysis and discussion in Spanish.

**463-C90-0 Undergraduate Seminar** Investigation of special problems; supervised readings and discussion. Open to qualified seniors. Offered in Spanish and English. Consult with department chair.

**463-C95-0 Topics in Literature** Lectures, readings, discussions, and papers on specific topics in Spanish and Latin American literature as announced annually.

**463-C99-0 Independent Study** Independent reading under supervision. Consult with department chair.

## *Portuguese*

### Courses

**459-A01-1,2,3 Intensive Elementary Portuguese** Rapid audiolingual study of the Portuguese language followed by readings from Portuguese and Brazilian writers. No prerequisite in Portuguese.

**459-C03-0 Advanced Portuguese** Development of competence in four areas of foreign language proficiency. Readings focus on Brazilian historical, cultural, and sociopolitical structures. Prerequisite: A01-3 or equivalent.

**459-C05-0 Brazilian Literature** The intellectual and social climate of Brazil as a monarchy. Representative Brazilian authors from independence to 1900. Prerequisite: A01-3 or equivalent.

**459-C06-0 20th-Century Brazilian Literature** From *modernismo* to the present: nationalism, censorship, and current trends. Prerequisite: A01-3 or equivalent.

**459-C97-0 Topics in Luso-Brazilian Culture and Civilization** Lectures, reading, and papers on specific topics in Luso-Brazilian culture and civilization. In English.

**459-C99-0 Independent Study** Independent study under supervision.

## History

The Department of History is distinguished by the breadth of its faculty's expertise. The faculty includes nationally distinguished scholars in United States, European, Latin American, African, and Asian history. These faculty resources enable the department to offer major fields of study in the history of the Americas, English/European history, African/Middle Eastern history, and Asian/Middle Eastern history. The department is particularly strong in social, cultural, and intellectual history.

Most history courses are open to any undergraduate. Few have specific prerequisites, although freshmen are generally advised to try A- and B-level courses before attempting C-level. History majors have priority in registering for classes, but the majority of students enrolled in most history courses are majoring in other departments and schools. The history faculty welcomes this diversity of students.

As all courses listed below cannot be given in any one academic year and the quarters in which they are offered are subject to change, see the *Class Schedule* for actual offerings.

### Major in History

The purpose of the major is to help students understand themselves as products and makers of history by introducing them to historical patterns and problems in a variety of areas and periods as well as to different historical materials and techniques of analysis. It encourages students to learn to think critically and to search deeply in at least one area of concentration. Achievement of these goals depends heavily on effective use of faculty advice, and each student should see his or her adviser as soon as one is assigned. Thereafter, each student should confer with the adviser at least once each quarter to ensure smooth progress through the program of study.

Students majoring in history select one of four concentrations:

- History of the Americas
- English/European history
- African/Middle Eastern history
- Asian/Middle Eastern history

Students may arrange to emphasize certain special fields within the context of one of these four areas.

The program for majors consists of 11 graded quarter-courses in history and 5 graded quarter-courses in related subjects, none of which may be substituted with advanced placement credits. These courses, chosen by the student in consultation with the adviser, are distributed as follows.

**Departmental courses (11)**

- Two undergraduate seminars: C95 plus one chosen from A01, A02, A03, C89, C92, and C93
- Nine B- and C-level quarter-courses: five in one of the four areas of concentration listed above and four that lie outside the area of concentration and are distributed to provide both geographical and chronological variety
- Two of those nine courses must be a C-trailer sequence, preferably taken in the junior or senior year. (A C-trailer sequence consists of two courses: a B- or C-level lecture course plus a linked C95 seminar in a subsequent quarter. The C-trailer sequence need not be within the student's concentration.)
- At least two of the nine courses must be in fields other than modern European or United States history. Such courses might be in the history of Europe before 1800 or in African, Asian, or Latin American history in any period.

**Related courses (5)**

- Five quarter-courses of related subjects at the B and C levels, at least two of which must be at the C level and must be chosen from at least two programs or departments in the social sciences and humanities. The courses should bear some coherent relationship to the student's major program. Students are encouraged to discuss their related courses with their adviser.

### Minor in History

The minor in history encourages students majoring in other fields to study history and to organize their historical studies in a coherent way. The structure of the minor requires students to gain both depth and breadth in history. Students must select a concentration, which enables them to acquire significant knowledge of one area of the world, and take courses outside the concentration, which encourages an understanding of diverse cultural contexts.

**Minor course requirements (7 units)**

- Seven history courses at the A, B, or C level; at least three must be at the C level
- Four of those seven courses must be in one of the following areas of concentration:
  Europe, including Britain
  United States
  Latin America
  Asia
  Middle East
  Africa

- At least two of those four courses must be at the C level
- Three of the seven courses must be outside the area of concentration

### Honors in History

Superior students may qualify for departmental honors by enrolling in the honors seminar (C98-1,2,3) during their senior year and completing a senior thesis judged to be of honors quality. See Honors under Academic Policies earlier in this section of the catalog.

### The Teaching of History

CAS students pursuing a major in history who also wish to be certified for secondary teaching must be admitted to the Secondary Teaching Program in the School of Education and Social Policy (SESP) and complete all requirements as outlined in the SESP section of this catalog. Students are urged to contact the Office of Student Affairs in SESP as early as possible in their academic career.

### Introductory Colloquia

The following three courses are colloquia, each limited to 15 undergraduates, which introduce students to modes of historical analysis through the study of various topics in history. Specific subjects will be listed in the *Class Schedule.* Open to freshmen and sophomores only.

**427-A01-0 Introduction to Historical Analysis: European History**

**427-A02-0 Introduction to Historical Analysis: American History**

**427-A03-0 Introduction to Historical Analysis: Non-Western History**

### United States

**427-B10-1,2 History of the United States** Interpretative survey from the 17th century to the present. **1.** Colonial settlements to the Civil War era. **2.** Reconstruction to the present. Lectures, discussion sections.

**427-B11-1,2 Problems in United States History** Basic problems in United States history, 17th–20th centuries. **1.** First European and African migrations to the American Civil War. **2.** American Civil War to the present. For students with a strong secondary-school preparation or special motivation.

**427-B91-0 Core Seminar in Latin American–Caribbean Studies** Option for core seminar requirement in Latin American and Caribbean studies program. Also open to other students, but a reading knowledge of Spanish or Portuguese is desirable. Prerequisite: consent of instructor.

**427-C01-1,2 Survey of African American History** **1.** Slavery: forms of oppression and resistance, 1700–1861. **2.** From the Civil War and reconstruction to school desegregation, 1861–1954.

**427-C03-1,2 American Women's History** Women and gender in American life, with attention to differences among women based on class, race, and ethnicity. **1.** To 1890. **2.** Since 1890.

**427-C05-0 American Immigration** Origins, social characteristics, cultural values, and assimilation of immigrants in the 19th and 20th centuries. Consequences of immigration in comparative and historical perspective.

**427-C10-1,2 Early American History 1.** Cultural and social development of England's mainland colonies from the reign of Queen Elizabeth to 1750. **2.** Creation of a new republic: from revolution to the Constitutional Convention.

**427-C14-0 The Civil War and Reconstruction** "Middle period" of American history, emphasizing origins of the Civil War, its revolutionary nature, and its immediate and long-term consequences for the South and the nation.

**427-C15-1,2,3 The United States in the 20th Century** America's domestic history and role in world affairs since 1900. **1.** 1900–29. **2.** 1929–60. **3.** 1960–present.

**427-C17-0 American Cultural History** Changing values of the American people, how they have been transmitted, and how they have shaped American society, politics, and economy, 1890–present.

**427-C18-1,2 Legal and Constitutional History of the United States 1.** Development of legal institutions, constitutionalism, law and social change, law and economic development, colonial–1857. **2.** Law in industrial society: administration, race relations, corporations, environmental protection, civil liberties, 1857–present.

**427-C19-0 History of American Foreign Relations** The relationship of Americans, their culture, and their government with the rest of the world; foreign, as well as American, perceptions of that interaction, 1945–present.

**427-C21-1,2 A History of American Society** Organization and development of American society from the 18th century to the present. **1.** Problems of cultural diversity and social consolidation, 1760–1880. **2.** Problems of class and power, 1880–1970.

**427-C22-1,2 Development of the Modern American City** Characteristics of urban society in America from the period of settlement to the present. **1.** To 1870. **2.** 1870–present. Prerequisite for C22-2: C22-1 or consent of instructor.

**427-C23-0 Development of American Political Thought** Major strands of American political thought from the revolutions of the 17th and 18th centuries to the 20th century. Changing meaning of liberalism; relationship between political ideology and society.

**427-C24-0 American Lesbian and Gay History** Gender, sexuality, and the rise of modern lesbian and gay identities. Lecture and discussion.

## Europe

**427-B01-1,2 European Civilization 1.** Culture and structure of preindustrial society, high medieval through mid-18th century. **2.** Impact of industrial and political change and development of modern society to the present.

**427-C32-1,2 The Development of Medieval Europe 1.** High Middle Ages. **2.** Late Middle Ages.

**427-C33-0 The Age of the Renaissance** Decline and revival of European civilization, 1350–1530. Cultural, political, economic, and social developments.

**427-C34-0 The Age of the Reformation** Europe in the 16th century, especially origins, evolution, and effects of changes in religion.

**427-C38-0 Europe in the 20th Century** Growth of mass politics, Fascism, the home fronts, rise of the welfare state, loss of empire, economic resurgence and integration, 1900–35.

**427-C42-0 History of Modern France** The old regime and the French revolution, 1715–99.

**427-C43-0 Modern Italy** Italy from the Enlightenment to the present, concentrating on the *Risorgimento,* the World Wars, Mussolini and fascism, the postwar economic miracle, and terrorism.

**427-C44-1,2 Modern Germany** German social, economic, political, and cultural developments. **1.** 1918–45. **2.** 1945–present.

**427-C45-1,2 History of Russia 1.** Russia from Peter to the Revolution, 1700–1917. **2.** The Soviet Union and its successor states, 1917–present.

**427-C49-0 History of the Holocaust** Origins and development of the massacre of European Jewry during World War II.

**427-C50-1,2,3,4 The Intellectual History of Europe 1.** Heritage from antiquity and the Middle Ages. **2.** From the Renaissance to the end of the 18th century. **3.** 19th century. **4.** 20th century.

**427-C51-0 History of Communism** Marx's Marxism and movements and regimes that have claimed to be Marxist. Specific content varies.

## Africa

**427-B55-1,2,3 Background to African Civilization and Culture** Historical approach to society, economy, polity, and culture in Africa. **1.** Origins of humankind to the mid-18th century. **2.** Mid-18th century to 1900. **3.** 1900 to the present.

**427-C55-0 Islam in Africa** The spread of Islam in Africa, 7th century–present: a thematic approach emphasizing African Muslim scholars and reformers.

**427-C56-1,2 History of South Africa 1.** From the African iron age to the establishment of the multinational gold mining industry, emphasizing the rise of African states and the contest for land with white settlers. **2.** Emphasis on the 20th century, the rise of African nationalism, and the clash with the apartheid state.

**427-C57-0 East Africa** Selected topics in the history of Kenya, Uganda, and Tanzania.

**427-C58-1,2,3 West Africa** Selected topics in West African history: economy, society, and government.

## England and the British Isles

**427-B60-0 Britain,1688–Present** National development, industrialization, democratization, and imperial expansion and decline.

**427-C62-1,2,3 Modern British History 1.** Social, political, and institutional history, 1688–1815. **2.** The age of industrialization and liberalism, 1780–1900. **3.** The welfare state, democracy, and total war, 1900–present.

**427-C63-0 Modern Ireland in Historical Perspective** History of Ireland from the Celts to the "troubles" in Northern Ireland; emphasis on 19th and 20th centuries.

**427-C64-1,2 Social and Intellectual History of Modern Britain 1.** Rise and fall of Victorian culture, 1780–1900. **2.** Main themes in 20th-century society and thought, 1900–present.

## Latin America

**427-C65-0 The Formation of Latin American Society** Development of Latin American socioeconomic structures, political institutions, and cultural tendencies from the pre-Columbian and Iberian backgrounds through the colonial period.

**427-C66-0 Latin America in the Independence Era** The 18th-century background to Latin American independence and 19th-century aftermath. The process of achieving independence, changing social structures, and economic patterns and the problem of forming new nations.

**427-C67-0 Politics and Development in Latin America** Political, economic, and social problems since 1880, with emphasis on the period since 1930. Interaction between economic change and politics of rapidly urbanizing societies.

**427-C68-1,2 Revolution in 20th-Century Latin America 1.** Mexico and its revolutions. Mexican history, from the modernizing regime of Díaz, through the revolutionary upheaval and the consolidation of a new regime, to contemporary problems. **2.** Comparative study of the origins and aftermaths of major 20th-century revolutions in Bolivia, Cuba, and Central America.

## Middle East

**427-B70-0 Islam in History** Influence of Islam on the components of Middle Eastern societies (nomads, agrarian and urban populations) from the inception of the faith (7th century A.D.) to the modern period.

**427-B74-0 History of Ancient Egypt (3100–30 B.C.)** The Old Kingdom: centralized government, divine kingship. The Middle Kingdom: new monarchic principles in the aftermath of social disorder. The New Kingdom: imperialism in response to foreign aggression, religious revolution of Akhenaton.

**427-C70-1,2,3 History of the Islamic Middle East** **1.** 600–1200: the classical Islamic community; medieval Islamic civilization. **2.** 1200–1789: the great empires—Mamluks, Ottomans, and Safavids; cultural and economic decline. **3.** 1789–present: Jewish and Arab nationalism, oil diplomacy, Islam in the modern context.

**427-C71-0 Islamic Institutions** Religious, legal, political, and socioeconomic institutions of traditional Muslim societies. Regional and cultural variations of principles and concepts common to all Muslims. Modernization and religious reform.

**427-C74-0 Historical Background of Jewish-Muslim Relations** Formation of Jewish-Muslim relations in the medieval Near East; process by which a common heritage became a basis for contention as well as mutual understanding.

## History of Science

**427-B75-1,2 History of Western Science and Medicine** **1.** Origins of science and medicine in early modern Europe: science, religion, and cosmology; anatomy and sexual difference; the Enlightenment and social science. **2.** Modern science and medicine in Europe and America: quantum physics and the A-bomb; Darwinism, genetics, and eugenics; DNA typing and "racial science."

**427-C25-0 History of American Technology** American history through its material culture; industrialization and its discontents; consumer culture and household technology; mass communication and democracy; technological utopia and the computer revolution.

**427-C75-1,2 Technology: History, Society, and Economy** Economic, cultural, and intellectual aspects of the history of technological change, including non-Western technologies, from medieval Europe to America. Students must enroll in both quarters, receive a grade of K for work completed in the first quarter, and letter grades for both quarters determined by the second-quarter final research project. Prerequisites: B01 and B02 or Economics B01 and B02 or consent of instructor.

**427-C76-1,2 Science and Modern Society** **1.** Rise of science in early modern Europe and colonial America; relationship with philosophy, theology, and Enlightenment culture; science, society, and utopian thought. **2.** Science in Europe and America, 1800–present: physical sciences and the power to transform the world; biological and medical sciences and changing social values.

## Asia

**427-B81-0 Chinese Civilization** Chinese history from antiquity to the 18th century, emphasizing cultural and intellectual history.

**427-B84-0 Japanese Civilization** Japanese history from antiquity to the 19th century. Integrates economic, political, intellectual, social, and cultural trends.

**427-B85-0 Indian Civilization** History of Hindu culture from antiquity to the 20th century. Change and continuity in religious ideas, practices, institutions, caste, and family life.

**427-C81-1,2 Late Imperial and Modern China** **1.** 1700–1911. **2.** 1911–present.

**427-C84-1,2 History of Modern Japan** **1.** Japan: the modern state, 1860–1943. **2.** Postwar Japan, 1943–1980s.

**427-C85-0 History of India** India since the mid-18th century. Focus on Hindu and Islamic cultural renovation movements, the politics of nation-building, and socio-economic change.

## Courses Primarily for Majors in History

**427-C91-0 Special Lectures** Lecture courses given on special topics not covered in regular course offerings. Content varies. May be repeated for credit with consent of department.

**427-C92-0 Topics in History** Advanced work through reading, research, and discussion in area of special significance. Graduate students permitted in some courses. Prerequisite: consent of instructor.

**401-C93-0 Chicago Field Studies Internship** See General Studies.

**427-C93-0 Seminar in Historical Writing** Advanced work in the research, organization, and writing of selected subjects. Prerequisite: consent of instructor.

**427-C95-0 C-Trailer Seminar** Research seminar linked to and following a designated B- or C-level history course; students research and complete a term paper on topic of choice related to prerequisite. Prerequisite: completion of a designated B- or C-level lecture course.

**427-C98-1,2,3 Honors Seminar** Advanced work through supervised reading, research, and discussion. Admission by written application, to be reviewed by department. Grade of K given in C98-1 and C98-2.

**427-C99-0 Independent Study** Reading and conferences on special subjects for advanced undergraduates. Open only with consent of student's adviser and instructor.

## Undergraduate Leadership Program Course

**427-B95-0 Leaders in History** Emphasis on the historical context within which leadership is exercised. Figures, periods, and cultures vary from year to year.

### Related Courses in Other Departments

A history major may take no more than two quarter-courses listed below to satisfy the history requirement.

African American Studies B14-1,2 History of Racial Minorities in North America
American Studies B15-1,2 Humanistic Dimensions of Technological Change
Classics B11 Classical Greece
Classics B12 Roman Civilization
Classics C21-1,2,3 Roman History
Economics C15 Topics in Economic History
Economics C23 Economic History of the United States
Economics C24 Western Economic History

## Humanities, Kaplan Center for the

The Alice Berline Kaplan Center for the Humanities promotes advanced research and stimulates educational innovation and curricular development, fosters a lively interdisciplinary community and continuing interdepartmental exchange, and provides a general coordinating resource for research and teaching initiatives in the humanities and related social science fields. The center offers two yearlong seminars, one at the graduate level and the other for undergraduates, as well as four junior/senior seminars each year. It administers an internship program that places undergraduates in Chicago humanities and arts institutions. It also offers undergraduates a minor in advanced interdisciplinary studies in the humanities.

For more information about lectures, conferences, courses, and programs offered, consult the Alice Berline Kaplan Center for the Humanities, 2010 Sheridan Road, 847/491-7946 or hum@nwu.edu.

### Minor in Humanities

The minor in advanced interdisciplinary studies in the humanities trains humanities and social science majors in interdisciplinary methods, topics, and theories and exposes them to contemporary developments and debates in disciplines other than their own.

The minor complements existing majors in small departments, which are often restricted in the diversity and range of their seminar offerings, and in large departments, which may find it difficult to make special provision for their students planning to continue graduate studies.

**Minor course requirements (6 or 7 units)**

- C95-1,2,3 (three-quarter sequence, counts as 1 unit)
- Three quarter courses chosen from C01 and/or C02 (3 units)
- Option A or B (2 or 3 units)

  *Option A:* three C-level humanities courses approved by the center; these may include C90 and C99

  *Option B:* one C-level humanities course approved by the center and C95-1,2,3 (three-quarter sequence, counts as 1 unit) with a different topic than that of the above-required C95

Students applying for the minor must present records showing that at least five courses have not been double-counted in their major. Students pursuing a minor in advanced interdisciplinary studies in the humanities must consult with the associate director of the center to establish their program.

**Sample program:** two yearlong C95 seminars on themes such as The Meanings of the Modern or Science and Defining the Human; 2 units of C01 and C02; and one C90 internship—for instance, at the Art Institute of Chicago or the Newberry Library.

### Courses

**410-C01-0 Topics in the Humanities** Interdisciplinary issues and current research in the humanities, offered by fellows of the Center for the Humanities: for example, ethnography and literature; gender, militarism, and modern culture; democracy, ancient and modern; literary theory and the practice of writing. May be repeated for credit with change in topic.

**410-C02-0 New Perspectives in the Humanities** New issues in the humanities and current innovative research, offered by fellows of the Center for the Humanities: for example, bandits, criminals, and outcasts; female divinity in the Christian tradition; technology and its discontents: the computer revolution; the language and art of the insane—from psychiatry to *art brut.* May be repeated for credit with change in topic.

**410-C90-0 Humanities Internship** Places undergraduates in Chicago-area humanities, arts, and cultural institutions, such as the Art Institute of Chicago, the Chicago Humanities Festival, the Guild Complex, the Lyric Opera of Chicago, the Newberry Library, and other museums and theaters for one quarter (1 unit). Involves about 10 hours of work each week at the host institution and an academic project done under the guidance of a Northwestern faculty mentor. Prerequisites: grade point average of 3.0 or above and consent of center.

**410-C95-1,2,3 Humanities Seminar** Yearlong seminar meeting approximately every two weeks; revolves around meetings with eminent visiting humanists from various fields, who address questions related to an annual theme (1995–96, The Claim of Theories; 1996–97, The Meanings of the Modern; 1997–98, Science and Defining the Human). One credit for successful completion of sequence. Prerequisite: consent of center.

**410-C99-0 Independent Study**

## *Integrated Arts Program*

The interschool Integrated Arts Program offers courses leading to a minor that explore the creative process from the perspective of the artist in the disciplines of theater, visual arts, music, dance, and media arts. (See Integrated Arts Program in the Other Undergraduate Programs section of this catalog.)

## Integrated Science Program

The Integrated Science Program (ISP) is a highly selective curriculum of natural sciences and mathematics presented predominantly in small classes at an accelerated pace. ISP courses emphasize the common base and interrelationships of the sciences, including the importance of mathematics and the development of first principles, leading to advanced topics at the forefront of science today. The goal is to provide students who are interested in careers in science and mathematics with a broad, quantitative background that will give them superior preparation for further work in graduate or professional school or for permanent employment. The curriculum is composed of 23 quarter-courses as well as a regular seminar series and the opportunity to pursue research. ISP may lead to a three-year bachelor of arts degree if, by the end of the third year, the student has completed 36 or more quarter-courses and satisfied all other college requirements.

Admission to ISP is by special application to the director of the Integrated Science Program. For more information on admission procedures, see the description of ISP under Academic Options in the Undergraduate Education section of this catalog. Also see the Admissions section for achievement tests required.

The ISP curriculum consists of specially designed courses taught by faculty members of the science and mathematics departments. Course descriptions are found with the appropriate departments in this catalog. Though listed in a three-year format, many students spread the program over four years, often to combine an ISP major with a second major in a traditional department. Specific second major requirements for ISP students can be found under individual departments in this catalog. For more information, see the ISP Web page <http://www.isp.nwu.edu>.

### Major in Integrated Science

- First year
  - ISP A01-1,2,3 Computing Applications
  - Chemistry A71 Accelerated General Inorganic Chemistry
  - Chemistry A72 Accelerated General Physical Chemistry
  - Mathematics B91-1,2,3 Accelerated Mathematics for ISP: First Year
  - Physics A25-1,2,3 General Physics for ISP
- Second year
  - Biological Sciences C09 ISP Biochemistry and Cell Biology
  - Biological Sciences C11 ISP Neurobiology
  - Chemistry B12-1 Organic Chemistry
  - Chemistry C48 Physical Chemistry for ISP
  - Geological Sciences C15 Physics of the Earth for ISP
  - Mathematics C91-1 and 3 Accelerated Mathematics for ISP: Second Year
  - Physics C39-1,2 Quantum Mechanics
- Third year
  - Astronomy C31 Astrophysics
  - Biological Sciences C01 Biochemistry
  - Biological Sciences C10 ISP Quantitative Biochemistry and Molecular Biology
  - Mathematics C91-2 Accelerated Mathematics for ISP: Second Year
  - Physics C39-3 Nuclear Physics

ISP C98 may substitute for up to three of the following courses: Astronomy C31; Biological Sciences C01, C10, or C11; Mathematics C91-2 or 3, Physics C39-3. All students must take at least one of the following courses: Biological Sciences C01, C10, C11, or Geological Sciences C17.

### Courses

**481-A01-1,2,3 Computing Applications** Introduction to formulation and solution of scientific problems on the computer. One-third credit each quarter.

**481-C98-0 Undergraduate Research** Advanced work for superior students through reading, research, and independent study. Consent of ISP director required.

## *International Studies Program*

International studies, an undergraduate interschool adjunct major that is taken in conjunction with a traditional major, is open to CAS students. (See International Studies Program in the Other Undergraduate Programs section of this catalog.)

## *Italian*

See French and Italian.

## Jewish Studies Program

The Jewish Studies Program focuses on Judaism, not only in its narrow sense as a religious phenomenon but also in its broader sense as a phenomenon of culture and civilization. A good case can be made that the roots of Western culture lie in two places: Athens and Jerusalem. The traditional education of the humanist scholar recognized this by requiring not only the mastery of Greek and Latin but also of Hebrew. Thus the study of Judaism in this program considers the many and varied dimensions of the phenomenon of Jewish civilization. A typical program of study includes, in addition to the religious dimension, the

historical, sociological, linguistic, philosophic, and artistic dimensions.

### Minor in Jewish Studies

The minor in Jewish studies requires the successful completion of seven courses in three general areas:

- A three-course survey of Jewish history providing a basis for advanced work and a unified view of the history of the Jews in the Western world:
  1) Religion B10 Introduction to Hebrew Bible
  2) one course that deals with the history or culture of the Jewish people in the Middle Ages (consent of director required)
  3) History C49 History of the Holocaust
- Two courses in Jewish literature chosen from Religion D32 Modern Jewish Literature, English courses studying Jewish themes in American literature, Slavic Languages and Literatures C72 Introduction to Eastern European Jewish Culture, and African and Asian Languages B03-1,2 Advanced Hebrew. Other courses, subject to approval by the Committee on Jewish Studies, can satisfy this requirement.
- Two courses in Jewish thought chosen from Religion B24 Introduction to Judaism, B27 Introduction to Medieval Jewish Philosophy, C05 History of Judaism, C06 Judaism in the Modern World, C31 Jewish Thought in the 20th Century, C32 The Rise of Rabbinic Judaism, C34 Literary Expressions of Rabbinic Judaism, C35 The Art of Biblical Narrative, and C52 Topics in Judaism.

For students who also satisfactorily complete two years of language study in Hebrew, requirements for the minor are the successful completion of five courses, three in the first area and one each in the second and third areas.

Students applying for minor in Jewish studies must present records showing a minimum of five courses not double-counted in their major.

## *Latin*

See Classics.

## Latin American and Caribbean Studies Program

The Program in Latin American and Caribbean Studies recognizes the importance of the Latin American and Caribbean regions to the foreign and domestic policies of the United States as well as the region's appeal to a variety of intellectual interests. This program allows a coherent interdisciplinary course of study with a particular emphasis on the social sciences in addition to history, languages, and literature. It also aims to create a community of students and faculty with common intellectual interests in the area. The program attempts to realize these goals through (1) core seminars required for all students wishing to enter the program, (2) a strong program of advising to give students a clear sense of direction while preserving flexibility toward individual interests, and (3) required senior research seminars.

### Advising

Regular contact between students and their adviser not only supports the sense of scholarly community but also offers students guidance in pursuing a course of study tailored to their particular needs and interests. Students must consult the director upon entering the program and also are required to discuss their plans with the program director at least once each quarter.

### Minor in Latin American and Caribbean Studies

Nine quarter-courses are required for the minor in Latin American and Caribbean studies, including one core seminar, three core courses, one interdisciplinary senior research seminar, and four additional courses in Latin American and Caribbean studies. All students in the program are required to have an effective reading knowledge of Spanish or Portuguese. The program expects the level of proficiency required by the Department of Hispanic Studies for entry into its C-level courses or successful completion of a B-level course or equivalent. Students applying for the minor must present records showing a minimum of five courses not double-counted in their major.

**Core seminar:** A core seminar should be taken as early as possible after entry into the program. These are C96 seminars, offered in Hispanic studies, history, and political science.

**Core courses:** Three courses, one each in Hispanic studies, history, and political science, must be selected from the following list:

- Hispanic Studies 463-B02-1,2,3 Introduction to the Literature and Civilization of Latin America
- History C65 The Formation of Latin American Society or C66 Latin America in the Independence Era
- Political Science C53 Politics in Latin America

**Senior seminars:** During the senior year, all students are required to take an interdisciplinary research seminar.

**Electives:** Four additional courses, not already taken to fulfill the core course requirement, may be drawn from the list of core courses or from the following list of related courses. (Other courses may be counted with the approval of the program director.)

- Economics C25 Economic Development
- Hispanic Studies 459-C03 Advanced Portuguese
- Hispanic Studies 459-C05 Brazilian Literature
- Hispanic Studies 463-C40 Latin American Literature and Civilization before 1888
- Hispanic Studies 463-C41 The Modernist Movement in Latin American Literature
- Hispanic Studies 463-C43 The Avant-Garde and Regionalism in Latin American Literature

- Hispanic Studies 463-C44 Contemporary Latin American Literature
- Hispanic Studies 463-C51 Latin American Culture and Civilization
- History B91 Core Seminar in Latin American–Caribbean Studies
- History C67 Politics and Development in Latin America
- History C68-1,2 Revolution in 20th-Century Latin America
- History C92 Topics in History (as they relate to Latin America or the Caribbean)
- Political Science C43 United States and Latin America
- Political Science C57 Politics of Post-Colonial States (when the content largely concerns Latin America or the Caribbean)
- Radio/Television/Film C51 National Cinema (when the content concerns Latin America or the Caribbean; Chuck Kleinhans uses Cuba as his principal case)
- Sociology B03 Revolutions and Social Change

## Linguistics

Linguistics is the scientific study of language. Since languages are systematic, linguistics, at its core, analyzes the structure of speech sounds (phonetics, phonology), the structure of words and sentences (morphology, syntax), and their meaning (semantics, pragmatics). In addition, linguistics is concerned with language change and the social and psychological factors that affect language use.

The members of the faculty are especially interested in theoretical foundations, experimental and computational methods, and the study of language use, including language in the professions.

Knowledge of the origins, nature, and functions of language is one of the best tools we can employ in seeking to understand our humanness. Holders of the BA in linguistics find employment in editorial work and technical writing and as legal, educational, and administrative assistants in business and government. The major also prepares students for professional studies such as law as well as for graduate work in linguistics, psycholinguistics, computational linguistics, and related disciplines. The PhD prepares individuals to teach at the college or university level or for a language-related position in business or government. At any level of preparation, the chances of securing attractive employment are greatly enhanced by interdisciplinary studies in language-related fields, education, social sciences, mathematics, or computer science.

### Major in Linguistics

**Departmental courses**

***Introductory courses (3):*** B05, B06, B07

***Core courses (9):*** three courses chosen from C05, C06, C16, C29, C71, plus six additional C-level linguistics courses (certain exceptions or substitutions, such as Cognitive Science B10, granted by consent of the undergraduate adviser)

**Related courses (4):** four courses selected from other departments in consultation with the linguistics undergraduate adviser

### Minor in Linguistics

The minor in linguistics broadens the academic background of students majoring in related fields, including anthropology, cognitive science, communication sciences and disorders, computer science, philosophy, psychology, a language, or a language and culture area, by offering training in the theory and methods of linguistic analysis.

**Minor course requirements (8 units)**

- B05, B06, B07
- Two courses chosen from C05, C06, C16, C29, C71
- Three additional C-level linguistics courses

### Four-Year BA/MA Program

Students with a strong record in their major courses and an interest in pursuing linguistics at the graduate level are eligible to apply for the four-year BA/MA program in linguistics. Applications should be made no later than spring quarter of the junior year. To be considered for this program, students must demonstrate that they will be able to complete by the end of their senior year all the CAS requirements for the BA degree plus the department's requirements for the MA degree. See Four-Year Master's Programs in the Undergraduate Education section of this catalog.

### Courses Primarily for Undergraduates

**434-A10-0 Languages and Linguistics** The nature and structure of language. Methods of linguistic analysis. Language change, acquisition, and varieties.

**434-B04-0 Language and Prejudice** How language represents and reproduces the stereotypic thinking of prejudice; analysis of derogatory labels, discourse of exclusion, discriminatory language polices and practices.

**434-B05-0 Meaning** Introduction to linguistic meaning. Basic concepts in word and sentence meaning, prototype theory, metaphor, presupposition, and philosophical and psychological issues.

**434-B06-0 Formal Analysis of Words and Sentences** Formal analysis, rules, and notation for morphology (word structure) and syntax (sentence structure) in human languages.

**434-B07-0 Sound Patterns in Human Language** The formal analysis, rules, and notation of sound contrasts and sequences in various languages.

**434-B09-0 Language and Society** Introduction to social structure and language use. Standard and nonstandard language; regional, social, and ethnic dialects; language functions, norms, and attitudes.

**452-B10-0 Introduction to Cognitive Science: Language, Vision, and Memory** See Cognitive Science.

**419-C02-0 History of the English Language** See English.

**434-C02-0 Introduction to Comparative and Historical Linguistics** Principles of the comparative method and the method of internal reconstruction. Historical syntax. Quantitative methods in historical linguistics. Prerequisite: A10 or B07.

**419-C04-0 Practical Rhetoric** See English.

**434-C05-0 Lexical Semantics** Introduction to lexical semantics; issues in the linguistic study of word meanings, including internal organization and interrelationships within the lexicon. Prerequisite: B05 or consent of instructor.

**434-C06-0 Fundamentals of Syntax** Principles of syntactic theory through analysis of various syntactic phenomena, based mainly on English data. Linguistic argumentation. Prerequisite: B06 or consent of instructor.

**434-C09-0 Psycholinguistics** Interrelationships of linguistic and psychological variables in human language use. Developmental and experimental psycholinguistics, the relationship between language and cognition.

**620-C09-0 Culture, Language, and Learning** See Communication Sciences and Disorders, School of Speech.

**434-C10-0 Sociolinguistics** Social factors in linguistic variation. Linguistic diversity; multidialectal and multilingual societies; diglossia. Prerequisite: B07 or consent of instructor.

**434-C11-0 Child Language** How children acquire the forms and functions of their native language. Child bilingualism, the acquisition of literacy.

**434-C12-0 Linguistics and English Composition** Recent trends in the study of the uses and forms of writing and the processes of written composition. The learning and teaching of written language.

**434-C15-0 Bilingualism** Sociological, psychological, and linguistic factors affecting the simultaneous or sequential acquisition of two or more languages. Effects of bilingualism on phonology, syntax, the lexicon, cognition.

**434-C16-0 Phonetics** Principles of articulatory and acoustic phonetics. Analysis of experimental evidence about language sound structure. Prerequisite: B07 or consent of instructor.

**434-C17-0 Language Variation** Historical, geographical, social, and functional differences in language. Theories of variation and their relation to the concepts of competence and idealization. Prerequisite: a B-level course or consent of instructor.

**434-C18-0 Language and Gender** Use of language by and about women and men, cross-cultural gender differences in language and language attitudes.

**434-C19-0 Language Typology** Comparative overview of the classification and analysis of major grammatical structures found across languages of the world.

**434-C24-0 Language and Law** Survey of contemporary social science research on the interaction of language variables and our legal system; application of linguistics to the resolution of legal cases. Prerequisite: an A- or B-level course or consent of instructor.

**434-C25-0 Language and Medicine** Analysis of language patterns used in medical settings, including doctor-patient interaction and technical language use. Prerequisite: A- or B-level course or senior standing.

**434-C29-0 Pragmatics** Nontruth-conditional meaning, role of context in utterance production and interpretation. Implicature, presupposition, speech acts. Prerequisite: B05 or consent of instructor.

**434-C30-0 Topics in Language and Behavior** Topics in the relationship between language and human behavior. Topics vary. Maybe repeated for credit with different topic.

**434-C44-0 Research Methods in Linguistics** Linguistic data collection, management, and analysis. Use of computational, experimental, and statistical methods.

**434-C46-0 Introduction to Computational Linguistics** Computer programs for syntactic analysis of sentences and semantic analysis of sentences and larger texts. Implications for design of natural language interfaces.

**434-C51-0 The History of Linguistics** Linguistics from antiquity to the present.

**434-C62-0 Second Language Acquisition** Major theories of second-language acquisition; current issues in the field. Cognitive, personality, and sociocultural variables affecting second-language learning.

**434-C71-0 Morphology** Examination of the internal structure of words. Introduction to central problems facing a theory of morphology. The evolution of theories of morphology within generative grammar.

**434-C80-0 English in the University** English conversational skills culturally appropriate for an American university, primarily for foreign graduate students. Content varies by quarter.

**434-C81-0 Advanced English in the University** Written argumentation skills and all aspects of academic writing, primarily for foreign graduate students.

**434-C98-0 Undergraduate Seminar in Linguistics** By invitation of the department. For students of superior ability, with choice of topic left to the group.

**434-C99-0 Independent Study**

## Mathematical Methods in the Social Sciences Program

A central feature of modern social, behavioral, managerial, and policy sciences is the use of mathematics, statistics, and computers, both as languages and as methods of abstraction and analysis. The Mathematical Methods in the Social Sciences (MMSS) Program was created to give students an opportunity to acquire these skills and to become acquainted with modern analysis of social systems. This is accomplished through an accelerated program for high-ability students and through the offering of courses open to all undergraduates.

### Major in Mathematical Methods in the Social Sciences

MMSS enables students to combine the study of social sciences with training in formal analytical methods. The program is intended for students with high mathematical aptitude and strong interest in social problems and issues, including their policy and research implications. It provides excellent preparation for graduate study in social or managerial sciences as well as for careers that require both quantitative skills and a solid background in the social sciences.

In each of their first two years in the program, students enroll in two coordinated three-quarter courses covering mathematical methods and their applications to the social sciences. In addition to this core curriculum, students participate in a senior seminar and complete a major in one of the social sciences—anthropology, economics, linguistics, political science, psychology, sociology, or statistics. Students who satisfy all requirements for a social science major and for the program are granted a dual major.

**Required courses:**

- First year: MMSS B92-1,2,3; Mathematics B92-1,2,3
- Second year: MMSS C92-1,2,3; Mathematics C92-1,2,3
- Senior year: MMSS C98-1,2

Admission to the MMSS program is very selective; it is limited to entering freshmen and to Northwestern sophomores with superior academic records and a demonstrated strong aptitude in mathematics.

Prerequisite for admission consideration is a full-year course in calculus. High school students fulfilling this prerequisite are encouraged to enter the program as freshmen. Students lacking calculus but planning to enter the program as sophomores should complete at least two quarters of calculus (Mathematics B14-1 and 2) in their freshman year.

Students who wish to be considered as candidates for the program should request an application from the director, MMSS, G26 Walter Annenberg Hall, Evanston, Illinois 60208-2250.

### Courses

**436-B92-1,2,3 MMSS:First Year 1.** Mathematical and statistical analysis of data; social science theories and methods. **2.** Mathematics and computer models for decision analysis. **3.** Political conflict and collective choice. Prerequisite: first-year standing in MMSS.

**435-B92-1,2,3 Accelerated Mathematics for MMSS: First Year** See Mathematics.

**436-C92-1,2,3 MMSS:Second Year 1.** Network/policy analysis. **2.** Game theory models. **3.** Welfare economics and social choice. Prerequisite: second-year standing in MMSS.

**435-C92-1,2,3 Accelerated Mathematics for MMSS: Second Year** See Mathematics.

**436-C94-0 Special Topics** Advanced work for investigation of topics of current interest. Offered in different quarters. May be repeated for credit with different topic. Prerequisite: third-year standing in MMSS or consent of instructor.

**436-C98-1,2,3 Senior Seminar** By invitation of the department.

## Mathematics

Mathematics plays a central role in modern society. It has long been an important tool in science and engineering, and it is now increasingly being used in varied and sophisticated ways in the social sciences, the humanities, and business. With expanding applications, many areas of mathematics, from pure to applied, have grown tremendously. At Northwestern, a variety of courses for nonmajors address these diverse applications of mathematics.

The department offers major programs in mathematics and applied mathematics as well as the more demanding MENU program. Applied mathematics will appeal to students who are primarily interested in applications of mathematics in the physical, biological, social, or behavioral sciences; management; or engineering. Talented undergraduates may take some graduate courses to enrich their studies, preparing them for employment or further study in graduate school.

A mathematics course that is a prerequisite for another mathematics course may not be taken for credit after the more advanced course has been completed. Consent of the department may be substituted for the prerequisite for any mathematics course. No A-level course may be taken for credit after a B- or higher level mathematics course has been completed. See the course descriptions for other restrictions.

### Majors in Mathematics

Mathematics majors are urged to take C08 early in their academic career. Also recommended are B21 and a course in computer science. Mathematics majors preparing for

graduate school should take C10 and C37 as early as possible; they should also take C28.

Students pursuing the applied mathematics major are urged to take computer programming courses.

Mathematics and applied mathematics majors interested in probability and statistics should take C30 and some further courses in statistics (Statistics C50, C51, C52, or C54). They should complete the requirements by taking additional courses from among real analysis (C10), computer science, and areas where probability and statistics are used.

Majors interested in economics should take Mathematics C10, C30, and Economics C80-1,2 or C81-1,2.

All majors are encouraged to discuss their programs with the department director of undergraduate studies.

### *Mathematics*

**Departmental courses**

***Basic courses:*** B14-1,2,3, B15, B17, or equivalent

***Required major courses:*** Students must take a total of nine C-level courses in mathematics, including either C34 or C37-1, and at least three courses must form one of the complete sequences C10-1,2,3, C30-1,2,3, or C37-1,2,3. Students may not count both C34 and C37-1 for the major without consent of the department. (Students may count both courses toward the 45 courses required for graduation.)

With the approval of the department, students may substitute as many as three of the remaining six courses with a coherent set of the same number of C-level courses offered by other departments. Those courses must be deemed to focus on serious applications of mathematics.

### *Applied Mathematics*

**Departmental courses**

***Basic courses:*** B14-1,2,3, B15, B17, B21, or equivalent

***Required major courses***

- C34
- Two groups chosen from the following (substitution of substantially equivalent courses may be allowed):
  C10-1,2
  C30-1,2,3 *or* C30-1 and Industrial Engineering and Management Sciences C03, C04
  C03, C05, C16 *or* C03, C13-1,2
  C17-1,2
- Additional C-level courses for a total of 10. Three or four must be in an area making substantial use of mathematics. Some suitable areas are computer science, economics, applied mathematics, geology, industrial engineering, physics, and statistics, but coherent sets of courses in other areas also may qualify. Approval of the program by the department's director of undergraduate studies is required.

### *MENU Program*

The MENU (Mathematical Experience for Northwestern Undergraduates) program is for students who would normally major in mathematics but want a more rigorous and individualized approach. Requirements include B90-1,2,3 (first-year course), C40-1,2,3 (second-year course), C38-1,2,3 (MENU algebra course), and three one-quarter courses chosen from a list approved by the director of the MENU program.

In addition, students in the MENU program must complete an honors project in their senior year under the direction of a mathematics faculty member.

## Four-Year BA/MS

For a small number of mathematically talented and highly motivated students, the department offers a combined graduate-undergraduate program. In this four-year program, students ordinarily begin taking graduate courses in the junior year. As they complete work for a bachelor's degree, they also earn a master's degree. Interested students should consult with the department as early as possible in their college career and should see Four-Year Master's Programs in the Undergraduate Education section of this catalog.

## Integrated Science Program

The Integrated Science Program (ISP) is a highly selective BA program in CAS (see Integrated Science Program). Students majoring in ISP who wish to complete a second major in mathematics should fulfill the following requirements instead of those listed above. They must take a full-year sequence, C10-1,2,3 or C37-1,2,3. It is recommended (but not required) that students planning graduate work in mathematics take both of these sequences. Students pursuing an ISP/math double major may not substitute ISP C98 for any mathematics course in the ISP curriculum.

## Honors in Mathematics

Majors with outstanding records may be nominated for graduation with departmental honors. Those graduating under the regular mathematics option should complete C10 and C37 (or the equivalent). Those graduating under the applied mathematics option should complete C10 (or the equivalent). In exceptional cases, students who have not completed these courses may also be considered for honors.

In addition, to be nominated for departmental honors a student must complete with distinction two quarters of independent study or two quarters of a graduate course; in either case the student must complete an acceptable project that culminates in an honors thesis. Finally, the student must have a grade point average of 3.5 or above in courses that satisfy major requirements. (Courses such at those in the calculus sequence that are prerequisites for the major are not counted.)

For more information on honors consult the director of undergraduate studies. See Honors under Academic Policies earlier in this section of the catalog.

### The Teaching of Mathematics

CAS students pursuing a major in mathematics who also wish to be certified for secondary teaching must be admitted to the Secondary Teaching Program in the School of Education and Social Policy (SESP) and complete all requirements as outlined in the SESP section of this catalog. Students are urged to contact the Office of Student Affairs in SESP as early as possible in their academic career.

### Placement in Calculus

Students who have taken three years of high school mathematics, including some trigonometry, should in most cases be adequately prepared for the first quarter of calculus (B14-1).

Students who have a weak preparation in trigonometry and algebra and who want eventually to take calculus should take the Mathematics Diagnostic Examination during New Student Week of their first year. This exam is necessary for placement in precalculus (A13) and special five-days-a-week sections of B14-1.

Students who have taken calculus in high school are encouraged to begin their study of calculus at Northwestern in the most advanced course appropriate to their background. Students who have completed a year's course in calculus with good grades should ordinarily register for B14-3 or B20-1. To help determine the appropriate placement before registration, students should take the Self-Placement Examination available at the department office. Students who skip B14-1 and/or B14-2 may earn credit for the course(s) skipped by passing a credit examination, which is given in October and must be taken during the first year of enrollment at Northwestern. Credit earned by this examination may not duplicate AP credit or transfer credit earned at other colleges or universities. For CAS students, this credit counts as elective credit but does not count toward the distribution requirement. Engineering students should consult with their advisers about the necessity for this examination.

### General Course Recommendations

Students interested in mathematics, natural sciences, premed, engineering, or economics should take the standard calculus sequence B14-1,2,3.

Students who intend to major in behavioral science ordinarily should take B10-1,2 but may take B14-1,2,3.

Students who desire an introduction to mathematics to fulfill the distribution requirement but who do not intend to do more advanced work in mathematics should consider an A-level course (except A13) or B10.

Students who have mastered the elements of single variable calculus in high school and desire an early introduction to theoretical mathematics should consider B90-1,2,3. They should take the CEEB Advanced Placement Examination (preferably the BC exam), on the basis of which invitations are given. Students who wish to take B90 but have not received an invitation must obtain consent from the department.

Material in the basic calculus sequence B14-1,2,3, B15, B17, B21 is covered in other sequences, particularly B20-1,2,3 and B91-1,2,3. Other sequences such as B90-1,2,3, B92-1,2,3 and Engineering Sciences and Applied Mathematics B52-1,2,3 cover substantial parts of this material as well as other topics. Students who are uncertain about the exact equivalences should consult with the department's director of undergraduate studies. Students who wish to pursue combinations from different sequences should plan a coherent program with the director of undergraduate studies. They will not be permitted to take courses in these sequences that lead to excessive duplication of subject matter.

### Courses Primarily for Undergraduates

**435-A04-0 Games and Fallacies** Number puzzles and games; conceptualizing numbers; common fallacies. For nonscience students who may never have seen the charm of pure mathematical play or the spirit of mathematical applications.

**435-A10-0 Survey of Modern Mathematics I** Set theory, probability and statistics, matrices, number theory. Students may not take A10 for credit after having taken a C-level mathematics course. Prerequisite: high school mathematics.

**435-A11-0 Survey of Modern Mathematics II** Continuation of A10. Prerequisite: high school mathematics.

**435-A13-0 Precalculus Mathematics** Preparation for calculus. Basic algebra, functions, and graphs; exponential and logarithmic functions; trigonometry. Prerequisites: Mathematics Diagnostic Examination and consent of department.

**435-B10-1,2 Mathematics for the Behavioral Sciences** **1.** Elementary linear algebra and applications. Finite probability. Elementary statistics. **2.** Differential calculus. Integral calculus. Examples drawn from the behavioral and social sciences. Students may not receive credit for both B10-2 and B14-1. Prerequisite: three years of high school mathematics.

**435-B13-0 Review of Calculus of One Variable** Elements of differential and integral calculus with an emphasis on problem solving, for entering students who have had calculus in high school. As a prerequisite for other courses, B13 is equivalent to B14-2. Students may not receive credit for B13 and any of the following: B10-2, B14-1,2. Prerequisite: one year of high school calculus or consent of the department.

**435-B14-1,2,3 Calculus 1,2.** Elements of differential and integral calculus. **3.** Vector algebra, vector functions, partial derivatives. Students may not receive credit for both B14-1 and B10-2 or for both B14-3 and B90-1, B91-1, or B92-1. Prerequisite: three years of high school mathematics.

**435-B15-0 Multiple Integration and Vector Calculus** Double and triple integrals. Line and surface integrals. Cylindrical and spherical coordinate systems. Change of variable in multiple integrals; Jacobians, gradient, divergence, and curl. Theorems of Green, Gauss, and Stokes. Prerequisite: B14-3.

**435-B17-0 Sequences and Series,Linear Algebra** Sequences and series: convergence tests; power series; Taylor series. Linear algebra: vectors and matrices; Gaussian elimination; inverses; determinants; eigenvalues and eigenvectors; quadratic forms and diagonalization; application to quadric surfaces. Prerequisite: B14-3.

**435-B20-1,2,3 Accelerated Calculus of Several Variables** Material of B14-3, B15, B17, and B21 covered in three quarters. Prerequisites: one year of high school calculus with good grades and good mathematics achievement test score.

**435-B21-0 Elementary Differential Equations** Applications of calculus and linear algebra to the solution of ordinary differential equations. Prerequisite: B17, concurrent registration in B17, or consent of department.

**435-B90-1,2,3 Accelerated Mathematics:First Year 1,2.** Deeper treatment of calculus, including a rigorous treatment of its basic concepts. **3.** Linear algebra. Prerequisites: one year of calculus (usually in high school) and consent of the department.

**435-B91-1,2,3 Accelerated Mathematics for ISP:First Year 1.** Vector differential calculus and multidimensional calculus. **2.** Vector integral calculus, differential equations, infinite series. **3.** Linear algebra, differential equations. Open only to students in ISP.

**435-B92-1,2,3 Accelerated Mathematics for MMSS: First Year 1.** Linear algebra. **2.** Multidimensional calculus. **3.** Calculus topics. Prerequisite: first-year standing in MMSS.

**435-C01-0 Mathematical Models in Finance** Analytic modeling of problems from finance; basics of partial differential equations, the diffusion equation, the Black-Scholes Equation, finite difference methods, and finite sampling. Prerequisite: B21 or equivalent.

**435-C03-0 Differential Equations** Intermediate course. Topics chosen from linear systems, nonsingular boundary value problems, theory of periodic solutions, stability theory, asymptotic expansions, special functions of mathematical physics, perturbation theory. Prerequisite: B21 or graduate standing.

**435-C04-0 Game Theory** Selected topics in game theory: noncooperative games, matrix games, optimal strategies, cooperative games. For students in mathematics, probability, business, social sciences. Prerequisite: B17 or consent of instructor.

**435-C05-0 Complex Variables for Applications** Complex numbers, functions of a complex variable, theory of analytic functions, series development, analytic continuation, contour integration, conformal mapping. Students may not receive credit for both C05 and Engineering Sciences and Applied Mathematics C11-3 except by consent of the department. Prerequisite: B21.

**435-C08-0 Foundations of Higher Mathematics** Introduction to fundamental mathematical ideas—such as sets, functions, equivalence relations, and cardinal numbers—and basic techniques of writing proofs. May be taken for credit after C10-1 or C37-1 only by consent of the department. Prerequisite: B17 or equivalent or consent of department.

**435-C10-1,2,3 Introduction to Real Analysis** Sets, functions, limits, properties of the real number system. Metric spaces. Foundations of differential and integral calculus, including Riemann integral and infinite series. Lebesgue integration. Fourier series. Prerequisites: B15, B17, C08, or consent of department.

**435-C13-1,2 Chaotic Dynamical Systems 1.** Chaotic phenomena in deterministic discrete dynamical systems, primarily through iteration of functions of one variable. **2.** Iteration of functions of two and more variables, including the study of the horseshoe map, attractors, and the Henon map. Complex analytic dynamics, including the study of the Julia set and Mandelbrot set. Prerequisite: B17.

**435-C16-0 Fourier Series and Boundary Value Problems** Expansion in orthogonal functions with emphasis on Fourier series. Applications to solution of partial differential equations arising in physics and engineering. Students may not receive credit for both C16 and C91-1 or Engineering Sciences and Applied Mathematics C11-2. Prerequisite: B21 or consent of department.

**435-C17-1,2 Experimental Mathematics 1.** C++ coding for basic mathematical concepts. Mathematical visualizations, graphic code; digital calculus. Simpson's rule, antidifferentiation. Vector fields, systems of ordinary differential equations, Runge Kutta. Simulation of nonlinear dynamical systems. **2.** C++ for scientific computing and graphics. Numerical integration, perturbation theory. Direct numerical procedures, calculus of variations. Visualization of contraction mappings, thermodynamic systems, vaporization.

**435-C20-0 Concrete Mathematics** Discrete mathematics emphasizing interplay between discrete and continuous mathematics. Recurrent problems, sums, floors and ceilings, divisibility and primes, binomial coefficients and

generating functions. Prerequisite: B14-1,2 or consent of department.

**435-C26-1,2 Geometry** Axiomatics for Euclidean geometry. Non-Euclidean geometry. Projective geometry. Introduction of coordinate system from the axioms. Quadrics. Erlangen program. Introduction to plane algebraic curves. Prerequisite: B14-3.

**435-C28-0 Introduction to Topology** Point-set topology. Prerequisite: C08, C10-1 (may be corequisite).

**435-C29-0 Introduction to Differential Geometry** Curves and surfaces in three-dimensional space. Prerequisites: B15, B17.

**435-C30-1,2,3 Probability and Statistics 1.** Discrete probability spaces. Random variables. Expected value. Combinatorial problems. Special distributions. Independence. Conditional probability. Introduction to continuous case. **2.** Integrating density functions. Convolutions. Law of large numbers. Central limit theorem. Random walk. Stochastic processes. **3.** Elementary decision theory. Estimation. Testing hypotheses. Bayes procedures. Linear models. Nonparametric procedures. Students may not receive credit for both C30 and C92. Prerequisites: B15, B17.

**435-C34-0 Linear Algebra for Applications** Linear functions, complex vector spaces, unitary and Hermitian matrices. Jordan canonical form. Selected applications from networks and incidence matrices, least squares approximation, systems of differential equations, fast Fourier transform, finite element method, linear programming. Prerequisite: B17 or equivalent.

**435-C35-1,2 Introduction to the Theory of Numbers 1.** Divisibility and primes, congruences, quadratic reciprocity, diophantine problems. **2.** Additional topics in analytic and algebraic number theory. Prerequisite: B14-3 or consent of department.

**435-C37-1,2,3 Introduction to Modern Algebra 1.** Abstract theory of vector spaces and linear transformations including canonical forms. Prerequisite: B17, C08, or concurrent registration in C08 or equivalent. **2.** Groups and their structure; elementary ring theory. Prerequisites: B17, C08 or equivalent, C37-1, or consent of department. **3.** Rings, modules, and fields with applications to the impossibility of certain ruler and compass constructions. Prerequisite: C37-2. Students may not take both C37-1 and C34-0 for credit without consent of the department.

**435-C38-1,2,3 MENU:Algebra 1.** Groups and their structure, including the Sylow theorems; elementary ring theory; polynomial rings. **2.** Basic field theory; Galois theory. **3.** Module theory, including application to canonical form theorems of linear algebra. Prerequisites: C40-1,2,3 or consent of department.

**435-C40-1,2,3 MENU:Second Year 1.** Multidimensional differential and integral calculus. **2,3.** Introduction to real analysis. Prerequisites: B90-1,2,3 or consent of department.

**435-C75-0 Mathematical Logic** Mathematical formulation and rigorous discussion of logical systems, particularly the propositional calculus and the functional calculi of first and second order. Well-formed formulae, formal languages, proofs, tautologies, effective procedures, deduction theorems, axiom schemata. Prerequisite: consent of instructor.

**435-C76-0 Theory of Computability and Turing Machines** Algorithms, computability, decidability, enumerability; formal replacements and Church's thesis. Turing machines, primitive recursive functions, mu-recursive functions, recursive functions. Undecidable predicates; the undecidability and incompleteness of arithmetic. Prerequisite: consent of instructor.

**435-C91-1,2,3 Accelerated Mathematics for ISP: Second Year 1.** Fourier series and boundary value problems. **2.** Probability and statistics. **3.** Complex analysis, elements of group theory. Students may not receive credit for both C91-1 and C16 or for C91-3 and C05. Ordinarily taken only by students in ISP. Prerequisites: B91-1,2,3; Physics A25-1,2,3.

**435-C92-1,2,3 Accelerated Mathematics for MMSS: Second Year 1.** Probability theory and its social science applications. **2.** Econometric methods. **3.** Stochastic processes. Students may not receive credit for both C92 and C30. Prerequisite: second-year standing in MMSS.

**435-C95-0 Undergraduate Seminar** (1–4 units) Topics of modern mathematics and relationships among different branches of mathematics. Open only to superior students by consent of department.

**435-C99-0 Independent Study** Open on approval of department to undergraduates who are qualified to do independent study and have a definite plan of study. Students who wish to enroll in C99 must file a plan of study with the department before registration.

## *Neurobiology and Physiology*

The Department of Neurobiology and Physiology does not offer a major to incoming students. See Biological Sciences, Undergraduate Program in, for a description of the major in biological sciences.

## Neuroscience Program

The Neuroscience Program provides an opportunity for undergraduates to do specialized work, including independent research during the academic year and Summer Session, on theoretical and practical approaches to the study of brain function.

On the recommendation of the program director, students who complete the approved course of study may apply for an ad hoc major in neuroscience. Participation in the program does not require election of the ad hoc

major in neuroscience. Students might instead follow the curriculum and, by the addition of appropriate courses, complete one of the regular major programs in biological sciences, psychology, or chemistry.

### Program of Study

- First year
  - Biological Sciences B10-1 Genetics and Evolutionary Biology
  - Biological Sciences B10-2 Biochemistry and Molecular Biology
  - Biological Sciences B10-3 Physiology and Cell Biology
  - Chemistry A01 General Chemistry
  - Chemistry A02 General Inorganic Chemistry
  - Chemistry A03 General Physical Chemistry
  - Mathematics B14-1,2,3 Calculus
  - Psychology B12 Introduction to Neuroscience
- Second year
  - Chemistry B10-1,2 Organic Chemistry
  - Psychology B01 Statistical Methods in Psychology
  - Psychology C12-1,2 Neurobiology and Behavior (or equivalent)
- Third year
  - Biological Sciences C02 Fundamentals of Neurobiology
  - Biological Sciences C03 Molecular Neurobiology
  - Biological Sciences C04 Developmental Neurobiology
  - Biological Sciences C90 Molecular Biology
  - Physics A35-1,2,3 General Physics
- Fourth year
  - Biological Sciences C77 Sensory Neurobiology
  - Biological Sciences C91 Eukaryotic Regulatory Mechanisms Seminar
  - Psychology C95 Psychobiology Research Seminar

## Philosophy

Perhaps the most notable feature of the Department of Philosophy is its pluralism—its commitment to exposing students to a broad range of philosophical traditions and philosophical issues. The department, long recognized as a leader in contemporary continental philosophy, also offers a strong array of courses in ancient, medieval, and modern philosophy as well as in other contemporary philosophies. All the major systematic areas of philosophy are taught, many of them from different perspectives in different courses. The research interests of members of the department show a similar breadth. This pluralism enables students to see philosophy's application to all areas of life and to appreciate the diversity of approaches possible in philosophy.

### Major in Philosophy

Because the study of philosophy involves the critical discussion of the most fundamental questions asked by human beings, it helps develop breadth of understanding and clarity of thought. This character of philosophical inquiry makes a double major attractive to many students. Moreover, with appropriate supporting courses, a philosophy major can be a sound preparation for many careers, whether or not they involve further study.

The core of our program is a firm grounding in the history of philosophy. Against this background, students can tailor a program that meets most fully their particular interests. Full descriptions of the courses offered each quarter are available in the department office two weeks before advanced registration.

**Departmental courses (12)**

Students should complete these required courses, especially B10-1 and B10-3, as early as possible, since material covered is a prerequisite to more advanced work.

- Logic: A50
- History of philosophy: B10-1, B10-3, B12 or B61, C10
- Of the remaining seven courses, at least four must be at the C level, and none may be at the A level. We strongly encourage our students to take at least one quarter of C95, a seminar open only to majors in their junior or senior year.

### Minor in Philosophy

The minor in philosophy requires students to be well-grounded in the history of philosophy, especially ancient and early modern, covering the major texts of ethical and political theory as well as the major texts of epistemology and metaphysics. The emphasis on argument and logical structure in philosophy requires students to be familiar with contemporary logic, at least up to the level of the first-order predicate calculus. Beyond this foundational requirement, students take four courses tailored to their individual interests and, typically, to complement work being done in their major. To provide the greatest latitude for this, only three of the four remaining courses need be at the C level.

**Minor course requirements (8 units)**

- Four foundation courses: A50, B10-1, B10-3, B61
- Four philosophy electives: no A-level courses, at least three C-level courses

### Honors in Philosophy

To be admitted to honors, a student must have a grade point average of 3.3 or above in the philosophy major and declare candidacy during the spring quarter of the junior year. The student must take C95 at least once. Declaration of candidacy involves approval of the project by a faculty adviser. The candidate then takes C98 in three successive quarters and submits a paper demonstrating an appropriate level of research or reflection. The paper is then read by the adviser and another faculty member. Their comments are submitted to the Committee on Undergraduate Studies, who recommends approved nominations to the CAS Committee on Superior Students and Honors. For more information, consult the director of undergraduate studies. See Honors under Academic Policies earlier in this section of the catalog.

### Courses Primarily for Freshmen and Sophomores

Beginning students of philosophy should take A10, A11, or A50 during their first year. Students with an informed interest in philosophy, especially those intending to choose philosophy as a major, should begin with B10-1 and B10-3 in their first year.

**439-A09-6 Introductory Seminar in Philosophy** Introduction to philosophy: special topics or a general survey. Offered in small, discussion-oriented classes.

**439-A10-0 Introduction to Philosophy** Fundamental problems and methods of philosophy.

**439-A11-0 Introduction to Contemporary Philosophy** Major problems and types of contemporary philosophy. Representative writings of the 20th century.

**439-A15-0 Society and the Individual** Traditional and contemporary moral problems concerning the relation of the individual to society: the rule of law, punishment, abortion, euthanasia, personal liberty, war, revolution.

**439-A50-0 Elementary Logic I** Study of argument through the use of elementary formal systems of deductive inference. Informal fallacies and nondeductive modes of inference. First quarter of A50-B50-C50 sequence.

**439-B05-0 Introduction to Oriental Philosophy** Philosophic conceptions developed in the Orient. Comparison with Western thought.

**439-B09-0 Introduction to Existentialism** The principal sources of existential philosophy: Kierkegaard, Jaspers, Marcel, Nietzsche, Sartre, Heidegger, Merleau-Ponty, and others.

**439-B10-1,2,3 The History of Philosophy 1.** Ancient philosophy. **2.** Medieval philosophy. **3.** Early modern philosophy.

**439-B20-0 Science in Human Culture** Interaction between science and other aspects of human culture. Emphasis on critical thinking about controversial issues. Content varies, e.g., creationism and sociobiology; abortion. May be repeated for credit with different topic.

**439-B50-0 Elementary Logic II** Formal systems of deductive inference and their properties. Translation from ordinary language to formal languages, including first-order quantification and identity and related philosophical problems. Second quarter of A50-B50-C50 sequence. Prerequisite: A50.

**439-B54-0 Scientific Method in the Natural Sciences** Philosophical and methodological issues in the natural sciences, such as the discovery and testing of hypotheses, explanation, theory selection, the nature of scientific laws, causality, space and time, determinism. Prerequisite: one course in the natural sciences.

**439-B55-0 Theory of Knowledge** Basic philosophical questions about human knowledge, focusing on skepticism; competing theories of knowledge.

**439-B60-0 Ethics** Representative theories of human conduct and character, dealing with such issues as the nature of the good, duty, happiness, virtue, freedom, and moral responsibility.

**439-B61-0 Classics of Ethical and Political Theory** Classical works of moral and political philosophy from the ancient, medieval, and modern periods. Individual offerings may concentrate exclusively on moral or on political philosophy and may consider works from one period only.

**439-B63-0 Social and Political Philosophy** Issues such as the rationale for existing in society, the justification and proper limits of political power, and the most desirable form of government.

**439-B65-0 Introduction to the Philosophy of Law** Ethical and conceptual issues arising in connection with the law, such as the nature of law, the nature of liberty and of justice, and the theory of punishment.

### Courses Primarily for Juniors and Seniors

**439-C03-0 The Philosophy of Education** Educational theories of representative philosophers as related to their culture and the problems of their times.

**439-C07-0 Studies in French Philosophy** One or more figures in French philosophy. The figures may vary, but the primary readings will be in French.

**439-C10-0 Kant's *Critique of Pure Reason*** A close examination of Kant's *Critique of Pure Reason*.

**425-C14-0 German Contributions to World Literature** When course is on Nietzsche; see German.

**439-C20-0 Studies in Ancient Philosophy** The work of one important philosopher or philosophical movement before 500 A.D. Subject varies. May be repeated for credit with different topic. Prerequisite: B10.

**439-C21-0 Studies in Medieval Philosophy** The work of one important philosopher or philosophical school between 500 and 1000 A.D. May be repeated for credit with different topic. Prerequisite: B10.

**439-C22-0 Studies in Modern Philosophy** The work of one important philosopher or philosophical movement between 1500 and 1800. Subject varies. May be repeated for credit with different topic. Prerequisite: B10.

**439-C23-0 Studies in Contemporary Philosophy** The work of one important philosopher or philosophical movement of the 19th and/or 20th centuries. Subject varies. May be repeated for credit with different topic. Prerequisite: B10.

**439-C24-0 Phenomenology** Major works contributing to the phenomenological movement: texts by Husserl, Heidegger, Sartre, and Merleau-Ponty. Questions of methodology, together with problems in theory of knowledge and ontology.

**439-C25-0 Philosophy of Mind** Selected topics in the philosophy of mind: mind-body problem, problem of other minds, self-knowledge, personal identity, philosophical psychology. May be repeated for credit with different topic.

**439-C26-0 Philosophy of Medicine** Introduces premedicine students to ethical problems they are likely to encounter. For example, is it ever ethical to withhold information from a patient; should physicians help terminally ill patients commit suicide; and should health care for the elderly be more limited than for children?

**439-C27-0 Philosophy of Psychology** Problems such as the nature of psychological explanation, experimentation and the testing of psychological claims, the standing of psychology as a science, reductionism, the unconscious, and conceptualizing the psyche and its processes.

**439-C28-0 Classics of Analytic Philosophy** Examination of classic texts that shaped the analytic movement of 20th-century Anglo-American philosophy. Readings from Frege, Russell, Wittgenstein, Carnap, Quine, and others.

**439-C29-0 On Being a Scientist** Investigation of science as a profession, its standards of conduct, strategies for surviving in the profession, and special problems that arise. Prerequisite: a major in an area of science.

**439-C50-0 Systematic Logic** Formal systems of deductive inference. Metatheory, formal semantics, completeness, and set theory. Third quarter of A50-B50-C50 sequence. Prerequisite: B50.

**439-C51-0 Advanced Topics in Philosophical Logic** Methods of modern formal logic applied to traditional philosophical questions, e.g., modal logic, deontic logic, epistemic logic, many-valued logic, tense logic. Prerequisite: B50.

**439-C53-0 Philosophy of Language** The nature and uses of language as presenting philosophical problems, e.g., theory of reference, the modes of meaning, definition, metaphor, problems of syntax, and semantics.

**439-C54-0 Advanced Topics in the Philosophy of Natural Science** Discovery, conceptual change and the growth of scientific knowledge, explanation, relation of theory to observation, confirmation theory, space and time, causality, and philosophical implications of relativistic and quantum mechanics. Prerequisite: B50 or consent of instructor.

**439-C55-0 Scientific Method in Social Sciences** Analysis of the philosophical foundations of social inquiry with reference to selected problems, thinkers, and schools, both classical and modern.

**439-C60-0 Ethical Theory** A systematic analysis of the nature of moral value judgments and their validity.

**439-C61-0 Advanced Studies Ethics** Philosophical study of a central problem, school of thought, or historical period or figure (e.g., Aristotle) in moral philosophy. Topics vary. May be repeated for credit with different topic.

**439-C64-0 Principles of Political Philosophy** Political power and authority; the notion of law; relations between society and the state; concepts of rights, liberty, equality, and justice. The problem of peace. Prerequisite: B63.

**439-C66-0 Advanced Studies in Philosophy of Religion** Central problems in the philosophy of religion.

**439-C67-0 Philosophical Issues Concerning Technology** Normative issues raised by technology, such as whether technology has intrinsic values and whether it is possible to make technology serve humane ends. Prerequisite: consent of instructor.

**439-C68-0 Problems in Social and Political Philosophy** Philosophical analysis of the social and political thought of a school, an individual philosopher, or an epoch. Problem varies.

**439-C80-0 Philosophy of Art** Nature and purpose of art, art and perception, the nature of creativity, and the social responsibility of the artist.

**439-C90-0 Special Topics in Philosophy** Topics vary from year to year; may be repeated for credit with different topic.

**439-C95-0 Junior-Senior Seminar** Open only to majors in their junior or senior year.

**439-C98-1,2,3 Senior Tutorial** Undergraduate honors thesis. Grade of K given in C98-1 and C98-2. Prerequisite: C95 or approval of the chair.

**439-C99-0 Independent Study** Open to properly qualified students with consent of department.

## Physics and Astronomy

The study of physics or astronomy provides an intellectual foundation appropriate to any field. The emphasis on quantitative thinking and mathematical analysis that characterizes physics and astronomy furnishes a good background for almost any career.

Students who major in physics or astronomy normally take A35-1,2,3 or A90-1,2,3 in their freshman year. Exceptionally qualified students may take Physics A25-1,2,3 with consent of the department. Depending on their high school preparation, majors in physics and astronomy normally also study mathematics in their freshman year, starting with Mathematics B14-1, B14-2, or B14-3. (See the prerequisites for Physics A35-1,2,3; students taking Physics A25-1,2,3 must be enrolled in either Mathematics B90-1,2,3 or B91-1,2,3.)

Students in the College of Arts and Sciences may complete their science distribution requirement by taking any of the following courses: Physics A03, A30-1,2, A35-1,2; Astronomy A01, A02, A03, or A20. Physics A03 and the four astronomy courses allow students who have taken only high school mathematics to explore important ideas in the physical sciences.

## Major in Physics

The physics major is designed to help students acquire a broad and varied background in physics and related fields. The three basic steps toward completing the physics major are (1) fulfilling prerequisites in introductory physics and calculus; (2) taking a core sequence of courses in classical physics, modern physics, and mathematics; and (3) completing a course concentration in areas such as advanced physics, astronomy, or materials science.

**Departmental courses**

***Basic courses (6 units)***

- Mathematics B14-1,2,3
- Physics A25-1,2,3 *or* A35-1,2,3 *or* A90-1,2,3

***Core sequence (9 units)***

- Mathematics B15, B17, B21 *or* B20-1,2,3 *or* B91-1,2,3
- Mathematics C16-0
- Physics C30-1, C32-0, C33-1, C39-1, C59-3

***Concentration:*** majors must choose one or more of the following areas

- *Advanced physics (6 units)*
  Physics C59-1, C30-2, C33-2, C39-2
  two other C-level physics or astronomy courses except C35-0, C98, C99
- *Astronomy (6 units)*
  Physics C30-2, C33-2, C39-2
  Astronomy B20
  two other C-level astronomy classes except C98 or C99
- *Materials Physics (8 units)*
  Chemistry A01, A02 *or* A71, A72
  Physics C37-0, C39-2
  Materials Science and Engineering C16-1,2 plus two courses chosen from C32, C55, C61, C80

Additional areas of concentration are currently under development. Students should check with the department's director of undergraduate studies to learn of the most recent updates to the curriculum.

Students intending to go to graduate school to continue their study of physics and/or astronomy should also consider taking some or all of the following:

- 2 or 3 units of C99 undertaken with the supervision of a faculty member and consisting of a research project in the student's area of concentration
- Mathematics C05, C34
- Selected introductory graduate courses such as Physics D11-1,2

Students should discuss specific options in undertaking this advanced program of study with the director of undergraduate studies before the end of the sophomore year.

## Minor in Physics

The minor in physics gives students a basic understanding of the most essential concepts in the field. It carries the same prerequisites as the physics major, a somewhat lighter core, and two physics electives. Students choosing the minor in physics must also complete the following six prerequisites or their equivalent.

**Prerequisites:** Mathematics B14-1,2,3; Physics A25-1,2,3 *or* A35-1,2,3 *or* A90-1,2,3

**Minor sequence (8 units)**

- Mathematics B15, B17, B21 *or* B20-1,2,3 *or* B91-1,2,3
- Physics C30-1, C33-1; C39-1 *or* C35
- Two other C-level physics or astronomy courses except C98 and C99

## Integrated Science Program

The Integrated Science Program (ISP) is a highly selective BA program in CAS that includes Physics A25-1,2,3 and C39-1,2,3 and Astronomy C31 as part of its curriculum (see the Integrated Science Program section of this catalog). A double major in ISP and physics is feasible in four years of study. See the director of undergraduate studies in physics or the director of ISP for detailed requirements.

## Honors in Physics or Astronomy

The honors program in physics and astronomy provides outstanding physics or astronomy majors with the opportunity to participate in research, under the supervision of a faculty adviser selected by the student. The program culminates in a written report that, in conjunction with the student's academic record, forms the basis for faculty decisions on the award of departmental honors. (Note that a student need not enter the honors program to participate in research. Students are welcome to initiate research projects by enrolling in C99 at any point in their undergraduate studies.)

The honors program is administered by the department's Undergraduate Curriculum Committee. This committee consists of the director of undergraduate studies, the assistant chair, and three other faculty members appointed by the chair of the department. The director of undergraduate studies serves as the departmental honors coordinator.

Physics or astronomy majors are eligible to participate in the honors program when they maintain an overall

grade point average of 3.3 or higher and a grade point average of 3.3 or higher in all physics, astronomy, and mathematics courses. These criteria also apply to all classes taken after the student has formally entered the honors program. Students who do not satisfy these requirements at graduation cannot be granted departmental honors.

Students who meet the above criteria and wish to participate in the honors program must notify the director of undergraduate studies. If the student has not yet selected an honors research adviser, the director can assist them in finding an appropriate faculty mentor.

Further details on completing the honors program and writing the honors thesis can be obtained from the director of undergraduate studies. See Honors under Academic Policies earlier in this section of the catalog.

### The Teaching of Physics

CAS students pursuing a major in physics who also wish to be certified for secondary teaching must be admitted to the Secondary Teaching Program in the School of Education and Social Policy (SESP) and complete all requirements as outlined in the SESP section of this catalog. Students are urged to contact the Office of Student Affairs in SESP as early as possible in their academic career.

### Advanced Placement

Freshmen who have taken a calculus-level physics course in high school may waive parts of the introductory physics sequence in the following ways:

1) A score of 4 or 5 on the College Board Advanced Placement Physics C1 exam (Mechanics) and/or the C2 exam (Electricity and Magnetism) will give the student full credit for Physics A35-1 and/or A35-2, respectively.

2) A score of 4 or 5 on the College Board Advanced Placement Physics B exam (algebra-based physics) will give the student full credit for Physics A30-1 and A30-2.

3) A passing score on the departmental placement examinations, given during New Student Week, will allow a student to place out of any or all parts of the A35-1,2,3 sequence. (No college credit is given for placing out of the course.)

4) High school students who have taken college-level physics while still in high school may apply to have that credit transferred to Northwestern. The class must have been taken on the campus of the accrediting college, and the student must have a transcript from the accrediting college. "College-level" classes taken at a high school are not eligible for transfer credit.

There is no placement exam or alternative credit mechanism for Physics A30-1,2,3.

## *Physics*

### Courses Primarily for Undergraduates

**447-A03-0 Ideas of Physics** Topics in modern and/or applied physics. Content varies: for example, relativity, the physics of music, and the progress of physics through history. Requires only high school mathematics and is designed for nonscience majors. Consult the Course and Teacher Evaluation Council listings for recent topics.

**447-A25-1,2,3 General Physics for ISP** General physics course relying extensively on calculus. Similar to A35-1,2,3 but more advanced and intended for ISP students. A concurrent advanced calculus course, Mathematics B91-1,2,3, is offered by the mathematics department. Prerequisite: first-year standing in ISP or consent of the department.

**447-A30-1,2,3 College Physics** Algebra-based physics primarily for premedical students who do not need to take calculus-based physics. Topics covered are similar to those of A35-1,2,3. Prerequisites: algebra and trigonometry.

**447-A35-1,2,3 General Physics** Classical physics for science and engineering majors and premedical students. **1.** Mechanics. Prerequisites: Mathematics B14-1,2; concurrent registration in Mathematics B14-3. **2.** Electricity and magnetism. Prerequisite: A35-1. **3.** Introduction to modern physics; wave phenomena. Prerequisite: A35-2.

**447-A90-1,2,3 General Physics for Majors** General physics for physics majors. Topics covered are similar to those of A35-1,2,3. Prerequisites: Mathematics B14-1,2; concurrent registration in Mathematics B14-3 or A90-1.

**447-B52-0 Introduction to Computational Physics** Computing and its application to physics: Monte Carlo simulation of physical systems and numerical integration of equations of motion, discrete element methods in electromagnetism. Prerequisites: A35-3, knowledge of either FORTRAN or C at the level of ISP A01, Electrical and Computer Engineering A01 or Computer Science A10.

**447-C30-1,2 Classical Mechanics 1.** Newtonian mechanics, conservation laws, oscillations, the Lagrangian and Hamiltonian formalisms, central-force motion. **2.** Two-particle collisions, motion in a noninertial reference frame, kinematics of rigid modes, systems with many degrees of freedom, and the wave equation. Prerequisites: A35-1 or equivalent; Mathematics B15, B17, B21, or equivalent.

**447-C31-0 Thermodynamics** Equations of state, the three laws of thermodynamics, entropy, phase changes, ideal gas, applications. Prerequisites: A35-1,2,3 or equivalent.

**447-C32-0 Statistical Mechanics** Ideal gas, Boltzmann distribution, transport phenomena, fluctuation theory, Bose-Einstein and Fermi-Dirac statistics, applications. Prerequisites: C30-1; Mathematics B15, B17, B21, or equivalent.

**447-C33-1,2 Advanced Electricity and Magnetism** **1.** Vector calculus, electrostatics and magnetostatics, multipole expansion, solutions of Laplace's equation by orthogonal function expansion, images, analytic functions. **2.** Maxwell's equations, electromagnetic equations, electromagnetic wave propagation and radiation, boundaries, microwave cavities, diffraction. Prerequisites: A35-1,2,3; Mathematics B15, B17, B21, or equivalent.

**447-C34-0 Introduction to Relativity** Time dilation, length contraction, the Lorentz transformation, equivalence of mass and energy, relativistic momentum, spacetime and some simple metrics, geodesics, classic tests of general relativity, black holes. Prerequisites: A35-1,2,3 or equivalent; C30-1,2; Mathematics B15, B17, B21, or equivalent.

**447-C35-0 Modern Physics for Nonmajors** Survey of modern physics for nonmajors with a technical background. Relativity and quantum physics; their application to nuclear, atomic, and molecular structure and electrical conductivity. Prerequisites: A35-1,2,3 or equivalent. Does not fulfill C-level requirement for majors.

**447-C37-0 Introduction to Solid-State Physics** Electrons in periodic lattices; phonons; electrical, optical and magnetic properties of metals and semiconductors; superconductivity. Prerequisites: C39-1,2.

**447-C39-1,2 Quantum Mechanics** Introduction to quantum theory. Applications to atomic and molecular systems, with some discussion of the experimental foundations of quantum theory. Several simple systems (the harmonic oscillator, the one-electron atom, the hydrogen molecule, barrier penetration, etc.) are studied in detail. Prerequisites: second-year standing in ISP or C30-1, C33-1; Mathematics C16.

**447-C39-3 Nuclear Physics** Topics covered include nuclei and their constituents, nuclear models, alpha and beta decay, nuclear reactions, nuclear fission and fusion, the strong, electromagnetic and weak interactions, and the fundamental particles and particle schemes. Prerequisites: C39-1,2.

**447-C59-1,2,3 Physics Laboratory** **1.** Introduction to modern electronics, construction of elementary analog and digital circuits. **2.** Introduction to microprocessors, hardware construction, interfacing to external devices, programming in BASIC, FORTRAN, or Pascal. **3.** Classic experiments in atomic, nuclear, and solid-state physics using modern electronics and microcomputers. Independent work. Prerequisites: C33-1,2 or consent of instructor; C59-1,2 are not prerequisites for C59-3.

**447-C98-0 Honors Independent Study** Individual study under the direction of a faculty member. Open only to advanced students pursuing departmental honors.

**447-C99-0 Independent Study** Opportunity to study an advanced subject of interest under the individual direction of a faculty member. Open to all advanced students; consent of instructor required.

### *Astronomy*

All A-level astronomy courses are specifically designed for students without technical backgrounds and require a mathematics background of only high school algebra.

**407-A01-0 Modern Cosmology** Modern views on the structure of the universe, its past, present, and future. For nonscience majors who seek to follow A20 with a more detailed course.

**407-A02-0 Milky Way Galaxy** Structure of the galaxy, star formation, interstellar clouds and dust, star clusters, neutron stars and black holes, the galactic center, the future evolution of the sun and our solar system. For nonscience majors who seek to follow A20 with a more detailed course.

**407-A03-0 Solar System** The planets and their moons, the sun, comets, asteroids. For nonscience majors who seek to follow A20 with a more detailed course.

**407-A20-0 Highlights of Astronomy** Acquaints students with modern ideas about the solar system, stars (including black holes, neutrons stars, and supernovae), galaxies, and the universe. Emphasizes fundamental principles and underlying concepts.

**407-B20-0 Highlights of Astrophysics** Classical mechanics, quantum mechanics, general relativity, statistical physics, fluid dynamics, and solid-state physics as they pertain to astrophysical phenomena. Prerequisites: Physics A35-1,2,3 or equivalent.

**407-C25-0 Stellar Structure and Evolution** Physical conditions in stellar interiors. Comparison of theory and observations in stellar evolution. White dwarfs, neutron stars, and black holes. Offered alternate years. Prerequisite: B20.

**407-C26-0 High-Energy Astrophysics** Physical processes occurring at high temperatures and pressures: X-ray and gamma-ray emission, cosmic rays, bremsstrahlung, synchrotron, inverse Compton radiation. Stellar and galactic accretion processes and jets, with applications to X-ray binaries, pulsars, and compact extragalactic objects. Offered alternate years. Prerequisite: B20.

**407-C28-0 Interstellar Matter** Mathematical and statistical treatment of interstellar matter. Physics of gas and dust clouds. Offered alternate years. Prerequisite: B20.

**407-C29-0 Galactic Structure and Dynamics** Observational topics include stellar populations, the disk and spheroidal components, galactic rotation, and the Galactic Center. Theoretical topics center on stellar dynamics,

including potential theory, stellar orbits, equilibria of collisionless systems, and spiral structure. Offered alternate years. Prerequisite: B20.

**407-C30-0 Cosmology** Introduction to the concepts and observational foundations of modern big bang cosmology. Topics include the Hubble expansion, Friedmann universes, the cosmic microwave background radiation, big bang nucleosynthesis, inflation, growth of gravitational instabilities and galaxy formation, correlation functions, local density and velocity perturbations, and dark matter. Offered alternate years. Prerequisite: B20.

**407-C31-0 Astrophysics** Stellar structure and evolution: basic equilibrium equations, physical conditions in the stellar interior, stellar energy sources, evolution of stars, nucleosynthesis, supernova phenomena, white dwarfs, neutron stars, and black holes. Prerequisite: Physics C39-3. Limited to students enrolled in the ISP or by consent of the physics department.

**407-C60-0 Instruments and Techniques for Astrophysics** Introduction to the theory, design, and operation of modern X-ray, optical, and radio astronomical instrumentation: photon statistics, noise sources, Fourier analysis, signal processing, and atmospheric limitations. Offered alternate years. Prerequisite: B20.

**407-C99-0 Independent Study** Opportunity to study an advanced subject under the individual direction of a faculty member. Open to all advanced students. Consent of instructor required.

## Political Science

A knowledge of political science is central to any occupation or profession that needs an understanding of human behavior, to the relationships between people and governments, or to the analysis and communication of information about public problems. A background in political science is virtually indispensable for people in politics and government, lawyers, journalists, scientists, business managers, or people working in medicine. Such professionals are in constant need of information on and understanding of the political, legal, governmental, and public implications of their fields. The Department of Political Science is internationally recognized for excellence at both the undergraduate and graduate levels.

The department is especially strong in American politics and government; the politics of foreign countries, especially in Europe, Latin America, Asia, and Africa; international studies; law and politics; political economy; and political theory. Much of the department's work is associated closely with the activities of the Program of African Studies, the Center for International and Comparative Studies, and the Institute for Policy Research, all of which are outstanding in their respective specialties.

The department offers an undergraduate major and minor and also graduate programs leading to the MA and PhD degrees in political science.

### Major in Political Science

As soon as students have declared a major in political science, a department adviser can be assigned to consult regularly with them about the program of study. Students planning to major in political science should try to complete the B-level prerequisites and one C-level course by the end of their sophomore year.

To prepare for research, students normally take the required C95 in the junior year. They should take at least one of the following before taking C95: C10, C11, C12. All majors also are urged to acquire a working knowledge of a foreign language.

**Departmental courses**

***Basic courses:*** three courses chosen from B01, B04, B20, B21, B30, B40, B50

***Major courses:*** seven C-level courses in political science, one of which must be C10, C11, or C12 and another of which must be C95

***Related courses:*** five quarter-courses in anthropology, economics, history, philosophy, psychology, or sociology, of which at least two must be at the C level; no more than one may be at the A level

### Minor in Political Science

The minor in political science offers students the opportunity to acquire a solid foundation in the discipline as well as significant exposure to advanced courses. It also is designed to allow students to develop specialized competencies.

**Minor course requirements (6 units)**

- At least two B-level courses chosen from B01, B04, B20, B21, B30, B40, B50
- Four additional political science courses, at least three at the C level

Students should begin pursuing the minor with B-level courses, which provide a general introduction to major subfields of political science as well as background for C-level courses. They may pursue specialized interests in the minor. For example, for students who aspire to a legal career, an appropriate minor might concentrate on law and politics and could include B30, C30, C31, C32, or C33. Minors can follow similar pathways for concentrations in political philosophy, urban politics and policy, international relations, comparative politics, and American political processes, or they may choose an array of courses that cut across subfields rather than concentrate on one or two areas. To develop an individual program of study for a minor in political science, students must consult with the director of undergraduate studies in the department.

## Four-Year BA/MA

The department offers a four-year BA/MA program in political science for outstanding undergraduate majors. Interested students should contact the director of undergraduate studies no later than the winter quarter of the junior year and should see Four-Year Master's Programs in the Undergraduate Education section of this catalog.

## Honors in Political Science

Majors with outstanding records both overall and within the department may apply for graduation with departmental honors. The primary route to earning the departmental recommendation for honors involves enrolling in C98 Honors Tutorial, a two-quarter course that requires writing a senior thesis. Students interested in exploring an alternate route to honors should meet with the director of undergraduate studies in the junior year. Either way, departmental honors requires outstanding work in connection with a research project. See Honors under Academic Policies earlier in this section of the catalog.

## The Teaching of Political Science

CAS students pursuing a major in political science who also wish to be certified for secondary teaching must be admitted to the Secondary Teaching Program in the School of Education and Social Policy (SESP) and complete all requirements as outlined in the SESP section of this catalog. Students are urged to contact the Office of Student Affairs in SESP as early as possible in their academic career.

## Courses Primarily for Undergraduates

### *Political Theory*

These courses examine the ideas that inform the thinking of today's citizens, representatives, and political scientists. They are organized by historical periods and conceptual similarity.

**449-B01-0 Introduction to Political Theory** Ideas like power, freedom, justice, and rationality in the work of major political theorists. How political thought influences political institutions and behavior.

**449-C01-0 Classical Political Theory** Contributions of classical political theorists, such as Plato, Aristotle, and Cicero, and their modern applications. Modern concepts of scope and method of political science.

**449-C02-0 Modern Political Thought** The nation-state, modern science, and the industrial revolution as context for a revolution in political ideals. Machiavelli, Hobbes, Locke, Rousseau, Marx. Relation of ideas to social movements and political institutions.

**449-C03-0 Concepts in Democratic Theory** Contemporary analyses of the meanings of liberty, equality, representation, and other key concepts in the theory and practice of democracy.

### *Research Methodology*

Courses in this field prepare students to do original research on the causes and consequences of political phenomena. The methodological techniques are often transferable to research problems in government and business.

**449-C10-0 Elementary Statistics for Political Research** Measuring political data, summarizing observations, analyzing contingency tables. Parametric and nonparametric tests of hypotheses. Basics of multiple regression. SPSS computer usage.

**449-C11-0 Methods of Political Research** Introduction to methods and techniques of political research: research design, experimentation, comparative inquiry, measurement, data collection, and data analysis. Application of these methods to political phenomena.

**449-C12-0 Logic of Political Inquiry** Political science as "science." Identity sources, construction, functions, and validation of social science theory and explanation from varied perspectives. Not open to students who have taken Sociology C26.

**449-C15-0 Introduction to Positive Political Theory** Techniques of formal modeling employed in the analysis of politics. Arms races, deterrence, bargaining and coalitions, rational choice, social choice and Arrow's paradox, voting, game theory. Prerequisite: C10.

### *American Politics*

These courses deal with the dynamics of behavior within and between domestic political institutions. Although focusing on American politics, the courses usually involve comparisons with behavior and institutions in foreign countries.

**449-B20-0 American Government and Politics** The structure and process of American politics from competing perspectives. Analysis of representation, voting, interest groups, parties, leadership, and policy-making institutions. The gateway course for the American politics subfield.

**449-B21-0 Urban Politics and Policies** Structure of local and regional political power and its relation to social and economic structure of community.

**449-C20-0 The Presidency** Contemporary presidency in terms of recruitment, presidential character, public opinion, institutional constraints, and foreign versus domestic policy making. Prerequisite: B20 or equivalent.

**449-C21-0 Community Political Processes** Selected problems of mobilizing and exercising political power in local and regional jurisdictional units. Relationships between political structure and community needs and demands. Prerequisite: B21.

**449-C23-0 Public Opinion and Voting Behavior** Who votes and for whom. Social, psychological, economic, and political factors influencing election choices. Sources of

opinions. Focus on American presidential elections but some comparative and nonpresidential material. Prerequisite: B20 or equivalent.

**449-C24-0 Political Parties and Elections** Role of political parties in a democratic society. Topics include nomination, national conventions, political funding, campaigns, party organization, and national, state, and local parties.

**449-C25-0 The Legislative Process** Organization of legislatures to make public policy; legislative-executive relations; impact of interest groups and other forms of citizen activity on legislative decision making. Emphasis on United States Congress. Prerequisite: B20 or equivalent.

**449-C27-0 Black American Politics in the United States** Historical survey of black politics and relationship of blacks to the government. Relevance of both reformist and revolutionary strategies in the struggle for black liberation.

**449-C28-0 State Politics of the United States** Political process at the state level in the United States. Variety of institutional forms and decision-making processes attached to different kinds of issues existing in the several states. Prerequisite: B20.

### *Law and Politics*

These courses study the role of the judiciary at the national, local, and emerging levels of government. They also investigate issues in jurisprudence and the administration of justice.

**449-B30-0 Introduction to Law in the Political Arena** Roles of law in society and politics—how disputes are resolved, organization of the bar, why people litigate, the consequences of litigation. Compares common law, civil code, and other legal traditions.

**449-C30-0 The Politics of Local Justice** Local justice systems, with emphasis on trial courts, civil and criminal litigation, and the political consequences of the involvement of the law in social conflicts.

**449-C31-0 Appellate Processes** Operation of appellate courts, with emphasis on the United States Supreme Court. Decision making by appellate courts and the development of public policy.

**449-C32-0 Constitutional Law I** Introduction to interpretation of the United States Constitution by the Supreme Court. Judicial review, federalism, separation of powers, economic and religious liberty, and personal privacy. Prerequisite: B20 or B30.

**449-C33-0 Constitutional Law II:Civil and Political Rights** Consideration of decisions of the United States Supreme Court dealing with civil and political rights, including equality, freedom of expression, and criminal procedures. Prerequisite: B20 or B30.

### *International Politics*

This field includes the study of major actors and arenas in the world scene, major processes through which cooperation and conflict are managed in the international system, and ways in which change occurs and resources become allocated in the global system.

**449-B40-0 Introduction to International Relations** Surveys basic concepts and processes in international and transnational relations, including major actors, management of conflict and cooperation, and systemic changes at the global level. The gateway course to the international politics subfield.

**449-C40-0 Global Society** Survey of human problems of global dimensions, such as population, poverty, human rights, and war. Evaluation of the adequacy of existing institutions for handling these problems. Alternative forms of global organization.

**449-C41-0 American Foreign Policy in a Global Context** Economic, military, and diplomatic dimensions of policy; internal and external influences on policy; theories of foreign policy decision making in the United States and other nations.

**449-C42-0 International Organizations** Role of international organizations in international relations. Similarities and differences between international and other political institutions. Comparison of different types of international organizations.

**449-C44-0 Advanced Studies in International Relations** Integrated analysis of collaborative and conflict processes in international politics, with intensive work on substantive topics of special interest to each student. Prerequisites: B40 and/or C40; C41 and/or C42 recommended.

**449-C45-0 National Security** Problems of maintaining national security in the military and economic spheres; deterrence theory, nuclear weapons, arms control, and defense policy among the major powers.

### *Comparative Politics*

This field analyzes political behavior and institutions in foreign countries and areas of the world. Some courses concentrate on understanding the politics of specific national systems, while others focus on certain types of political phenomena and make cross-national comparisons.

**449-B50-0 Introduction to Comparative Politics** Emphasis may be on industrialized and/or developing states; socialist and/or capitalist states. Major issues include regime-society relations, revolution, and policy making.

**449-C43-0 United States and Latin America** Interactions between U.S. foreign policy and Latin American politics. The evolving importance of Latin America in U.S. geostrategic objectives from the turn of the century through the Cold War and during the emerging post–Cold

War period. How the projection of U.S. power and influence shapes the domestic politics of selected countries.

**449-C46-0 Politics of European Unification** The development and prospects of the European Union are examined by placing it in geopolitical and historical context.

**449-C50-0 Communism and Post-Communism** Causes, processes, and consequences of revolutionary movements. Theories and case studies, including victorious and unsuccessful urban and rural-based movements.

**449-C51-0 Peasant Politics** Characteristics of agrarian economic structures, social organizations, and peasant politics, movements, and revolutions; elite responses to, interactions with, rural society through public policy, clientelist mobilization, etc.

**449-C52-0 Politics of East Asia** Examines East Asia as a site for studying various concepts in comparative politics: war, revolution, imperialism, modernization, dependency, development, authoritarianism, party politics, and democratization.

**449-C53-0 Politics in Latin America** Patterns of socioeconomic development and regime forms in Latin America. Interaction of internal and international economic and political structures and processes.

**449-C54-0 Southeast Asian Politics** Exploration of the political economy of Indonesia, Singapore, Burma, the Philippines, Thailand, Malaysia, Vietnam, as well as the smaller states of Laos, Cambodia, East Timor, and Brunei. Focus on the post–World War II period; attention also paid to colonial influences and the Japanese invasion. Important themes include industrialization, human rights, and democracy.

**449-C55-0 Chinese Politics** Fundamental conflicts in Chinese politics: party-mass relations; class; the urban-rural split; and debates over ideology, democracy, and development strategy.

**449-C57-0 Politics of Post-Colonial States** Problems and political behavior in underdeveloped areas in regard to their internal affairs and international relations. Interplay between economic conditions and political patterns.

**449-C58-0 Nationalism** Social, linguistic, religious, and political bases of the rise of modern nationalism in Europe, Asia, and Africa; wars of national liberation in relation to imperialism and colonialism.

**449-C59-0 Politics in Africa** Political structures and relation of cultural factors to political stability and change; development of modern political systems.

**449-C60-0 Comparative Racial Politics** The interplay of racial, socioeconomic, and cultural tensions in Germany, Trinidad, and Britain. Methods of comparative analysis used to identify and distinguish patterns of racial politics between and within multiracial nation-states. Theories and concepts of race and ethnicity and their relationship to issues of state power, national identity, and social policy.

**449-C61-0 Democratic Transitions** Causes for emergence and breakdown of democracy in cases from Europe, Latin America, Africa, and Asia. Focus on relationship between capitalist economic development, international forces, and timing of democratization across the globe.

**449-C62-0 Politics of Western Europe** Historical development, mass behavior, interest groups and parties, policy making, and social and economic policy.

### *Public Policy and Political Economy*

The consequences of governmental action on political, social, and economic activity are analyzed in these courses. Other courses concerned with public policy and political economy are listed under the law and politics and international politics subfields.

**449-B04-0 Politics and Nature** Introduction to the study of environmental policy. Consideration of some fundamental issues and concepts concerning the maintenance of a livable planet, such as sustainable development, common property regimes, transformation of the environmental movement from a primary emphasis upon nature conservation to a complex set of foci concerning biodiversity, possible climate change.

**449-C71-0 Environmental Politics** Political problems associated with human impact on natural environment; pollution, natural resources, public lands, land use, energy, and population.

**449-C72-0 The Politics of the Global Economy** Interactions of politics and economies in the relations between nations and among subnational groups. Theories of imperialism, dependency, and the evolution of the global system; international policy and institution reform.

**449-C74-0 Politics and Markets** How democratic politics and markets interact. Examines the politics of policy choices democratic governments make and the economic impact those choices have. Explores some of the most significant ways in which the United States, Western Europe and Japan differ.

**449-C75-0 Comparative Politics of Business-Government Relations** Relations between business and government in a variety of economic, social, and political contexts. Patterns of influence in both business and government. Theories of business influence in politics, such as pluralism, corporatism, collective action, and instrumental and structural Marxism.

**449-C76-0 Comparative Capitalism in the Advanced Industrialized Countries** Different patterns of industrialization produce differences in the political organization of capitalism, i.e., in the position and role of labor and in

relations between business and the state. Historical roots of those differences and their implications for contemporary politics and policy.

### *Seminars, Independent Study, and Special Opportunities*

C95 is required of all political science majors, who will be notified of scheduling arrangements in advance. C95 is ordinarily taken in the spring quarter of the junior year or the fall quarter of the senior year. With consent of the department, students may receive full credit for more than one quarter of C95 provided that, if C98 and C99 are also taken, C95 with C98 and C99 do not exceed a total of four course credits.

**449-C90-0 Special Topics in Political Science** Designed for investigation of topics that are of current interest to students and faculty but are not adequately covered by other course offerings. No prerequisites. Offered in different quarters as announced.

**401-C93-0 Chicago Field Studies Internship** See General Studies.

**449-C94-0 Senior Linkage Seminar** Topics vary. Open only to senior majors and nonmajors.

**449-C95-0 Political Research Seminar** Led by different members of the department, small seminars in research topics, providing students the chance to conduct research.

**449-C98-1,2 Honors Tutorial** For seniors with excellent records, by department invitation. First quarter taken fall or winter for K grade, final grades given after research paper at end of second quarter. Two consecutive quarters. Prerequisite: C95.

**449-C99-0 Independent Study** Study and research programs for unusual needs of political science majors. A written proposal, signed by the professor with whom the student will study, to be submitted to the department.

## *Portuguese*

See Hispanic Studies.

## Psychology

The study of psychology covers a wide range of topics in the natural and social sciences. It provides students a unique opportunity to increase their understanding of themselves and other people as developing individuals, biological organisms, and participants in society. Because of the strong research orientation of the department, it also provides an understanding of how research is done and an opportunity to participate directly in research.

Majors in psychology can lead in various directions after graduation. Graduate study can prepare students for a career as an academic, clinical, industrial, or other kind of psychologist. Psychology is a useful major for students planning careers in medicine, law, or management, as the department is strong in cognitive science, psychobiology, psychopathology, and social psychology. Whether or not students continue their education beyond the bachelor's degree, they will find that the psychology major provides knowledge about human behavior and methods of research and data analysis that is valuable in business, the helping fields, and other occupations.

At the graduate level, the department recognizes several specialties with programs leading to the PhD. Though opportunities for study and research are available to undergraduates in all these areas, there is only one undergraduate psychology major. Its requirements are designed to give every student a mastery of the basic methods and a balanced exposure to different aspects of psychology. Beyond that, students are encouraged to follow their interests in regular courses and in independent study. Extensive laboratory facilities, including a number of microcomputers, are available.

### Major in Psychology

**Departmental courses**

***Basic course:*** A10

***Major courses:*** B01, B05, and at least seven additional psychology courses, subject to the following restrictions:

- At least one upper-level research course chosen from C01, C11, C13, C16, C21, C27, C33, C34, C35, C42, C51, C62, C97-2, C98 (any course listed both here and in one of the following two categories may be counted toward that category as well)
- At least two personality/clinical or social courses chosen from B04, B15, C01, C03, C06, C16, C26, C84, C85
- At least two cognitive or physiological courses chosen from B12, B28, C11, C12-1, C12-2, C21, C24, C27, C33, C34, C35, C60, C61, C62
- At least three C-level courses
- No more than two courses chosen from Cognitive Science B07, B10, and B11 may be counted toward the requirements
- No more than one quarter of C97-1 and C99 may be counted toward the requirements
- No more than one quarter of C97-2 may be counted toward the requirements
- B39 may not be counted toward the requirements
- Psychology majors should be aware of the following restrictions imposed by the college:
  1) Students may not register for more than two total credits of C97-1 and C99 in any quarter.
  2) No more than nine total credits of C97, C98, and C99 may be counted toward CAS graduation requirements

**Related courses**

- Any three courses from the following: mathematics at the B level or higher, statistics at the C level or higher, and computer science at any level
- Any two courses from biological sciences, chemistry, or physics

## Minor in Psychology

The minor in psychology reflects the view that the most appropriate undergraduate study of psychology combines a methodological core with breadth of content. The minor therefore contains the general prerequisite (A10), the two central methods courses (B01 and B05), and at least one course from each of the two main content areas defined for the major.

**Minor course requirements (7 units)**

- A10
- B01 and B05
- Four additional psychology courses, subject to the following restrictions:
  at least one personality/clinical or social course chosen from B04, B15, C03, C06
  at least one cognitive or physiological course chosen from B12, B28, C12-1, C24, C60, C61, C62
  at least two C level courses
- No more than one quarter of C97-1 and C99 may be counted toward the requirements
- B39 may not be counted toward the requirements

## Integrated Science Program

The Integrated Science Program is a highly selective BA program within CAS (see Integrated Science Program). Students in ISP who also wish to complete a major in psychology should consult with the program director and the director of undergraduate studies in psychology as early as possible to determine their specific additional major requirements.

## Honors in Psychology

Each spring quarter a few students with superior records in psychology are invited into C98 for the following academic year. Those who accept carry out a yearlong research project that, if completed, commonly leads to departmental honors in psychology. In exceptional circumstances honors in psychology may also be achieved by carrying out a major research project through two or more quarters of C99. For more information, consult the director of undergraduate studies. See Honors under Academic Policies earlier in this section of the catalog.

## Courses Primarily for Freshmen and Sophomores

**451-A10-0 Introduction to Psychology** Basic psychological facts and principles of normal behavior. Laboratory experience is included and provides an introduction to psychology as a research science.

**451-B01-0 Statistical Methods in Psychology** Measurement scales. Descriptive statistics. Introduction to probability theory and sampling distributions. Inferential statistics, including t-test, ANOVA; correlation and regression. Prerequisite: A10; some college mathematics recommended.

**451-B04-0 Social Psychology** Psychological processes in social behavior. Prerequisite: A10.

**451-B05-0 Research Methods in Psychology** Study of methods of psychological research; experimental design; reliability and validity; review and application of statistics; execution and reporting of psychological research. Prerequisite: B01.

**452-B07-0 Introduction to Cognitive Modeling** See Cognitive Science.

**452-B10-0 Introduction to Cognitive Science: Language,Vision,and Memory** See Cognitive Science.

**452-B11-0 Introduction to Cognitive Science: Learning,Representation,and Reasoning** See Cognitive Science.

**451-B12-0 Introduction to Neuroscience** Brain processes in relation to behavior, including memory, perception, and motivation. Dissection, histology, and surgery for brain stimulation. One college or advanced high school course in biology recommended.

**451-B15-0 Psychology of Personality** Nature of personality and its development. Modern theoretical interpretations. Prerequisite: A10.

**451-B18-0 Developmental Psychology** Development of cognitive, social, and other psychological functions. Prerequisite: A10.

**451-B28-0 Cognitive Psychology** Introduction to research conducted by psychologists studying mental processes such as memory, reasoning, problem solving, and decision making. Prerequisite: A10; B05 is recommended.

**451-B39-0 Marketing Management** Basic principles and applications of marketing management; market segmentation, target marketing, brand positioning; survey of market research and consumer behavior; marketing of services, nonprofits, the arts. Prerequisite: one introductory behavioral social science course (e.g., anthropology, psychology, sociology).

## Courses Primarily for Juniors and Seniors

**451-C01-0 Personality Research** Current research in personality, with emphasis on experimental approaches and methods. Basic concepts of test reliability and validity. Lecture and laboratory. Prerequisites: B05, B15.

**451-C03-0 Psychopathology** Deviations in psychological processes as they occur in psychopathology. Prerequisite: A10.

**451-C06-0 Introduction to Clinical Psychology** Definition and history of clinical psychology, personality theory in clinical psychology, diagnosis and classification of disorders, assessment, psychotherapy, and ethical issues. Prerequisite: A10.

**451-C11-0 Human Learning and Memory** The nature of human learning and memory with an emphasis on research methodology and report writing. Lecture and laboratory. Prerequisites: B05, B28.

**451-C12-1,2 Neurobiology and Behavior 1.** Neurophysiology, neuroanatomy, and electrophysiological substrates of behavior. Prerequisites: A10; one biology course. **2.** Neuroanatomical, electrophysiological, and biochemical substrates of psychological processes and biofeedback. Prerequisite: C12-1 or equivalent; B05 recommended.

**451-C13-0 Research-Focused Seminar** Topic to be announced. Discussion and critical analysis of relevant research methods. Prerequisite: B05; additional prerequisites may apply for particular topics. May be repeated for credit with different topic.

**451-C14-0 Special Topics in Psychology** Topic to be announced. Prerequisites vary. May be repeated for credit with different topic.

**451-C16-0 Experimental Social Psychology** Social psychological experimentation (laboratory experiments, field experiments, quasi-experiments), with students conducting original research. Prerequisites: B04, B05.

**451-C21-0 Neuroscience and Behavior Laboratory** Classical exercises in the physiological psychology laboratory, including brain-wave recording and electrophysiology. Prerequisites: B05, C12-2.

**451-C24-0 Perception** Human perception, particularly vision. Also hearing, taste, smell, and touch. Biological foundations, development, and disorders of perception. The role of the senses in everyday life. Prerequisite: A10.

**451-C26-0 Personality Development** Research methods, theories, and facts relating to the development and modification of children's attitudes and behavior. Prerequisite: consent of instructor.

**451-C27-0 Formal Models of Cognition** Practical aspects of formal modeling in psychology. Possible topics: curve fitting, distribution theory, reaction-time models, semantic and neural network models, models of human choice and decision making, multidimensional scaling. Prerequisites: B05, B28; Mathematics B14-3 or equivalent.

**451-C33-0 Psychology of Thinking** Research methods and recent experimental findings for simple types of human thinking. Lecture and laboratory. Prerequisites: B05, B28.

**451-C34-0 Psychology of Language** Exposure to original research, journal articles, theoretical and methodological criticism, and experimental design. Prerequisites: B05, B28, or consent of instructor.

**451-C35-0 Decision Making** Human decision making from both descriptive and prescriptive perspectives. Theories and models of decision making applied to a variety of contexts. Prerequisites: B05, B28.

**451-C37-0 Human Sexuality** Sexual development and differentiation, deviations, dysfunctions, and controversies in sexology. Prerequisite: A10.

**451-C39-0 Psychology of Gender** Examination of sex differences and similarities. Evaluation of social and biological explanations for differences. Review of research on how gender affects achievement, relationships, and mental health. Prerequisite: A10.

**451-C42-0 Biological Bases of Mental Illness** Effects of brain abnormalities on cognition, emotion, and behavior. Neurological aspects of mental disorders. Discussion of theories and research methods. Prerequisite: B05, C03, or consent of instructor; B12 or C12-1 strongly recommended.

**451-C51-0 Advanced Statistics and Experimental Design** Theory and use of advanced analytic techniques, including exploratory data analysis, model fitting, analysis of variance, and multidimensional scaling. Advanced topics in experimental design. Prerequisites: B05, Mathematics B14-3.

**451-C60-0 Human Memory and Cognition** In-depth survey of recent work in human memory and cognition. Prerequisite: B28 or consent of instructor.

**451-C61-0 Brain Damage and the Mind** Survey of human cognition (including attention, memory, and awareness) as studied via investigations of brain damage and modern brain imaging techniques. Prerequisite: A10, B12, or Cognitive Science B10.

**451-C62-0 Cognitive Development** Development of cognition and perception. Infant perception; development of human memory, concepts, language, and expertise. Prerequisites: B05, B18 or B28, or consent of instructor.

**452-C66-0 Cognitive Science Proseminar** See Cognitive Science.

**451-C84-0 Interpersonal Relations** Psychological processes in social perception and interaction; focus on attraction and relationships, aggression, and conflict. Prerequisite: B04.

**451-C85-0 Psychology of Attitudes** Survey of social psychological research on attitudes; focus on the formation and measurement of attitudes, their structure and

function, the relationship between attitudes and behavior, and attitude change. Prerequisite: B04.

**451-C95-0 Psychobiology Research Seminar** Research methods and advanced topics related to brain function. Limited enrollment. Prerequisite: consent of instructor.

**451-C97-1,2 Advanced Supervised Research** Design and implementation of a psychology research project. Data analysis and preparation of a written report. Prerequisites: B05 and consent of instructor; C97-2 must be taken with the same professor as C97-1.

**451-C98-1,2,3 Undergraduate Seminar** (1–4 units) Senior honors research. Open only by invitation of the faculty.

**451-C99-0 Independent Study** Consent of instructor required.

## Religion

Because religion is a multifaceted phenomenon, the academic study of religion and the religious is a multidisciplinary field. The undergraduate major in religion is designed to develop an understanding of several major religions through study of their historical development, sacred literature, and social manifestations. The faculty's training and the course offerings concentrate on the traditions of Hinduism, Buddhism, Judaism, Christianity, and Islam, though courses in other areas are presented occasionally. Study of the interaction of two or more traditions constitutes a regular part of the curriculum and the extracurricular seminars, lectures, and discussions. Undergraduate majors enjoy a wide range of extracurricular events and daily association with the faculty, staff, and graduate students.

Students, in consultation with the department adviser, may organize highly individual major programs of study that include courses from this department and other departments in the University. To ensure coherence and balance with the individuality of each program, students submit their proposed program for approval to both the department director of undergraduate studies and the department chair.

### Major in Religion

The program for majors in religion consists of ten courses in the department and four courses in related subjects.

**Departmental courses (10)**

- A10, C95
- Eight courses beyond the A level and at least five at the C or D level, including two in Eastern religions and two in Western religions

**Related courses (4):** four courses in related subjects chosen in consultation with the department's undergraduate adviser.

### Minor in Religion

The minor in religion provides a coherent and balanced set of courses with work on general theories of religion and Western and Eastern religious traditions. Enrollment in C95 ensures that students completing the minor have the opportunity to interact with religion majors. Students minoring in religion may preregister for courses with majors.

**Minor course requirements (6 units)**

- A10, C95
- Four other religion courses, at least two at the C or D level, at least one in Western religions (Christianity, Islam, Judaism), and one in Eastern religions

### Honors in Religion

Superior students in the department become eligible for departmental honors by writing a senior thesis. This is usually accomplished by enrolling in two quarters of C96 during the fall and winter quarters of their senior year. Students who intend to qualify for honors should notify the undergraduate adviser in writing by the end of the spring quarter of the junior year. For more information, consult the director of undergraduate studies. See Honors under Academic Policies earlier in this section of the catalog.

### Courses Primarily for Freshmen and Sophomores

**429-A10-0 Religion in Human Experience** Religion as it has appeared in the past and as humans continue to express it in their personal and social lives.

**429-A11-0 Varieties of Religious Tradition** Introduction to a variety of the major religious traditions of the world.

**429-B10-0 Introduction to Hebrew Bible** Major genres of Old Testament literature. Basic theological views and the social-political history of ancient Israel.

**429-B11-0 New Testament Origins** The beginning, development, and content of the New Testament. Its Jewish and Hellenistic environment.

**429-B20-0 Introduction to Hinduism** Unity and diversity of Hindu mythology, beliefs, and practices from ancient times to the present.

**429-B22-0 Introduction to Buddhism** The Buddha's life and teachings, the traditions that developed from this teaching, and the systems of meditation, rituals, and ethics.

**429-B23-0 Religion in China** Historical development of religious traditions in China from ancient to modern times; Confucianism, Taoism, and Buddhism.

**429-B24-0 Introduction to Judaism** Main concepts in the theology of Judaism, main rituals and customs, and main institutions.

**429-B25-0 Religion in Japan** Introduction to the religions in Japan from ancient to modern times, including Shinto, Confucianism, Taoism, and Buddhism.

**429-B26-0 Introduction to Christianity** Christian doctrine, worship, and institutions in the various branches of Christianity.

**429-B27-0 Introduction to Medieval Jewish Philosophy** Philosophic tradition of medieval Judaism focusing on the history of Judaism through study of the thought of Moses Maimonides (1138–1204), the most important Jewish medieval philosopher.

**429-B28-0 Introduction to Islam** Principal beliefs and practices of Muslims set against the historic development of the faith.

## Courses Primarily for Juniors and Seniors

### *Buddhism*

**429-C24-0 Buddhism in the Contemporary World: Traditional and Reform** Buddhism's reinterpretation of its thought and practice in response to postcolonial modernizations.

**429-C25-0 Theravada Buddhism and Culture** Theravada Buddhism in interaction with its culture.

**429-C38-0 Central Ideas of Mahayana Buddhist Thought** Mahayana philosophy of life, its concept of reality, notion of individual existence, and view of the world.

**429-C44-0 Nagarjuna's Madhyamika Philosophy**

**429-C46-0 Contemporary Buddhist Philosophy**

**429-C48-0 Zen Buddhism** Historical development of Zen Buddhist theory and practice.

**429-C55-0 Topics in Buddhism** May be repeated for credit with different topic.

### *Judaism*

**429-C05-0 History of Judaism** Survey of the religious history of Judaism from the post-Biblical period to the emancipation.

**429-C06-0 Judaism in the Modern World** Impact of emancipation and modernity on Judaism. Fundamental problems that emancipation and modernity precipitate and the radical changes they bring to the religious expression of Judaism.

**429-C13-0 Varieties in Ancient Judaism** Introduction to the Judaisms that flourished from the fifth century B.C. to the third century A.D.

**429-C31-0 Jewish Thought in the 20th Century** Distinctive themes in the main 20th-century Jewish philosophers.

**429-C32-0 The Rise of Rabbinic Judaism** Investigation of how Judaism was recreated after the destruction of the Temple in 70 A.D.

**429-C34-0 Literary Expressions of Rabbinic Judaism** An examination of the forms of expression of Rabbinic Judaism: legal, mystical, philosophical, and poetic.

**429-C35-0 The Art of Biblical Narrative** Ways in which the religious imagination of ancient Israel expresses itself through literary artistry.

**429-C36-0 Religion and Mythology of the Ancient Near East** Myths, religious ideologies, and cultic practices of Sumer, Babylonia, Assyria, and Canaan, including Phoenicia; relation to ancient Greece and Israel, women, literature.

**429-C37-0 Prophecy in Ancient Israel** Writings of ancient Israelite prophets and history of the prophetic movement; parallels with Near Eastern prophecy; prophecy in early Judaism and Christianity; themes and types of prophetic thought. Prerequisite: B10 or equivalent.

**429-C52-0 Topics in Judaism** May be repeated for credit with different topic.

### *Christianity*

**429-C02-0 Christian Ethics** Content and role of ethics in Jesus' formation of Christian teaching and in the theology of some recent Christian thinkers.

**429-C12-0 Modern Study of Jesus** Recent approaches to the study of Jesus.

**429-C51-0 Topics in Christianity** May be repeated for credit with different topic.

**429-C60-0 Medieval Christianity** Major thought, institutions, and figures of medieval Christianity.

**429-C61-1,2 Foundations of Christian Thought** Survey of the development of Christian thought. **1.** Early or traditional Christianity. **2.** Christian thought since the Reformation.

**429-C64-0 The Idea of Sainthood in Christianity** Historical and contemporary conceptions of sanctity, especially in Roman Catholicism and Eastern Orthodoxy.

**429-C65-0 The Christian Mystical Tradition** Writings of mystics (e.g., Meister Eckhart, *Cloud of Unknowing*, Julian of Norwich, Teresa of Avila) in their cultural context.

**429-C69-0 Topics in Medieval Christianity** Selected themes in the history of Christianity during the Middle Ages. May be repeated for credit with different topic.

### *Islam*

**427-C55-0 Islam in Africa** See History.

**429-C57-0 Topics in Islam** Selected topics in Islamic history and thought. May be repeated for credit with different topic.

### Courses in Method and Comparative Study

**429-C07-0 Judaism in Contemporary Christian Theology** Judaism in the theologies of Barth, Bultmann, Tillich, Niebuhr, Danielou, et al.

**429-C50-0 Topics in Religion** May be repeated for credit with different topic.

**429-C90-0 Comparative Study of Religions** History and present use of the comparative method of studying religions.

**429-C95-0 Theories of Religion** Ways of analyzing critically religious experience and its meaning. Phenomenology of religion, history of religions, comparative religions.

**429-C96-1,2 Senior Seminar**

**429-C99-0 Independent Study** For advanced students, reading and conferences on special subjects. Consent of instructor required.

## *Russian*

See Slavic Languages and Literatures.

## Science in Human Culture Program

### Minor in Science in Human Culture

The minor in science in human culture prepares students to confront the impact of science, medicine, and technology on society and on their own lives. The program welcomes science majors interested in thinking beyond the problem sets assigned in their specialized courses, as well as students in the humanities who wish to surmount the compartmentalization of knowledge that accompanied the rise of modern science. The minor seeks to foster critical thinking about the limits, authority, and impact of science, a mode of understanding that is often said to be the defining feature of modern culture.

For an up-to-date listing of courses and for more information about the minor, consult the program director (Harris Hall, room 102C, 847/491-7260), any of the faculty advisers teaching the courses listed below, or the program Web page at <http://www2.mmlc.nwu.edu/shc/>.

**Minor course requirements (7 units)**

In consultation with a faculty adviser, students develop a coherent theme that ties together their choice of seven courses selected from the partial list below. Students must take at least one C-level seminar. Students applying for the minor in science in human culture must show a minimum of five courses not double-counted in any other major(s).

Some of the themes adopted by students have included medicine and society, technology and social change, science and gender, religion and scientific knowledge, and philosophy of science. For example, students interested in medicine and society might explore the interaction of medical knowledge and practice, medical ethics, and the boundaries between sickness and health. Topics addressed might include the authority of the physician, the role of the hospital, the social dimensions of racial and gender differences, and the changing conception of disease and healing.

***Eligible courses (partial list)***

Anthropology C70 Anthropology in Historical Perspective
Biological Sciences A60 Human Reproduction
Civil Engineering B06 Environmental Literacy
Classics C42 Early European Medicine
Communication Studies B29 Communication Technology, Community, and Personal Identity
European Thought and Culture B16 The Age of Enlightenment
Geological Sciences B88 Earth in Science and Art
History B75-1,2 History of Western Science and Medicine
History C25 History of American Technology
History C50-3,4 The Intellectual History of Europe
History C75-1,2 Technology: History, Society, and Economy
History C76-1,2 Science and Modern Society
Philosophy B20 Science in Human Culture
Philosophy B54 Scientific Method in the Natural Sciences
Philosophy C25 Philosophy of Mind
Philosophy C54 Advanced Topics in the Philosophy of Natural Science
Philosophy C67 Philosophical Issues Concerning Technology
Political Science B04 Politics and Nature
Psychology C37 Human Sexuality
Sociology C12 Social Basis of Environmental Change
Sociology C19 Sociology of Science
Sociology C55 Medical Sociology

Other courses are available periodically, including History C91 Special Lectures (e.g., The History of Abortion, The Origins of Modern Medicine) and History C92 Topics in History seminars (e.g., The Two-Cultures Problem, Gender and Medicine in History).

## Slavic Languages and Literatures

The department offers a full program of study in Russian language and literature and a range of other courses on the languages, culture, and history of Eastern Europe. Russian study encompasses a broad discipline that touches on many others. The rich heritage of Russia includes much that is fundamental to Western culture. For example, Turgenev, Dostoevsky, Tolstoy, and Chekhov probe philosophical, social, political, and psychological issues that are central to the 20th-century experience. Courses in Russian literature open up the artistry and ideas of this

intellectual tradition. Russian language study can also serve as an entrée into other Slavic languages; with a foundation in Russian, one can branch off into related Slavic traditions. At this time, of course, Russian study has obvious practical significance as well.

Nonmajors as well as prospective specialists are served by the department's courses. Many courses offering a general acquaintance with some facet of Slavic studies have no prerequisite. All periods of Russian literature are represented, with emphasis on the 19th and 20th centuries. Russian language at all levels is taught by Americans and native speakers.

Students major in Russian language and literature for a variety of reasons. Some want the rigorous intellectual training and the breadth of cultural exposure. Some students are primarily interested in acquiring language skills for use in government service, international law or trade, journalism, or scientific research. Others use the major as a foundation for graduate work in comparative literature, linguistics, history, or political science. A number of students combine the major in Russian with a second major in one of these fields. Northwestern's library is an excellent resource for undergraduate and graduate study in Russian literature. Qualified advanced students have the opportunity to spend a quarter in Russia through a Northwestern study abroad program.

## Major in Slavic Languages and Literatures

**Departmental courses**

***Basic courses:*** A02-1,2,3 or equivalent

***Electives:*** 14 additional courses in Slavic languages and literatures and related fields

***Honors:*** two additional courses

### *Plan A: No Study Abroad*

***Basic electives (7):*** B03-1,2,3 and four courses chosen from B10-1,2,3, B11-1,2, B55

***Advanced electives (7):*** C60 or C61 and five other C- or D-level Slavic languages and literatures courses; one course in a related field chosen with the undergraduate adviser

### *Plan B: Study in Russia*

***Basic electives (4):*** four courses chosen from B10-1,2,3, B11-1,2, B55

***Study abroad:*** 4 or more units toward the major

***Advanced electives (6):*** C60 or C61 and five other C- or D-level Slavic languages and literatures courses

## Minor Concentrations in Slavic Languages and Literatures

The department offers minor concentrations in Russian and Slavic studies.

### *Russian*

The minor concentration in Russian is particularly suitable for students who wish to study the Russian language intensively (possibly for use in such fields as political science, international relations, law, or business) or for the increasing number of students of Russian background at Northwestern who major in other fields but wish to broaden their knowledge of their native language.

**Prerequisites:** completion of two years of college-level language or equivalent as demonstrated by course work such as A02-3 or equivalent

**Minor course requirements (7 units)**

- B03-1,2,3
- Four courses chosen from C03-1,2,3, C59-1,2, C60, C61

### *Slavic Studies*

The minor concentration in Slavic studies offers a broad survey of literature and culture but does not include a sequence of language courses. The program is particularly suited for engineering and science majors whose heavy course loads do not allow them to take a language course each quarter. The B-level offerings provide a broad background in literature and culture, and the C-level courses offer the opportunity to deal with more specific issues.

**Minor course requirements (8 units)**

- Four B-level courses in Slavic languages and literatures
- Four C-level courses, at least two of them in Slavic languages and literatures; up to two can be courses in a related field chosen with consent of the undergraduate adviser (History C45 is strongly recommended)

## Honors in Slavic Languages and Literatures

The honors program in Slavic languages and literatures gives outstanding senior majors an opportunity to undertake a research project under the supervision of a faculty adviser. This honors thesis, together with the student's record in Slavic courses, forms the basis for faculty decisions on the award of departmental honors. Most honors candidates research and write the thesis in two quarters of C99. Another option is to take a D-level seminar followed by C99 in which the student pursues a topic arising out of the D-level course. Students interested in pursuing honors should consult the director of undergraduate studies by the end of their junior year. See Honors under Academic Policies earlier in this section of the catalog.

## Courses in Language and Linguistics

**467-A01-1,2,3 Elementary Russian 1.** A largely oral approach to the basic grammar and vocabulary necessary for reading, speaking, and writing simple Russian. **2,3.** Graded readings, conversation, writing.

**467-A02-1,2,3 Intermediate Russian** The language of conversation, literature, and today's posters and newspapers. Weekly language lab; unabridged poetry and fiction; tapes and films. Prerequisite: A01-3 or equivalent.

**467-A06-1,2,3 Elementary Czech** A largely oral approach to the basic grammar and vocabulary necessary for reading, speaking, and writing simple Czech.

**467-B03-1,2,3 Russian Language and Culture** Conversation, listening comprehension, reading, and composition. Unabridged contemporary readings on Russian culture and society. Third-year, multiskill course. Prerequisite: A02-3 or equivalent.

**467-B06-1,2,3 Intermediate Czech:Language and Culture** Continuation of A06; reading on topics in Czech culture. Prerequisite: A06-3.

**467-C03-1,2,3 Advanced Russian Language and Culture** Conversation, listening comprehension, reading, and composition. Unabridged contemporary reading and media, including television, on Russian culture and society. Fourth-year course. Prerequisite: B03-3 or equivalent.

**467-C04-1,2,3 Russians:New and Old Values** Advanced Russian with stress on oral and aural comprehension and writing; documentary films, newspaper and magazine articles in Russian. Prerequisite: C03-3 or equivalent.

**467-C20-0 Structure of Serbian and Croatian** Phonological and syntactic structure of Serbian and Croatian. Historical background.

**467-C40-0 History of the Russian Language** Russian phonology and morphology from Proto-Indo-European to modern Russian. Effects of the changes on the contemporary language.

**467-C41-0 Structure of Modern Russian** Theories and methods of linguistics as applied to the description of modern Russian. Phonetics, morphology, syntax.

## Courses with Reading and Discussion in English

**467-B10-1,2,3 Introduction to Russian Literature** Comprehensive overview of the central prose works and literary movements in 19th-century Russia. **1.** Thematic and formal study of major works by Pushkin, Gogol, Lermontov, Turgenev. **2.** Tolstoy, Dostoevsky. **3.** Turgenev, Leskov, the late Tolstoy, Chekhov, Bunin, Gorky.

**467-B11-1,2 20th-Century Russian Literature** Major works in cultural-historical context, from the Russian revolutions of 1917 through the avant-garde 1920s and Stalinist repression to the present. **1.** Literature of revolution, civil war, the transition to socialism (Babel, Olesha, Platonov, Bulgakov's *The Master and Margarita*). **2.** Post–World War II writers and problems (Pasternak's *Doctor Zhivago*; Solzhenitsyn, Sinyavsky, and other dissidents; contemporary fiction).

**467-B55-0 Early Slavic Civilization** History, literature, and culture of the Slavs (Bulgarians, Macedonians, Serbs, Croats, Russians, Ukrainians, Byelorussians, Poles, Czechs, Slovaks) from antiquity through the 13th century.

**467-B57-0 Introduction to the Soviet Union and Successor States** Broad survey of Russian cultural, social, political, and economic life in the 20th century. Focus on the Soviet period and its aftermath in light of Russia's historical background.

**467-B67-0 Czech Culture:Film,Visual Arts,Music** Cultural legacy of the Czech nation as represented in various media.

**467-C10-0 Tolstoy** Tolstoy's artistic and intellectual development through his major fiction.

**467-C11-0 Dostoevsky** Dostoevsky's artistic and intellectual position in Russian literature as revealed in the major novels, shorter fiction, and diaries.

**467-C13-0 Nabokov** Vladimir Nabokov's major Russian and American prose, from his émigré years *(The Defense, The Gift,* and *Invitation to a Beheading)* to his celebrated English language works *(Lolita, Speak Memory,* and *Pale Fire).*

**467-C14-0 Chekhov** Major short stories and plays considered in their broader literary and cultural context.

**467-C18-0 19th-Century Russian Comedy and Satire** The nature of comedy, the types of satire, and the functions of laughter in the works of Gogol and Chekhov.

**467-C19-0 The Philosophical Story** A key form of Russian and East European fiction, the story about abstract philosophical issues. The role it played in general philosophical debates, how it works as literature, philosophical issues raised.

**467-C50-0 Folklore, Music, Poetry** Traditional folk and religious folklore and poetry: from Biblical and Greek origins through East Slavic, Russian, and Western European works. Forms, literary and political implications, Russian and Western European poetic and rhythmic interrelations.

**467-C67-1,2 Russian Film** Development of Russian film and film theory from the silent era to the 1980s. **1.** The Golden Age of Russian cinema (Eisenstein, Pudovkin, Vertov, Protazanov, Vasiliev brothers, Dovzhenko, socialist realism). **2.** Russian film since World War II (more socialist realism, neorealism, Tarkovsky, Mikhalkov, Paradjanov, Abuladze; criticism and semiotic theory).

**467-C68-0 Andrei Tarkovsky's Aesthetics and World Cinema** Major films of Tarkovsky and of those Russian and non-Russian directors whose work is related to his (Eisenstein, Wenders, Bergman, Kurosawa).

**467-C69-0 20th-Century Russian Drama and Theater** Modernist dramatic and theatrical traditions of Russia

from the rise of the Moscow Art Theater to the advent of Socialist Realism. Dramas by Chekhov, Blok, Khlebnikov, Mayakovsky; productions of Stanislavsky, Diaghilev, Meierkhold; design innovations of Tatlin, Malevich, Exter.

**467-C72-0 Introduction to Eastern European Jewish Culture** Cultural heritage of Russian and Eastern European Jewish communities from the 18th to 20th centuries. Works of Sholom Aleichem and Isaac Bashevis Singer; relations of Jewish culture to surrounding European cultures.

**467-C75-0 Eastern European Literature of the Holocaust** Novels, short stories, and memoirs by Eastern Europeans who experienced the Nazi occupation or were marked by its aftermath; problems of identity, memory, genre.

**467-C90-0 Literature and Politics in Russia** More than in any other European tradition, Russian literature has played a central role in defining the nation's political agenda. The interaction of literature with Russian cultural and political history.

**467-C91-0 The Rise and Fall of Yugoslavia** Yugoslavia from origins as a dream to existence as a multinational state and collapse in the late 1980s; nationalism, interrelationship of politics and culture; readings from historians, cultural critics, and literary works.

**467-C92-0 Contemporary East European Literature** Post–World War II literature of the Czech Republic, Hungary, Poland, Romania, and the former Yugoslavia; national identity, dissidence, and literary postmodernism.

### Courses in Literature with Prerequisite in Russian

Unless otherwise indicated, the prerequisite for C-level courses is B03-3 or equivalent.

**467-C37-0 Pushkin** Critical analysis of Pushkin's major works.

**467-C59-1,2 Russian Prose** Selected works of Russian masters. **1.** 19th century. **2.** 20th century. Content varies; may be repeated for credit. All reading in Russian. Prerequisite: A02-3 or equivalent.

**467-C60-0 Survey of 19th-Century Russian Poetry** Introduction to the wealth of Russian 19th-century lyric poetry and basic techniques for its study: Pushkin, Baratynsky, Lermontov, Tyutchev, Fet.

**467-C61-0 Survey of 20th-Century Russian Poetry** Introduction to the major currents of Russian 20th-century lyric poetry and basic techniques for its study: Blok, Mayakovsky, Khlebnikov, Akhmatova, Tsvetaeva, Mandelshtam, Pasternak, Brodsky.

**467-C98-0 Senior Honors Seminar** Topics vary yearly.

**467-C99-0 Independent Study** For Russian majors selected by the department as candidates for departmental honors and for other advanced students with consent of instructor.

## Sociology

The Department of Sociology offers preparation for students who want to pursue careers in social research, social policy applications, and teaching. It provides an excellent background for all professions involved in the major structures of modern society, such as business, public administration, law, medicine, journalism, and planning. The department also emphasizes the sociological perspective as a fundamental part of a liberal education and a discipline for developing a humane understanding of the world.

The department is particularly strong in the areas of urban studies, comparative historical sociology, the sociology of art and culture, deviance and social control, organizations, and the sociology of law, education, and science. Unusually good opportunities are available for independent study, field internships, and the use of qualitative historical and comparative methods of research. In addition to the courses listed below, the department offers quarterly seminars on special topics of interest. The department offers a wide variety of approaches to fundamental issues of social inequality, its origins and consequences, including class and economic domination, race, ethnicity, and gender.

### Major in Sociology

**Departmental courses:** one sociology quarter-course at the A or B level (except B26) and nine additional quarter-courses, distributed as follows:

- Three courses in methods of social research: B26, C03, C29 (B26 should be taken in the freshman or sophomore year; C03 and C29 in the junior year)
- C06 (junior or senior year)
- C98-1,2 (fall and winter quarters of the senior year)
- Four additional C-level sociology courses; only 1 unit each of C76, C99, and General Studies C93 Chicago Field Studies Internship may be used to fulfill this requirement

In certain cases, students who are combining a major in sociology with a major in another field that also requires a senior research seminar may arrange to fulfill their seminar requirement in a combined project.

**Related courses:** four C-level quarter-courses in African American studies, anthropology, economics, history, linguistics, philosophy, political science, psychology, or women's studies selected with the approval of the adviser.

### Minor Concentrations in Sociology

The Department of Sociology offers minor concentrations in sociological research and in sociological studies. Students seeking a minor in sociology must consult with the director of undergraduate studies.

#### *Sociological Research*

The minor concentration in sociological research prepares students to carry out their own research by offering an

introduction to the discipline, followed by an array of courses in quantitative and qualitative methods. Students learn how data are gathered and prepared for analysis and a variety of techniques and methods for presenting information, arguments, and conclusions. Two C-level courses allow students to see how these methods are used in practice.

**Minor course requirements (6 units)**

- A10 or a B-level sociology course
- B26
- C03 or equivalent
- C29
- Two C-level sociology courses approved by the director of undergraduate studies; although they may be taken more than once, only one credit may be counted toward the minor for each of the following courses: C76, C99, General Studies C93 Chicago Field Studies Internship

### *Sociological Studies*

The minor concentration in sociological studies introduces basic information about the social world and provides the rudimentary tools to understand it. It prepares students to compare, evaluate, and critically analyze information about various institutions, processes of stratification, and social change.

**Minor course requirements (7 units)**

- A10 or a B-level sociology course
- B26
- Five C-level sociology courses approved by the director of undergraduate studies; although they may be taken more than once, only one credit may be counted toward the minor for each of the following courses: C76, C99, General Studies C93 Chicago Field Studies Internship

## Four-Year BA/MA

In rare instances, superior students may petition the department to complete BA and MA degrees in the normal four-year period required for the BA. Only unusually gifted and motivated students are accepted into this rigorous program. Interested students should consult with the undergraduate advisers early in their academic career. See Four-Year Master's Programs in the Undergraduate Education section of this catalog.

## Honors in Sociology

Students who complete all requirements for the major, maintain a grade point average of 3.3 or above in their major courses, and complete an outstanding senior research project in C98-1,2 or its equivalent will be nominated for honors in sociology to the College Committee on Superior Students and Honors, which has final authority to grant the honors degree. For more information, consult the director of undergraduate studies. See Honors under Academic Policies earlier in this section of the catalog.

## The Teaching of Sociology

CAS students pursuing a major in sociology who also wish to be certified for secondary teaching must be admitted to the Secondary Teaching Program in the School of Education and Social Policy (SESP) and complete all requirements as outlined in the SESP section of this catalog. Students are urged to contact the Office of Student Affairs in SESP as early as possible in their academic career.

## Courses Primarily for Undergraduates

**471-A10-0 Introduction to Sociology** Essential characteristics of group life. Interrelations of society, culture, and personality. Basic institutions and processes.

**471-B01-0 Social Inequality:Race, Class,and Power** Origins and functions of stratification. Class, prestige, and esteem. Interaction of racial and cultural groups in various settings. Black-white relationships in the United States.

**471-B02-0 Social Problems:Norms and Deviance** How issues emerge. Rules, rule enforcers, rule breakers; advocates, opponents, and victims of problems. Blame, help, and entitlement. Current problems and systemic contradictions.

**471-B03-0 Revolutions and Social Change** Causes and outcomes of large-scale social change. Role of violence and revolution in the development of the modern world.

**471-B04-0 Social Interaction:The Individual and Society** Development of individual attitudes and behavior patterns through social interaction. Relation to students' everyday life and problems.

**471-B05-0 American Society** How American society works as a whole. How major institutions relate and affect each other; how the different segments and strata of society experience such institutional processes. Tensions associated with differential experience of common and shared institutions.

**471-B06-0 Law and Society** Introduction to the role of law in American society. Relationship of law, inequality, and social change. Patterns of change in major legal institutions: the courts, the legal profession, and legal services for the poor.

**471-B07-0 Problems of Cities** Problems of American urban communities and possible solutions. Spatial, economic, and political trends; private and public decision making; class, race, and family needs. Consequences for adequate public services.

**471-B15-0 Economy and Society** Introduction to sociological approaches to economic life. Topics include property rights, illegal markets, money, economic inequalities, direct sales, and boycotts.

**471-B16-0 Gender and Society** Social determination of gender-appropriate behavior. Origins, values, and effects of sex-role stereotypes. How stereotypes fit social reality.

Socialization (childhood and adult), values, economic opportunities in the United States, now and in the past.

**471-B26-0 Sociological Analysis** Logic and methods of social research, qualitative and quantitative analysis of social data, and ethical, political, and policy issues in social research. Foundation for further work in social research.

**471-C01-0 The City:Urbanization and Urbanism** Theories of urbanization, housing, jobs, race and class, segregation, social networks, politics, and reform policies. Research projects. Prerequisite: A10 or B07.

**471-C02-0 Sociology of Organizations** Structure and function of formal organizations, especially in business and government. Stratification, social control, and conflict. Discretion, rules, and information in achieving goals. Modes of participation. Development of informal norms. Prerequisite: A- or B-level sociology course.

**471-C03-0 Analysis and Interpretation of Social Data** Introduction to quantitative methods: the interpretation of descriptive statistics, relationships between variables, and the logic of inferential statistics. Prerequisite: B26 or consent of instructor.

**471-C05-0 Demography and Population Problems** Social causes and consequences of population dynamics (fertility, mortality, marriage, divorce, and migration) and population structures (age, sex, size, density). Possible roles of population changes in environmental and economic development problems. Prerequisite: A- or B-level sociology course.

**471-C06-0 Sociological Theory** Sociological perspective as developed by classic theorists. Elucidation and testing of sociological principles in contemporary research. Primarily for sociology majors. Open to others with consent of instructor. Prerequisite: B26.

**471-C07-0 School and Society** Reciprocal influences between formal institutions of education and the broader society from different theoretical perspectives. Internal organization of schools. Relationship between education and inequality and to problems of contemporary urban education. Prerequisite: A- or B-level sociology course.

**471-C08-0 Sociology of Deviance and Crime** The social organization of crime and other misdeeds, explanations of crime and deviance, creating criminal law, policing, detection and investigation, prosecution, plea bargaining, the courts, sentencing, punishment, prisons, and alternatives to criminal law. Prerequisite: A10 or B02.

**471-C09-0 Political Sociology** Selected topics in political economy and sociology: revolutions, the development of the modern state, third world development, international conflict. Prerequisite: A- or B-level sociology course.

**471-C10-0 The Family and Social Learning** Influence of socioeconomic and other structural and cultural resources and constraints on family structure and dynamics. Historical and comparative perspectives on the modern family. Prerequisite: A- or B-level sociology course.

**471-C12-0 Social Basis of Environmental Change** The role of production structures and other social institutions on pollution and depletion. Social support for and resistance to environmental protection policies. Inequalities in use of resources and incidence of environmental hazards. Prerequisite: A- or B-level sociology course.

**471-C14-0 Sociology of Religion and Ideology** Belief systems in society. Production of ideas. Religion, art, science, political ideology, and folk-knowledge as social products. Prerequisite: A- or B-level sociology course.

**471-C15-0 Industrialism and Industrialization** Structure and culture of modern industry; consequences for status and class organization. Labor force, formal and informal organization of management and labor. Union-management interaction. Factors affecting industrial morale. Prerequisite: A- or B-level sociology course.

**471-C16-0 Economic Sociology** Sociological approach to production, distribution, consumption, and markets. Classic and contemporary approaches to the economy compared across social science disciplines. Prerequisite: B15 or Economics B02 or equivalent.

**471-C18-0 Sociology of Law** Sociological analysis of legal institutions such as courts, the police, and lawyers. Law, inequality, and social change. Prerequisite: A10 or B06.

**471-C19-0 Sociology of Science** Science as a social system. Personality, social class, and cultural factors in scientific development, creativity, choice of role, simultaneous invention, and priority disputes. Social effects on objectivity and bias.

**471-C21-0 Armed Forces and Society** Contemporary military institutions and sociological theory. Changing dynamics of combat, peacekeeping, race relations, gender, and other social issues. Prerequisite: A- or B-level sociology course.

**471-C23-0 American Subcultures and Ethnic Groups** Differentiation, organization, and stratification by ethnicity, race, lifestyle, and other traits. Maintenance of subgroup boundaries and distinctiveness. Development and continuity of American society as a system of subgroups. Consequences of difference: identity, political and economic participation, group solidarity. Prerequisite: A- or B-level sociology course.

**471-C24-0 Social Structure in African American Communities** Institutional variation and social change. Black populations in local settings, urban and rural, contemporary and historical. Some attention to different eras and regions in United States and other New World societies. Prerequisite: A- or B-level sociology course.

**471-C25-0 Social Stratification** Bases of social stratification. Effects on life conditions and social organization.

Theoretical, methodological, and empirical dimensions. Emphasis on advanced industrial societies. Prerequisite: B26.

**471-C26-0 The Logic of Social Inquiry** Tensions between methodological rules and researcher judgments in the practice of social inquiry. Trade-off in various research designs. Social contexts and their resources for or restraints on social researchers. Impact of research context on forms of observation and reporting of inferences. Prerequisite: B26.

**471-C27-0 Youth and Society** How young people interact with families, schools, peers, neighborhoods, and workplaces, influencing them and being influenced by them. Prerequisite: A- or B-level sociology course.

**471-C29-0 Field Research and Methods of Data Collection** Practicum in first-hand data collection using observation and structured and unstructured interviewing. Issues of reliability and validity, and qualitative analysis. Prerequisite: B26.

**471-C31-0 Markets,Hierarchies,and Democracies** The forms and social structures for making economic decisions in modern societies. Prerequisite: A- or B-level sociology course.

**471-C32-0 Work and Occupation in Modern, Industrialized Societies** Sociological perspectives on work. Students view their own occupational futures in the context of the changing social relations of production. Prerequisite: A- or B-level sociology course.

**471-C33-0 Law, Norms,and Power** How laws and informal social rules are related to the exercise of power by some people over others. Prerequisite: A- or B-level sociology course.

**471-C35-0 Sociology of Rational Decision Making** Analysis of the role played by numerical and quantitative information in organizational decision making in the private and public sectors. Prerequisites: B15 and C02 or Economics B02 or consent of instructor.

**471-C39-0 Comparative and Historical Sociology** Theoretical and methodological issues in the comparison of whole societies and other macrosocial units. Prerequisite: A- or B-level sociology course.

**471-C45-0 Class and Culture** The role that culture plays in the formation and reproduction of social classes. Class socialization, culture and class boundaries, class identities and class consciousness, culture and class action. Prerequisite: A- or B-level sociology course.

**471-C47-0 Sociology of Time and Space** Social construction of time and space. Standardization of time, maps as ideological documents, capitalist time and space, personal and social spaces and memories. Prerequisite: A- or B-level sociology course.

**471-C50-0 Sociology of the Arts** Art as collective activity. Conventions in art and aesthetics. Professionals and audiences and other aspects of culture. Prerequisite: A- or B-level sociology course.

**471-C55-0 Medical Sociology** Social construction of health and illness; inequalities in distribution of illness and health care; organization of health care work and occupations. Prerequisite: A- or B-level sociology course.

**471-C56-0 Sociology of Gender** Gender and issues of social reproduction and social change with sexuality and reproduction emphasized. Prerequisite: B16 or B26.

**471-C76-0 Topics in Sociological Analysis** Advanced work on special topics in sociological study.

**471-C80-7 Junior Year Tutorial** Small seminar group in conjunction with various scheduled C-level classes.

**401-C93-0 Chicago Field Studies Internship** See General Studies.

**471-C98-1,2 Senior Research Seminar** Independent research projects carried out under faculty supervision. Prerequisite: C03, C29, or equivalent.

**471-C99-0 Independent Study** (1 or 2 units) Open with consent of department. Registration extension to more than one quarter.

## *Spanish*

See Hispanic Studies.

## Statistics

Statistics is the scientific discipline that deals with the organization, analysis, collection, and interpretation of numerical data. Statistical methods are widely used to design and analyze experiments, sample surveys, censuses, and other observational programs. Such analysis involves both description of the properties of groups of observations and problems of drawing inferences from such data. Applications to the biological, social, and physical sciences are widespread, and statistical analyses are increasingly required in actuarial work, accounting, finance, engineering, medicine, and law.

### Major in Statistics

**Departmental courses**

- Mathematics C30-1 *or* Industrial Engineering and Management Sciences C02
- Statistics C25, C50, C51
- Industrial Engineering and Management Sciences C03, C04
- Two of the following courses: Mathematics C30-2; Industrial Engineering and Management Sciences C05, C15; Statistics C52, C55; C59. (Students may not apply both Mathematics C30-2 and Industrial Engineering and Management Sciences C15 to the major requirement.)

**Related courses:** (a) Mathematics B14-1,2,3; B15; and B17; (b) Mathematics B20-1,2,3; (c) Mathematics B90-1,2,3; or (d) equivalent

## Minor in Statistics

Students who complete the minor in statistics receive serious exposure to probability theory, statistical estimation theory, statistical analysis, and the design of statistical data collection. Students choosing to minor in statistics are assumed to have completed Mathematics B14-1,2,3 or equivalent.

**Minor course requirements (6 units)**

- Statistics B01, B02, B10, *or* C03 (1 unit)
- Mathematics C30-1 *or* Industrial Engineering and Management Sciences C02 (1 unit)
- Industrial Engineering and Management Sciences C03, C04 (2 units)
- Statistics C50 *or* Economics C81-2 (1 unit)
- Statistics C25 *or* C51 (1 unit)

## Four-Year BA/MS

The department offers a four-year BA/MS program in statistics for outstanding undergraduate majors. Interested students should contact their adviser or department chair and should see Four-Year Master's Programs in the Undergraduate Education section of this catalog.

## Honors in Statistics

Departmental majors with outstanding records both overall and within the department may apply for graduation with departmental honors. A departmental recommendation for honors requires that students take two quarters of C98, through which a research paper is developed. For more information, consult the director of undergraduate studies. See Honors under Academic Policies earlier in this section of the catalog.

## Courses Primarily for Undergraduates

**473-B01-0 Statistics and Public Policy** Basic statistical concepts and techniques introduced via case studies of interesting public policy issues. The cases illustrate methods of data collection and analysis.

**473-B02-0 Introduction to Statistics** Data collection, summarization, correlation, regression, probability, sampling, estimation, tests of significance. Does not require calculus and makes minimal use of mathematics.

**473-B06-0 Elementary Statistics for Research** Design of experiments, descriptive statistics, correlation and regression, probability, confidence intervals, and significance testing.

**473-B10-0 Introductory Statistics for the Social Sciences** Introduction to basic concepts and methods of statistics and probability. Methods of data collection, descriptive statistics, probability, estimation, sampling distributions, confidence intervals, hypothesis testing.

**473-C02-0 Elementary Statistical Methods** Tabular and graphical presentation of data, hypothesis tests, confidence intervals, comparisons of means and proportions, regression and correlation. Prerequisite: Mathematics B14-2 or equivalent.

**473-C03-0 Concepts in Statistics with Public Policy Applications** Public policy case studies introduce basic statistical concepts and techniques. The cases illustrate various data collection methods and their strengths and weaknesses. Emphasis on concepts.

**473-C25-0 Survey Sampling** Probability sampling, simple random sampling, error estimation, sample size, stratification, systematic sampling, replication methods, ratio and regression estimation, cluster sampling. Prerequisites: two quarters of statistics or consent of instructor.

**473-C30-1 Applied Statistics for Research I** Design of experiments and surveys, numerical and graphical summaries of data, correlation and regression, confidence intervals and tests of significance, one- and two-sample problems. Prerequisite: Mathematics B14-2 or equivalent.

**473-C30-2 Applied Statistics for Research II** Simple linear regression, inference, diagnostics, multiple regression, diagnostics, autocorrelation, one-way ANOVA, power and sample size determination, two-way ANOVA, ANCOVA, randomized block designs. Prerequisite: C30-1.

**473-C50-0 Regression Analysis** Simple linear regression and correlation, multiple regression, residual analysis, selection of subsets of variables, multicollinearity and shrinkage estimation, nonlinear regression. Prerequisite: Industrial Engineering and Management Sciences C04 or equivalent.

**473-C51-0 Design and Analysis of Experiments** Methods of designing experiments and analyzing data obtained from them: one-way and two-way layouts, incomplete block designs, factorial designs, random-effects, split-plot and nested designs. Prerequisite: Industrial Engineering and Management Sciences C04 or equivalent.

**473-C52-0 Nonparametric Statistical Methods** Survey of nonparametric methods, with emphasis on understanding their application. Prerequisite: Industrial Engineering and Management Sciences C04 or equivalent.

**473-C55-0 Analysis of Qualitative Data** Introduction to the analysis of qualitative data. Measures of association, log-linear models, logits, and probits. Prerequisite: Industrial Engineering and Management Sciences C04 or equivalent.

**473-C59-0 Topics in Statistics** Topics in theoretical and applied statistics to be chosen by instructor. Prerequisite: consent of instructor.

**473-C98-0 Undergraduate Seminar**

### Related Courses in Other Departments

Mathematics C30-1,2,3 Probability and Statistics
Industrial Engineering and Management Sciences C02 Probability
Industrial Engineering and Management Sciences C05 Statistical Methods for Quality Improvement
Industrial Engineering and Management Sciences C15 Stochastic Models and Simulation

## *Undergraduate Leadership Program*

The Undergraduate Leadership Program, a certificate program open to all undergraduates, helps students understand the nature of leadership and prepares them to become leaders. (See Undergraduate Leadership Program in the Other Undergraduate Programs section of this catalog.)

## Urban Studies Program

The Program in Urban Studies enables students majoring in anthropology, economics, history, political science, or sociology to master their disciplinary major and to complement it with a second major in urban studies. With special permission of the director of the program, students with other majors in CAS also may elect urban studies as a second major. The purpose of the program is to introduce students to an interdisciplinary perspective on the city and its problems, bringing together faculty and students who share common interests but have different academic backgrounds. In addition to the following requirements, it is recommended that students who major in urban studies complete a methods or statistics course in one of the social science departments and participate in the Chicago field studies program.

### Major in Urban Studies

**Program courses**

- Fulfillment of the major requirements in any one of the following undergraduate departments: anthropology, economics, history, political science, sociology; or with consent of the director of the program, fulfillment of the major requirements in another department of the College of Arts and Sciences. Majors in urban studies must show a minimum of seven courses not double-counted in any other major(s). Of the courses that are double-counted, one may be counted in the the core requirement; another may be counted as an elective.
- Completion of four courses chosen from an urban studies core: Economics C53, C54; History C22-1,2; Political Science B21, C21; Sociology B07, C01
- Completion of three additional courses chosen from the following list, no more than two from the same department and no more than one from urban field studies or internships: African American Studies B36-2; Anthropology C92; Art History C79; Civil Engineering C71; Economics C37, C53, C54, C55; History C22-1,2; Political Science B21, C21, C27, C30; Sociology B07, C01, C24; any approved unit of urban field studies in any relevant department
- Completion of the two-unit Urban Studies Seminar during the fall and winter or winter and spring quarters of the student's senior year. Check *Class Schedule* for quarters this seminar is offered.

### Course

**475-C98-1,2 Urban Studies Seminar** Open to senior majors in urban studies. Interdisciplinary approach to urban studies entailing design and execution of a research project over two quarters. Grade of K given in C98-1 changed to letter grade after completion of C98-2.

## Women's Studies Program

The Women's Studies Program offers an interdisciplinary program of courses focused on scholarly research on women and issues of concern to women. These courses are supplemented by courses on women offered through other academic departments on campus. The curriculum is designed to examine women's experiences historically and cross-culturally and to explore social, political, and cultural issues as they relate to women's lives.

The rich and varied curriculum offers students a range of academic experience, including seminars, fieldwork, performance, and opportunities for original research. Consistently emphasized are the ways in which attention to women's lives and experiences has altered scholarly preconceptions and research methods.

### Major in Women's Studies

The women's studies major is an adjunct major. Students majoring in women's studies must also fulfill the requirements of another major in CAS or in any other school in the University. The major in women's studies must show a minimum of nine courses not double-counted in any other major(s).

**Program courses (at least 11 units)**

- Three core courses: B10, B30, B31
- Six elective one-quarter courses, at least four at the C-level, focusing on women; four of those six courses must be offered by the women's studies program. Others may be women's studies courses or courses from other departments cross-listed under women's studies.
- C97 followed by either:
  a) C98 and C99, or
  b) one other C-level elective course
  Students who choose option a) will generate an independent research project (a senior thesis) and may be recommended for departmental honors. Students who choose option b) will not write a thesis and will not be eligible for departmental honors.

Examples of courses that fulfill the elective requirement include, but are not limited to, the following:

African American Studies C79 African American Women Playwrights
Anthropology C54 Gender and Anthropology
History C03-2 American Women's History
Linguistics C18 Language and Gender
Radio/Television/Film C25 Feminism and Film/Video
Sociology B16 Gender and Society

### Minor in Women's Studies

Students who wish to focus their interest in women's studies may earn a minor in women's studies while simultaneously pursuing a departmental major in any undergraduate school. Students qualify for the minor in women's studies by satisfactorily completing the requirements listed below and presenting a minimum of five courses not double-counted in their majors.

**Minor course requirements (7 units)**

- Two core courses chosen from B10, B30, B31
- Five electives chosen in consultation with an adviser in the Women's Studies Program. At least three courses must be at the C-level; three must be women's studies courses; the remaining two may be women's studies courses or courses from other departments cross-listed under women's studies. Students are encouraged (but not required) to take C97 as one of the five.

For examples of electives, see the list under Major in Women's Studies.

### Courses

**480-B10-0 Introduction to Women's Studies: Life As Women Know It** Theoretical, personal, and political issues; connections between gender, race, class, and sexual orientation.

**480-B30-0 The Roots of Feminism** The development of feminist thought and the women's movement. Readings contextualized in terms of social, political, and intellectual background.

**480-B31-0 Feminisms: Voices and Visions** A cross-cultural study of women as makers and consumers of literature and the arts. Challenges to tradition; strategies of resistance and revision.

**480-B50-0 Women and the Scientific Community** The integration of women into the culture of science and medicine. Women's contributions to science; development of sexual differences; contemporary health issues.

**480-B90-0 Women in Culture and Society: Topics** Changing role and image of women in society. Investigates one or several cultural and/or national traditions.

**480-C75-0 Internship in Women's Studies** Field research and practical work experience in women's organizations; biweekly meeting with the instructor and other interns for discussions of common readings and their internship experiences. Consent of instructor.

**480-C90-0 Topics in Women's Studies** Topics vary: for example, contemporary women writers, activism in the sixties and beyond, women and war.

**480-C91-0 Writing Women's Lives** Seminar launching each student on a research project that illuminates the life of a woman or group of women. Exploration of archives, theories of the self, and historical contexts. Prerequisite: consent of instructor.

**480-C92-0 Women and Autobiography** Investigation of women as readers and producers of autobiography. Exploration of memory and construction of self in relation to gender, culture, ethics.

**480-C95-0 Sexuality and Its Discontents** Social and historical constructions of sexuality; emergence of lesbianism and homosexuality as categories; issues of sexuality, race, and class; problems of sexual domination and violence. Prerequisite: one introductory course in women's studies or consent of instructor.

**480-C96-0 Feminist Therapy** Theoretical basis for the feminist critique of traditional psychotherapy. Exploration of problems presented by female clients; gender-related causes and feminist strategies for resolution. Prerequisite: one course in women's studies or psychology; junior/senior standing.

**480-C97-0 Senior Seminar in Feminist Theory** Issues in feminist theory and research methods.

**480-C98-0 Senior Research Seminar** Continuation of C97. Students work with an adviser and begin research on a senior thesis project, meeting on a reduced schedule. Prerequisites: C97 and consent of undergraduate adviser.

**480-C99-0 Independent Study** Individual tutorial or research projects. Prerequisite: consent of instructor and a women's studies adviser.

## Writing Program

The Writing Program is an independent CAS unit that seeks to help all Northwestern undergraduates learn to write clearly and persuasively. A core faculty of experienced writing instructors teaches the program's main sequence of basic, intermediate, and advanced expository writing courses. These are listed as English A05, A06, B05, and C05. Writing courses are limited to 15 students, allowing instructors to comment extensively on students' writing and to meet regularly with students in individual conferences. Courses at every level emphasize revision, with the goal of strengthening each student's ability to think clearly, analyze carefully, argue convincingly, and communicate effectively.

The Writing Program also operates the Writing Place, a center that provides free composition tutoring and consulting for all Northwestern students. The Writing Place, located in the University Library, is open most mornings, afternoons, and evenings during the academic

year. Students may make appointments, use the schedule of drop-in hours, or interact with Writing Place tutors through the campus computer network.

The Writing Program helps to oversee writing requirements—and thus provides writing advising—for undergraduates in the College of Arts and Sciences, McCormick School of Engineering and Applied Science, School of Music, and some programs in the School of Speech. Members of the Writing Program faculty also occasionally teach specialized courses and workshops. In recent years, these offerings have included courses in technical writing, a residential college tutorial on management communication, and a course in the Women's Studies Program, Writing Women's Lives. In all its courses and special offerings, the Writing Program concentrates on helping students develop skill, confidence, and insight as writers.

Students interested in a writing major should see English Major in Writing under English.

## Courses

**419-A05-0 Expository Writing** See English.

**419-A06-1,2 Writing in Special Contexts** See English.

**419-B05-0 Intermediate Composition** See English.

**419-C05-0 Advanced Composition** See English.

# School of Education and Social Policy

The mission of the School of Education and Social Policy (SESP) is to understand and improve learning communities, defined as groups of people working together in structured social and/or technical environments that influence human development. Viewed in this way, learning environments include not only schools and classrooms but also workplaces, families, neighborhoods, and other societal arrangements in which learning takes place. Through their broad-based interdisciplinary research, teaching, and outreach activities, SESP faculty strive to better understand how social, psychological, and economic factors shape human development and learning and how innovations in pedagogical, technological, and social policies can benefit human lives.

At the undergraduate level, the school provides preprofessional training and research activities. Students learn to understand human development and improve learning in its various social contexts by applying the social and behavioral sciences. The school offers four programs leading to the degree of bachelor of science in education and social policy: Social Policy, Psychological Services, Learning and Organizational Change, and Secondary Teaching. Students in other undergraduate schools also may complete the requirements of the Secondary Teaching Program and qualify for secondary certification.

Applicants who hold a baccalaureate degree may apply to the school's master of science program, which leads to elementary or secondary teaching certification in the state of Illinois.

## Academic Policies

### Requirements for the Degree of Bachelor of Science in Education and Social Policy

The following requirements concerning residence and grade point average apply to all students seeking the degree of bachelor of science in education and social policy.

1. A minimum of 45 course units is required for graduation from the School of Education and Social Policy.

2. Students are required to maintain a minimum grade point average of 2.0 in all work presented for the degree. To qualify for teacher certification, students must earn a grade of A, B, or C for an overall average of 2.5 in all required core courses and all courses used to complete their teaching major. Students in the Social Policy, Psychological Services, and Learning and Organizational Change programs must earn a grade of A, B, or C in all their core and program courses.

3. Full-time students in the School of Education and Social Policy may elect to enroll in some courses with the understanding that they will not receive a regular letter grade but that they will receive the notation P (pass) or N (no credit). They may elect one course per quarter under this option and may not elect this option in any course in their core, program, or teaching major.

4. Not more than one-fifth of the grades in courses taken at Northwestern and presented for graduation may be a combination of P's and D's.

5. Any work taken at universities other than Northwestern that is to be counted toward fulfilling Northwestern requirements must be approved in advance by the student's adviser and the assistant dean.

6. Every candidate for a degree must file an application for the degree, along with a Planning and Advising Schedule, in the Office of Student Affairs one year in advance of the date of graduation (see Academic Calendar). That office will forward the application, when approved, to the Registrar's Office.

7. Students who wish to transfer into the School of Education and Social Policy's Secondary Teaching Program may not be able to meet the requirements unless they plan carefully throughout their undergraduate program.

8. Transfer students must meet the following conditions:

- Applicants must meet all program requirements expected of students in the School of Education and Social Policy

• Applicants must present evidence of acceptable academic performance at Northwestern

9. Students transferring from another university are required to complete the last 23 course units at Northwestern University.

In addition to and independent of the requirements set by the School of Education and Social Policy, all students must satisfy the University Enrollment Requirement (see Financial Regulations).

### Honors

Students who maintain records of academic distinction may qualify for the Honors Program. Following completion of the junior year, any student who has attained an overall cumulative grade point average of 3.5 or above is eligible for the program. Students selected for the program work with a faculty adviser on an honors project during the senior year. The three-quarter program begins with registration for 210-C98 Honors Thesis with the honors project adviser. If progress is satisfactory, students are then eligible to register for C98 during winter and spring quarters of the senior year. Grades are based on performance throughout the project and on readers' evaluations of the project report. Additional information about the Honors Program is available from the honors program coordinator.

### Probation

In addition to the University regulations regarding academic probation, an undergraduate student in the School of Education and Social Policy is ordinarily placed on academic probation when, in any one quarter, that student does not receive at least three final grades of A, B, C, or P or has a cumulative grade point average below 2.0.

### Academic Advisers

Each undergraduate student is assigned to an adviser in the Office of Student Affairs. This adviser is responsible for helping students plan their programs to meet the requirements for graduation and for completion of the major or program. Students consult with faculty about area interests and career planning.

For the advising system to work effectively, students must take all academic questions to their adviser in the Office of Student Affairs.

Students are required to obtain their adviser's permission to register for at least the first two quarters of the freshman year.

### Petitions

Students must petition if they wish to be exempted from any of the regular degree requirements of the School of Education and Social Policy. Petition forms may be obtained from the School of Education and Social Policy Office of Student Affairs. No petition is considered unless it is signed by a member of the advisory staff of the Office of Student Affairs.

### Placement Service

A complete range of services is provided at the University's Placement Center in Scott Hall.

Students should register with the Placement Center by securing the necessary forms as early in their final year as possible. When the forms are completed, students should attend an orientation session. They also may receive individual help in preparing a resume as well as in career search and interviewing.

Students also should establish a reference file in the Placement Center to assemble credentials and confidential recommendations for future job or graduate school applications. Students who wish to register for on-campus job interviews should become familiar with the Placement Center's procedures early in the final year.

## Academic Programs

### Social Policy, Psychological Services, and Learning and Organizational Change Programs

Students in the Social Policy, Psychological Services, and Learning and Organizational Change programs receive a bachelor of science in education and social policy; 45 units are required for the degree.

#### *Preprofessional Preparation*

These three programs offer students an opportunity to prepare for a number of career options. Students in these programs have a wide variety of academic and career goals. Some intend to go immediately to graduate and professional schools, while others plan to enter a profession upon graduation. They are encouraged to design their program with career objectives and/or graduate and professional school admission policies in mind. The programs are especially appropriate for those seeking careers in management, consulting, clinical psychology, social work, counseling, law, public service, human resources, and public sector management.

Students interested in public service and law normally choose to follow the requirements of the Social Policy Program, where they can combine the policy-related course work of that program with courses in political science, communication studies, economics, urban affairs, and sociology to prepare either for graduate work in law or public policy or for policy positions in public and private agencies. Students in the Social Policy Program are encouraged to use their program electives to build specialties in such areas as juvenile justice, advocacy programs, or policy analysis and to develop the oral and written communication skills important to success in law school and in public policy positions.

Students interested in such fields as social work, clinical psychology, health, and counseling normally enter the Psychological Services Program. The core course work in human development and psychological counseling of this program, combined with other courses in psychology, sociology, and interpersonal communication, is particularly important for students considering such careers. Students with these interests are encouraged to use the program to complete the prerequisites in psychology and quantitative methods needed for graduate work in psychology and in the human service professions.

The Learning and Organizational Change Program is well suited to students who plan careers in management, consulting, training, and human resources in profit and not-for-profit organizations. Students combine core course work in learning sciences, organization behavior, psychology, and social policy with the necessary work in economics, quantitative methods, communications, and technology that will prepare them for careers as organizational leaders and change agents and for graduate study in the social sciences and management.

In all three programs, students focus on the interdisciplinary study of human behavior as it is influenced by social institutions, understanding the behaviors that people bring to various institutional contexts, identifying and analyzing how behaviors are shaped in these environments, and establishing criteria by which to evaluate the purposes and effectiveness of institutional activities.

To work toward these goals, students register for a one-quarter practicum in off-campus settings such as governmental entities, community agencies, hospitals, juvenile homes, service-oriented departments of for-profit organizations, and law firms where they can observe and participate in the activities of a socializing institution. During this quarter, usually during their junior year, students meet in a weekly practicum analysis seminar. This seminar helps students integrate their past learning from course work with their observations of human behavior in an organizational setting.

***Distribution Requirements***

All students must complete at least two courses in each of the following distributional areas:

**I. Natural sciences**
**II. Formal studies**
**III. Historical studies**
**IV. Values**
**V. Literature and fine arts**

Distribution requirements for the School of Education and Social Policy follow the pattern approved by the College of Arts and Sciences. Courses approved by the College of Arts and Sciences may be used to meet School of Education and Social Policy distribution requirements. In addition, selected courses in the School of Education and Social Policy or other professional schools may be used with the consent of the student's adviser.

***Intellectual Core***

All students must complete the School of Education and Social Policy intellectual core. The core course 210-B05 Undergraduate Proseminar introduces the concepts, research, methods, and faculty from across SESP. Students gain a basic understanding of a particular period of human development by choosing either 225-C01 Human Development: Childhood and Adolescence or C02 Human Development: Adulthood and Aging. One course chosen from the following is also required:

210-B12 Learning and Understanding
225-C01 Human Development: Childhood and Adolescence
225-C02 Human Development: Adulthood and Aging
225-C12 Development of African American Children and Families: Theory and Research
225-C13 Development of African American Children and Families: Research and Policy
225-C17 Gender and the Life Course
225-C18 Adult Development and Work Careers
225-C19 Family Development in Changing Society

Students must demonstrate theoretical and practical mastery of quantitative and conceptual analysis by completing two research methods courses, Statistics B06 Elementary Statistics for Research and 225-C72 Methods of Observing Human Behavior. Students must complete C72 before undertaking the practicum and practicum analysis seminar component of the intellectual core.

In the practicum component, taken during the junior year, students complete a supervised practicum experience during the course of their program of study. The practicum involves a one-quarter, unpaid internship in an off-campus setting related to the student's program. Concurrent with the internship, students attend a weekly seminar on campus that integrates their experiential knowledge with the theoretical training in their course work.

Students must contact the practicum director in the school's Office of Student Affairs at least two quarters before the beginning of the quarter in which the practicum will be taken. The practicum director advises students about procedures and application materials for a practicum placement.

### *Individually Planned Programs*

Students in the Social Policy, Psychological Services, and Learning and Organizational Change programs must prepare a program plan that includes a rationale for the configuration of courses chosen for their program of study. The program plan must be submitted to the Office of Student Affairs for approval in the sophomore year no later than the quarter before the intended practicum.

#### Social Policy

Students in the Social Policy Program explore in depth the way in which policy decisions and social institutions influence the course of human lives.

Required courses include 225-B01 Introduction to Social Policy and three of the following:

- 225-C04 Social Policy and the Human Services
- 225-C07 Educational Policy
- 225-C11 The Political Economy of Social Policy
- 225-C30 Economics of Social Policy

The remaining units are composed of individually planned combinations of courses related to some aspect of social policy, chosen from an approved list of courses offered by the School of Education and Social Policy and other departments (anthropology, political science, psychology, sociology) in consultation with the student's adviser. The Office of Student Affairs maintains the approved list from which students must select these courses, at least eight of which must be at the C level.

#### Psychological Services

Students in the Psychological Services Program explore in depth the complexity of the contributions of institutions such as the family, the educational system, government, religious organizations, and the workplace to human development.

Required courses include 230-C01 Introduction to Counseling and three of the following:

- 230-C02 The Human Personality
- 230-C03 Intervention Strategies
- 230-C11 Group Dynamics
- 225-C04 Social Policy and the Human Services

The remaining units are composed of individually planned combinations of courses related to some aspect of human services, chosen from an approved list of courses offered by the School of Education and Social Policy and other departments (anthropology, communication studies, linguistics, psychology, sociology) in consultation with the student's adviser. The Office of Student Affairs maintains the approved list from which students must select these courses, at least eight of which must be at the C level.

#### Learning and Organizational Change

The Learning and Organizational Change Program teaches students how to increase effectiveness within organizations. This innovative concentration embodies technology internationalization, changing demographics, and new discoveries about effective learning and organizational behavior.

Required courses include

- 210-B11 Introduction to Organization Theory and Practice
- 210-C01 Learning in Context: Cognitive Science Foundations of the Learning Sciences
- 210-C02 Education and the Changing Workplace
- 210-C06 Studies in Organizational Change
- 210-C10 Learning Organizations for Complex Environments
- One C-level design course agreed upon by the student and academic adviser.

The remaining units are composed of other required courses, combinations of courses, and electives approved by the student's adviser, to complete the 45-unit degree requirement. Students planning to do graduate work in management are encouraged to take at least three courses in economics, including Economics C10-1 Microeconomics and C11-1 Macroeconomics. At least eight of the courses must be at the C level.

## Secondary Teaching Program

Students enrolled in the School of Education and Social Policy or elsewhere in the University who wish to pursue a secondary teaching major and recommendation for secondary teaching certification must apply for formal admission to the Secondary Teaching Program. Students completing degree requirements within the School of Education and Social Policy receive the degree of bachelor of science in education and social policy; 45 units are required for the degree. Students in other undergraduate schools also must complete a major and fulfill degree requirements of their school.

### *Preparation for Professional Work in Middle and Secondary Schools*

Individuals interested in the undergraduate Secondary Teaching Program should contact the Office of Student Affairs in the School of Education and Social Policy. The Secondary Teaching Program is approved by the Illinois State Teacher Certification Board; those completing the program therefore qualify for secondary certification in Illinois through entitlement. Students who plan carefully may qualify for provisional certification in another state.

Students in the Secondary Teaching Program take extensive course work in the liberal arts and complete a major in the academic subject they expect to teach. Students also observe in a variety of educational settings and complete a part-time co-teaching practicum experience and a full-time student teaching internship.

### *Distribution Requirements (21 units)*

Distribution requirements for the Secondary Teaching Program meet the general education requirements of the Illinois State Board of Education.

**I. Communications** (4)
- Two courses in written composition
- One course in oral communication
- One additional course in speech or composition

**II. Mathematics** (2)
- Two courses chosen from mathematics and/or statistics

**III. Biological and physical sciences** (4)
- At least one biological sciences course
- At least one physical science course chosen from astronomy, chemistry, geological sciences, or physics
- One course with a laboratory component

**IV. Humanities** (6)
- One quarter of History B10 History of the United States (can be used to fulfill social and behavioral sciences or humanities requirement)
- One course in English literature
- One course focusing on Asian, African, Central American, Native American, and/or South American cultures (can be used to fulfill social and behavioral sciences or humanities requirement)
- Three additional courses chosen from the arts, history, languages, literature, philosophy, or religion

**V. Social and behavioral sciences** (4)
- Political Science B20 American Government and Politics
- Three additional courses chosen from African American studies, anthropology, economics, history, political science, psychology, or sociology

**VI. Health and physical development** (1)
- 230-C90 Health and Physical Development

### *Professional Core (9 units)*

- 225-C01 Human Development: Childhood and Adolescence
- 236-C03 Problems in the Philosophy of Education or C04 History of Education in the United States
- 236-C27 Educating Exceptional Children *or* Speech and Language Pathology C36 The Field of Special Education
- 236-C41 Teaching and Learning in Social and Cultural Contexts
- One methods and techniques course chosen from 236-C54 through 59 Methods and Techniques
- 236-C81 Tutorial in Education: Student Teaching (4 units)

***Teaching Major Requirements***

Majors are as listed below under specific teaching major fields, which are designed to meet requirements of the Illinois State Board of Education. Teaching major requirements may differ from those of a departmental major, and departmental course offerings change frequently. Teacher certification candidates are required to meet regularly with the advising staff of the Office of Student Affairs to ensure that certification requirements are met.

**Art (12 units)**

- Three introductory courses: Art Theory and Practice A20, A24, A25
- Six studio courses: Art Theory and Practice B25; B22 *or* C20; four additional courses in painting and drawing, printmaking, sculpture, or photography
- Three art history, theory, and criticism courses: two chosen from Art History B10, B20, B30, B40, B50; one chosen from Art Theory and Practice B70, B72, or C72

**Biological and Physical Sciences**

***Biological Sciences (12 units)***

- Four core courses: Biological Sciences B10-1,2,3; C01
- Two botany courses chosen from Biological Sciences C15, C33, C90
- Three zoology courses chosen from Anthropology C06; Biological Sciences C02, C03, C04, C06, C20, C25, C45, C92
- One laboratory course chosen from Biological Sciences C05, C08, C45, C54
- Electives: two C-level biological sciences courses

Related courses: Chemistry A01, A02, A03, B10-1,2; Mathematics B14-3 *or* Statistics B02 *or* C02; Physics A30-1,2,3 *or* A35-1,2,3

***Chemistry (12 units)***

- General chemistry: Chemistry A01, A02, A03; *or* A71, A72
- Organic chemistry: Chemistry B10-1,2 *or* B12-1,2
- Physical chemistry: Chemistry C42-1,2
- Advanced chemistry: Chemistry C29; C33
- Laboratory: one course chosen from Biological Sciences C01; Chemistry B15, C35, C45, or C61
- Electives: two or three B- or C-level chemistry courses to bring total to 12 units

Related courses: Mathematics B14-1,2,3; Physics A35-1,2,3 and one additional physics course

***Physics (12 units)***

- Three introductory courses: Physics A25-1,2,3 *or* A35-1,2,3
- Four classical physics courses chosen from Physics C30-1,2, C31, C32, C33-1,2, C34
- Modern physics: Physics C39-1,2
- Laboratory: Physics C59-1,2,3

Related courses: Mathematics B14-1,2,3, B15, B17, B21

Students must also complete course work to qualify for a second teaching area.

**English (14 units)**

- Two prerequisites: English B10, B98
- Two composition courses: English B05 and one additional composition course
- Seven literature courses: two American literature courses, two English literature courses, and three additional literature courses
- One linguistics course chosen from Linguistics A10, B04, B05, B06, B07, B09, C11, C12, C15, C17, C18, C19, C62
- One reading and language acquisition course: 236-C23
- One course in Asian, African, Central American, Native American, or South American literature

**Foreign Languages**

***French (12 units)***

- Six language courses: French B02, B03, C02-1,2, C03, C05
- Three literature courses: French B10 and two additional C-level literature courses taught in French
- Three culture and civilization courses: two courses chosen from French B01, B80, B82; one chosen from C80, C91-1,2, C96

***German (12 units)***

- Four courses in language: two courses chosen from German B04, B05, B08; two quarters of C91 with different topics
- Three courses in literature: three quarters of German B01 with different topics

- Five courses in literature and culture: three quarters of German C10; two courses chosen from C29 and/or C32

***Latin (12 units)***
- Three language courses: Latin A01-1,2,3
- Four literature courses: Latin B01-1,2,3, C10
- Five other B- or C-level Latin, Greek, or classics courses

***Russian (12 units)***
- Six language courses: Slavic Languages and Literatures B03-1,2,3 and C03-1,2,3
- Four literature courses chosen from Slavic Languages and Literatures B10-1,2,3; B11-1,2; B55
- Two courses of advanced study: Slavic Languages and Literatures C60, C61

***Spanish (12 units)***
- Two courses in language and composition chosen from Hispanic Studies 463-B03-1,2,3, C02, C03
- Five literature courses: Hispanic Studies 463-C23 and C80; three courses chosen from B01-1,2,3 and B02-1,2,3
- Culture and civilization: Hispanic Studies 463-C50 or C51
- Four additional B- or C-level courses taught in Spanish

**Mathematics (12 units)**
- Five calculus/analysis courses chosen from Mathematics B14-1,2,3; B15; B20-1,2,3; B21; C03; C05; C10-1,2,3; C17-1,2
- Two geometry courses chosen from Mathematics C08; C26-1,2; C28; C29
- Two algebra courses chosen from Mathematics B17; C34; C37-1,2,3
- One probability and statistics course chosen from Mathematics C30-1; Statistics B02, C02
- One computer science course
- One additional C-level mathematics course

**Social Sciences**

***History (12 units)***
- Three courses in U. S. history
- Two courses in European history
- One course in non-Western/third world history
- Six additional history courses, four of which must be B- or C-level courses

***Economics with History (16 units)***
- Four introductory courses: Economics B01, B02, B81; Statistics B10
- Four major courses: Economics C10-1, C11-1, two additional B- or C-level economics courses
- Four U.S. history courses
- Four world history courses

***Political Science with History (16 units)***
- Three introductory courses: Political Science B20 and two courses chosen from B01, B21, B30, B40, B50
- Two methods courses: Political Science C95; one course chosen from C10, C11, or C12
- Three C-level political science courses
- Four U.S. history courses
- Four world history courses

***Sociology with History (16 units)***
- Two A- or B-level sociology courses
- Four theory and methods courses: Sociology B26, C03, C06, C29
- Two C-level sociology courses
- Four U.S. history courses
- Four world history courses

***Electives***

Additional units of elective course work must be taken to complete the 45-unit degree requirement.

***Clinical Experiences***

Students complete a co-teaching practicum during fall quarter of their junior or senior year. Applications for co-teaching placements must be submitted to the Office of Field Experience by the fourth week of the spring quarter preceding the co-teaching practicum. The co-teaching practicum includes a minimum of 10 hours per week in a classroom for 10 weeks. Students also take two evening seminars (236-C41 and the applicable methods and techniques course, C54–59) and at least one additional course that quarter. Students must complete a preliminary contract for their co-teaching practicum during the first two weeks of the quarter.

Students complete a student teaching internship during fall or winter quarter of their senior year. To apply for student teaching, students must have satisfactorily completed their co-teaching practicum, 236-C41, the applicable methods and techniques course (C54–59), and at least nine courses in their

teaching major. Further, students must have a grade point average of 2.5 or above in their major and professional core courses. (Note: While a grade point average of 2.5 is the minimum requirement, we recommend a grade point average closer to 3.0 to be competitive for a student teaching placement.)

Applications for student teaching must be submitted to the Office of Field Experience by the fourth week of the quarter preceding the student teaching internship. The student teaching internship is a full-time placement (40 hours per week) for 10 weeks in a local school. Students must also attend one evening seminar (236-C81). The student teaching internship and the evening seminar combined are worth 4 units of credit. No other courses are taken during that quarter. Students must complete a preliminary contract for their student teaching internship during the first two weeks of the quarter.

***Additional Requirements for Certification***

- United States citizenship or evidence of permanent resident status
- Illinois State Teacher Certification Examination (Basic Skills and Content Area tests)

Information about the required Illinois State Teacher Certification Examination is available in the Office of Student Affairs.

***Teacher Certification at Northwestern***

Students successfully completing approved teacher training programs at Northwestern qualify to receive Illinois certification. Although legal requirements for certification vary from state to state, each teacher training program offered at Northwestern is sufficiently flexible to permit a student who plans carefully to complete provisional requirements of most states. Information concerning these requirements is available in the Office of Student Affairs of the School of Education and Social Policy.

Northwestern will recommend a student for a teaching certificate only when the student has successfully completed an approved Northwestern University teacher preparation program. A student who qualifies for certification as described above must apply to the University's designated certifying official for a recommendation for certification. Students in the Schools of Music and Speech should apply through their schools. All other students should apply through the Office of Student Affairs of the School of Education and Social Policy. Applications must be submitted early in the quarter preceding the final quarter of study at Northwestern.

Graduates of a teacher training program at Northwestern who do not apply for certification upon graduation may not be eligible for licensure. The University will make every effort to assist its graduates in obtaining teaching certification but cannot guarantee eligibility at a later date.

### Accelerated Master of Science Program in Education and Social Policy

Students who exhibit exceptional ability as Northwestern undergraduates and wish to become certified in elementary or secondary education as part of a master's degree may apply to the School of Education and Social Policy Master of Science Program in their senior year. This program allows students to complete their master's degree and certification requirements at an accelerated pace. Students who wish to pursue this option *must* consult with a certification adviser in the School of Education and Social Policy before their senior year for special undergraduate course planning.

### International Studies Program

Any Northwestern undergraduate may enroll in international studies, an undergraduate interschool adjunct major that is taken in conjunction with a traditional major. (See International Studies Program in the Other Undergraduate Programs section of this catalog.)

### Undergraduate Leadership Program

The Undergraduate Leadership Program, an interschool certificate program open to all undergraduates, helps students understand the nature of leadership and prepares them to become leaders. (See Undergraduate Leadership Program in the Other Undergraduate Programs section of this catalog.)

## Learning Sciences

### Courses Primarily for Freshmen and Sophomores

**210-B05-0 Undergraduate Proseminar** Introduction to issues faced by educators, policy makers, business leaders, and human service professionals and the methods used in addressing these issues. SESP faculty research and themes explored. Writing-intensive course.

**473-B06-0 Elementary Statistics for Research** See Statistics, College of Arts and Sciences.

**210-B11-0 Introduction to Organization Theory and Practice** Major organizational theories; opportunities for students to apply these theories in organizations.

**210-B12-0 Learning and Understanding** Framework for learning in all aspects of life: traditional school subjects, professional training, creative and performing arts, personal health, basic survival skills. Students are encouraged to draw from their own experiences.

### Courses Primarily for Juniors and Seniors

**210-C01-0 Learning in Context:Cognitive Science Foundations of the Learning Sciences** How people learn to understand, reason, and solve problems; knowledge representation, expertise, transfer, and metacognition; learning in mathematics, science, reading and writing, and informal reasoning.

**210-C02-0 Education and the Changing Workplace** The changing nature of work and how this will affect skills required for work and the teaching of those skills in the 21st century.

**210-C06-0 Studies in Organizational Change** Theories and methods of organizational learning and change. Students design change interventions. Prerequisite: B11.

**210-C10-0 Learning Organizations for Complex Environments** Major change factors, including technology, globalization, and demographics, and their impact on organizations; how organizations are creating and responding to these changes through organizational design, learning systems, and human resource changes.

**210-C26-0 Mathematics in the Elementary School** Selected mathematical topics taught in the elementary school. Relevant teaching strategies and instructional materials. Mathematical and psychological aspects of the concepts studied.

**210-C83-0 Undergraduate Internship** Opportunity for advanced undergraduates to gain field experience in practical and theoretical aspects of learning. No more than two units may be taken in any one quarter. Prerequisite: consent of instructor directing the field study and of assistant dean. (Students wishing to register must first complete the Request for Independent Study/Internship in Education form available from the Office of Student Affairs.)

**210-C98-0 Honors Thesis** Open to seniors who have attained a cumulative grade point average of 3.5 by the end of junior year. Prerequisites: consent of assistant dean and instructor directing the honors thesis.

## Human Development and Social Policy

### Courses Primarily for Freshmen and Sophomores

**225-B01-0 Introduction to Social Policy** Social policy formulation: substance of major American social policies and manner in which the American political system shapes social policy in this country.

**225-B98-0 Student Organized Seminar** Students initiate courses supervised by sponsoring faculty to explore topics not covered in other courses. Consulting with a faculty sponsor, students prepare a seminar plan and submit it to the assistant dean for student affairs before the middle of the quarter preceding the quarter in which the seminar is to be held. The plan includes a topic description, reading list, specifications of term papers and written examinations, prerequisites, and meeting schedule. All proposals are formally reviewed and approved before the seminar is offered. Enrollment is allowed in only one Student Organized Seminar per quarter and must be on the pass/no credit basis. Consult with the assistant dean for further details.

### Courses Primarily for Juniors and Seniors

**225-C01-0 Human Development:Childhood and Adolescence** Personal, social, and cognitive development, birth through adolescence. Interplay of biological and experiential factors on ego, personality, linguistic, and conceptual development.

**225-C02-0 Human Development:Adulthood and Aging** Psychological, sociological, and biological factors influencing socialization and development from young and middle adulthood through old age. Influences of family, school, and work on the individual.

**225-C03-0 Administration and Policy Studies** Education and human development as a multi-institutional, ecological, and macrosociological phenomenon. Issues in the philosophy, history, economics, and politics of education.

**225-C04-0 Social Policy and the Human Services** Development of social policy for human services in the United States. Human service policies for education, mental health, physical health, income, and aging.

**225-C05-0 Law and Social Policy** Use and influence of the legal system in and on social institutions and policy.

**225-C07-0 Educational Policy** Conflict between societal imperatives for selecting and preparing youth for future careers and offering youth opportunity; how society and schools address this conflict; various approaches to policy reform.

**225-C10-0 Legal Aspects of Education** Structure of school governance; decision making; relevant state and federal legislation affecting public schooling.

**225-C11-0 The Political Economy of Social Policy** American social policy from a cross-national comparative perspective. Examines the historical development of social policy in the Western world; assesses three competing perspectives on the "crisis" of the welfare state.

**225-C12-0 Development of African American Children and Families:Theory and Research** African American children and families from a holistic, multidisciplinary, developmental perspective; child and family life cycles linked to ecological factors in society; historical-evolutionary approach.

**225-C13-0 Development of African American Children and Families:Research and Social Policy** Educational and human service policy concerns of African Americans; contemporary social policies affecting children and families; associated developmental, educational, and socio-psychological research.

**225-C16-0 Moral Values and Human Development: An Introduction** Moral development of the individual. Explores moral values from several perspectives: age-developmental differences, cross-cultural and gender differences, relationship between moral reasoning and moral behavior.

**225-C17-0 Gender and the Life Course** How age and sex serve as a basis for the social construction of men's and women's lives. How social forces operate to create contrasting life trajectories, role patterns, and transitions; the role of social policies. Comparative view of different societies and periods in recent history.

**225-C18-0 Adult Development and Work Careers** Adult development and careers from the perspectives of psychology, sociology, and organizational behavior. Individual career-development strategies and alternative career systems.

**225-C19 Family Development in Changing Society** Societal changes and their effects on the family.

**225-C30-0 Economics of Social Policy** How economists view social policy issues. Economic models of household decision making. How economists account for costs and benefits of of public and private programs and decisions. Prerequisite: Economics B01 or consent of instructor.

**225-C72-0 Methods of Observing Human Behavior** Guided practice in systematic and participant observation of human behavior. Observer bias, field notes, unobtrusive measures. Prerequisite for C83 and C85.

**225-C83-0 Practicum** (2 units) Internship *only* for students in the Learning and Organizational Change, Psychological Services, and Social Policy programs. Intensive, supervised participant observation of (1) interpersonal relationships, especially those of professional and client, and (2) the effects of institutional structure and policy on both professionals and clients. Prerequisites: C72 and consent of program director.

**225-C85-0 Practicum Analysis Seminar** (2 units) Small-group meetings *only* for students in the Learning and Organizational Change, Psychological Services, and Social Policy programs to analyze C83 practicum experiences, organize their perceptions of their own internships, and share them with other class members. To be taken concurrently with 225-C83. Prerequisite: C72.

**225-C99-0 Independent Study** Opportunity for students to pursue, under the direction of faculty members, special topics in education not covered by regular courses. Prerequisites: consent of instructor directing the study and of associate dean. (Students wishing to register in C99 must first complete the Request for Independent Study/ Internship in Education form available from the Office of Student Affairs.)

## Counseling Psychology

### Courses Primarily for Juniors and Seniors

**230-C01-0 Introduction to Counseling** Overview of counseling theories, techniques, client systems, and service settings.

**230-C02-0 The Human Personality** Classic and contemporary psychological approaches to personality; understanding the whole person in his or her societal and historical context. Emphasis on both theory and research.

**230-C03-0 Intervention Strategies** Intervention strategies in the areas of human development, education, psychological well-being, and social welfare within a social-ecological framework. Emphasis on long-term change in people and social environments.

**230-C11-0 Group Dynamics** Theory and research in the social psychology of groups and social systems. Small- and large-group dynamics; intergroup relations. Participation in a weekend group relations conference.

**230-C32-0 Career Development:Theory and Counseling** Process of career development and its relation to the world of work. Discussion of career development theories. Focus on self-assessment; decision-making skills; educational, occupational, and community information; and job-seeking skills.

**230-C90-0 Health and Physical Development** Interaction and interdependence of physical well-being, mental and emotional health, and surrounding social environment. Topical areas covered for secondary education students completing state certification requirements.

# Teacher Education

## Courses Primarily for Juniors and Seniors

**236-C03-0 Problems in the Philosophy of Education** Classical and modern philosophies of education. Text interpretation, analysis of ideas, argument construction; relationship of philosophy to educational issues. Students develop their own philosophy of education.

**236-C04-0 History of Education in the United States** Education and social change in the United States since 1789. Development of the American commitment to commonality in education; the changing relation between school and community since 1899; and the rise of the professional educator.

**236-C23-0 Foundations of Reading and Language Acquisition** Cognitive foundations of reading comprehension processes and their influences on methods of instruction and assessment. Interrelationships among reading processes and language learning and their implications for instruction and assessment.

**236-C25-0 Foundations of Writing Processes (Secondary)** Cognitive and sociocultural foundations of writing processes and their implications for instruction and assessment. Includes supervised field experience.

**236-C27-0 Educating Exceptional Children** Students with disabilities, including learning disabilities resulting from human development and/or accidents; understanding and application of approved emergency, educational, and rehabilitative activities; interrelationships with medical, health, and educational personnel.

**236-C41-0 Teaching and Learning in Social and Cultural Contexts** Current instructional theory, research, and practice. Definition of instructional goals, implementation of goals through curricular design, measurement of relevant outcomes. Minimum of 50 hours of observation in selected schools. Open only to teacher certification candidates. Concurrent registration with co-teaching required. Prerequisite: consent of Office of Student Affairs.

**236-C54–C59 Methods and Techniques** Students in the Secondary Teaching Program take one of the following six methods courses:

- 236-C54 Methods and Techniques: Art
- 236-C55 Methods and Techniques: Foreign Languages
- 236-C56 Methods and Techniques: English
- 236-C57 Methods and Techniques: Secondary Mathematics
- 236-C58 Methods and Techniques: Sciences
- 236-C59 Methods and Techniques: Social Sciences

These methods courses analyze the literature and research related to the subject area and teaching methodology. In addition, they examine the development of learning experiences, methods, and educational techniques appropriate to the middle and high school levels.

Students also complete a co-teaching practicum that requires a minimum of 10 hours per week for 10 weeks observing and assisting in a school approved by the Office of Field Experience. Within the first two weeks of the quarter, students must develop a contract for their co-teaching practicum with the methods professor and a teacher or administrator in the school where the practicum is to be completed. This contract must be approved by the Office of Field Experience for the co-teaching practicum to continue. Methods courses are taken simultaneously with C41.

**236-C81-0 Tutorial in Education:Student Teaching** (4 units) Further development of teaching methodologies through an intensive, 10-week clinical experience and teaching under the supervision of master teachers in the teacher training schools. Increasingly sophisticated teaching responsibilities and, finally, primary responsibility for teaching a group or a class. Prerequisites: successful completion of the co-teaching experience, an approved contract for the internship experience, and consent of the Office of Field Experience.

# Robert R. McCormick School of Engineering and Applied Science

The McCormick School of Engineering and Applied Science is committed to providing leadership for the technological foundation of our society, economy, environment, and culture. The school's mission is twofold: the personal and professional development of its students and faculty and the development and application of new technology, which is increasingly of an interdisciplinary nature.

McCormick is dedicated to a high standard of excellence in

- Teaching fundamentals of science and engineering disciplines and stimulating students to become innovative thinkers and leaders able to cope with complex issues in a changing environment
- Preparing undergraduate and graduate students for professional engineering careers in a competitive world, capable of understanding, applying, and contributing to technology in whatever areas or careers they subsequently pursue

Undergraduate students in McCormick may follow a curriculum leading to a bachelor of science degree in any of the following fields:

Applied mathematics
Biomedical engineering
Chemical engineering
Civil engineering
Computer engineering
Computer science
Electrical engineering
Engineering science
Environmental engineering
Industrial engineering
Manufacturing engineering
Materials science and engineering
Mechanical engineering
Medical engineering (Honors Program in Medical Education only)

The degrees in biomedical, chemical, civil, computer, electrical, environmental, industrial, and mechanical engineering and materials science and engineering, as well as the McCormick School and its cooperative education program, are accredited by the Accreditation Board for Engineering and Technology (ABET).

With proper use and combination of requirements, options, and electives, students may prepare themselves for graduate work in engineering and also for graduate studies in medicine, law, business, or other areas. Bachelor of science degrees are awarded also in approved ad hoc combined studies programs.

Graduate programs of study are available in all the above fields as well as in theoretical and applied mechanics, manufacturing management, project management, and engineering management. These programs leading to degrees at the master's and doctoral levels are described completely in the Graduate School catalog or in publications on engineering graduate programs.

Excellence in research is a distinguishing characteristic of the engineering faculty. A faculty such as this, working at the frontiers of knowledge, is in the best position to maintain courses and curricula in a state of currency and to develop an atmosphere inspiring scholarship and originality among students.

The McCormick School has a student body of approximately 1,500 undergraduates and 950 graduate students. The school is housed in the Technological Institute, which contains more than 750,000 square feet of floor area and provides excellent educational and research facilities.

The Seeley G. Mudd Library for Science and Engineering, adjoining the Technological Institute, is an integrated and centralized collection serving engineering, applied mathematics, astronomy, biochemistry, biology, chemistry, and physics.

## Academic Policies

### Requirements for the Degree of Bachelor of Science

Students must successfully complete all 48 courses of the curriculum or have equivalent academic experience. Students who interrupt their programs of study for an extended time during which degree requirements are changed will normally be held to

the new requirements. Students who encounter curricular changes during their period of enrollment may choose to follow any curriculum during that period but must meet the requirements completely.

Students must earn a grade average of not less than C for all courses presented for the degree.

The grade point average of the 16 major program courses presented for the degree must be at least 2.00. Further, no more than two of these courses may carry grades of D.

Students must complete the last 23 quarter-courses while enrolled as an undergraduate in Northwestern University and must be enrolled in the McCormick School during the last three quarters of study.

Every candidate for a degree must file an application for the degree a year in advance of the date of graduation (see Academic Calendar).

In addition to and independent of the requirements set by the McCormick School, all students must satisfy the University Enrollment Requirement. (See Financial Regulations in the Undergraduate Regulations section of this catalog.)

### Pass/No Credit Option

Undergraduates in the McCormick School may take a maximum of eight quarter-courses under the pass/no credit (P/N) option for use toward the degree. During the freshman and sophomore years, however, only one course per quarter may be taken under the P/N option.

The P/N option may be used in the following areas:

- Basic program: In courses taken as social sciences/humanities selections or as unrestricted electives. Although the number of C-level courses is not restricted (to the limit of eight as above), only four A- or B-level courses may be taken under the P/N option and used to satisfy the nine-course requirement in the social sciences/humanities area. This option may not be used in mathematics, basic sciences, and basic engineering courses.
- Departmental program: Consult the department office or the McCormick School Records Office regarding the regulations for use of P/N in each departmental program.

### Advanced Placement

Advanced placement and college credit may be granted on the basis of the College Entrance Examination Board (CEEB) advanced placement tests. Placement or exemption may be granted on the basis of the CEEB tests or special examinations in subject areas or by appropriate analysis of high school background. Any placement (verified by a grade above C– in a subsequent course) in approved sequential work will reduce the course requirements for the BS by the number of courses preceding the placement. These stipulations regarding placement and exemption and degree requirements may differ from those of other schools of the University.

### Personal Computers

Northwestern's campus is fully networked, so students can access local and remote information sources from dormitory rooms and laboratories. Accordingly, the McCormick faculty has adopted a policy making each engineering undergraduate responsible for his or her own computing hardware and software for basic tasks such as word processing, spreadsheet calculations, and graphics and for connection to the University's computer network. McCormick maintains a number of public and departmental computing laboratories, but these are used primarily for higher-level or specialized applications.

## Academic Options

### Cooperative Engineering Education Program

The Walter P. Murphy Cooperative Engineering Education Program alternates periods of paid industrial experience and academic studies for full-time students in all departments of engineering and applied science. During 18 months of industrial employment, students can apply theory while gaining practical experience. This perspective enables them to develop an understanding of the responsibilities of their future professional careers.

Freshmen are invited to participate in workshops to prepare them for the co-op program. Sophomores in good academic standing begin applying for co-op positions as early as the fall quarter. The co-op coordinator makes every effort to secure interviews for the students, so that cooperative work assignments are related to their professional objectives.

Generally, the first work experience for sophomore co-op students occurs the summer before their junior year. Co-op experience for junior and transfer students and others may begin as late as the spring of their junior year. If necessary, with the help of the academic advisers, special schedules may be arranged to enable students to meet individual academic requirements as well as co-op requirements.

Students register for their work quarters, but no tuition or fee is charged. The registration keeps co-op students enrolled at Northwestern during work periods. While no academic credit is given for co-op, special BS/MS programs may use co-op experience as the basis for undergraduate projects and master's theses.

Although emphasis is on the experience gained from cooperative work rather than on the income, students in the co-op program may earn at least a portion of their educational expenses.

The following table shows the college-industry schedule for the full five years of undergraduate education:

***College-Industry Schedule***

| | Summer | Fall | Winter | Spring |
|---|---|---|---|---|
| Freshman | | 1 | 2 | 3 |
| Sophomore | vacation | 4 | 5 | 6 |
| Junior | work | 7 | 8 | work |
| Presenior | work | 9 | work | 10 |
| Senior | work | work | 11 | 12 |

Students may be enrolled simultaneously in the co-op program and the Naval Reserve Officers Training Corps.

Students who complete the co-op plan receive tuition rebates during their final academic quarters to assure that they will not pay higher total tuition than other students in the same entering class.

In addition to the academic degree, the faculty of the McCormick School awards co-op students a certificate in recognition of successful completion of the Walter P. Murphy Cooperative Engineering Education Program. Students must successfully complete the schedule of school and work, which meets standards set by the program, the co-op employer, and ABET, in order to receive recognition as co-op students on graduation from the McCormick School.

In some states, ABET-accredited co-op experience may be credited for up to one year of the usual four years of engineering experience required for the Professional Engineer's License.

Employers of co-op students include government and service institutions as well as industry. Northwestern coordinators visit participating employers periodically to discuss the students' abilities, attitudes, and progress on the job. At the end of each work period employers are asked to evaluate student performance and progress. It is important to note that neither students nor cooperative employers obligate themselves to permanent employment by virtue of the co-op status, although most students get impressive permanent job offers as a result of the co-op experience. Others are admitted to prestigious graduate and professional schools.

### Undergraduate Honors Program

Students with good scholastic records may be admitted to the Undergraduate Honors Program any time during their junior or presenior year. At the time of admission, they must have a cumulative grade point average of 3.5 or better. Students who become eligible will be notified by the dean.

Honors students participating in the program must (a) complete at least three units of approved advanced study (including courses normally accepted at the graduate level) with an average grade of B or better and (b) complete an extended independent study project (at least two quarters on the same topic) leading to an acceptable report.

Successful completion of the Honors Program will be noted on the student's transcript. Recognition also will be given in the commencement program. If a student's individually evaluated performance is not judged to meet the standards of success, the student will receive course grades and credits as earned.

### Undergraduate Research

Opportunities for undergraduate research are made available and encouraged in several ways. Each major field of study offers C99 Projects for research enrollment on an elective basis. The Undergraduate Honors Program incorporates a required research component.

The McCormick School Undergraduate Research Board, composed of student leaders, administers a program that funds individual research projects from

the Sara Boley Undergraduate Research Fund. The board helps select the winner of the Harold Benedict Gotaas Award, presented to the senior engineering student who submits the best original research paper.

Students normally perform undergraduate research projects under the direction of faculty who are doing research in their department or in a University or McCormick School research center, laboratory, or council. Engineering faculty may be associated with a variety of research centers, including the Center for Advanced Cement-Based Materials, Center for High-Temperature Superconductivity, Materials Research Center, Center for Catalysis and Surface Science, Institute for the Learning Sciences, and McCormick School Centers for Engineering Tribology, Information Technology, Manufacturing Engineering, Optimization Technology, Parallel and Distributed Computing, and Quality Engineering and Failure Prevention. Important research is also carried out by faculty working in the Applied Optics Laboratory, Quantum Devices Laboratory, and Council on Theoretical and Applied Mechanics.

Students admitted as freshmen to the Honors Program in Undergraduate Research will have the opportunity to be involved in faculty-guided research in all four years of study.

### Multiple BS Degrees

Students with wide-ranging interests may work toward two or more bachelor of science degrees in the McCormick School. The work in additional areas does not need to be completed at the same time, but the full requirements for each degree must be approved by each department (program) no later than two academic quarters before the completion of work for the second degree yet no earlier than the junior year. The full requirements for each degree must be satisfied. At least six additional courses or equivalents must be presented before the awarding of each additional degree.

### Second Field of Specialization

The elective opportunities in the McCormick School curriculum may be used toward a departmental program in another school of the University. Satisfactory completion of the requirements for the second program, verified by the appropriate department, will be noted on the student's transcript. Carefully planned electives will normally enable students to obtain a second field of specialization within the 48-course requirement for the BS degree.

### Concurrent BS/MS

During their senior year, qualified undergraduate students in the McCormick School may work simultaneously toward the bachelor of science and master of science degrees in engineering. Integrated planning of coursework allows the possibilityof taking graduate-level courses during the third and fourth years. Also provided are early assurance of graduate admission and early planning of project or research work.

It is possible for some students to finish the work for an MS in a combined program in less than the normal five years. In the McCormick School, any advanced placement, exemption, or demonstrated proficiency will reduce the course work requirement.

The course requirements remain unchanged for the two degrees. In the McCormick School, the requirement for the BS is 48 courses, and the requirement for the MS is specified by the individual department (9–12 courses). No course used for the MS requirement may be used for the BS requirement.

Application for admission to concurrent BS/MS study may be made any time during the seventh through the ninth quarters, in accordance with departmental advice. However, upon beginning graduate study, students may have no more than four courses to complete toward the undergraduate degree. The graduate application must be accompanied by a full plan of BS/MS studies and must be approved by the appropriate department and the Graduate School. A department may require that students do additional work preliminary to a concurrent BS/MS program at any level.

### Five-Year BA/BS

The McCormick School encourages breadth of interest and to this end supports combined degree programs in engineering and liberal arts. One approach is the 3-2 program, in which students attend a liberal arts college for the first three years with a course of study that develops a basic understanding of science and mathematics and a strong component in the social sciences and humanities. Following the three years of basic studies and on recommendation of their liberal arts college, students transfer to Northwestern. When they complete the requirements of a field of engineering in two years, a BS in engineering

is awarded by Northwestern and a BA by the original college. Any student enrolled in an accredited liberal arts college program may apply for transfer admission to follow a 3-2 plan.

Another approach to combining liberal arts and engineering is a parallel arrangement of studies at Northwestern, in which a fifth year results in a BA with a major in the College of Arts and Sciences and a BS in a particular field of engineering. Students should file a petition outlining this dual plan of study before their fourth year; it must be approved by the departments and schools administering the degree work. Students must complete the stated requirements of both schools and expected majors.

### Engineering and Music

Highly capable students who have a strong interest in and commitment to both engineering and music may pursue a five-year program leading to bachelor's degrees in both fields. In engineering, any field of study may be chosen, resulting in a bachelor of science in the chosen field. In music, the bachelor of music or bachelor of arts in music is awarded. The program may be entered no later than the beginning of the sophomore year; admission requires concurrent approval of both the School of Music and the McCormick School. (See also Five-Year BS/BMus or BS/BAMus in the School of Music section of this catalog.)

### International Education

McCormick students will be awarded a certificate in international engineering experience for both completing three quarters of foreign language study while enrolled at Northwestern and spending six months abroad as full-time students or on co-op assignments, in paid engineering employment, or on project work at a foreign university, research institute, or company. Northwestern and the McCormick School have connections with selected leading universities around the world. Some of these provide access to academic opportunities and others to research collaborations. Contact the Undergraduate Engineering Office for more information.

The social science/humanities distribution is an opportunity for pursuing international themes. Appropriate sequences of course work, including language study, are suggested.

International studies, an undergraduate interschool adjunct major that is taken in conjunction with a traditional major, is open to McCormick students. (See International Studies Program in the Other Undergraduate Programs section of this catalog.)

### Honors Program in Undergraduate Research

The Honors Program in Undergraduate Research in the McCormick School provides an unusual opportunity for students with superior motivation and scholastic credentials (high school rank and test scores) to be admitted to work with an engineering faculty mentor/adviser in a challenging research project. This research project participation could begin in the first year and continue through all the undergraduate years, allowing close association with a faculty researcher probing the frontiers of knowledge in engineering or engineering science.

This unique opportunity for experiencing the excitement of original research and the associated approach to learning provides students with not only encouragement but also excellent preparation for graduate study. If students in the Honors Program in Undergraduate Research achieve advanced placement as well as satisfactory performance in the research project and accompanying course work, during their third year of undergraduate study they will be considered for admission to the Graduate School and for award of financial aid.

### Honors Program in Engineering and Management

Students are eligible to participate in a joint program between the McCormick School and the J. L. Kellogg Graduate School of Management. High school students whose scholastic credentials are superior and who are strongly motivated to combine engineering and management expertise in their future careers may be admitted to undergraduate engineering in McCormick and also granted deferred admission to the master of management program in Kellogg.

The program requires eight years, consisting of a combination of undergraduate and graduate study interspersed with related work experience. The initial studies are in a chosen field of engineering, with a schedule of school and work in industry in accordance with the co-op program. The five-year co-op program requires four academic years and $1^1/_2$ years of industrial work; academic and industrial quarters are alternated during the last three years. Students must maintain a 3.0 grade point average.

After five years, participants receive a bachelor of science degree in the chosen engineering field and are admitted to the Kellogg Graduate School of Management. A condition of admission is one further year of full-time work experience in industry before the two years of full-time study leading to the master of management degree.

### Honors Program in Medical Education

The Honors Program in Medical Education (HPME) is designed for unusually gifted high school students who seek a career in medicine or medical science. It provides a plan whereby students entering Northwestern are admitted simultaneously to the College of Arts and Sciences, McCormick School, or School of Speech and to the Medical School. HPME students then participate in a challenging program, with the first three years in undergraduate study and the last four years in the Medical School, thus reducing the period of formal training by at least one year.

Students who meet the entrance requirements of the McCormick School may pursue a program leading to the bachelor of science in medical engineering degree after five years and the doctor of medicine degree after seven years.

### Honors Program in Engineering and Education

The Honors Program in Engineering and Education is designed for students who have strong interest in education and training as well as in science, mathematics, and engineering. The program provides an opportunity to complete a graduate degree in the learning sciences and an undergraduate degree in engineering in five years while gaining industrial or research experience related to a specific expertise in the field.

The program places high value on both academic research and industrial experience. Students may choose industry experience in educational software development through the co-op program, research experience with a faculty member at the Institute for the Learning Sciences, or a selective combination of both during their undergraduate and graduate studies.

Students admitted to the program must maintain a 3.0 grade point average. A one-quarter grace period to bring a lower grade point average up to 3.0 will be granted.

### Honors Program in Engineering and Journalism

The Honors Program in Engineering and Journalism is intended to prepare exceptional students for communications careers emphasizing engineering, science, and technology. This joint program involves completing a McCormick bachelor's degree and then a Medill School of Journalism master's degree. It normally requires five years of study, but unusually capable students may be able to shorten the time through use of advanced placement credits and accelerated scheduling. To be considered for the program, applicants to Northwestern complete an additional questionnaire that is evaluated by a Medill faculty panel. Students are evaluated by the faculty during the program to verify that performance is satisfactory. Part of the engineering humanities requirements must be fulfilled with the Medill courses B01 Editing and Writing the News and B02 History and Issues of Journalism.

### Combined BS/DDS

A combined BS/DDS program is offered to qualified students in the biomedical engineering curriculum. Application is made for admission to Northwestern University Dental School after three years in the undergraduate program. Upon completion of the first year in Dental School, credits earned are accepted as electives and the BS is awarded by the McCormick School, provided all the requirements for that degree have been met. A number of places in each entering class at the Dental School are reserved for students who qualify for this program.

### Undergraduate Leadership Program

The Undergraduate Leadership Program, an interschool certificate program open to all undergraduates, helps students understand the nature of leadership and prepares them to become leaders. (See Undergraduate Leadership Program in the Other Undergraduate Programs section of this catalog.)

## Student Resources

### Tutorial Program

The McCormick School conducts a program of guided study and tutorial help for freshmen and sophomores in all the required courses in mathematics, chemistry, physics, and engineering. This program encourages out-of-class work and good study habits and helps provide a full understanding

of the early courses that are the foundation for much that is to follow. The aim is not to displace students in their learning efforts but to provide explanations to bridge the uncertain or unknown and lead to depth of understanding.

### Faculty Advisers

During the first year, students are assigned a special freshman adviser. At the beginning of the sophomore year, most students will have selected a major field of study and will be reassigned an adviser in that area. The adviser assists in planning the program of study, but students retain the responsibility of meeting overall graduation requirements. Curricular and other advice may be obtained from the school by addressing an e-mail request to mccormick-school@nwu.edu.

### Counseling Office

The McCormick School employs professional counselors available to give students educational, vocational, academic, and personal counseling. Students may arrange to have interest testing through the Counseling Office. Vocational materials relating to engineering are available.

### Organizations for Engineering Students

The Northwestern Engineering Student Council is composed of representatives from each class in engineering and from approved McCormick organizations. It is the recognized representative body of undergraduate engineering students and as such serves as a link between the students and faculty and administration. It encourages and coordinates the activities of engineering students and student groups.

The McCormick Undergraduate Research Board is organized to stimulate undergraduate research and to provide financial support for projects begun by individual students.

The following professional societies have established student branches on the campus:

American Institute of Chemical Engineers
American Institute of Industrial Engineers
American Society of Civil Engineers
American Society of Mechanical Engineers
ASM International
Biomedical Engineering Society
Institute of Electrical and Electronics Engineers
Institute of Electrical and Electronics Engineers (computer subchapter)
Institute of Electrical and Electronics Engineers (engineering in medicine and biology subchapter)
Materials Research Society
National Society of Black Engineers
Society of Automotive Engineers
Society of Hispanic Professional Engineers
Society of Manufacturing Engineers
Society of Women Engineers

The following honorary societies recognize high-achieving McCormick undergraduates:

Eta Kappa Nu: open to upperclass students in electrical engineering who demonstrate superior scholarship and ability
Kappa Theta Epsilon: cooperative engineering education honorary society
Omega Chi Epsilon: for upperclass students in chemical engineering who demonstrate superior scholarship and leadership ability
Phi Eta Sigma: for freshmen who make a scholastic average equivalent to a grade of A
Phi Lambda Upsilon: open to upperclass students in chemistry and chemical engineering who demonstrate superior scholarship and academic ability
Pi Tau Sigma: for upperclass students in mechanical engineering who demonstrate superior scholarship and leadership ability
Sigma Xi Society: eligibility for associate membership for seniors who excel in scholarship in at least two departments
Tau Beta Pi: for upperclass students who have shown superiority in scholarship and ability in engineering work

## Undergraduate Programs of Study

### Accreditation

McCormick programs are accredited by the Accreditation Board for Engineering and Technology. National ABET accreditation is important in professional engineering fields. Additional information concerning professional accreditation may be obtained from the office of the associate dean for undergraduate engineering.

### McCormick School Curriculum Requirements

All curricula leading to the bachelor of science degree in engineering or applied science must have the same basic components—mathematics, engineering analysis and computer proficiency, basic sciences, design and communications, basic engineering, social sciences/humanities, unrestricted electives, and major program. McCormick is making a transition to the requirements

shown in the following pages; they differ from the previous requirements in including 2 core-level sequence courses, General Engineering A06-1,2 Engineering Design and Communications and General Engineering B05-1,2,3,4 Engineering Analysis.Duringthe transition time,it may not be possible to enroll all students in the new courses; students may be directed into either the new courses or the previously requiredcourses,which willsatisfytheirdegree requirements.

The abbreviations used for McCormick departments in the listings that follow are
BME (biomedical engineering)
ChE (chemical engineering)
CE (civil engineering)
CS (computer science)
ECE (electrical and computer engineering)
ESAM (engineering sciences and applied mathematics)
EnvE (environmental engineering)
IEMS (industrial engineering and management sciences)
MSc (materials science and engineering)
ME (mechanical engineering)

### *Mathematics (4 courses)*

Mathematics B14-1,2,3 Calculus
Mathematics B15 Multiple Integration and Vector Calculus

### *Engineering Analysis and Computer Proficiency (4 courses)*

General Engineering B05-1,2,3,4 Engineering Analysis

### *Basic Sciences (4 courses)*

4 courses in at least two of the four areas below, but not more than 3 in one area and not more than 2 from earth sciences:

- Physics
  Physics A35-2,3 General Physics
- Biological sciences
  Biological Sciences B10-1 Genetics and Evolutionary Biology
  Biological Sciences B10-2 Biochemistry and Molecular Biology
  Biological Sciences B10-3 Physiology and Cell Biology
  BME B01 Biology for Engineers
- Chemistry
  Chemistry A01 General Chemistry
  Chemistry A02 General Inorganic Chemistry
  Chemistry A03 General Physical Chemistry
  Chemistry A71Accelerated GeneralInorganic Chemistry
  Chemistry A72 Accelerated General Physical Chemistry
  Chemistry B10-1,2 Organic Chemistry
- Earth sciences
  Geological Sciences B01 The Skin of the Earth
  Geological Sciences B02 The Body of the Earth

### *Design and Communications (3 courses)*

- Writing and design
  General Engineering A06-1,2 Engineering Design and Communication
- Speaking, 1 course from
  Speech A01InterpersonalCommunication
  Speech A02 Public Speaking
  Speech A03 Analysis and Performance of Literature
  Higher-level courses may satisfy this requirement; they are approved on an individual basis.

### *Basic Engineering (5 courses)*

5 courses from at least four of the following eight areas:

- Thermodynamics
  Chemistry C42-1 Thermodynamics
  *May be taken alone or as prerequisite to ChE B11*
  ChE B11 Thermodynamics
  *Chemistry C42-1 is prerequisite*
  ME B20 Thermodynamics I
  *May not be taken with Chemistry C42-1 or ChE B11*
  ME C25 Kinetic Theory and Statistical Thermodynamics
  ME C70 Thermodynamics II
  MSc C21 Applications of Thermodynamics
- Fluids and solids
  BME B70 Introduction to Biomedical Fluid Mechanics
  ChE C21 Fluid Mechanics
  CE B16 Mechanics of Materials I
  CE B19 Continuum Mechanics I
  ME B41 Fluid Mechanics I
- Materials science
  MSc B01 Principles of the Properties of Materials
  *or* MScC01 ChemicalAspects ofEngineering Materials
  *or* MSc B03 Microstructure and Engineering Properties of Materials
- Electrical science
  ECE B41 Circuits I
  ECE B42 Circuits II
  ECE B70 Applications of Electronic Devices
  ECE C01 Fundamentals of Electromagnetics
- Systems engineering and analysis
  ChE B10 Analysis of Chemical Process Systems
  IEMS C19 Operations Research
  IEMS C26 Economics for Engineering I
- Computer engineering
  ECE B01 Introduction to Digital Logic Design
  ECE B05 Fundamentals of Computer Systems Software
  ECE B30 Programming for Computer Engineers
  ECE C16 Mini/Microcomputers and Real-Time Applications
  ECE C28 Numerical Methods for Engineers
- Computer science
  CS B11 Fundamentals of Computer Programming II
  CS B30 Introduction to Software Engineering
  CS C17 Data Management and Information Processing

• Probability, statistics, and quality control
  BME B20 Introduction to Biomedical Statistics
  ChE C12 Process Models by Statistical Methods
  CE C06 Uncertainty Analysis in Civil Engineering
  ECE C02 Probabilistic Systems and Random Signals
  IEMS B03 Probability
  IEMS C03 Statistics I
  ME C59 Reliability Engineering

### *Social Sciences/Humanities (7 courses)*

7 courses, which must be approved in advance by the McCormick Humanities Panel, chosen according to one of two options in the following three areas:
Social and behavioral sciences (SBS)
Historical studies and values (HSV)
Fine arts, language, and literature (FAL)

- Option A: At least 2 courses must be chosen in each area. Of the 7 courses, only 3 may be A-level introductory courses; 3 courses must be thematically related to provide depth.
- Option B: 5 of the 7 courses must be clearly thematically related. For breadth, no more than 5 courses may come from a single area.

### *Unrestricted Electives (5 courses)*

Students may take any credit course in the University. Course choices are open to students to enable technical or nontechnical exploration or extension.

### *Major Program (16 courses)*

Any program of study finds its depth or concentration in the 16 courses given to the major program of the curriculum. Each engineering curriculum provides considerable elective opportunity within these courses. The intent is to provide opportunity for individualization, but there is the necessity for coherence in the selection of elective courses. In accredited programs, the understanding is that certain criteria will be met, and guidance to this end is necessary. Accordingly, it is required that a plan of study listing intended selections be submitted for approval by the end of the eighth quarter of study (winter quarter of junior year).

Most curricula offer suggested areas of specialization or options that provide excellent guidance in use of electives. These course plans are available in the department or program offices or the McCormick Records Office and can be the basis for course planning. Alternately, self-designed plans may be submitted, but they should be worked out in consultation with a faculty adviser.

## Department Curricula

Students must meet not only the McCormick School curriculum requirement but also the specific requirement for the department curriculum being pursued. The following listings of these curricula present additional information or specifics to be used with the basic curriculum.

Some of the listed curricula contain specializations or options within the curriculum. These are for advice and guidance for elective course choice. For further details about the options/specializations within a particular program, consult with the department coordinator sponsoring that curriculum or check with the McCormick Records Office.

### *Applied Mathematics Curriculum*

**Total requirement**—48 courses

**Mathematics**—4 courses
Mathematics B14-1,2,3
Mathematics B15

**Engineering analysisandcomputerproficiency—**4 courses
General Engineering B05-1,2,3,4

**Basic sciences**—4 courses
Physics A35-2,3; 2 courses in chemistry, biological sciences, and/or earth sciences

**Design and communications**—3 courses

**Basic engineering**—5 courses
5 courses from at least four of the following areas: systems engineering and analysis, mechanics, thermodynamics, fluids and solids, materials science, electrical science, computer science

**Social sciences/humanities**—7 courses

**Unrestricted electives**—5 courses

**Major program**—16 courses

- Required courses—7 courses
  ESAM C11-1,2,3 Methods of Applied Mathematics
  3 courses from ESAM C22 Applied Dynamical Systems, ESAM C99 Projects, and ESAM D21-1,2,3 Models in Applied Mathematics
  ESAM C46 Computation in Science and Engineering
- Additional courses—3 courses from the following areas, atleast 1 in linear algebra and 1 in probability (suggested courses listed):
  Linear algebra: Mathematics C34 or IEMS C11
  Numerical analysis: ECE C28, D70, D71; ESAM D46-1,2
  Probability: IEMS C02,IEMS C03 *or* Mathematics C30-1,2,3 *or* ECE C02
- Engineering or the sciences—4 courses leading to an in-depth understanding of an area of application
- Technical electives—2 courses
  *Must be C-level or above in engineering, science, or mathematics*

### *Biomedical Engineering Curriculum*

**Total requirements**—48 courses

**Mathematics**—4 courses
Mathematics B14-1,2,3
Mathematics B15

**Engineeringanalysisand computerproficiency—**4 courses

General Engineering B05-1,2,3,4

**Basic sciences**—4 courses
Physics A35-2; Chemistry A01, A02, and A03 *or*
Chemistry A71, A72, and 1 more basic science course

**Design and communications**—3 courses

**Basic engineering**—5 courses from the following six areas, no more than 1 course per area:
Thermodynamics: Chemistry C42-1 or ME B20
Fluids and solids: CE B16, ME B41, ChE C21, or BME B70
Materials science: MSc B01 or C01
Electrical science: ECE B41 or B70
Computer engineering: ECE B01, C16, or C28
Probability, statistics, and quality control: BME B20, ChE C12, ECE C02, IEMS B03, IEMS C03, or ME C59

**Social sciences/humanities**—7 courses

**Unrestricted electives**—5 courses

**Major program**—16 courses at the B level or higher

- Core—7 courses
  Chemistry B10-1,2 Organic Chemistry
  Biological Sciences B10-2 Biochemistry and Molecular Biology
  2 quarters of BME C01, C02, C03 Systems Physiology *or* physiology in the Medical or Dental School
  BME C08 Biomedical Engineering Laboratory
  BME C90 Biomedical Engineering Design
- Areas of specialization—9 courses
  Students complete a course of study by selecting one of the five areas of specialization listed below or by developing an alternate set of courses with their adviser that is subsequently approved by the BME Undergraduate Committee. The specialization provides depth in one area of biomedical engineering. Specific course requirements are provided to students when they enter the department or may be obtained from the department office.
  Electronic instrumentation
  Mechanics
  Transport processes
  Biotechnology
  Biomedical signals and images

### *Chemical Engineering Curriculum*

**Total requirements**—48 courses

**Mathematics**—4 courses
Mathematics B14-1,2,3
Mathematics B15

**Engineering analysisand computerproficiency—**4 courses

General Engineering B05-1,2,3,4

**Basic sciences**—4 courses
Physics A35-2,3; Chemistry A02, A03 *or* A71, A72
*Chemistry A01, the prerequisite for Chemistry A02, must be taken as an unrestricted elective.*

**Design and communications**—3 courses

**Basic engineering**—5 courses
Thermodynamics: Chemistry C42-1, ChE B11
Fluids and solids: ChE C21
Materials science: MSc C01
Systems engineering analysis: ChE B10

**Social sciences/humanities**—7 courses

**Unrestricted electives**—5 courses

**Major program**—16 courses

- Required courses—11 courses
  Chemistry B10-1,2 Organic Chemistry
  Chemistry C43 Kinetics and Spectroscopy
  ChE B12 Equilibrium Separations
  ChE C07 Kinetics and Reactor Engineering
  ChE C22 Heat Transfer
  ChE C23 Mass Transfer
  ChE C41 Process Dynamics and Control
  ChE C42 Chemical Engineering Laboratory
  ChE C51 Process Economics, Design, and Evaluation
  ChE C52 Chemical Engineering Design Projects
- Advanced science electives—2 courses
  1 approved B- or C-level chemistry, physics, biological sciences, or materials science course; 1 B- or C-level chemistry course or equivalent (e.g., ChE C61 Introduction to Polymers)
- Areas of specialization—3 courses
  The remaining 3 courses are chosen from advanced engineering, mathematics, or science courses. They should be selected to fulfill one of the seven areas of specialization offered by the Department of Chemical Engineering. Students may select one of these programs or may petition the chemical engineering faculty for approval of other course selections in accordance with the overall departmental major program.
  Chemical process engineering
  Biomedical engineering
  Biotechnology
  Environmental engineering
  General chemical engineering
  Polymer science and engineering
  Process control and simulation

### *Civil Engineering Curriculum*

**Total requirements**—48 courses

**Mathematics**—4 courses
Mathematics B14-1,2,3
Mathematics B15

**Engineering analysisandcomputerproficiency—**4 courses

General Engineering B05-1,2,3,4

**Basic sciences**—4 courses
Physics A35-2; Chemistry A01, A02; Chemistry A03 or Physics A35-3

**Design and communications**—3 courses

**Basic engineering**—5 courses
Fluids and solids: CE B16 and ME B41
Thermodynamics: 1 course
Electrical science: 1 course
MSc B03 or 1 other course from systems engineering and analysis, computer science, or materials science

**Social sciences/humanities**—7 courses

**Unrestricted electives**—5 courses

**Major program**—16 courses
*10 must be CE courses*
- Basic civil engineering—6 courses
  CE B21 Theory of Structures I
  CE B22 Structural Steel Design
  CE B50 Introductory Soil Mechanics
  CE B60 Fundamentals of Environmental Engineering
  CE C40 Fluid Mechanics II
  CE C71 Introduction to Transportation Planning and Analysis
  *or* CE C76 Transportation System Operations
- Mathematical techniques and science—2 courses from approved list
- Technical electives—8 courses in mathematics, science, engineering, or other area supporting student's specialty. Any 2 of the 8 must be from an approved list of design and synthesis courses.

  Areas of specialization: Listed below are samples of some traditional areas of specialization, but students are encouraged with the help of their advisers to design a program that meets their own particular interests.
  Applied mechanics
  Structural engineering
  Geotechnical engineering
  Environmental engineering
  Transportation systems
  Construction

### *Computer Engineering Curriculum*

**Total requirements**—48 courses

**Mathematics**—4 courses
Mathematics B14-1,2,3
Mathematics B15

**Engineeringanalysisandcomputerproficiency—**4 courses
General Engineering B05-1,2,3,4

**Basic sciences**—4 courses
Physics A35-2,3; 2 courses from chemistry, biological sciences, or earth sciences

**Design and communications**—3 courses

**Basic engineering**—5 courses
Probability, statistics and quality control: ECE C02
Electrical science: ECE B41
Computer engineering: ECE B01 and B05
1 course from thermodynamics, fluids and solids, systems engineering and analysis, or materials science

**Social sciences/humanities**—7 courses

**Unrestricted electives**—5 courses

**Major program**—16 courses
- Required courses—8 courses
  ECE B30 Programming for Computer Engineers
  ECE B42 Circuits II
  ECE B50 Physical Electronics
  ECE C03 Advanced Digital Logic Design
  ECE C61 Computer Architecture
  CS C10 Mathematical Foundations of Computer Science
  CS C11 Data Structures and Data Management
  CS C43-1 Operating Systems
- Design requirement—1 course from
  ECE C47 Digital Electronic Systems Design Projects
  ECE C62 Computer Architecture Projects
  ECE C92 VLSI Systems Design Projects
  ECE C99 Projects, when C99 is a design project
- Technical electives—7 courses, including 4 from
  ECE C33 Introduction to Communication Networks
  ECE C46 Microprocessor System Design
  ECE C57 Design Automation in VLSI
  ECE C58 Introduction to Parallel Computing
  ECE C90 Introduction to Robotics
  ECE C91 VLSI Systems Design
  CS C22 Compiler Construction
  CS C94 Software Project Management and Development
  Plus 3 courses from the previous group or from
  ECE B43 Signals and Systems
  ECE C01 Fundamentals of Electromagnetics
  ECE C06 Electronic Circuits
  ECE C28 Numerical Methods for Engineers
  ECE C32 Digital Image Analysis
  ECE C53 Digital Electronic Circuits and Systems
  ECE C59 Digital Signal Processing
  ECE C60 Introduction to Feedback Systems
  ECE C74 Introduction to Digital Control
  BME C84 Biomedical Computing
  CS C36 Design and Analysis of Algorithms
  CS C39 Introduction to Database Systems
  CS C51 Introduction to Computer Graphics

*A grade of C– or better is required in each of ECE B01, B05, B41, and B42 for continuation in the computer engineering program.*

### *Computer Science Curriculum*

**Total requirements**—48 courses

**Mathematics**—4 courses
Mathematics B14-1,2,3
1 course from computer science mathematics list

**Engineering AnalysisandComputerProficiency—**4 courses
General Engineering B05-1,2,3; CS A11

**Basic sciences**—4 courses, including
Physics A35-2

**Design and communications**—3 courses

**Basic engineering**—5 courses, including
Computer Science: CS B11
Probability, statistics, and quality control: 1 course
3 other courses chosen from the basic engineering list, excluding computer science courses

**Social sciences/humanities**—7 courses

**Unrestricted electives**—5 courses

**Major program**—16 courses

- Required courses—8 courses
  CS C11 Data Structure and Data Management
  7 courses from
  CSB30 Introduction to Software Engineering
  CSC10 Mathematical Foundations of Computer Science
  CSC11 Data Structures and Data Management
  CSC14 Applied Artificial Intelligence
  CSC17 Data Management and Information Processing
  CSC20 Formal Languages and Automata Theory
  CSC22 Compiler Construction
  CSC25 Artificial Intelligence Programming
  CSC27 Intelligent Information Management Systems
  CSC32 Introduction to Computer Vision
  CSC36 Design and Analysis of Algorithms
  CSC37 Natural Language Processing
  CSC39 Introduction to Database Systems
  CSC43 Operating Systems
  CSC44 Design of Computer Problem Solvers
  CSC48 Introduction to Artificial Intelligence
  CSC49 Introduction to Theorem Proving
  CSC50 Introduction to Computational Linguistics
  CSC51 Introduction to Computer Graphics
  CSC52 Applied Combinatorics
  CSC54 Introduction to the Theory of Parallel Computation
  CSC94 Software Project Management and Development
  CSC95 Special Topics in Computer Science
  CSC99 Projects
- Technical electives—8 courses
  4 courses from the advanced computer science list; 2 from any of the three lists below; and the remaining 2 unrestricted, subject to the approval of the student's department adviser
- Project work
  The courses above must be chosen to include two quarters of project work, resulting in the construction and demonstration of a proposed solution to some organization's problem. Projects must be approved by a faculty adviser beforehand. Project work will typically occur in independent study projects (CS C99) or in project-oriented courses (e.g., CS C94).

  Courses at the D level are primarily for graduate students but may be open to advanced undergraduate students with permission. CS A10 may be used as an unrestricted technical elective if taken before CS A11. Technical electives may not satisfy other requirements.

*Computer science mathematics list:*
CS C10 Mathematical Foundations of Computer Science
CS C52 Applied Combinatorics
Mathematics B15 Multiple Integration and Vector Calculus
Mathematics B21 Elementary Differential Equations
Mathematics C08 Foundations of Higher Mathematics
Mathematics C10 Introduction to Real Analysis
MathematicsC35 Introduction tothe Theory of Numbers
Mathematics C37 Introduction to Modern Algebra

*Computer science external technical elective list:*
Mathematics C13 Chaotic Dynamical Systems
IEMS C13 Deterministic Models and Optimization
IEMS C15 Stochastic Models and Simulation
IEMS C19 Operations Research
IEMS C28 Location Analysis and Spatial Planning
IEMS C34 Systems Project Management I, II
IEMS C35 Systems Simulation
Statistics C20 Statistical Methods
ESAM C11 Methods of Applied Mathematics
ECE C13 Telecommunication Networks for Multimedia
ECE C28 Numerical Methods for Engineers
ECE C53 Digital Electronic Circuits and Systems
ECE C57 Design Automation in VLSI

*Advanced computer science list:*
CS C10 Mathematical Foundations of Computer Science
CS C11 Data Structures and Data Management
CS C14 Applied Artificial Intelligence
CS C17 Data Management and Information Processing
CS C20 Formal Languages and Automata Theory
CS C22 Compiler Construction
CS C25 Artificial Intelligence Programming
CS C27 Intelligent Information Management Systems
CS C32 Introduction to Computer Vision
CS C36 Design and Analysis of Algorithms
CS C37 Natural Language Processing
CS C39 Introduction to Database Systems
CS C43 Operating Systems
CS C44 Design of Computer Problem Solvers
CS C48 Introduction to Artificial Intelligence
CS C49 Introduction to Theorem Proving
CS C50 Introduction to Computational Linguistics
CS C51 Introduction to Computer Graphics
CS C52 Applied Combinatorics
CS C54 Introduction to the Theory of Parallel Computation
CS C94Software Project Management and Development
CS C95 Special Topics in Computer Science
CS C99 Projects

### *Electrical Engineering Curriculum*

**Total requirements**—48 courses

**Mathematics**—4 courses
Mathematics B14-1,2,3
Mathematics B15

**Engineering analysisandcomputerproficiency—**4 courses

General Engineering B05-1,2,3,4

**Basic sciences**—4 courses
Physics A35-2,3; 2 chemistry courses

**Design and communications**—3 courses

**Basic engineering**—5 courses
Thermodynamics: ME B20
Electrical science: ECE B41 and C01
*A grade of C– or better in ECE B41 required for registration in ECE B42 or ECE B50.*
Computer engineering: ECE B01
Probability, statistics, and quality control: ECE C02

**Social sciences/humanities**—7 courses

**Unrestricted electives**—5 courses

**Major program**—16 courses
- Required courses—9 courses
  ECE B42 Circuits II
  *A grade of C– or better in ECE B42 required for regis-tration in ECE C06, C60, C65, and C66.*
  ECE B43 Signals and Systems
  ECE B50 Physical Electronics
  ECE C06 Electronic Circuits
  ECE C07 Communications
  ECE C08 Applications of Electromagnetic Fields
  ECE C53 Digital Electronic Circuits and Systems
  ECE C60 Introduction to Feedback Systems
  ECE C81 Electrical Materials: Properties and Applications
- Technical electives—6 courses
  A technical elective is any C-level science, mathematics, computer science, or engineering course. The B-level courses ECE B05 Fundamentals of Computer System Software and Chemistry B10-1 Organic Chemistry are accepted also as technical electives. The distribution of such courses must constitute a viable and educationally sound program for electrical engineering. In particular, this means that all students must choose a technical electives program that, with their other course work, satisfies ABET requirements for engineering science and engineering design content. At least 4 of the 6 technical electives must be in ECE.
- Design requirement—1 course from
  ECE C41 Design of Real-Time Digital Systems
  ECE C46 Microprocessor System Design
  ECE C47 Digital Electronic Systems Design Projects
  ECE C91 VLSI Systems Design
  ECE C96 Engineering Design and Entrepreneurship
  ECE C98 ElectricalEngineering Design
  ECE C99 Projects (when C99 is a design project)

### *Engineering Science Curriculum*

**Total requirements**—48 courses

**Mathematics**—4 courses
Mathematics B14-1,2,3; B15

**Engineering analysisand computerproficiency—**4 courses

General Engineering B05-1,2,3,4

**Basic sciences**—4 courses
Physics A35-2,3; any 2 from Chemistry A01, A02, Biological Sciences B10-1,2

**Design and communications**—3 courses

**Basic engineering**—5 courses
Thermodynamics: ChE B11 or ME B20
Fluids and solids: CE B16 and ME B41 *or* BME B70
Materials science: MSc B01
Electrical science: ECE C01

**Social sciences/humanities**—7 courses

**Unrestricted electives**—5 courses

**Major program**—16 courses
Required courses—7 courses
ESAM C11-1,2 Methods of Applied Mathematics
3 courses from ESAM C22 Applied Dynamical Systems, ESAM C99 Projects, and ESAM D21-1,2,3 Models in Applied Mathematics
IEMS C01 Introduction to Statistics and C02 Probability *or* Mathematics C30-1,2 Probability and Statistics
Areas of specialization—9 courses
Chosen from C- and D-level offerings in engineering, science, or mathematics. Some part of the selection should constitute an area of specialization. Consent of the departmental adviser is required.

### *Environmental Engineering Curriculum*

**Total requirements**—48 courses

**Mathematics**—4 courses
Mathematics B14-1,2,3
Mathematics B15

**Engineering analysisand computerproficiency—**4 courses

General Engineering B05-1,2,3,4

**Basic sciences**—4 courses
Physics A35-2; Chemistry A01, A02, A03

**Design and communications**—3 courses

**Basic engineering**—5 courses
Thermodynamics: Chemistry C42-1
Fluids and solids: ME B41
Electrical science or materials science: 1 course
Probability, statistics, and quality control: 1 course
Systems engineering and analysis: IEMS C26

**Social sciences/humanities**—7 courses

**Unrestricted electives**—5 courses

**Major program**—16 courses
- Core—11 courses
  Chemistry B10-1 Organic Chemistry
  CE B60 Fundamentals of Environmental Engineering
  CE B61 Environmental Engineering Analysis
  CE B67 Chemistry of the Natural Environment
  CE C40 Fluid Mechanics II
  CE C60 Environmental Impact Evaluation
  CE C61 Public Health Engineering
  CE C63 Community Air Pollution
  CE C64 Sanitary Engineering
  CE C66 Ecosystems and Ecotoxicology
  CE C67 Aquatic Chemistry
- Design—1 course from
  CE C68 Industrial Hygiene and Environmental Control
  CE C70 Environmental Engineering Design
- Technical electives—4 courses
  2 courses from approved list
  2 courses, B level or higher, in engineering or CAS mathematics or science

### *Industrial Engineering Curriculum*

**Total requirements**—48 courses

**Mathematics**—4 courses
Mathematics B14-1,2,3
Mathematics B15

**Engineering analysisandcomputerproficiency—**4 courses
General Engineering B05-1,2,3,4

**Basic sciences**—4 courses
Physics A35-2; Physics A35-3 and 2 other courses *or* Chemistry A01, A02, A03

**Design and communications**—3 courses

**Basic engineering**—5 courses
IEMS C26; ECE B30; CS C17 or ECE C28; and 2 courses chosen from two of the following areas: fluids and solids, thermodynamics, materials science, electrical science

**Social sciences/humanities**—7 courses

**Unrestricted electives**—5 courses

**Major program**—16 courses
- Probability and statistics—2 courses
  IEMS C02 Probability
  IEMS C03 Statistics I
- Operations research—3 courses
  IEMS C13 Deterministic Models and Optimization
  IEMS C15 Stochastic Models and Simulation
  IEMS C35 Systems Simulation
- Applied behavioral science—1 course
  IEMS C40 Field Project Methods
- Senior design project—2 courses
  IEMS C34-1,2 Systems Project Management I, II
  *or* IEMS C36-1,2 Industrial Engineering Design Project I, II
- Electives—8 courses
  3 methodology courses; 3 applications courses; and 2 courses from any B-level or higher engineering or CAS mathematics, science, statistics, or economics courses (P/N is permitted only in the last group). At least 6 of these must be engineering courses, including 4 IEMS courses. Students must receive at least a half-year of engineering design experience through the electives.
  The undergraduate industrial engineering coordinator can provide a list of electives by category.

### *Manufacturing Engineering Curriculum*

**Total requirements**—48 courses

**Mathematics**—4 courses
Mathematics B14-1,2,3
Mathematics B15

**Engineeringanalysisandcomputerproficiency—**4 courses
General Engineering B05-1,2,3,4

**Basic sciences**—4 courses
Physics A35-2,3; Chemistry A01, A02

**Design and communications**—3 courses

**Basic engineering**—5 courses
Thermodynamics: ME B20 recommended
Materials science: MSc B01 recommended
Electrical science: ECE B70 recommended
Systems analysis: IEMS C19 and IEMS C26

**Social sciences/humanities**—7 courses

**Unrestricted electives**—5 courses

**Major program**—16 courses
- Core—10 courses
  Computerprogramming:ECE A01, CS A10,orECE B30
  CE B16 Mechanics of Materials I
  IEMS B03 Probability and Statistics for Engineers
  *or* IEMS C01 Introduction to Statistics
  IEMS C05 Statistical Methods for Quality Improvement
  IEMS C29 Production Planning and Scheduling
  ECE C16 Mini/Micro Computers and Real-Time Applications
  *or* CS C17 Data Management and Information Processing
  *or* IEMSC30 Information Technology in Manufacturing
  MSc C17 Materials in Manufacturing
  ME B40 Introduction to Mechanical Design and Manufacturing
  ME C40-1,2 Computer-Integrated Manufacturing
- Senior design project—2 courses from a single engineering department. The following are preapproved options; other options are available by petition.
  ChE C51 Process Economics, Design, and Evaluation and ChE C52 Chemical Engineering Design Projects
  ECE C99 Projects (2 units)
  IEMS C34-1,2 Systems Project Management I, II
  IEMS C36-1,2 IndustrialEngineering DesignProject I,II
  ME C98 Engineering Design and ME C99 Projects
  MSc C96-1,2 Senior Project in Materials Science and Engineering
- Technical electives—4 courses from the approved list, which is updated annually by the manufacturing engineering curriculum committee and the IEMS department

### *Materials Science and Engineering Curriculum*

**Total requirements**—48 courses

**Mathematics**—4 courses
Mathematics B14-1,2,3
Mathematics B15

**Engineering analysisandcomputerproficiency—**4 courses
General Engineering B05-1,2,3,4

**Basic sciences**—4 courses
Physics A35-2,3;Chemistry A02andA03 *or* A71andA72

**Design and communications**—3 courses

**Basic engineering**—5 courses, including
Fluids and solids: CE B16 or CE B19
Thermodynamics: Chemistry C42-1 and MSc C21
Materials science: MSc B01
Elective: selected from electrical science, systems engineering and analysis (IEMS C26 recommended), or computer science or computer engineering

**Social sciences/humanities**—7 courses

**Unrestricted electives**—5 courses
MSc A90 recommended

**Major program**—16 courses
- Required courses—11 courses
  MSc C16-1,2 Microstructural Dynamics I, II
  MSc C31 Physical Properties of Polymers
  MSc C32 Mechanical Behavior of Solids
  MSc C51-1,2 Introductory Physics of Materials I, II
  MSc C61 Crystallography and Diffraction
  MSc C90 Materials Design
  MSc C91 Process Design
  MSc C96-1,2 Senior Project I, II
- Technical electives—5 courses
  Each student must choose the remaining courses in a consistent manner to fulfill an area of concentration. These courses may be in engineering, natural sciences (usually chemistry or physics), and mathematics. At least 2 of the 5 technical electives must be from materials science and engineering. No more than 2 of the 5 courses may be B-level courses. Advanced mathematics courses such as the following are strongly recommended:
  Mathematics C05 Complex Variables for Applications
  ESAM C11-1,2,3 Methods of Applied Mathematics

  Examples of programs for concentrations in biomaterials, electronic materials, metals and ceramics, polymeric materials, and surface science are described in a departmental manual for majors.

### *Mechanical Engineering Curriculum*

**Total requirements**—48 courses

**Mathematics**—4 courses
Mathematics B14-1,2,3
Mathematics B15

**Engineeringanalysisand computerproficiency—**4 courses
General Engineering B05-1,2,3,4

**Basic sciences**—4 courses
Physics A35-2,3; Chemistry A01, A02, *or* A71, A72

**Design and communications**—3 courses

**Basic engineering**—5 courses
Thermodynamics: ME B20
Fluids and solids: CE B16, ME B41
Materials science: MSc B01 or MSc B03
Electrical science: ECE B70
*Students planning to take advanced ECE courses as electives may substitute ECE B41 Circuits I.*

**Social sciences/humanities**—7 courses

**Unrestricted electives**—5 courses

**Major program**—16 courses
- Required courses—10 courses
  ME B02 Mechanics II
  ME B24 Experimental Engineering I
  ME B40 Introduction to Mechanical Design and Manufacturing
  ME C14 Theory of Machines—Dynamics
  ME C15 Theory of Machines—Design of Elements
  ME C70 Thermodynamics II
  ME C73 Engineering Fluid Mechanics
  ME C77 Heat Transfer
  ME C90 Introduction to Dynamic Systems
  ME C91 Fundamentals of Control Systems I *or* ECE C60 Introduction to Feedback Systems
- Options—6 courses
  *General option:*
  2 C-level mechanical engineering courses
  3 C-level technical electives
  1 design course from the following:
  ME C40-2 Computer Integrated Manufacturing
  ME C66 Finite Elements for Design and Optimization
  ME C98 Engineering Design
  Options are also available in biomedical engineering, energy, intelligent mechanical systems, manufacturing, solid mechanics, and design. The 6 courses making up each of these options are contained in a listing that may be obtained from the department office.

## Combined Studies Program

For students whose particular interests and goals cannot be satisfied by one of the regular programs of study in engineering or applied science, the Combined Studies Program provides an alternative. If endorsed and guided by three faculty members and approved by the McCormick School Curriculum Committee, an ad hoc curriculum leading to the bachelor of science degree may be pursued.

Available courses may be combined in a variety of interdisciplinary plans as long as the all-school specification of eight basic components is met. Some examples of combined studies programs entered into in recent years include such titles as public health, engineering physics, biomedical engineering and molecular biology, and computers and mechanical design.

Students interested in the Combined Studies Program should consult with the associate dean for undergraduate engineering.

## General Engineering Courses

**703-A06-1,2 Engineering Design and Communications** Integrated introduction to the engineering design process and technical communication. Approaches to unstructured and poorly defined problems; conceptual and detailed design; team structure and teamwork; project planning; written, oral, graphical, and interpersonal communications; use of software tools; discussion of societal and business issues. One lecture, two workshops, lab. Registration for both quarters required.

**703-B05-1,2,3,4 Engineering Analysis 1.** Introduction to linear algebra from computational, mathematical, and applications viewpoints. Computational methods using a higher-level software package, such as Matlab. **2.** Linear algebra and introduction to vector methods in engineering analysis. Statics and dynamics of rigid bodies and matrix analysis of trusses and networks. Engineering design problems. **3.** Dynamic behavior of the elements. Modeling of mechanical(both translational and rotational), electrical, thermal, hydraulic, and chemical systems composed of those elements. **4.** Solution methods for ordinary differential equations, including exact, numerical, and qualitative methods. Applications and modeling principles; solution techniques.

**703-A90-0 Engineering Freshman Seminar** Subjects of current interest in broad engineering or interdisciplinary areas.

**703-B20-0 Analytic and Computer Graphics** Microcomputer-aided drawing (CAD) for graphical three-dimensional problem solving and presentation.

## Biomedical Engineering

Biomedical engineers solve problems in the life sciences and clinical medicine by applying engineering and mathematical techniques. This approach has been fruitful where a descriptive approach is no longer adequate for studying complex systems involved in the body's transport, regulation, and information processing. Equally important has been the development of devices used inside or outside the body to replace or supplement physiological functions and to enhance the quality of diagnosis and care. Thus, biomedical engineering refers to the application of engineering techniques to problems in medicine and biology.

The interplay among the physical sciences, engineering, biology, and the medical sciences takes many forms. The traditional study of complex systems, whether for power transmission, communications, or the operation and control of industrial processes, has provided engineers with a number of concepts and techniques that proved valuable in analysis and design. These principles expressed in mathematical form are applicable to a wide range of phenomena, including those in biological processes. Information theory, statistics, and computer technology have opened new areas for exploration of sensory and central nervous activity as well as patient handling and diagnosis. Theories for feedback controls, transport processes, materials science, and mechanics provide new insight into homeostatic physiological processes. Analysis of heat transfer, fluid flow, and chemical-process control in living organisms requires competence in both engineering and the life sciences. Current studies help provide understanding of many physiological processes. This understanding, in turn, leads to improvements in clinical practice, diagnosis, and patient care.

### Undergraduate Program

Northwestern was among the first schools to recognize the value of a biomedical engineering background, and today the Department of Biomedical Engineering offers, at both the undergraduate and graduate levels, one of the largest and broadest programs in the country. The primary path interested students may follow is the biomedical engineering program administered by the biomedical engineering department. Alternative curricula are the biomedical options in other engineering departments.

The biomedical engineering program provides biomedical training that is quantitative, emphasizes problem solving, and treats phenomena from the molecular to the systems level. This curriculum prepares students for careers in dentistry, medicine, and/or research or with corporations in the health care industry. Required courses in mathematics, engineering, and science establish a strong foundation on which to build a biomedical framework. In addition, each student selects one sequence of courses with which to develop an area of specialization.

### Areas of Specialization

All areas are suitable for students planning to enter medical school, continue their biomedical engineering education in graduate school, or pursue careers in the biomedical industry or hospitals.

#### *Electronic Instrumentation*

Electronic instruments are used widely in the diagnosis and treatment of disease and in the study of normal physiological function. Students in this area learn the fundamentals of electronic and computer (hardware and software) instrumentation.

#### *Mechanics*

Solid (e.g., musculoskeletal) and fluid (e.g., cardiovascular, pulmonary) mechanics are applied to human physiology in the design and manufacture of limb prostheses or artificial organs. Students in this area learn the fundamental engineering principles needed for this work.

### *Transport Processes*

The study of transport processes in living tissue is important in understanding blood flow, lung ventilation, and oxygen transport to and from red blood cells to various tissue beds. Students in this area learn the fundamental chemical engineering principles that relate to these processes.

### *Biotechnology*

Biochemical engineering, biochemistry, molecular biology, and biosensors are components of the broad field that goes under the name biotechnology. Students in this area learn the various aspects of biotechnology from the engineer's perspective.

### *Biomedical Signals and Images*

The application of imaging, signal processing, and signal analysis to biomedical problems has become an important part of medicine. MRI, CT-imaging, PET, EKG, and EEG are all examples of physiological signals. Students in this area learn the physiology that underlies these signals and the engineering that underlies their recording and analysis.

## Curriculum

Students earning a biomedical engineering degree must obtain a minimum of 18 total course credits in engineering design and engineering science and have obtained substantial training in design.

Students seeking admission to dental or medical school should be familiar with the entrance requirements of those schools to which they intend to apply. In addition to the specifically required courses of the biomedical engineering program, many professional schools also require additional courses in physics, organic and/or physical chemistry, and laboratory biology. These requirements may be satisfied by judicious use of electives.

## Courses Primarily for Undergraduates

**765-A70-0 Introduction to Biomedical Engineering** Emphasis on areas of medicine and physiology where engineering techniques are particularly useful or where a clear need exists for an engineering approach.

**765-B01-0 Biology for Engineers** A survey of biological topics relevant to engineering, focusing on cellular and molecular biology, population growth, and species formation. Prerequisites: Mathematics B14-1 and Chemistry A01 or A71.

**765-B20-0 Introduction to Biomedical Statistics** Basic statistical concepts presented with emphasis on their relevance to biological and medical investigations.

**765-B70-0 Introduction to Biomedical Fluid Mechanics** Fundamentals of fluid mechanics and their applications to biological systems.

**765-C01-0 Systems Physiology** Functional/structural aspects of mammalian nervous system. Neural biophysics. Laboratory exercises. Prerequisites: Physics A35-2 and junior standing.

**765-C02-0 Systems Physiology** Cardiovascular and respiratory physiology. Human physiology from a quantitative viewpoint. Anatomy and pathology, where appropriate. Prerequisite: Mathematics B14-3.

**765-C03-0 Systems Physiology** Cellular mechanisms of and quantitative systems approach to human renal, digestive, endocrine, and metabolic physiology. Prerequisite: Biological Sciences B10-2; junior standing recommended.

**765-C08-0 Biomedical Engineering Laboratory** Laboratory and associated lecture concerning quantitative physiology, testing, and evaluation of biomedical apparatus. Prerequisites: At least 2 from C01, C02, and C03; ECE B41 or B70. Preference given to seniors in BME.

**765-C10-0 Molecular and Cellular Aspects of Bioengineering** Molecular/cellular structure and function, mechanical influences on biological systems, molecular/cellular experiments. Prerequisites: Biological Sciences B10-2 and CE B12.

**765-C14-0 Models of Biochemistry and Molecular Biology** Mathematical modeling of biochemical and molecular biological problems, such as allosteric enzymes, bacterial transduction, X-ray diffraction, study of DNA.

**765-C15-0 Application of Genetic Engineering to Immunochemistry** Recent developments in genetic engineering as applied to the rapidly developing field of immunochemistry for antibodies and related proteins.

**765-C17-0 Biochemical Sensors** Theory, design, and applications of chemical sensors used in medical diagnosis and patient monitoring. Electrochemical and optical sensors. Prerequisites: chemistry through B10-2; physics through A35-3.

**765-C20-0 Biomedical Signals and Imaging** Fundamentals of signals and systems, time and frequency domain issues. Fourier series and transforms, convolution, frequency response, filtering, and laboratories in biomedical systems and imaging. Prerequisites: Mathematics B21 and Physics A35-3.

**765-C21-0 Theory and Control of Biological Systems** Linear control theory, mathematical foundations, transfer functions, modeling of biological systems, stability. Prerequisite: Mathematics B21.

**765-C22-0 Mathematical Modeling of Physiological Systems** Analysis and modeling of physiological systems. System identification. Traditional approaches. White noise method. Prerequisites: C01, C02, or C03; C20.

**765-C23-0 Visual Science** Mammalian visual system. Optics of the eye. Visual image representation and interpretation. Visual adaptation. Motion. Color vision. Prerequisite: Physics A35-2.

**765-C25-0 Introduction to Medical Imaging** Diagnostic X rays; X-ray film and radiographic image; computed tomography; ultrasound. Prerequisites: C20 and Physics A35-3 or equivalent.

**765-C26-0 Physiological Imaging** Medical images applied to physiological measurement. Tomographic reconstruction. Related digital angiography techniques. Computer exercises in image manipulation.

**765-C27-0 Magnetic Resonance Imaging** Nuclear magnetic resonance; two-dimensional Fourier transform, spin-echo and gradient-echo imaging; gradient and RF hardware. Prerequisites: C20 and Physics A35-3.

**765-C38-0 Interaction of Laser Radiation with Tissue** Propagation, scattering, and absorption of light in biological materials. Modeling of diagnostic and therapeutic uses of light. Engineering evaluation of laser-based clinical systems. Prerequisite: junior standing or higher.

**765-C43-0 Biomaterials and Medical Devices** Structure-property relationships for biomaterials. Metal, ceramic, and polymeric implant materials and their implant applications. Interactions of materials with the body. Prerequisite: senior standing.

**765-C44-0 Biological Performance of Materials** Structure-property relationships of materials, physical chemistry of surfaces and interfaces, materials-tissue interactions, applications to the selection and design of materials for medical implants and devices. Prerequisite: MSc B01.

**765-C46-0 Tissue Engineering** *In vivo* molecular, cellular, and organ engineering, with an emphasis on the foundations, techniques, experiments, and clinical applications of tissue engineering. Prerequisites: Biological Sciences B10-2 or ChE C75, CE B12.

**765-C50-0 Transport Fundamentals** Fundamental and biomedical applications of diffusive and convective heat and mass transfer. Prerequisites: B70 and Mathematics B14-3.

**765-C62-0 Musculoskeletal Biomechanics** Introductory class presenting the fundamentals of orthopaedic biomechanics. Topics include mechanical properties of bone, cartilage, ligament, tendon, and muscle. Prerequisite: CE B12.

**765-C65-0 Control of Human Limbs and Their Artificial Replacements** Human movement, biomechanics, skeletal and muscular anatomy, comparative anatomy, muscle physiology, and locomotion. Engineering design of artificial limbs. Prerequisite: senior standing with engineering or physical science background.

**765-C66-0 Biomechanics of Movement** Engineering mechanics applied to analyze human movement, including models of muscle and tendon, kinematics of joints, and dynamics of multijoint movement. Applications in sports, rehabilitation, and orthopaedics. Prerequisite: ME B02 or consent of instructor.

**765-C71-0 Mechanics of Biological Tissues** Stress and strain for small and large deformations. Nonlinear elastic, viscoelastic, pseudoelastic, and biphasic models. Prerequisite: CE B16 or equivalent.

**710-C71-0 Transport Phenomena in Living Systems** See Chemical Engineering.

**765-C72-0 Hemodynamics** Mechanical aspects of the human circulation system. Blood and blood vessel rheology. Pressures and flows in the arterial system. Prerequisites: B70; C02 or D02 or consent of instructor.

**765-C73-0 Cardiac Mechanics** Mechanical behavior of isolated muscle fibers, ventricular walls, and isolated ventricles. Interactions between ventricles and circulation systems. Prerequisite: C71, CE B16, or consent of instructor.

**765-C75-0 Pulmonary Mechanics** Basic physiology of lung function and its mechanical aspects, including tissue viscoelasticity, airway instability, mucus transport, interfacial phenomena, gas exchange, cellular biomechanics, air flow and its limitation. Prerequisites: B70 and Mathematics B21.

**765-C77-0 Intermediate Fluid Mechanics** Fundamental concepts of fluid dynamics. Kinematics, maaso and momentum balances, constitutive relations. Navier-Stokes equations and methods of solution. Sealing techniques. Prerequisite: B70 or consent of instructor.

**765-C79-0 Artificial Organs** Basic transport process analyses. Engineering analyses and design of artificial organs: kidneys, lungs, hearts, pancreas, liver. Comparison of natural/artificial organ function. Prerequisites: C02 and C03 or D02 and D03; a heat and/or mass transport course.

**765-C80-0 Biomedical Transducers and Instrumentation** Instrumentation to quantify temperature, displacement, force, pressure, sound, and flow. Optical spectroscopy and electrodes. Prerequisite: senior standing in engineering.

**765-C83-0 Cardiovascular Instrumentation** Theory, design, and application of instrumentation used for diagnosis, monitoring, treatment, and research investigation of cardiac and cardiovascular diseases. Examples from the current literature. Prerequisite: ECE B41, B70, or equivalent or consent of instructor.

**765-C84-0 Biomedical Computing** Principles of modern (computer-based) medical instrumentation, including analogy vs. digital design trade-offs, efficient digital filter designs, and algorithms for physiological signal processing, automated event recognition, and classification. Prerequisites: ECE C06, B70, or equivalent and some experience in computer programming or consent of instructor.

**765-C90-0 Biomedical Engineering Design** Design strategy and concepts, including reliability, safety, ethics, economic analysis, and marketing. FDA regulations and patents. Prerequisite: senior standing in BME.

**765-C95-0 Special Topics in Biomedical Engineering**

**765-C99-0 Projects**

## Chemical Engineering

Chemical engineering is concerned primarily with the principles and processes involved in the conversion of raw materials into products vital to modern civilization. The products of the chemical and process industries range from antibiotics to zirconium, from petroleum to plutonium, from agricultural chemicals to plastics and synthetic rubber. The rapid introduction of new products by the chemical process industries gives chemical engineering its characteristic concern with the management and development of innovation. Preparation for careers in chemical engineering requires a comprehension of physical, chemical, and engineering principles. The program aims at developing people who can plan, design, and operate new processes and who may have potential for managerial responsibility in highly technical industrial enterprises.

The Department of Chemical Engineering curriculum provides this broad fundamental training and prepares graduates for the chemical and process industries or advanced study. The first two years are devoted largely to mathematics, physics, and chemistry. After this, the fundamentals of chemical engineering fall into two sequences: the chemical process principles, emphasizing thermodynamics and kinetics of chemical change, and the transport processes, emphasizing the transfer of mass, momentum, and thermal energy in the physical handling of substances and in their heating, cooling, separation, and purification. Theoretical principles and practical applications are then integrated in courses in systems design and control. Supporting courses in allied fields of engineering and the sciences broaden the technical proficiency of chemical engineers, while courses in the social sciences, humanities, and arts deepens their background in the common hopes and problems of humanity.

### Areas of Specialization

The curriculum permits students to select an area of specialization and to develop background for further study at the graduate level or for application to specific industries. Students are encouraged to select one of the seven areas listed below or to plan an alternate program with an adviser. There are numerous electives in the basic program, and students are urged to give early consideration to planning for effective use of these opportunities.

#### *Chemical Process Engineering*

The chemical process engineering option is designed to prepare students for many areas, including design, operations, research, and management. Recommended for students who want a broad background in chemical engineering, it provides preparation for employment in many fields, including the chemical process and petroleum industries. It is also good preparation for graduate work in chemical engineering or other areas, both technical and nontechnical.

#### *Biomedical Engineering*

Increasing numbers of chemical engineers enter medical school and work in related areas such as pharmaceutical production, biomedical materials, and artificial organs. The biomedical engineering option satisfies the needs of these students by adding courses in biology, biochemistry, and biomedical engineering to the foundation in chemical engineering. Students therefore can prepare for careers in medicine or biomedical engineering as they obtain a degree in chemical engineering.

#### *Biotechnology*

Biotechnology is the industrial exploitation of biological systems or processes. Microorganisms are employed for production of food, beverages, antibiotics, and solvents as well as for waste treatment. Advances in genetic engineering have led to the production (in animal cells, yeast, and bacteria) of a wide range of enzymes, growth factors, hormones, immunoregulators, and monoclonal antibodies for use in disease diagnosis and therapy. Animal cells and microorganisms produce chemicals via a complex network of tightly regulated chemical reactions, making biotechnology a natural extension of chemical engineering. The biotechnology option provides the background necessary to apply chemical engineering skills in biological systems, especially for process optimization, control, scale-up, and product recovery.

#### *Environmental Engineering*

Means for improving the quality of our environment, disposing of wastes, and devising waste-free processes often involve chemical processing. The development, construction, and operation of these processes increasingly involves chemical engineers in a leading role. The next decade will see the replacement of many present industrial processes by new ones designed to eliminate or minimize waste products, requiring imaginative engineering. The environmental engineering specialization offers students a way to add special competence in environmental and civil engineering concerns to a chemical engineering degree and to prepare for attacking environmental problems.

### *Polymer Science and Engineering*

Synthetic polymers are large molecular substances that now provide the basis for the plastics, fiber, and rubber industries. Synthetic polymers are used in fields as diverse as the automotive industry, pollution abatement, low-cost housing, and biomedical engineering and indeed wherever needs exist for new materials with unique properties. The polymer field requires a knowledge of chemistry and some background in materials science in combination with expertise in chemical engineering, especially in transport processes. The option in polymer science and engineering provides training to undergraduates considering working in the field or going to graduate school.

### *Process Control and Simulation*

The chemical process industries have long been concerned with the optimal design and control of large-scale systems. In recent years, chemical engineers have played a significant role in the continued evolution of control systems theory and applications and have been instrumental in the use of modern computing methods for such tasks. The process control and simulation specialty provides background for immediate applications or graduate study.

### *General Chemical Engineering*

This option provides flexibility for students who desire exposure to a wide range of topics or who wish to specialize in fields of science or engineering not listed above.

## Laboratories

The Undergraduate Chemical Engineering Laboratory provides facilities for exploring firsthand the quantitative experimental implications of fundamental laws in their application to practical problems of heat transfer, gas absorption, distillation, and other basic operations. Process dynamics and automatic control principles are studied in the Process Dynamics and Control Laboratory, which is furnished with typical control equipment plus a number of personal computers. A computing laboratory is used in a variety of courses. Chemical laboratory experience is also a part of the polymer course.

## Courses Primarily for Undergraduates

**710-A90-0 Survey of Chemical Engineering Concepts and Opportunities** Application of chemical engineering principles illustrated by examples from the chemical, petroleum, food processing, pharmaceutical, electronics, and other industries. Impact of economics, ethics, and other nontechnical constraints.

**710-B10-0 Analysis of Chemical Process Systems** Introduction to process systems. Material balances and stoichiometry. Analysis of process system flow sheets. Introduction to departmental computing facilities. Basic numerical analysis. Prerequisites: Chemistry A03, ECE A01, and Mathematics B21; may take Mathematics B21 concurrently.

**710-B11-0 Thermodynamics** The first and second laws of thermodynamics. Entropy and equilibrium. Material and energy balances. Equations of state and properties of fluids. Solutions, phase equilibria, and chemical reactions. Prerequisites: B10 and Chemistry C42-1.

**710-B12-0 Equilibrium Separations** Design and analysis of chemical separation processes such as distillation, absorption, extraction, and leaching. Plant equipment and operations. Prerequisite: B11.

**710-C07-0 Kinetics and Reactor Engineering** Chemical reaction kinetics with application to the design of chemical reactors. Prerequisites: B10 (C– or better) and Chemistry C43.

**710-C12-0 Process Models by Statistical Methods** Statistical methods necessary for building mathematical models of chemical engineering processes, including linear and nonlinear regression analysis, analysis of variance, experimental design, and response surface methods.

**710-C21-0 Fluid Mechanics** Derivation and applications of continuity and Navier-Stokes equations. Macroscopic mass, momentum, and energy balance. Dimensional analysis: friction factors in pipes and packed beds; drag coefficients. Prerequisites: completion of mathematics requirements with no grades of D and CE B12.

**710-C22-0 Heat Transfer** The differential equations of energy transport. Solutions for various applications. Prerequisite: completion of mathematics requirements with no grades of D.

**710-C23-0 Mass Transfer** Diffusion and rate concepts; application to distillation, extraction, absorption, humidification, drying. Prerequisites: C21 and C22.

**710-C41-0 Process Dynamics and Control** Dynamic behavior of chemical process components. Feedback control principles. Prerequisite: senior standing; C07 recommended.

**710-C42-0 Chemical Engineering Laboratory** Operation and control of process equipment for the determination of operating data. Analysis and written presentation of results. Prerequisites: C07 and C23.

**710-C45-0 Process Optimization** Modern techniques and application to the design and operation of chemical process systems. Steady-state and dynamic methods. Experimental search for the optimum. Prerequisite: senior standing.

**710-C49-0 Advanced Process Control** Digital sampling; sampled data models; digital controllers; hierarchical, distributed, and advanced regulatory control concepts; plant data and control system tuning; model-based control algorithms; nonlinear consideration; multivariable and noninteracting control systems. Prerequisite: C41.

**710-C51-0 Process Economics,Design,and Evaluation** Preliminary design of industrial processes for the production of chemical and allied products by the application

of the engineering sciences and economics. Prerequisites: B12, C07, and C23.

**710-C52-0 Chemical Engineering Design Projects** Design of chemical and process plants applying the principles of unit operations, thermodynamics, reaction kinetics, and economics. Mechanical design and selection of chemical process equipment. Prerequisite: C51.

**710-C61-0 Introduction to Polymers** Polymerization mechanisms and their relation to molecular structure, polymerization processes, and the mechanical properties of polymers, especially flow behavior. Prerequisites: Chemistry B10-1 and Chemistry C42-1.

**710-C64-0 Chemical Processing and the Environment** Application of chemical engineering fundamentals to environmental problems. Chemistry and mechanisms, chemical reaction and rate, and transport emphasized. Risk assessment and analysis revealed through case studies. Prerequisites: B12 and C07.

**710-C67-0 Fabrication of Microelectronic Devices** Application of chemical engineering fundamentals to the analysis and design of basic operations in microelectronics manufacturing, including thin film preparation, lithography, and electronic packaging. Prerequisite: C07.

**710-C71-0 Transport Phenomena in Living Systems** Application of transport theory, principally diffusion, to movement of molecules in biological systems, including blood, cornea, microcirculation, and lung. Prerequisites: C22 and Mathematics B21 or consent of instructor; C21 and C23 recommended.

**710-C75-0 Biochemical Engineering** Modern biochemical engineering. Life sciences: microbiology, biochemistry, and molecular genetics. Metabolic stoichiometry, energetics, growth kinetics, transport phenomena in bioreactors, and product recovery. Prerequisite: C07, C23, or consent of instructor.

**710-C77-0 Bioseparations** Downstream process in biotechnology. Separation and lysis of cells. Recovery of organelles and proteins. Protein separation and purification. Prerequisite: C75.

**710-C95-0 Special Topics in Chemical Engineering** Topics suggested by students or faculty and approved by the department.

**710-C96-0 Focused Topics in Chemical Engineering** (.5 unit) Emerging topics suggested by students or faculty and approved by the department.

**710-C99-0 Projects** Supervised investigation of a chemical engineering problem with submission of a final report.

## Civil Engineering

Civil engineers plan systems such as transportation networks or procedures for water control and supply, and they design structures such as buildings, bridges, dams, and sewage disposal plants. They work together with ecologists, sociologists, economists, lawyers, and others to plan how to use wisely the human and natural resources of large areas such as river basins and how to redevelop cities. With few exceptions, each planning or design job is one of a kind, as contrasted with more routine solutions to other engineering problems.

Planning, of course, requires abundant data of all sorts—topography, geology, soils, vegetation, weather and climate, stream-flow and lake currents, traffic routes and patterns, pollution, population, cultural background and preferences, skills and ambitions. Many civil engineers collect, analyze, and present the data, developing and improving measuring instruments as part of their job. Others apply probability and statistical methods to the data to forecast such things as population growth, demand for water and transportation, maximum winds and precipitation, height of floods, and air and water quality.

Designing systems and structures requires the planning forecasts plus accurate data on the mechanical properties of materials such as steel, concrete, soils, rocks, and plastics and on the behavior of structural components made from them. Some civil engineers test materials and physical models to obtain such data. Many more use known physical properties and the laws of mechanics—energy, momentum, and conservation of mass—to design structures, foundations, pavements, pipe networks, and treatment plants that will do the job safely and economically.

Civil engineers who design water and waste treatment facilities or set up programs to reduce air and water pollution need to understand certain chemical reactions and biological processes as well as the usual fluid and solid mechanics. Engineers who help to plan and design a system understand how and why it works and what may go wrong with it. Hence, civil engineers may operate treatment facilities or systems of flood control reservoirs or set up and administer traffic control plans. Civil engineers may become city engineers.

Engineers who design structures and know soil mechanics learn the practical difficulties of providing a foundation and erecting the structure. Thus, they become partly qualified to operate construction companies, and some civil engineers enter the construction business. Administrative and business activities require them also to learn something about accounting, personnel management, and contracts.

Since civil engineering students have such a wide range of career options, the Department of Civil Engineering prescribes a minimum of required courses and required subjects. Students elect the remainder freely or from specified broad categories. The breakdown, from which honors students may deviate with permission, is as follows:

| | |
|---|---|
| Courses specified by name and number | 20 |
| Courses specified by subject | 6 |
| Courses required to fit into broad categories | 17 |
| Free electives | 5 |
| Total | 48 |

For details see the civil engineering curriculum.

## Areas of Specialization

Civil engineering students may select a program that fits their needs by choosing courses judiciously. The 5 free electives, the 17 courses required to fit into broad categories, and most of the 8 courses specified by subject only (such as mathematical techniques or electrical engineering science or chemistry) allow students to construct diverse specialized curricula, broadly based study programs, or intermediate combinations. Students are encouraged to discuss with faculty any proposed program that meets a well-defined goal. Examples of courses selected in the areas of specialization most often pursued by students are listed in the civil engineering curriculum.

## Laboratories

### *Environmental Engineering*

Facilities are provided for instruction and research in environmental biology and chemistry, industrial hygiene, radiological health, and the unit operations of water and waste treatment. Specialized apparatus and instrumentation are available for studies in each area.

### *Geotechnical Engineering*

This facility has a variety of conventional and special equipment for the testing and evaluation of rocks, soils, and soil-foundation systems—under both static and dynamic loadings—for undergraduate study, graduate study, and research. The laboratory contains many specialized instruments, including consolidation devices and triaxial compression units equipped for computer-controlled stress, strain, and cyclic loading.

### *Structural Engineering and Structural Mechanics*

The department has a large first-class modern laboratory for testing structural materials, especially cement-based materials and composites. The laboratory is equipped with several closed-loop computer-controlled or servo-controlled testing machines capable of static and dynamic loading as well as advanced instrumentation for electron and optical microscopy studies with facilities for image analysis and holographic capabilities, creep testing in programmed environmental chambers, multiaxial or torsional loading, impact testing, acoustic defect detection, and other nondestructive test methods. Basic facilities, including a perforated testing floor, are available also for static and dynamic testing of structural models and structural components. Students conduct experiments using electrical and mechanical strain gauges, structural models, and photoelastic models. A fully equipped shop and technical assistance are available for the design and construction of special loading devices.

### *Computer Graphics*

The computer graphics undergraduate laboratory contains specialized workstations and input-output devices to support computer-aided design, geographical information systems, facility management and scheduling, and scientific visualization software.

## Courses Primarily for Undergraduates

**720-A90-0 Microcomputer Applications in Civil Engineering** Introduction to microcomputer use in civil engineering. Problems from various areas of civil engineering that involve the use of software such as spreadsheets, databases, and word processing for solution.

**750-B03-0 Microstructure and Engineering Properties of Materials** See Materials Science and Engineering.

**720-B06-0 Environmental Literacy** Simple concepts from the sciences and engineering applied to specific environmental problems, including the concepts of risk. Understanding of and quantitative facility in multidisciplinary aspects of environmental decisions.

**720-B12-0 Mechanics** Force systems, equivalence of force systems, and resultants. Equilibrium of a rigid body and systems. Kinematics and dynamics of a rigid body in plane motion. Work and energy relations for a rigid body in plane motion. Prerequisites: Physics A35-1 and registration in Mathematics B15.

**720-B16-0 Mechanics of Materials I** Analytical and experimental study of stresses and deformations and their application to the design of machine and structural elements subjected to static, dynamic, and repeated loads. Prerequisite: B12 or ME B01.

**720-B19-0 Continuum Mechanics I** Introductory concepts of mechanics of continua. Analysis of deformation and stress and the equations of motion, with special emphasis on the elastic solid and Newtonian fluid. Prerequisites: Physics A35-1 and Mathematics B17.

**703-B20-0 Analytical and Computer Graphics** See General Engineering Courses.

**720-B21-0 Theory of Structures I** Deflections of structures, energy concepts, idealization of structures, truss analysis, column stability, and influence lines. Introduction to indeterminate truss and frame analyses, slope-deflection analysis, and moment distribution. Portal method. Prerequisite: B16.

**720-B22-0 Structural Steel Design** Rational basis of structural design. Design approach for structural steel components of a building system. Prerequisite: B21.

**740-B41-0 FluidMechanics I** SeeMechanicalEngineering.

**720-B50-0 Introductory Soil Mechanics** Fundamental properties and behavior of soils as engineering materials. Origin of soils through the properties of soil components to the strength, permeability, and deformation of soil masses. Prerequisite: B16.

**720-B60-0 Fundamentals of Environmental Engineering** Mass and energy concepts applied to major issues facing environmental engineers: safe drinking water,

surface water quality, ambient air quality, global atmosphere, managing solid and hazardous wastes. Prerequisites: Chemistry A01 and Mathematics B14-2 (may be taken concurrently).

**720-B61-0 Environmental Engineering Analysis** Development of quantitative analytical tools for describing physical, chemical, and microbiological processes in natural and engineering systems relevant to environmental engineering. Prerequisites: B60 and Chemistry A02.

**720-B67-0 Chemistry of the Natural Environment** Fundamental principles of organic and inorganic chemistry applied to air, water, soil, and river sediments. Focus on problem solving. Laboratory/field projects. Prerequisite: Chemistry A03.

**720-C02-0 Engineering Law** Relationship between social, political, and economic problems in engineering; contracts; competitive bidding; the engineer's role in management; liability; insurance; lawsuits; arbitration; legal implications of environmental laws; professional societies; ethics. Prerequisite: junior standing.

**720-C06-0 Uncertainty Analysis in Civil Engineering** Development and applications of the analysis of uncertainty, including basic probability, statistics, and decision theory, in the civil engineering areas of soil mechanics, structures, transportation, and water resources.

**720-C07-0 Microstructure of Cement-Based Materials** Chemistry of the principal silicate and aluminate cements used in building and civil engineering. Emphasis on underlying science rather than on practical application. Experimental and theoretical aspects of cement chemistry; relationships between processing, microstructure, and properties.

**720-C13-0 Experimental Stress Analysis** Study and use of experimental techniques in measuring stress and strain. Strain gauge, photoelastic, brittle coating, and moiré techniques studied and applied with selected laboratory experiments. Prerequisite: B16.

**720-C17-0 Mechanics of Continua I** Introduction to the mechanics of continuous media. Cartesian tensors; kinematics of deformable media; stress; balance laws; constitutive relations for selected solids and fluids. Prerequisites: B12 and Mathematics B17 or equivalent.

**720-C18-0 Mechanics of Fracture** Stress concentration: analysis of the stress field near a crack tip; fracture modes; brittle and ductile fracture; fracture toughness; fracture criteria; fracture-mechanics design; fatigue; dynamic effects. Prerequisites: course in mechanics of materials and Mathematics B17.

**720-C19-0 Theory of Structures II** Shear center, biaxial bending, and torsion for beams. Approximate methods of analysis, moment distribution, and Muller-Breslau principle. Introduction to limit analysis, plate and shell problems. Computer applications. Prerequisite: B21.

**720-C20-0 Structural Analysis** Analysis of deflection and indeterminate structures by the interchange concept. Continuous beams and frames having nonprismatic members. Analysis of vibration characteristics of structures, response of buildings to dynamic loads.

**720-C21-0 Properties of Concrete** Concrete as a composite material; relationship between constitutive laws and microstructure; failure theories; fracture; fatigue; strain rate effects; destructive and nondestructive testing; creep and shrinkage; chemistry of cement hydration; admixtures; aggregates; proportioning; new materials.

**720-C22-0 Structural Design** Design criteria; planning and design aspects of structural systems for gravity and lateral loads. A total design project involving the analysis and design of a structure. Prerequisite: B22 or equivalent.

**720-C25-0 Reinforced Concrete** Fundamentals of reinforced concrete theory and design. Analysis and design of beams, slabs, and columns. Introduction to ultimate-strength design and prestressed concrete. Concurrent familiarization with current building codes, specifications, and practices. Prerequisite: B21.

**720-C26-0 Matrix Analysis of Structures** The use of matrix methods in analysis of structural systems. Application of flexibility and stiffness methods to trusses, frames, and plate structures. The approximate solution of plane stress problems. Application of digital computers to structural analysis. Prerequisite: B21.

**720-C27-0 Finite Element Methods in Mechanics** Development of elements from variational principles and application to static continuum problems. Introduction to techniques for dynamics and generalized field problems. Computer implementation of finite element techniques.

**720-C28-0 Prestressed Concrete** Principles of prestressed concrete. Prestressing systems, end anchorage, and loss of prestress. Analysis and design of sections for flexure, shear, bond, bearing, and deflection. Continuous beams, slab, tension, and compression members. Circular prestressing.

**720-C30-0 Construction Management** Techniques for coordinating decisions and actions of various parties in the design and construction of civil engineering projects. Delivery systems; preconstruction services; project planning; cost control and value engineering; bidding. Prerequisite: presenior or senior standing.

**720-C32-0 Construction Estimating** Estimation of cost at different stages of design; conceptual estimating, quantity takeoff of various elements, such as materials, labor, equipment. Prerequisite: senior standing.

**720-C34-0 Total Quality Management** How to achieve quality through continuous improvement of processes, customer satisfaction, and a team environment. Includes data collection and analysis process improvement. Prerequisite: senior standing.

**720-C36-0 Project Scheduling** Project planning, scheduling, and control using CPM arrow and precedence

networks; minimum cost scheduling; basic resource allocation and leveling; overlapping networks; PERT charts; hands-on experience in using computer tools. Prerequisite: senior standing.

**720-C38-0 Public Infrastructure Management** Addresses the complexity of managing public infrastructure facilities by means of a five-part interactive model. Objective is to impart a realistic appreciation of contemporary public infrastructure management policies and practices. Prerequisite: senior standing.

**720-C40-0 Fluid Mechanics II** Civil engineering applications of fluid mechanics. Turbulent flow in pipes, pipe networks, and open channels.

**720-C42-0 Water Microbiology** Principles of microbial physiology and biochemistry applied to microorganisms of environmental interest. Prerequisite: C67.

**720-C44-0 Physical Principles in Environmental Engineering** Fate, transport, and control of chemicals in air, water, and soil environments. Materials balances, suspension phenomena, flow chemical partitioning, mass transfer, filtration and reactor theory. Prerequisites: Physics A35-1,2 and ChE C21, ME B41, or equivalent.

**720-C45-0 Environmental Analytical Chemistry** Laboratory course in the theory and the applications of analytical chemistry as applied to complex, multiphase environmental systems. Prerequisite: CE C67.

**720-C46-0 Meteorology and Hydrology** Weather instruments and observations. Mechanics of the atmosphere. Precipitation, runoff, groundwater flow. Methods of analyzing rainfall and stream-flow records for power generation, flood control, and water supply. Prerequisite: ME B41.

**720-C51-0 Engineering Properties of Soils** Determination, interpretation, significance, application of index and engineering properties of soils. Laboratory testing procedures, sample handling, reliability of results, methods of evaluation and control. Prerequisite: B50.

**720-C52-0 Foundation Engineering** Application of soil mechanics to analysis and design. Settlement of structures, bearing capacities of shallow and deep foundations, earth pressures on retaining structures, and slope stability. Prerequisite: B50.

**720-C55-0 Engineering Aspects of Groundwater Flow** Applied aspects of groundwater flow and seepage, including Darcy's law, parameter determination, aquifer test analysis, flow-net construction and application, modeling techniques, slope stability analysis, drainage, and filter design. Lecture and laboratory. Prerequisite: fluid mechanics.

**720-C56-0 Transport Processes in Porous Media** Transport processes in porous media, including unsaturated flow, flow in deformable porous media, convective transport of solutes with hydrodynamic dispersion effects, and coupled flow phenomena with particular emphasis on electrokinetics. Prerequisite: C55.

**720-C58-0 Airphoto Interpretation** Principles and practice of using aerial photographs to obtain information about natural features of the earth's surface, with emphasis on earth materials. Landforms, geological processes, rocks, and soils. Stereoscopic photographs, elements of photogrammetry. Prerequisite: junior standing or consent of instructor.

**720-C59-0 Hazardous Waste Management** Definition and regulation of wastes. Pollutant transport, fate, and toxicology. Management via audits and prevention. Treatment and control. Risk and site assessment and site remediation. Prerequisite: upperclass standing in engineering or science or consent of instructor.

**720-C60-0 Environmental Impact Evaluation** Methods for evaluating impacts of engineering projects on environmental quality; environmental legislation; environmental quality indices. Participation in a multidisciplinary group project; preparation of impact report. Prerequisite: junior standing.

**720-C61-0 Public Health Engineering** Evaluation of the disease status of a community; elements of vital statistics and epidemiology; etiology of infectious and noninfectious diseases; control of environmentally based health hazards.

**720-C63-0 Community Air Pollution** Nature and control of community air pollution. Sources, physical and chemical properties, and effects of major air pollutants; analytical measurements and monitoring of air pollutants; engineering and legislative control. Prerequisite: junior standing.

**720-C64-0 Sanitary Engineering** Engineering elements of water supply and water pollution abatement. Water quality standards, water and wastewater treatment processes, and the management of receiving waters to control pollution. Prerequisite: ME B41 (C40 desirable).

**720-C65-1,2,3 Radiation Health,Radiation Safety Evaluation,and Radiation Health Engineering** **1.** Radiation health: survey of the principles of health physics: sources of radiation, physics of radioactivity and ionizing radiation, interaction of radiation and radiation dosimetry, biological effects of radiation, radiation safety standards, principles of radiation protection. **2.** Radiation safety evaluation: interaction of radiation with matter. Bragg-Gray principle and external dosimetry, MIRD method for internal dosimetry, population dose, application of radiation safety standards. **3.** Radiation health engineering: shielding design, criticality control, contamination control, waste management, legal controls, administrative procedures.

**720-C66-0 Ecosystems and Ecotoxicology** Responses of terrestrial and aquatic ecosystems to environmental stress, with emphasis on ecotoxicological effects; ecosystem considerations in engineering problems and solutions. Prerequisite: junior standing in engineering or science.

**720-C67-0 Aquatic Chemistry** Physical chemistry of the aqueous environment; solution and heterogeneous equilibria; reactions at solid-solution interface. Water and wastewater analyses. Lecture, laboratory. Prerequisite: Chemistry A03.

**720-C68-0 Industrial Hygiene and Environmental Control** Application of industrial hygiene principles and practice; measurement and control of atmospheric contaminants. Design and evaluation of industrial ventilation systems. Prerequisite: junior standing.

**720-C69-0 Principles of Industrial Hygiene** Recognition, evaluation, and control of health hazards in the working environment. Principles of industrial toxicology, occupational diseases, and occupational health standards. Environmental sampling and analysis. Lecture, laboratory.

**720-C70-0 Environmental Engineering Design** Decision making in selection and implementation of environmental control measures. Water supply and wastewater management: quantities to be handled, transportation systems, treatment processes, solid wastes management. Prerequisite: C64.

**720-C71-0 Introduction to Transportation Planning and Analysis** Analysis and design of solutions to transportation problems; introduction to selected operations research and statistical analysis techniques; extensive use of case studies in urban transportation, intercity passenger transport, and freight movements. Prerequisite: junior standing or consent of instructor.

**720-C72-0 Transportation System Design and Analysis** Integrative design and analysis experience; physical and programmatic problems, including operations, terminals, and management; fundamental concepts of transportation; systematic approaches to creative problem solving.

**720-C76-0 Transportation System Operations** Characteristics of roadway travel; vehicle and human factors, intersection performance and control; management and control of arterial streets and networks; neighborhood traffic restraint, urban transit operations. Operations concepts and theories applied to actual problems through laboratory practice.

**720-C95-0 Special Topics in Civil Engineering** Topics suggested by students or faculty and approved by the department.

**720-C99-0 Projects** Special studies under faculty direction. Credit to be arranged.

## Computer Science

The Department of Computer Science offers a wide variety of programs leading to the BS degree. Courses and research focus on software, ranging from theoretical models to practical applications. Particular areas of research include

- Artificial intelligence, including mobile robots with perceptual systems, models of memory and reasoning, knowledge representation, natural language comprehension, planning, and problem solving
- Software engineering, including the analysis, design, implementation, evaluation, and maintenance of large applications
- Human computer interaction, including interface design, task modeling, intelligent interfaces, authoring tools
- Distributed interactive systems, including client-server and Web-based applications such as heterogeneous databases and multimedia learning environments
- Theoretical computer science, focusing on algorithm design and analysis of algorithms' worst- and average-case behavior

Courses and research are highly interdisciplinary, with particularly strong connections to education and psychology, both in shared faculty and joint research projects. Detailed information on degree requirements and elective courses is available from the department office.

### Facilities

Computer science students have access to state-of-the-art facilities, ranging from simple microcomputers to the latest multimedia workstations. The campus, including residence halls, is extensively networked with a 100-megabit FDDI University network backbone. All students have full Internet access. Electronic mail, Web sites, and other computer-based communication facilities are used to increase the bandwidth between students and faculty beyond the classroom.

The computer science department is the home of the Institute for the Learning Sciences, an interdisciplinary research and development center comprising more than 150 people dedicated to building innovative educational software for schools, businesses, government, and the general community. Students often are involved in its research projects through independent study courses, thus gaining valuable experience in a world-class research environment.

### Courses Primarily for Undergraduates

**725-A10-0 Introduction to Computer Programming** Introduction to programming practice using a modern programming language. Analysis and formulation of problems for computer solution. Systematic design, construction, and testing of programs. Substantial programming assignments.

**725-A11-0 Fundamentals of Computer Programming** Introduction to principles of programming and procedural thinking. Procedural abstraction, data abstraction, modularity, object-oriented programming. Uses computer facilities and the Scheme programming language. Substantial programming assignments, including numerical and symbolic programs. Required for computer science majors.

**725-A20-0 Introduction to Computers and Information Technology** Basic concepts of computer

systems. Considerable hands-on experience with applications such as word processors, databases, and spreadsheets. Information technology's impact on today's society. No previous experience with computers needed. Not for engineering or computer science majors or students who have taken A10, A11, or ECE A01.

**725-B11-0 Fundamentals of Computer Programming II** Continuation of A11. Key concepts in software design and systems programming. Object-oriented programming (in C++), design of interpreters and compilers, and register machines. Required for computer science majors. Prerequisite: A11.

**725-B30-0 Introduction to Software Engineering** Advanced program design and debugging. Methodologies for design and implementation of larger programs. Object-oriented concepts and programming in C++. Prerequisites: A10, A11, ECE A01, or equivalent.

**725-C10-0 Mathematical Foundations of Computer Science** Basic concepts of finite and structural mathematics. Sets, axiomatic systems, the propositional and predicate calculi, and graph theory. Application to computer science: sequential machines, formal grammars, and software design. Prerequisites: A10 or A11 and Mathematics B14-3.

**725-C11-0 Data Structures and Data Management** The design, implementation, and analysis of abstract data types; data structures and their algorithms. Topics include data and procedural abstraction, linked lists, stacks, queues, binary trees, searching, and sorting. Required for computer science majors. Prerequisites: B11 or B30.

**725-C14-0 Applied Artificial Intelligence** Applications that include intelligent capability for relieving the user of routine aspects of problem solving. Computer-aided design, computer-assisted manufacturing, and design of decision-support systems.

**725-C17-0 Data Management and Information Processing** Data representation, file and record organization, linear and linked lists, and scatter storage techniques. Sorting and searching algorithms. Solving problems involving large databases. Not for students in computer science. Prerequisites: A10, A11, or programming experience.

**725-C20-0 Formal Languages and Automata Theory** Regular languages, deterministic and nondeterministic finite automata, context-free grammars and push-down automata, Turing machines and unsolvability. Prerequisite: C10.

**725-C22-1,2 Compiler Construction** Overview of compilers and context-free languages, top-down parsing, LL(1) parser construction, translation grammars, implementation of lexical analyzer, parser and translator, compiler optimization, error handling, and recovery. Prerequisite: C11.

**725-C25-1,2 Artificial Intelligence Programming** Introduction to LISP and programming knowledge-based systems and interfaces. Strong emphasis on writing maintainable, extensible systems. Topics include semantic networks, frames, pattern matching, deductive inference rules, case-based reasoning, discrimination trees. Project driven. Substantial programming assignments. Prerequisite: A10, A11, or programming experience.

**725-C27-0 Intelligent Information Management Systems** Principles for simplifying human interactions with complex information management systems. Methods from AI applied to the design of interfaces and the redesign of systems to improve performance and simplify training in the use of these systems. Prerequisites: junior standing and permission of instructor.

**725-C32-0 Introduction to Computer Vision** Introduction to computer and biological vision systems, image formation, edge detection, image segmentation, texture, representation and analysis of two- and three-dimensional structures. Prerequisites: C11 and Mathematics B17.

**725-C36-0 Design and Analysis of Algorithms** Analysis techniques: solving recurrence equations. Algorithm design techniques: divide and conquer, the greedy method, backtracking, branch-and-bound, and dynamic programming. Sorting and selection algorithms, order statistics, heaps, and priority queues. Prerequisite: C10, C11, or consent of instructor.

**725-C37-0 Natural Language Processing** Semantics-oriented introduction to natural language processing, broadly construed. Representation of meaning and knowledge inference in story understanding, script/frame theory, plans and plan recognition, counterplanning, and thematic structures. Prerequisite: C48 or consent of instructor.

**725-C39-0 Introduction to Database Systems** Data models and database design. Modeling the real world: structures, constraints, and operations. The entity relationship to data modeling (including network hierarchical and object-oriented), emphasis on the relational model. Use of existing database systems for the implemention of information systems. Prerequisite: C11.

**725-C43-1,2 Operating Systems** Fundamental overview of operating systems. **1.** Operating system structures, processes, process synchronization, deadlocks, CPU scheduling, and memory management. **2.** File systems, secondary storage management, issues in distributed systems, case studies, and special topics. Requires substantial programming projects. Prerequisite: C11.

**725-C44-0 Design of Computer Problem Solvers** Principles and practice of organizing and building artificial intelligence reasoning systems. Pattern-directed rule systems, truth-maintenance systems, and constraint languages. Prerequisite: C48 and C25-1 or equivalent LISP experience.

**725-C48-0 Introduction to Artificial Intelligence** Core techniques and applications of AI. Representing, retrieving, and applying knowledge for problem solving. Hypothesis exploration. Theorem proving. Vision and neural networks. Prerequisites: C25-1, A11, or LISP programming experience.

**725-C49-0 Introduction to Theorem Proving** First-order logic and normal forms. The resolution principle. Unification. Completeness. Implementation issues. Applications to mathematics, logic, and databases, program verification and generation. Prerequisite: C48 or consent of instructor.

**725-C50-0 Introduction to Computational Linguistics** Grammars: syntactic analysis with augmented transition networks. Semantics, frames, schemas, story grammars, and computer analysis of text. Continuity of text, metaphorical forms, and literary analysis.

**725-C51-0 Introduction to Computer Graphics** Mathematical software and hardware requirements for computer graphics systems. Data structures and programming languages. Random displays. Graphic applications. Prerequisite: C11.

**725-C52-0 Applied Combinatorics** Fundamental problems in combinatorics, including selection, arrangements, counting methods, generating functions, and graph theory. Focusing on applications to science and engineering. Prerequisite: C10.

**725-C54-0 Introduction to the Theory of Parallel Computation** Design and analysis of parallel algorithms. Arithmetic, matrix, and graph algorithms for arrays, trees, hypercubes, and related networks. Sorting and packet routing algorithms. Parallel Random Access Machine (PRAM) model. Layouts and realizations of processor networks. Prerequisite: C36 or consent of instructor.

**725-C94-0 Software Project Management and Development** Software development methodologies. Object-oriented analysis and design, CASE tools, software life cycle. Project management tools, programming teams. Executable specifications, automatic test generation. Prerequisite: C43 or equivalent programming experience.

**725-C95-0 Special Topics in Computer Science** Topics suggested by students or faculty and approved by the department.

**725-C99-0 Projects** Seminar and projects for advanced undergraduates on subjects of current interest in computer science.

## Electrical and Computer Engineering

The Department of Electrical and Computer Engineering has two distinct curricula, electrical engineering and computer engineering, both of which offer a broad range of programs leading to the BS degree. In addition, the department offers MS and PhD degrees.

Electrical engineering is concerned with the theory, design, implementation, and actual and potential applications of various devices and systems based on electrical phenomena and properties.

Computer engineering is concerned with applying engineering principles to computer hardware design, the relationship between hardware and software in making effective use of computers, the use of embedded microprocessors, and distributed and parallel computing.

Because the disciplines of electrical engineering and computer engineering are very broad, the curricula are designed to appeal to students with various educational and professional goals. By properly selecting elective courses, students can specialize in one or two areas in the department or in an interdisciplinary program. More detailed information on requirements and electives leading to specializations is available from the department office.

### Areas of Specialization

#### *Communication Systems*

A communication system involves the generation of an electrical signal representing information to be transmitted, its encoding in some form for efficient transmission, its actual transmission, its decoding at the receiving end of the system, and its reconversion into something intelligible to the user. The thorough study of communications systems theory requires knowledge of a broad range of mathematical methods and of the capabilities and limitations of electronic circuits. This subject also covers the design and analysis of communication networks for the transmission of audio, video, and data among many users.

#### *Control Systems*

The study of control systems deals with the analysis and design of automatic regulators, guidance systems, numerical control of machines, robotics, and computer control of industrial processes. Students are concerned with identifying these systems and with such topics as systems stability, system performance criteria, and optimization. These concepts find application in other fields of engineering and in the development of better understanding of biological, energy, economic, and social systems.

#### *Electronic Circuits*

This area of study is concerned with the analysis and design of circuits that employ electronic devices such as integrated circuits, transistors, diodes, light-emitting diodes, data storage elements, and image-forming devices.

Important applications include AM and FM radio, television, digital computers, and electronic control and instrumentation systems.

***Electromagnetic Waves and Devices***
This area of study is concerned with the analysis and synthesis of electromagnetic devices, structures, and systems. Transmission lines, waveguides, antennae, resonant structures, diffracting and scattering elements, Impatt and Gunn diodes, and gyrotrons are examples of devices and structures that are electromagnetic in nature. Applications include radar, radio astronomy, microwave radio relaying, satellite relaying for transoceanic communication, space communication, radio and television broadcasting, optical imaging and devices, and the diagnosis and treatment of human disease, including cancer.

***Optoelectronics***
This area includes geometric and wave optics, interference, polarization, diffraction, Fourier transformation by lenses, and holography. Laser sources with appropriate modulation techniques are fabricated and studied. Optical communication systems are analyzed with an emphasis on signal transmission through optical fibers. Other important topics include microelectronics techniques in device fabrication, fiber-optic imaging, integrated and nonlinear optics, solar energy conversion, LED, liquid crystal, and other electro-optic display devices.

***Solid-State Electronics***
This area is concerned with the design, physical principles, and applications of solid-state devices both as discrete units and integrated circuit systems. In addition to the various diode, transistor, and FET devices fabricated from silicon technology, other devices developed from compound semiconductor materials are reviewed. Both analog and digital circuit applications are stressed. Another important topic is the behavior of conductors in the superconducting state, with a stress on applications.

***Biomedical Engineering***
This area combines electrical engineering training with a strong background in the life sciences, which allows students to apply quantitative techniques to the study of living systems. The program offers training in premedical studies, biomedical instrumentation, health care engineering, bioacoustics, and biosciences. Medical schools consider undergraduate engineering an excellent premedical background, filling a strong need for MD students with good mathematics, science, and engineering preparation. Other graduates may find rewarding careers with hospitals, industry, and research centers in such diverse fields as hospital and research laboratory instrumentation, patient monitoring, and computerized patient diagnosis.

***Computer Architecture and Systems Design***
This area focuses on the design of computer system hardware. Topics include processor design, computer arithmetic, controller design, instruction set design, memory subsystems, and pipelining. Computer-aided design tools are used for the various levels of the design hierarchy.

***Parallel and Distributed Computing***
This program introduces students to the state-of-the-art fieldof high-performance computing. In particular, it deals withaspectsofcomputinginvolving multiple processors working together on a common problem, including issues of computer architectures, parallel programming and algorithms, numerical computing, and computer networking.

***VLSI and Computer-Aided Design***
This area focuses on systematic approaches to designing high-performance integrated circuits consisting of millions of transistors. This specialization includes topics such as low-power, high-speed, and reliable circuit design, hardware-software codesign, design verification, design of multi-FPGA systems, and CAD techniques.

***Embedded Systems Design***
This area focuses on the use of digital hardware to monitor and control physical systems. Topics include discrete-dynamics systems, digital controllers, analog-to-digital converters, microprocessor-based design, and the economic trade-offs of different software and hardware systems.

***Robotics***
This area focuses on computer vision, pattern recognition and robotics. Emphasis in on the software and hardware aspects of robotic design. Topics include robotic control, kinematics, differential relations, dynamic motion, and homogeneous transformations.

**Laboratory and Computer Facilities**
The department has a variety of modern, well-equipped instructional and research laboratories. Facilities primarily for electrical engineering include laboratories for electronic circuits, digital circuits, solid-state electronics, the fabrication of solid-state lasers and other quantum electronic/photonic devices, thin-film device development, biomedical electronics, microwave techniques, holography and coherent light optics, biological and other control systems, and signal, image, and speech processing.

Facilities for electrical and computer engineering include laboratories in digital systems design, microprocessor systems, microprogramming, computer communication networks, robotics, computer-aided design, and computer networking.

The department has major research facilities for work in parallel and distributed computing systems, database systems, computer vision, VLSI design, CAD, robotics,

solid-state devices, fiber optics, lasers, computational electromagnetics, electronic materials, and biomedical engineering. It also has access to the facilities of the Rehabilitation Institute of Chicago and the Materials Research Center at Northwestern. Students working in collaboration with faculty at University laboratories and research centers also have access to appropriate facilities at those laboratories.

The department also maintains the ECE Computing Laboratory, which has many networked workstations and appropriate software to support class work and projects. The machines are connected to external networks, allowing off-site computing. There are also two parallel machines available at the Center for Parallel and Distributed Computing.

Undergraduate ECE majors are entitled to accounts on departmental computers that are generally more powerful and less heavily used than other University computers.

### Courses Primarily for Undergraduates

**730-A01-0 Introduction to Scientific Programming and FORTRAN** Introduction to the FORTRAN programming language and methodology for the computer solution of engineering problems. Numerical methods such as root finding and numerical integration. Pre/corequisite: Mathematics B14-2 or equivalent.

**730-A40-0 Introduction to Electrical and Computer Engineering** Breadth of electrical and computer engineering, applications to modern technological society. Computer industry, telecommunications and controls, electronic and optical devices, software, and artificial intelligence. Open only to freshmen.

**730-A41-0 Introduction to Electrical Engineering via Amateur Radio** Modulation, coding, computer and personal communications, networking, wireless and satellite technology. Laboratory includes design and on-the-air operation of radio transmitters and receivers in analog and digital modes. Students earn FCC amateur radio licenses. Open to ECE freshmen and all students in other departments.

**730-B01-0 Introduction to Digital Logic Design** Principles of hardware design. Number systems and Boolean algebra. Logic gates. Design of combinational circuits. Decoders, multiplexers, adders, and other MSI circuits.Sequential logic.Memory elementsand flip-flops.

**730-B05-0 Fundamentals of Computer System Software** Addressing schemes. Assembly language programming. Linking to high-level programs. System utilities for video, keyboard, and file processing. Device handlers. 1-pass and 2-pass assemblers. Prerequisite: freshman programming requirement.

**730-B30-0 Programming for Computer Engineers** Introduction to computer programming in an object-oriented language. Emphasis on applications to computer systems, computer simulation, and discrete optimization. Basic principles of software engineering. Prerequisite: freshman programming requirement.

**730-B41-0 Circuits I** Circuit analysis and network theorems. Transient and sinusoidal steady-state analysis. Students must receive a grade of C– or better to register for B42 and B50. Prerequisites: Physics A35-2 and Mathematics B21.

**730-B42-0 Circuits II** Complex frequency, frequency response, parallel and series resonance, Bode diagrams, coupled circuits, two-port networks, Fourier analysis. Students must receive a grade of C– or better to register for B43, C06, C60, C65, C66. Prerequisite: B41 (C– or better).

**730-B43-0 Signals and Systems** Comprehensive introduction to analysis of signals in linear systems. Linear time-invariant systems, convolution integral, Fourier and Laplace transform techniques, elements of discrete-time signal and system analysis. Prerequisite: B42 (C– or better).

**730-B50-0 Physical Electronics** Electronic conduction in semiconductors; physical principles of p-n junctions; diodes and transistors; device characteristics and models; elementary diode circuits and amplifiers. Prerequisites: Physics A35-2 and concurrent registration in B42.

**730-B70-0 Applications of Electronic Devices** DC and AC networks, rectifiers, transistor amplifiers, feedback and operational amplifiers, digital electronics, and microprocessors. Not open to electrical engineering majors. Prerequisites: Mathematics B14-2 and Physics A35-2 or equivalent.

**730-C01-0 Fundamentals of Electromagnetics** Concepts of flux, potential, gradient, divergence, curl, and field intensity. Boundary conditions and solutions to Laplace and Poisson equations. Capacitance and inductance calculations. Conductors, insulators, and magnetic materials. Application of Maxwell's equations. Prerequisites: B41, Mathematics B21, and Physics A35-1,2,3.

**730-C02-0 Probabilistic Systems and Random Signals** Basic concepts of probability theory, random variables, moments; multiple random variables, conditional distributions, correlation; sequence of random variables. Prerequisite: Mathematics B15.

**730-C03-0 Advanced Digital Logic Design** Overview of digital logic design. Technology review. Delay on combinational and sequential circuits, CAD tools, arithmetic units such as ALUs and multipliers. Overview of the computer organization, controller design, and application. Prerequisite: B01.

**730-C06-0 Electronic Circuits** Single-stage FET and BJT amplifier configurations; multistage amplifiers and feedback; frequency response; differential amplifiers and active loads; elementary operational amplifier circuits. Prerequisites: B42 (C– or better) and B50.

**730-C07-0 Communications** Analysis of analog communications systems, including modulation, transmission, and demodulation of AM, FM, and TV systems. Design issues, channel distortion and loss, bandwidth limitations, additive noise. Prerequisites: B43 and C02.

**730-C08-0 Applications of Electromagnetic Fields** Transmission lines, wave equation, Maxwell's equations, plane waves, Poynting theorem, solution of Maxwell's equations for rectangular and circular waveguides, applications. Prerequisite: C01.

**730-C12-0 A Journey through the Electronic Age** An examination, in the context of their times, of the lives and accomplishments of the leading contributors to significant developments in electronic and communication technologies. This is a humanities course and may not be used as a technical elective.

**730-C13-0 Telecommunication Networks for Multimedia** Modern technologies that represent and transmit multimedia information such as voice, music, documents, still images, and video. Emerging network applications of multimedia in home, academia, and business. Not open to electrical or computer engineering majors.

**730-C16-0 Mini/Microcomputers and Real-Time Applications** Basic computer architecture. Low-level program development tools, mini/micro organization, and software development. Laboratory experience to reinforce classroom topics. Not open to electrical or computer engineering or to computer science or computer studies majors. Prerequisite: CS A10 or equivalent.

**730-C28-0 Numerical Methods for Engineers** Introduction to numerical methods; numerical differentiation, numerical integration, solution of ordinary and partial differential equations. Students write programs in FORTRAN, C, or Pascal using methods presented in class. Mathematics B21 or General Engineering B05-4 may be taken concurrently.

**730-C32-0 Digital Image Analysis** Introduction to computer and biological vision systems, image formation, edge detection, image segmentation, texture, representation, analysis of two-dimensional geometric structures, and representation and analysis of three-dimensional structures. Prerequisites: Mathematics B17, CS C11, and IEMS C02.

**730-C33-0 Introduction to Communication Networks** Network architectures, models, protocols, routing, flow control, and services. Queueing models for network performance analysis. Prerequisite: C02, IEMS C02, Mathematics C30, or equivalent basic probability theory or consent of instructor.

**730-C41-0 Design of Real-Time Digital Systems** Design of digital systems for automatic control and automatic manufacturing. Numerical control, microprocessor-based control, robotics. Algorithms for control strategies; optimization techniques. Prerequisites: C03 and C46.

**730-C46-0 Microprocessor System Design** Design of digital systems using microprocessors. Comparison of microprocessor architecture. Software/hardware and economic trade-offs. Example designs. Designing for flexibility, ease of maintenance, and economy of development. Prerequisites: B01 and B05.

**730-C47-0 Digital Electronic Systems Design Projects** Laboratory project experience in design of electronic systems, with appropriate lectures and discussions. Provides practical experience to supplement C46. Prerequisites: C46 and C03.

**730-C53-0 Digital Electronic Circuits and Systems** Logic families, comparators, A/D and D/A converters, combinational systems, sequential systems, solid-state memory, large-scale integrated circuits, and design of electronic systems. Prerequisites: B01 and C06.

**730-C57-0 Design Automation in VLSI** VLSI chip design, including logic design, architectural design, and packaging. Develop CAD tools for VLSI physical design. Prerequisites: C03 and CS C11.

**730-C58-0 Introduction to Parallel Computing** Introduction to parallel computing for scientists and engineers. Shared memory, parallel architectures and programming, distributed memory, message-passing data-parallel architectures, and programming. Prerequisites: C61 and B30 or CS B11.

**730-C59-0 Digital Signal Processing** Discrete-time signals and systems, the z-transform, discrete Fourier transform, discrete random processes, effects of finite register length, homomorphic signal processing. Prerequisite: B43.

**730-C60-0 Introduction to Feedback Systems** Linear feedback control systems, their physical behavior, dynamical analysis, and stability. Laplace transform, frequency spectrum, root locus methods. System design and compensation. Prerequisites: B42 (C– or better) and Mathematics B21.

**730-C61-0 Computer Architecture** Understanding of the computer system as a whole unit—instruction set design, data path design, pipeline implementation, pipeline hazards, caches, virtual memory, peripheral devices, I/0. Prerequisites: B05 and C03.

**730-C62-0 Computer Architecture Projects** Capstone design course in computer architecture. Extensive design of an entire pipeline processor with a CAD tool. Emphasis on group collaboration and engineering design. Prerequisite: C61.

**730-C63-0 Digital Filtering** Recursive and nonrecursive digital filters, decimation and interpolation, A/D and D/A conversion as digital filtering problems. Implementation of nonrecursive filters via FFT, quantization problems, e.g., companding and limit cycles. Prerequisite: C59.

**730-C65-0 Communication Filters** Analytical approximations in the design of analog filters. Matched filters and their implementation with surface-acoustic-wave and

charge-coupled devices. Prerequisites: B42 (C– or better) and C07.

**730-C66-0 Communication Circuits** Advanced treatment stressing methods of analysis and design. Coupling network and narrowband filters. Active device modeling. Oscillator and r-f amplifier design. Amplitude and frequency modulators and demodulators. Prerequisites: B42 (C– or better), C06, and C07.

**730-C74-0 Introduction to Digital Control** Discrete dynamics systems; discrete models of continuous systems feedback and digital controllers; analog-digital conversion; numerical control with microcomputers. Prerequisite: C60 (C or better).

**730-C75-0 Nonlinear Problems in Engineering** Analysis of nonlinear circuits and mechanical systems using phase-plane and analytical methods; singularities, stability of equilibrium, periodic solutions and limit cycles, switched circuits, perturbation theory, and numerical solutions.

**730-C78-0 Digital Communications** Sample and time-division multiplexing baseband digital signals and systems. Coded pulse modulation, error control coding, digital modulation systems, information measure and source encoding, spread spectrum. Prerequisites: C02 and C07.

**730-C79-0 Optics and Information Systems** Properties of optical fibers and light sources; optical modulation, switching, and receivers; fiber-optic communication systems and networks; optical storage and data processing systems. Prerequisite: C08.

**730-C81-0 Electronic Materials:Properties and Applications** Quantum physics; energy bands; electronic transport in metals and semiconductors; interfaces; superconductivity; optoelectronic properties and quantum semiconductor devices; magnetic materials. Prerequisite: C08 or consent of instructor.

**730-C82-0 Introduction to Applied Optics** Wave equation; dipole radiation; reflection, refraction. Lenses, stops, mirrors, prisms. Polarized light, retardation plates. Interferometers, thin films. Prerequisite: C08 or consent of instructor.

**730-C83-0 Lasers and Coherent Optics** Fundamental principles of operation of lasers. Characteristics of coherent and incoherent radiation. Fresnel and Fraunhofer diffraction theory. Fourier transforming properties of lenses. Spatial filtering and optical information processing. Prerequisite: C08.

**730-C84-0 Solid-State Electronic Devices** Energy band model for semiconductors; carrier statistics and transport; diodes, bipolar, and field-effect transistors; integrated circuits, optoelectronic and heterojunction devices. Prerequisite: C81 or consent of instructor.

**730-C85-0 Solid-State Optoelectronics** Introduction to solid-state optoelectronic devices; display devices, laser diodes, photodetectors, and light modulators; optical waveguides and fibers; system application of optoelectronic devices. Prerequisite: C08.

**730-C86-0 Computational Electromagnetics** Numerical approaches for modeling the interaction of electromagnetic waves with complex structures, differential equation formulation, time-domain solution, integral equation formulation, method of moments, 2-D and 3-D problems. Prerequisites: C08 and C28.

**730-C88-0 Microelectronic Technology** Physics and fabrication of photonic and electronic devices. Physics of semiconductors: heterojunctions, quantum wells, and superlattices; bulk and epitaxial growth. Device processing techniques: diffusion oxidation, ion implantation, annealing, etching, and photolithography. Prerequisite: concurrent registration in C81 or consent of instructor.

**730-C89-0 Introduction to Superconductivity and Its Applications** Properties of materials in superconducting state; charge flow dynamics of type II superconductors; high-Tc superconductors; applications for computers and high-frequency devices. Prerequisite: C81 or consent of instructor.

**730-C90-0 Introduction to Robotics** Basic mathematics of robotic control. Homogeneous transformation, kinematics and kinematic solutions, differential relationships, dynamic motion trajectory, robotic control system, and programming. Prerequisites: vector and matrix operations and high-level language (C or Pascal).

**730-C91-0 VLSI Systems Design** Design of CMOS digital integrated circuits, concentrating on architectural and topological issues. Trade-offs in custom design, standard cells, gate arrays. Use of VLSI design tools on a small project. Prerequisite: C03.

**730-C92-0 VLSISystems Design Projects** Design of a cutting-edge VLSI chip. Teams of 5 to 10 students undertake a large circuit design problem, going from specification to VLSI implementation while optimizing for speed, area, and/or power. Group collaboration and engineering design. Prerequisite: C91.

**730-C96-0 Engineering Design and Entrepreunership** Capstone design course. Launching and operating a business producing electronic products and services. Students earn FCC radio licenses. Open to juniors and seniors in engineering and science. May be taken once as an electrical or computer engineering design or technical elective; may be repeated as an unrestricted elective.

**730-C97-0 Special Topics in Electrical Engineering** Topics suggested by students or faculty and approved by the department.

**730-C98-0 Electrical Engineering Design** Design of electrical and electronic devices, circuits, and systems by the application of the engineering sciences, economics, and IEEE or other national standards. Prerequisite: senior standing.

**730-C99-0 Projects** Seminar and projects for advanced undergraduates on subjects of current interest in electrical and computer engineering.

## Engineering Sciences and Applied Mathematics

The Department of Engineering Sciences and Applied Mathematics offers course work in applied mathematics and administers an undergraduate program leading to a BS in applied mathematics and a graduate program in applied mathematics.

The applied mathematics program is intended to provide the knowledge necessary for applying mathematical ideas and techniques to the problems that arise in engineering or science. It is expected that a student receiving a BS in applied mathematics would have the background for suitable employment in industry or for graduate study in either mathematics (pure or applied) or an engineering field, including computer science and operations research. To achieve these goals, the applied mathematics program is designed to be flexible and allow the student to concentrate a substantial part of the course work either in mathematics or one or more areas of application.

### Courses Primarily for Undergraduates

**760-B52-1,2,3 Honors Calculus for Engineers** Yearlong sequence; alternative to standard calculus sequence. Covers more material at a deeper level, with more applications. Satisfies same requirements as Mathematics B14-3, B15, and B17.

**760-C11-1,2 Methods of Applied Mathematics** Ordinary differential equations; Sturm-Liouville theory, properties of special functions, solution methods including Laplace transforms. Fourier series: eigenvalue problems and expansions in orthogonal functions. Partial differential equations: classification, separation of variables, solution by series and transform methods. Prerequisite: Mathematics B21.

**760-C11-3 Methods of Applied Mathematics:Complex Variables** Imaginary numbers and complex variables, analytic functions, calculus of complex functions, contour integration with application to transform inversion, conformal mapping. May be taken independently of C11-1,2. Prerequisite: Mathematics B21.

**760-C22-0 Applied Dynamical Systems** Example-oriented survey of nonlinear dynamical systems, including chaos. Combines numerical exploration of differential equations describing physical problems with analytic methods and geometric concepts. Applications to mechanical, fluid dynamical, electrical, chemical, and biological systems. Prerequisites: C11-1,2 or equivalent or consent of instructor.

**760-C46-0 Modeling and Computation in Science and Engineering** Advanced techniques for initial value problems, differential algebraic systems, bifurcations, chaos, and partial differential equations. Applications drawn from different physical areas. Prerequisites: Mathematics B15, B17, and B21 or General Engineering B05-4; Physics A35-1,2 or the equivalent; familiarity with a programming language or consent of instructor.

**760-C99-0 Projects** Special studies to be carried out under faculty direction. Credit to be arranged.

## Environmental Engineering

Environmental engineering is concerned with the interactions of people and environment, applications of scientific knowledge to the understanding and analyses of these interactions, and the improvement of the quality of our environment. This undergraduate program provides an engineering and scientific basis for the understanding of contemporary environmental problems and approaches to their solutions, an understanding of the natural systems with which human activities must be compatible, and the development of a grasp of engineering analysis and design for environmental control systems planning and design.

Faculty members of the McCormick School are engaged in research on physical, chemical, and biological processes for water supply, waste treatment, pollution control, and resource recovery; water resources; toxicology; the establishment of quantitative relationships between radiation exposure and biological damage; environmental systems planning and design; chemistry and treatment of industrial wastes; land reclamation and contaminant effects on ecosystems.

Completion of the undergraduate degree program in environmental engineering prepares students to practice engineering at the entry level or to continue their education at the graduate level. It serves as preparation for the Fundamentals of Engineering (FE) examination and, with adequate experience, the Professional Engineer (PE) examination.

## Industrial Engineering and Management Sciences

The Department of Industrial Engineering and Management Sciences offers two undergraduate degrees, one in industrial engineering and the other in manufacturing engineering.

The industrial engineering degree provides students with the knowledge, principles, and techniques for analysis, design, and installation of complex systems involving people, materials, and modern technology. Graduates find employment in the private sector; in manufacturing and service firms; in the public sector as professional engineers, technical specialists, and analysts; and in general management. Many students use the degree as the basis for graduate study of law, business, engineering, management science, mathematics, social sciences, and medicine.

The manufacturing engineering degree prepares students for careers as specialists in manufacturing firms. It

also provides a solid technical foundation for a career in manufacturing management.

Course work in industrial engineering and management sciences covers core areas of probability and statistics, operations research, applied behavioral science, and engineering economy. Eight electives may be chosen from a list consisting of methodology areas (statistics and decision analysis, economics and business management, human factors and industrial organization, and mathematics) and application areas (quality control and reliability, production and logistics, manufacturing, transportation, and information and communication systems). Course work in manufacturing engineeering is organized into three areas: manufacturing core, probability and statistics, and technical electives. A two-quarter senior capstone design project is required in both the programs.

## Courses Primarily for Undergraduates

**738-B03-0 Probability and Statistics for Engineers** Elementary probability; standard probability distribution models; descriptive statistics; inferential statistics, including confidence intervals and hypotheses tests; regression and correlation; applications to engineering problems, especially quality control and reliability. Not open to IE majors.

**738-C01-0 Introduction to Statistics** Collecting data; summarizing and displaying data; drawing conclusions from data; probability background, confidence intervals, hypotheses tests, regression, correlation. Not open to IE majors.

**738-C02-0 Probability** Fundamentals of probability theory with applications. Probability spaces, random variables, distribution and density functions, expectations. Binomial, Poisson, Gaussian distributions. Prerequisite: Mathematics B15.

**738-C03-0 Statistics I** Descriptive statistics; observational and experimental studies; confidence interval estimation; hypothesis testing;simplelinear regression and correlation. Lectures and laboratory. Prerequisite: C02 or equivalent.

**738-C04-0 Statistics II** Multiple regression; analysis of variance; design and analysis of single-factor and multifactor experiments; categorical data; nonparametric methods. Prerequisite: C03 or equivalent.

**738-C05-0 Statistical Methods for Quality Improvement** Control charts and process capability studies; other graphical methods. Industrial experimentation: multifactor experiments, screening experiments, quality engineering using robust designs. Reliability and life testing. Prerequisite: B03, C03, or equivalent.

**738-C06-0 Decision Analysis and Behavioral Decision Theory** Theory of optimal decisions and psychology of human decision making. Probability, utility, risk and uncertainty, rare events, group decision making, probability revision, interpersonal conflict. Background in probability desirable. Prerequisite: C02 or equivalent.

**738-C07-0 Quality Improvement by Experimental Design** Methods for designing and analyzing industrial experiments. Planning experiments, blocking and randomization, multiple regression, factorial and fractional factorial experiments, response surface methodology. Taguchi's robust design, split plot experiments. Prerequisite: C03 or equivalent.

**738-C11-0 Linear Algebra for Operations Research** Linear spaces, linear transformations, matrices. Systems of linear equations: properties; solution by elimination. Orthogonality; the linear least-squares problem. Eigenvalues, eigenvectors, powers of matrices, dynamic equations. Prerequisite: Mathematics B15.

**738-C13-0 Deterministic Models and Optimization** Formulation and solution of applicable optimization models, including linear, integer, dynamic, and nonlinear programs and network problems. Algorithmic methods and efficient use of computers. Prerequisite: C11 or equivalent course in linear algebra.

**738-C15-0 Stochastic Models and Simulation** Modeling and analysis of systems under uncertainty. Integrated approach of stochastic analysis and simulation. Elementary queueing systems and networks. Discrete event simulation, choice of distributions, output analysis, animation. Prerequisites: C02, C03, and CS A10.

**738-C19-0 Operations Research** One-quarter survey of operations research techniques for nonmajors. Linear programming, decision theory, stochastic processes, game theory. Not open to IE majors.

**738-C21-0 Human Factors Engineering** System development, human functions in systems, human capabilities and equipment design, personnel selection and training, human performance assessment, and system evaluation. Human-machine systems design.

**738-C22-0 Industrial Psychology** For managers in industry and nonprofit organizations. Human resources (HR) processes that affect productivity, quality of work life, and legal obligations. HR planning, job analysis, recruitment, selection, placement, appraisal, compensation, training, and development. Prerequisite for nonmajors: consent of instructor.

**738-C24-1,2 Engineering Management I,II** Two-course introduction to the fundamentals of accounting, finance, and marketing for managers of engineering and other technology-based functions of an organization. Prerequisites: IE junior or senior standing; C24-1 prerequisite for C24-2.

**738-C26-0 Economics for Engineering I** Financial decisions of firms: investment and capital budgeting under certainty and uncertainty; common evaluation models in terms of applicability; cost-benefit analysis of public sector investment decisions. Prerequisite: Mathematics B15.

**738-C27-0 Economics for Engineering II** Economics of firms: demand; cost and production; stock-flow production technologies; equipment investment and replacement

and facility location decisions; behavior under different forms of competition. Prerequisite: Mathematics B15.

**738-C28-0 Location Analysis and Spatial Planning** Plant layout problems and their solutions. Increasingly complex models of plant location problems. Case studies. Prerequisite: C13 or C19.

**738-C29-0 Production Planning and Scheduling** Production planning and scheduling under various demand environments. Application of operations research methods to practical problems of production and inventory control. Prerequisites: C02 and C13 or C19.

**738-C30-0 Information Technology in Manufacturing** An overview of the information technology used in the high-technology manufacturing environment. Integration of people, business processes, manufacturing processes, and information technology.

**738-C34-1,2 Systems Project Management I,II** **1.** Introduction to systems problems and methods, including problem definition, analysis, design, evaluation, proposals, and related areas; preliminary exploration of potential team systems projects. **2.** Project management methods applied to the analysis and design of a complex, real-world system. Initiation and planning; organizing and staffing; performance, schedule, and cost control; evaluation, proposals, and implementation. Prerequisites: C21 or C22, C40, and IE senior standing.

**738-C35-0 Systems Simulation** Discrete event simulation using microcomputers. Generating and testing random deviates, analyzing simulation output, simulating complex systems, and reviewing commonly used simulation languages. Modeling and programming exercises. Prerequisites: C03, C15, and CS A10.

**738-C36-1,2 Industrial Engineering Design Project I,II** **1.** Case studies and small-scale projects involving application of operations research techniques to complex decisions problems. Mathematical modeling, optimization, and policy analysis in public and private sector systems. Written and oral presentations of analyses. **2.** Large-scale, open-ended team projects from selected fields of industrial engineering. Systems approach requiring establishment of objectives and criteria, analysis and synthesis of alternatives, feasibility, trade-offs, testing, and evaluation. Written and oral presentations of reports. Prerequisites: senior standing, C13, and C15 for industrial engineering majors or C19 for manufacturing engineering majors.

**738-C40-0 Field Project Methods** Bases for theories and practices in organizational behavior and complex systems problem solving. Methods of identifying and defining problems, choosing among methods of data collection and analysis, and designing and carrying out inquiries and related projects. Prerequisite for nonmajors: consent of instructor.

**738-C41-0 Introduction to Organizational Design** Design of operating organizations or their components. Work in planned change and a field project in an operating organization. Prerequisites: C40 or D10, D11.

**738-C95-0 Special Topics in Industrial Engineering** Topics suggested by students or faculty and approved by the department.

**738-C99-0 Seminar and Project** Comprehensive study by each student of a selected topic. Engineering literature, experiments, field studies, computer programming. Credit to be arranged. Departmental form required before registration.

## Materials Science and Engineering

Materials science and engineering is a new discipline that has expanded rapidly in response to growing needs for improved use of existing resources and the development of new, specialized materials for future technologies. The program at Northwestern is broad-based, encompassing solid-state physics, polymer science, ceramics, metallurgy, geophysics, surface science, biomaterials, and electronic materials. Engineers, scientists, and technologists who work on different materials for our modern technology all apply basically the same scientific principles governing the interrelation of processing, structure, properties, and material performance. A key theme of the Northwestern program is the integration of these principles in the systematic design of new materials, exploiting the controlled evolution of multilevel structure.

The Department of Materials Science and Engineering offers an undergraduate program leading to the BS degree as well as programs for the MS and PhD degrees. Preparation for a career in materials science and engineering is founded on engineering principles as well as on thermodynamics and kinetics, chemistry, physics, and mathematics. Students who complete one of the programs described below will be well prepared for professional work or graduate studies in the structural or electronic applications of the materials science and engineering of metals, ceramics, or polymers.

An essential component of the undergraduate program is the senior project, in which each student works with a faculty member on a development or research project. The curriculum provides a fundamental education that prepares students for careers in application, production, processing, or research and development of materials. A student's educational experience is broadened by provision of adequate time for courses in the humanities, arts and sciences, and other areas of engineering.

### Areas of Concentration

The undergraduate program at Northwestern offers a close relationship between students and faculty. Every effort is made to tailor specific programs to needs and interests. Several broad areas of concentration are described below. Students are encouraged to create other areas that fit particular interests.

### *Biomaterials*

The growth of biotechnology has stimulated interest in the interface of the life sciences and materials science. The field of biomaterials spans three broad areas: biomedical implant materials to replace natural structures; biomimetic materials applying biological concepts to the design of new engineering materials; and application of materials science principles to the understanding of structure and function in biological systems.

### *Electronic Materials*

As microelectronics enters the era of very large-scale integration, materials scientists face new challenges in developing materials and processes for integrated circuits with components of micrometer dimensions. New scientific principles, materials fabrication techniques, and improved instrumentation will be needed to exploit electronic-level structure/property relations in these devices and their components. New electronic materials must be developed to meet ever-increasing requirements such as the exciting new area of high-Tc superconductivity.

### *Metals and Ceramics*

The ability to design increasingly higher-strength alloys allows for lighter structures, and higher-temperature materials provide energy efficiency. Heat-treatable and toughened ceramics exploit advanced knowledge of solid-state phase transformations and reactions. Exciting developments are taking place in high-performance composite combinations of these and other materials.

### *Polymeric Materials*

Synthetic polymers offer the engineering community an ever-expanding array of materials having properties that are tailored by chemical and physical processing. New developments are opening up applications for polymers as high-strength, low-weight materials; optoelectronic components; and key materials in other revolutionary areas. The basic understanding of engineering properties in terms of multilevel microstructure is essential for the full utilization of polymers.

### *Surface Science*

A solid communicates with the outside world through its surface. Wear, corrosion, and passivation are well-known surface processes. Mechanical properties of materials depend critically on composition at grain boundaries (internal surfaces), surface treatments, and the environment. The surface scientist must not only be able to determine the properties of surfaces or interfaces but also be able to control them.

## Laboratories and Facilities

Materialsscience and engineering demands sophisticated experimental techniques for the preparation and characterization of advanced materials The undergraduate program makes heavy use of state-of-the-art laboratory facilities in core courses, technical electives, and senior projects.

Materialspreparationand processing equipment is available for all classes of materials, including an advanced crystal growth facility in a clean room environment for preparing single crystals of metals, oxides, alkali halides, and semiconductors. Investigation of complex microstructures employs a wide array of microscopy, diffraction, and microanalysis techniques. This features a unique combination of instruments (cold field–emission transmission electron microscope, atom-probe field-ion microscopes, scanning tunneling microscopes), providing atomic resolution imaging and chemical analysis, complemented by an extensive surface analytical laboratory. Characterization of material properties employs an advanced mechanical testing facility featuring static and dynamic loading under controlled temperature and environment. Specialized facilities measure electrical, spectroscopic, magnetic, and photonic properties. Computer laboratories address thermodynamic modeling and simulation of microstructural evolution, with application in materials design.

## Courses Primarily for Undergraduates

**750-A01-0 Modern Materials and Society** Introduction to materials—how they function, how they are made, the devices they enable, and their impact on society. Role of materials developments in technological innovation and global competitiveness. Prerequisites: high school mathematics and science background. Fulfills CAS distribution requirements. Not intended for engineering majors.

**750-A90-0 Materials Science and Engineering Freshman Projects** Laboratory-oriented, with research projects emphasizing use of the scanning electron microscope and other modern apparatus; correlation of structure with other properties of materials. Lectures, laboratory.

**750-B01-0 Principles of the Properties of Materials** Introduction to atomic and molecular organization in solids, with emphasis on structure-property relations in ceramics, electronic materials, metals, and polymers. Prerequisite: Chemistry A02.

**750-B03-0 Microstructure and Engineering Properties of Materials** Processing, microstructure, and properties of engineering materials with emphasis on structural materials such as concrete, steel, wood, glass, and ceramics. Prerequisites: Chemistry A02 and Mathematics B14-3.

**750-C01-0 Chemical Aspects of Engineering Materials** Equilibrium and nonequilibrium development of microstructures. Mechanical behavior of metals, ceramics, and polymers. Corrosion and stability of engineering materials. Materials processing. Not usable in MSc program. Prerequisite: Chemistry C42-1 or ChE B11.

**750-C16-1,2 Microstructural Dynamics** Principles underlying development of microstructures. Defects, diffusion, phase transformations, nucleation and growth, thermal and mechanical treatment of materials. Lectures, laboratory. Prerequisite: C21 or equivalent.

**750-C17-0 Materials in Manufacturing** Ways in which structure-property relationships of engineering materials determine and are affected by the processes employed in their manufacture. Not open to MSc majors. Prerequisite: B01 or equivalent.

**750-C21-0 Applications of Thermodynamics** Classical thermodynamics; entropy and energy functions in liquid and solid solutions and their applications to phase equilibria. Lectures, problem solving. Prerequisite: Chemistry C42-1 or equivalent.

**750-C22-0 Kinetics of Heterogeneous Reactions** Rates and mechanisms of heterogeneous gas-solid, liquid-solid, and solid-solid reactions such as carburization, reduction, oxidation, corrosion, stress-corrosion, and heterogeneous structural transformations. Role of microscopic and macroscopic defects.

**750-C31-0 Physical Properties of Polymers** Different kinds of polymeric materials. Relationships between structure and physical properties; rubber elasticity, the glassy state, crystallinity in polymers. Lectures, laboratory. Prerequisites: B01 or equivalent and Chemistry C42-1.

**750-C32-0 Mechanical Behavior of Solids** Plastic deformation and fracture of metals, ceramics, and polymeric materials; structure/property relations. Role of imperfections, state of stress, temperatures, strain-rate. Lectures, laboratory. Prerequisites: C16-1,2; may take C16-2 concurrently.

**750-C33-0 Composite Materials** Introduction to ceramic-, metal-, polymer-matrix composites for structural applications. Emphasis on structure (reinforcements, architecture), properties, processing, role of interface.

**750-C40-0 Ceramic Processing** Steps in production of fired ceramic articles. Powder preparation and characterization, compact formation, slip casting, extrusion and injection molding; firing, liquid phase and solid-state sintering. Lectures, laboratory. Prerequisite: C16-1 or equivalent.

**750-C41-0 Introduction to Modern Ceramics** Applications of ceramic materials, with emphasis on structure (bond, crystal, glass, defect, micro-); properties (thermal, electrical, optical, magnetic, mechanical); and processing (powders, forming, densification). Prerequisites: C16-1,2 or consent of instructor.

**750-C51-1,2 Introductory Physics of Materials** Quantum mechanics; applications to materials and engineering. Band structures and cohesive energy; thermal behavior; electrical conduction; semiconductors; amorphous semiconductors; magnetic behavior of materials; liquid crystals. Lectures, laboratory, problem solving. Prerequisites: Mathematics B21 and Physics A35-2,3.

**750-C55-0 Electronic Materials** Principles, models, and characterization of semiconductor materials. Crystal growth and doping. Diffusion, epitaxy, and monolithic processes. Current transport, nonequilibrium processes, thin films, low-mobility materials, and interfaces. Prerequisite: C51-1, ECE C81, or consent of instructor.

**750-C60-0 Introduction to Electron Microscopy** Theories and practice involved in application of scanning electron microscopy and transmission electron microscopy. Lectures, laboratory. Primarily for undergraduate and non-MSc graduate students. Prerequisites: B01 and Physics A35-2,3 or equivalent.

**750-C61-0 Crystallography and Diffraction** Elementary crystallography. Basic diffraction theory; reciprocal space. Applications to structure analysis, preferred orientation. Film and counter techniques. Lectures, laboratory. Prerequisites: Mathematics B21 and Physics A35-2,3.

**750-C62-0 Point,Line, and Planar Imperfections** Introduction to point defects, dislocations, and internal interfaces in crystalline solids. Interactions among point, line, and planar imperfections. Metals, ionic solids, semiconductors. Prerequisite: C21.

**750-C80-0 Introduction to Surface Science and Spectroscopy** Surface spectroscopy, including Auger spectroscopy, photoemission, and LEED. Surface dynamics and thermodynamics. Electronic properties of surfaces and interfaces. Gas-surface interactions. Prerequisite: C51-1 or equivalent.

**750-C85-0 Image Analysis** Quantitative analysis of microstructures in materials, from measurements on two-dimensional sections, transmission micrographs, and scanning electron micrographs.

**750-C90-0 Materials Design** Analysis and control of microstructures. Quantitative process/structure/property/performance relations with case studies. Computer lab for modeling multicomponent thermodynamics and transformation kinetics. Prerequisites: C21 and C16-1,2 or consent of instructor.

**750-C91-0 Process Design** Processing of materials. Design and analysis of experiments to identify and optimize key parameters to control properties and performance. Resolving conflicting requirements. Statistical process control.

**750-C94-0 Honors Project in Materials Science** Independent study and/or research linked to C96. Comprehensive report on a specific area of modern materials science and engineering. Prerequisite: registration in department honors program.

**750-C95-0 Special Topics in Materials Science and Engineering** Topics suggested by students or faculty and approved by the department.

**750-C96-1,2 Senior Project in Materials Science and Engineering** To be taken in two consecutive quarters. Independent basic or applied research project, conceived

and performed under the direction of a department faculty member. Prerequisite: senior standing in MSc.

**750-C98-0 Introduction to Plasma Science and Processing Technology** Plasma production, plasma properties (microscopic and macroscopic); plasma characterization, transport phenomena, plasma processing of powders and advanced materials.

**750-C99-0 Special Problems in Materials Science** Individual problems including library and design work; comprehensive report on a specific phase of modern materials science. Credit to be arranged.

## Mechanical Engineering

The Department of Mechanical Engineering offers a broad range of programs leading to the bachelor of science degree in mechanical engineering.

Mechanical engineering has always meant engines and machinery, but the character of modern engines and machinery has changed enormously because of the ever-increasing demands of performance, compactness, reliability, and productivity. The early devices were built by ingenious mechanics, individuals possessed with the know-how to reduce these ideas to practice. Today, traditional know-how and creative ability are as necessary as ever but no longer sufficient in an increasingly competitive world. It has become necessary also to know why things occur and, thus, to be able to exert the proper guidance at the earliest stages of planning. Furthermore, in a world of finite resources and in a society increasingly aware of its environment, mechanical engineers must cope with not only the traditional concerns of efficiency and safety but also the undesirable effects of pollution. Clearly, the tools that future mechanical engineers need to possess must be more sophisticated to allow the important but ever-subtle effects to be recognized and controlled.

Mechanical engineering plays a dominant role in a wide spectrum of industries, among them the transportation industry (automotive, rail, air, and marine), heavy machinery (machines producing other machines), the power industry, the environmental industry (heating, ventilation, and air-conditioning), robotics, the light precision-machine enterprises (optical, prosthetic devices, mechanical instruments, and the like), and numerous commercial product industries. Preparation for a career in mechanical engineering requires a basic understanding of the mathematical, physical, and engineering principles essential to planning, designing, and manufacturing new equipment.

The curriculum in mechanical engineering provides a broad fundamental education preparing students for direct entry into industry as well as further professional study. The first part of the curriculum is devoted to mathematics, physics, and chemistry. With this background, fundamental mechanical engineering subjects are studied. These include dynamics, solid mechanics, fluid mechanics, and thermodynamics followed by specialized subjects such as manufacturing, heat transfer, and automatic control. During the final two years, design courses, laboratory courses, and project courses allow students to acquire a taste for the complex task of designing, analyzing, and building a piece of "hardware." In particular, students become aware of the coupling between conceptual design, subsequent analysis (mathematical modeling), manufacturing, systematic experimentation, and final testing. Supporting courses in allied fields of science and engineering broaden the technical proficiency of mechanical engineering, while the elective courses in social sciences, fine arts, history, and philosophy enlarge their background in the problems of humanity.

### Areas of Specialization

The program in mechanical engineering is designed to appeal to students with a wide variety of interests and professional goals. By an appropriate choice of elective courses, students can develop a highly personalized curriculum.

Some areas of specialization are computer-aided design/computer-aided manufacturing, systems and control, robotics, tribology, and fluid mechanics. In addition, there are special options—energy, intelligent mechanical systems, biomedical engineering, and manufacturing. The energyoptionemphasizesthe mechanicalaspects ofenergy conversion and management. The intelligent mechanical systems option focuses on the design of devices featuring mechanical hardware interfaces to electronic hardware and software. The biomedical engineering option is open to students interested in the biological and medical applications of mechanical engineering procedures. Students in this option can also satisfy the entrance requirements of medical schools. The manufacturing option is directed toward planning and selecting manufacturing methods, design for manufacture, computer-aided flexible automation and robotics, and increasing the efficiency and productivity of current and emerging manufacturing technologies.

### Facilities

A detailed description of ME facilities in the reconstructed mechanical engineering laboratories is available at the ME department office.

### Courses Primarily for Undergraduates

**740-B01-0 Mechanics I** Equivalent force systems. Equilibrium of rigid bodies. Distributed forces and centers of gravity. Kinematics of rigid bodies in planar motion. Prerequisites: Physics A35-1 and concurrent registration in Mathematics B15.

**740-B02-0 Mechanics II** Kinetics of rigid bodies in planar motion. Moments of inertia. Energy and momentum methods. Principle of virtual work. Prerequisite: B01.

**740-B20-0 Thermodynamics I** Basic definitions; Zeroth Law and the meaning of temperature; the First Law applied to flow and nonflow processes; the Second Law and its applications; properties of pure substances; equations of state, the Third Law of Thermodynamics, and introduction to cycles. Prerequisites: Physics A35-1 and concurrent registration in Mathematics B15.

**740-B24-0 Experimental Engineering I** Modern electronics; analog and digital circuit construction and conversion. Modern data acquisition involving temperature measurements, control of stepper motors, transient heat transfer, fluid mechanics, deformation of beams. Prerequisites: B20, B41, ECE B70, and CE B16.

**740-B40-0 Introduction to Mechanical Design and Manufacturing** Introduction to strategy and methods of designing, manufacturing, and testing of mechanical products. Material properties and selection methodology, engineering drawing and CAD, and simple manufacturing processes. Prerequisite: concurrent registration in CE B16.

**740-B41-0 Fluid Mechanics I** Fundamentals of fluid mechanics. Properties and statics of fluids. Kinematics and dynamics of fluid motion—continuity, momentum, and energy equations. Dimensional analysis, flow in closed conduits. Prerequisites: CE B12 and Mathematics B17 or equivalent.

**740-C14-0 Theory of Machines—Dynamics** Three-dimensional kinematics: rotation axes and mechanism analysis, rotation matrices and Euler's angles for rigid bodies. Three-dimensional kinetics: dynamics of particles, central force problems, dynamics of rigid bodies, rotational inertia matrices and principal axes, dynamics of mechanisms, the gyroscope and other torque-free problems. Prerequisite: B02.

**740-C15-0 Theory of Machines—Design of Elements** Factors influencing the proportioning of machine elements—stresses, deformations, and failure criteria as applied to shafts, springs, belts, bearings, gears. Lectures, laboratory. Prerequisite: CE B16.

**740-C25-0 Kinetic Theory and Statistical Thermodynamics** Kinetic theory of ideal gas; temperature; Maxwell velocity distribution; transport phenomena, Maxwell-Boltzmann statistics; Bose-Einstein and Fermi-Dirac statistics; partition functions and thermodynamics. Prerequisite: B20 or equivalent.

**720-C27-0 Finite Element Methods in Mechanics** See Civil Engineering.

**740-C40-1,2,3 Computer-Integrated Manufacturing** Use of computers to improve productivity and reduce costs in the manufacture of discrete parts and assemblies. **1.** Manufacturing processes: Analysis and evaluation of process usage in the contemporary manufacturing environment. Prerequisite: B40 or consent of instructor. **2.** CAD/CAM: Geometric modeling, dimensioning systems, tolerances, design for manufacture, programming of machine tools. Prerequisites: C40-1 and CE B16 or consent of instructor. **3.** Manufacturing automation: Metrology, machine tool control, forming processes, parts feeding, assembly, robotics, factory control, communications. Prerequisite: C40-2 or consent of instructor.

**740-C46-0 Introduction to Tribology** Fundamentals of surface contact: surface topography hardness, asperity contact. Friction theories and wear mechanisms. Temperatures in sliding contacts. Hydrodynamic, hydrostatic, elastohydrodynamic, and boundary lubrication.

**740-C50-0 Introduction to Nuclear Engineering** Energy sources and needs and the interrelationship of nuclear power and the environment. Nuclear physics as it relates to radiation protection and nuclear fission and fusion reactions; nuclear designs, economic and environmental considerations; nuclear reactor types and characteristics. Prerequisites: Physics A35-2,3 and Mathematics B21.

**740-C58-0 Experimental Engineering II** Optical metrology. Stress analysis, fluid flows, combustion, dynamics, and control. Use of optical interferometry, anemometers and pitot tubes, accelerometers, and other advanced measurement devices.

**740-C59-0 Reliability Engineering** Probability concepts and random variables. Failure rates and reliability testing. Wear-in, wear-out, random failures. Probabilistic treatment of loads, capacity, safety factors. Reliability of redundant and maintained systems. Fault tree analysis. Prerequisite: Mathematics B21.

**740-C62-0 Stress Analysis** Theory of elasticity: plane stress, and plane strain problems. Bernoulli-Euler beam theory. Elastic stability. Principle of minimum potential energy; Rayleigh-Ritz methods applied to problems involving rods, beams, columns, plates. Prerequisite: CE B16 or equivalent.

**740-C63-0 Mechanical Vibrations** Analysis of vibrations in single- and multidegree-of-freedom systems. Free and forced vibrations with various types of damping. Response to steady-state and transient excitations. Applications to vibration measurement and control systems. Prerequisites: B02 and Mathematics B21.

**740-C65-0 Finite Elements for Stress Analysis** Application of computer-based modeling techniques to analysis of mechanical systems; databases; computer graphics and their use in analysis. Prerequisites: Mathematics B15, CE B16, and computer programming.

**740-C66-0 Finite Elements for Design and Optimization** Numerical methods for interaction and optimal CAD. Fully stressed design; design sensitivity analysis and descent methods; optimality criteria to automated design. Prerequisites: senior standing and C65 or consent of instructor.

**740-C68-0 Aerodynamics** Behavior of lifting surfaces in ideal fluid flows. Two-dimensional airfoil theory;

Joukowski transformation. Finite wing theory; the Prandtl lifting line. Prerequisite: B41.

**740-C70-0 Thermodynamics II** Elementary classical thermodynamics, application of first and second laws of thermodynamics to power and refrigeration cycles, mixtures and solution, thermodynamic relations, chemical reactions, phase and chemical equilibrium. Prerequisite: B20.

**740-C71-0 Combustion Engines** Theoretical and actual cycles, combustion, detonation, carburetion, fuels; performance characteristics, fuel-cell power. Prerequisite: B20.

**740-C72-0 Introduction to Turbomachinery** Application of fluid dynamics and thermodynamics to the analysis and design of steady flow machinery, such as pump, compressor, and turbine. Introduction to aircraft engines. Prerequisites: C70 and C73.

**740-C73-0 Engineering Fluid Mechanics** Laminar and turbulent duct flows. Boundary layers and potential flows. Lift and drag forces. Thermodynamics and mechanics of compressible flow. Nozzle flows and choking. Wave motion and shock waves. Applications to fluid machinery. Lab required. Prerequisite: B20, B41, or equivalent.

**740-C75-0 Air-Conditioning and Refrigeration** Heating and cooling requirements for buildings and various technical processes; thermodynamic analysis; heating and refrigeration systems; system design. Prerequisite: B20.

**740-C77-0 Heat Transfer** Fundamentals of heat transfer by conduction, convection, and radiation. Steady and transient heat conduction in solids. Forced and free convection in fluids. Properties of thermal radiation. Radiation heat transfer between solids. Solar radiation. Prerequisite: C73.

**740-C79-0 Elements of Combustion Engineering** Introduction to combustion processes, providing an understanding of flame processes as they relate to efficiency and pollution due to propulsion and power generating systems. Diffusion and premixed flames, problems of ignition, quenching, flammability limits, and detonation. Prerequisite: senior standing in ME or consent of instructor.

**740-C90-0 Introduction to Dynamic Systems** Modeling the dynamic behavior of physical systems. Concepts of causality, dependent and independent storages, and state. Introduction to bond graphs. Generation of state equations; analytical and computer simulation of system behavior. Application to problems of engineering interest. Prerequisite: Mathematics B21.

**740-C91-0 Fundamentals of Control Systems I** Mathematical modeling of automatic control systems. Open loop and closed loop control. Laplace transform techniques and transfer functions. Stability. Root locus technique, Bode plots, Nyquist criterion. Approaches to control system design, including PID and lead-lag compensation. Prerequisite: C90 or consent of instructor.

**740-C95-0 Special Topics in Mechanical Engineering** Topics suggested by students or faculty and approved by the department.

**740-C98-0 Engineering Design** Product or system design projects carried out by small student groups. Project definition, conceptual and detailed design, evaluation, and documentation. Prerequisite: senior standing.

**740-C99-0 Projects** Special studies to be done under faculty direction. Credit to be arranged.

# Medill School of Journalism

Journalists perform a vital function in a democracy whose existence depends on an informed electorate and in a world that depends on effective communication. The Medill School of Journalism seeks to develop professional writers and editors who are broadly educated in the liberal arts and sciences; who are technically skilled; who understand the historical underpinnings of a free press in America; and who appreciate the social, legal, and ethical issues of the news media in modern-day society.

The core journalism courses—which make up 25 percent of the undergraduate curriculum—are designed to prepare students for careers in the mass media, with emphases on writing, reporting, editing, and graphics.

During the junior year, students participate in Teaching Media (the Teaching Newspaper, Teaching Magazine, or Teaching Television program), receiving course credit for an academic internship at 1 of about 50 newspapers located in 25 states or at various magazines or television stations. These programs offer a professional laboratory in which students study under the supervision and guidance of editor-instructors monitored and supervised by Medill faculty. Students who encounter financial hardship while on these programs may apply to the school's Benjamin H. Baldwin Fund for some support.

The nonjournalism courses—about 75 percent of the undergraduate curriculum over four years—include a wide selection of social and natural sciences, arts, and humanities classes, so that students will have the background to understand and communicate the world's events.

Many undergraduates find media jobs in print or broadcast journalism, public relations, or allied fields directly after graduation. Others pursue a Medill master's degree. The graduate program in editorial journalism offers concentrated study in reporting and writing, newspaper management, broadcast journalism, and magazine publishing. The school's other graduate program, integrated marketing communications, has specialized concentrations in advertising, corporate public relations, direct marketing, and interdisciplinary studies. Students are admitted to a graduate program only if their undergraduate course work indicates the aptitude necessary for rigorous, specialized education.

Through the Accelerated Master's Program, Medill allows a few students each year to earn both bachelor's and master's degrees in editorial journalism in less than five years. Students apply to this program in their junior year; those accepted into the highly selective program must show academic excellence and the promise of success in journalism.

Medill has awarded nearly 13,000 degrees since its founding in 1921; the school's graduates stand among the leaders of the profession. Medill's 900 students—600 undergraduates and 300 graduate students representing nearly every state in the union—take pride in the school's ranking as one of the country's preeminent journalism centers.

## Academic Policies

### Requirements for the Degree of Bachelor of Science in Journalism

1. A minimum of 45 units must be completed on the college level.

2. Students must take the final 23 units (of 45 required for graduation) at Northwestern and complete the last three quarters of work while enrolled at Medill.

3. At least 11 but no more than 12 units in journalism may be counted toward the 45 course units required for graduation; 33 of the 45 must be in areas other than journalism. Students with more than 45 units may take additional journalism units.

4. Required journalism courses:

*Freshman year*

B01 Editing and Writing the News

B02 History and Issues of Journalism

*Sophomore year*

C01 Newswriting and Reporting (prerequisite: B01)

*Late sophomore year and/or junior year—*
*Option A, B, or C (choose one)*

**Option A**

C40 Newspaper Editing and Writing (prerequisite: C01)
C41 News and New Media (prerequisites: C40, C55, or C65)
C45 Teaching Newspaper (TN): Reporting (1 or 2 units; prerequisites: C40, C41)
C46 Teaching Newspaper: Editing (1 or 2 units)

**Option B**

C50 Magazine Writing (prerequisite: C01)
C51 Magazine Editing (prerequisite: C01)
C55 Teaching Magazine (TM): Writing (2 units; prerequisites: C50, C51)
C56 Teaching Magazine: Editing

**Option C**

C60 Broadcast Writing (prerequisite: C01)
C61 Television News Editing (prerequisite: C60)
C65 Teaching Television (TT): Broadcast News (2 units; prerequisite: C61)
C66 Teaching Television: Editing

*Senior year*

C70 Law and Ethics of Journalism

In addition, seniors take 2 or 3 elective journalism courses from the following list. (Journalism electives taken before the senior year are counted in place of senior-year electives.)

C40 NewspaperEditing and Writing (required for TN)
C41 News and New Media (required for TN)
C50 Magazine Writing (required for TM)
C51 Magazine Editing (required for TM)
C60 Broadcast Writing (required for TT)
C61 Television News Editing (required for TT)
C67 Broadcast Reporting (prerequisite: C60)
C68 Television News Documentary (prerequisite: TT or C67)
C73 Investigative Journalism
C74 Analytical Reporting
C75 Literary Journalism
C90 Special Topics
C99 Independent Study

Journalism course electives from the following list are also open to sophomores and juniors:

C03 Advertising
C04 Direct Marketing
C88 Internship (no credit)

Students may take both C03 Advertising and C04 Direct Marketing only if 1 of these courses is taken as a 12th journalism unit. Of the 11 required journalism units for the bachelor of science in journalism degree, 10 must be in editorial courses.

Seniors may take courses in any area of journalism, regardless of the Teaching Media program they did in the junior year. For example, a Teaching Television student could take magazine courses, newspaper courses, a new-media course, additional television courses, or a combination of courses.

5. Three units of literature are required. They may be from any department in the University dealing with literature, either in English or in a foreign language. Selected courses in other departments will satisfy the literature requirement.

6. Three units of mathematics/science/logic are required. At least 1 of the required courses must be taken from this list: Anthropology C62-1,2,3 Quantitative Methods of Analysis; Biomedical Engineering B20 Introduction to Biomedical Statistics; Mathematical Methods in the Social Sciences B92-1,2,3 Mathematical Methods in the Social Sciences: First Year; Mathematics B10-1,2 Mathematics for the Behavioral Sciences; Political Science C10 Elementary Statistics for Political Research, C11 Methods of Political Research, C12 Logic of Political Inquiry, and C15 Introduction to Positive Political Theory; Psychology B01 Statistical Methods in Psychology; Sociology C03 Analysis and Interpretation of Social Data; and any course in the Department of Statistics.

The other 2 mathematics/science/logic courses may be from the above list or from any of the following core subjects: astronomy, biochemistry, biological sciences, chemistry, computer science, geography, geological sciences, logic (philosophy), mathematics, and physics.

7. Three units of history are required. At least 1 course must be in U.S. history, and at least 1 must be in non-U.S. history.

8. Students are required to take 1 American government course in the Department of Political Science and 1 course in international relations or international studies.

9. One unit of religion, philosophy, or ethics is required, not including courses in logic.

10. One unit of art or art history is required.

11. One unit of economics is required.

12. A social science concentration is required:

- Students must take 3 units in any one of the following departments: anthropology, economics, history, political science, psychology, or sociology. If, for example, the student selects economics, history, or political science, the 3 units taken to fulfill the social science concentration must be in addition to those required of all Medill students (see 7, 8, and 11). At least 1 of the 3 units must be at the C level. Students may apply no more than 1 A-level course toward the social science concentration. International Studies B01-1,2,3 Introduction to the World System may be used toward the 3-unit social science concentration in political science.
- Students may not apply more than 1 unit of field study credit toward the 3-unit social science concentration. Requests for field study credit must be approved by the director of undergraduate studies.

13. Students are required to complete a 6-unit concentration in any department of the College of Arts and Sciences other than the area selected for the 3-unit social science concentration. For any 6-unit concentration except in astronomy, biological sciences, chemistry, geological sciences, mathematics, physics, or a foreign language, students may apply no more than 1 A-level course and must take at least 2 C-level courses.

- Students are exempt from this requirement if they (1) complete a minor in the College of Arts and Sciences, (2) complete a second major in any department of CAS, or (3) complete an adjunct major offered through CAS. Permission to pursue a second or adjunct major must be secured from the appropriate CAS department chair.
- Students may apply not more than 2 units of field study credit toward the 6-unit concentration. Requests for field study credit must be approved by the director of undergraduate studies.

14. First-year students are encouraged to take Communication Studies B72 Communication and American Democracy, normally offered in the winter quarter and cotaught by journalism faculty.

15. No course may count toward more than one requirement.

16. Exceptions to any degree requirements must be approved by the Medill Academic Standards Committee. Petitions and the committee's rules for filing petitions are available in the Medill Office of Student Records and Services or from the chair of the committee.

17. In addition to and independent of the requirements set by Medill, all students must satisfy the University Enrollment Requirement (see Financial Regulations). Also, see the *Medill Undergraduate Handbook* for a complete list of courses that fulfill the nonjournalism course requirements.

### Grade Requirements

1. Students must achieve a 2.00 minimum grade point average in all nonjournalism courses taken for a letter grade and a 2.25 minimum grade point average in journalism courses. In addition, all journalism students are subject to the following grade requirements:

- The journalism grade point average shall reflect the grades of all required journalism courses attempted (including F's) and of any journalism elective courses applied toward the degree.
- All Y and X grades, unless made up satisfactorily by the end of the subsequent quarter, shall be counted as F's.
- A grade of F and/or N earned twice in the same required course shall be grounds for mandatory transfer out of Medill.
- To be eligible for the junior-year Teaching Media program, students must earn a grade of C or better in Newswriting and Reporting and in the 2 media-specific courses that immediately precede the Teaching Media program and a minimum 2.25 grade point average in those 3 courses plus Editing and Writing the News.
- A maximum of 2 units of D or below in required journalism courses or 3 units of D or below overall will be permitted. Exceeding these limits shall be grounds for mandatory transfer out of Medill.
- When journalism courses are repeated, both the previous grade and the subsequent grade are computed in the journalism grade point average. One course does not substitute for the other.
- Students who do not meet the minimum grade point requirements are placed on academic probation. Continued poor performance will result in a mandatory transfer to another school within Northwestern University or dismissal from the University.

2. Medill undergraduates are required to take these courses for letter grades (A, A–, B+, B, B–, C+, C, C–, D, F):

- All journalism courses (except those offered by the faculty under the P/N option)
- All courses in the social science concentration
- All basic requirements in art/art history, economics, history, literature, mathematics/science/logic, philosophy/religion, and political science

3. Other courses may be taken on the pass/no credit (P/N) option, if that option is available. A total of no more than 6 units of credit shall be taken P/N and counted toward the 45 units required for graduation. (P/N grades from Teaching Newspaper, Teaching Magazine, or Teaching Television are included in these 6.) Only 1 course per quarter may be taken P/N.

### Leaves of Absence

Because students often can gain some advantages by taking a leave of absence from their studies, the school generally will approve requests for a leave of absence for a year or less. Leaves of more than a year will be granted only in special circumstances.

Because a leave of absence interrupts the usual academic program, students may require more than four years to complete their degree. Before taking a leave of absence, students should consult with their adviser and with the Medill Office of Student Records and Services. The school cannot guarantee that the student will be able to resume studies precisely at the point at which they were interrupted. The sequence in which various courses are offered may be changed during the student's absence, and it is the student's responsibility to adjust to the new course structure on returning to school.

Once a student is accepted by Northwestern University and enrolled in the Medill School of Journalism, all decisions on leaves of absence and readmission to Medill are made not by the University but by Medill. Therefore, all correspondence about requests for leaves of absence or extension of existing leaves should be addressed to Medill's director of undergraduate studies.

Students who interrupt a degree program by not registering or by withdrawing for one calendar year must apply to the director of undergraduate studies for readmission. There is no fee for this application. In every case, the student's record is thoroughly reexamined before readmission. When a student has been inactive in a program for longer than a calendar year, readmission will be granted only when persuasive evidence of that student's preparation and ability to complete a degree program has been supplied.

Requests for a leave of absence must be received by the Medill School of Journalism at least one month before the leave would begin.

### Faculty Advisers

When students enter Medill, they are assigned to a faculty adviser who is available to help develop an individual academic program. Medill staff and students also help advise students in such areas as degree requirements, career paths, noncredit internships (especially during the summers), and work on campus media.

## Academic Options

### Internships

Internship employment by newspapers, magazines, radio and television stations, and advertising agencies may be available to Medill juniors, seniors, and graduate students, particularly during the summer. Many employers look to Medill for talented young people who can be introduced to their organizations through internships. The school encourages these opportunities as a means of enriching students' education but gives academic credit only for the Teaching Newspaper, Teaching Magazine, and Teaching Television programs.

### Other Undergraduate Programs

Students in the Medill School of Journalism also may enroll in courses offered by the Center for the Writing Arts, the interschool Undergraduate Leadership Program, and the international studies adjunct major, among other areas (see the Other Undergraduate Programs section of this catalog).

### Activities

Medill students, through student publications and broadcast media, professional organizations, and convocations, have many journalistically related opportunities outside of the classroom.

Students write and edit the independent student newspaper, the *Daily Northwestern*, published during the academic year, and the *Summer Northwestern*, a weekly newspaper published during Summer Session.

Also published on campus are the *Syllabus,* the student yearbook, and a wide variety of other publications. The University gives no academic credit for work on student-run publications. The *Daily Northwestern, Summer Northwestern,* and *Syllabus* are published by the Students Publishing Company and have no formal connection with the School of Journalism.

Radio station WNUR-FM provides another outlet for student newswriters, sportswriters, editors, and commentators. *Northwestern News Network* is a student-produced news program aired on a local cable television channel.

Writing skills help the student in other extracurricular activities such as campus politics, the Waa-Mu Show, student-planned colloquia, and various literary publications.

The Society of Professional Journalists and the National Association of Black Journalists, professional organizations that promote high standards among journalists, have chapters on campus. Other organizations for students interested in journalism include Blackboard and the Communications Residential College. Top scholars in the senior and graduate classes are initiated into Kappa Tau Alpha, a national journalism honorary society.

### ROTC Course Credits

ROTC course credits may be used as a portion of the 45 units required for graduation. These units may be considered elective courses.

### Accelerated Master's Program

Through the Accelerated Master's Program, the Medill School of Journalism allows a few students each year to earn both the bachelor's and master's degrees in editorial journalism in less than five years. Students apply to this program in their junior year; those accepted into the highly selective program must show academic excellence and the promise of success in journalism.

### Early Graduation

Students who plan to graduate early must notify the school in writing at least three quarters before the expected date of graduation. These students also should check with the Registrar's Office to make sure they have fulfilled the University Enrollment Requirement.

## Courses

### Required Courses

Note: Students select either C40, C41, C45, and C46; C50, C51, C55, and C56; or C60, C61, C65, and C66.

**325-B01-0 Editing and Writing the News** The fundamentals of journalistic editing, writing, research, and visual presentation.

**325-B02-0 History and Issues of Journalism** The history of print and broadcast journalism, primarily in the United States, as well as the historical development of several contemporary media and ethical issues.

**325-C01-0 Newswriting and Reporting** Reporting and writing several types of news stories for print and broadcast media under deadline pressure; exploring the use of graphics. Prerequisites: B01 and sophomore standing.

**325-C40-0 Newspaper Editing and Writing** Fundamentals of newspaper editing, including headlines, page layout and design, photo editing, information graphics, and appropriate electronic tools. Prerequisite: C01.

**325-C41-0 News and New Media** An exploration of the move of traditional publications into electronic publishing; understanding the journalist's role in that process and mastering the appropriate electronic tools. Prerequisite: C40, C55, or C65.

**325-C45-0 Teaching Newspaper: Reporting** (1 or 2 units) Honing reporting and newswriting skills in a newsroom through practical assignments under deadline pressure and close editorial supervision. Prerequisites: C40 and C41. Taken with C46.

**325-C46-0 Teaching Newspaper: Editing** (1 or 2 units) Honing skills in news editing, headline writing, page layout/design, and graphics in a newsroom through practical assignments under deadline pressure and close editorial supervision. Prerequisites: C40 and C41. Taken with C45.

**325-C50-0 Magazine Writing** Reporting, writing, and illustrating magazine articles, with emphasis on voice, style, subject matter, and organization; the development of ideas; the marketing of articles. Prerequisite: C01.

**325-C51-0 Magazine Editing** Editing magazine copy and graphics, with emphasis on precision, style, and structure; an overview of the magazine industry and the role of magazines in society. Prerequisite: C01.

**325-C55-0 Teaching Magazine:Writing** (2 units) An exploration of most aspects of magazine writing and reporting. Practical assignments in a magazine office with deadline pressure and close professional supervision. Prerequisites: C50 and C51. Taken with C56.

**325-C56-0 Teaching Magazine:Editing** An exploration of most aspects of magazine editing, graphics, and publishing. Practical assignments in a magazine office with

deadline pressure and close professional supervision. Prerequisites: C50 and C51. Taken with C55.

**325-C60-0 Broadcast Writing** Writing news scripts for television on an appropriate computer system, editing videotape, and writing stories to coordinate with the video. Prerequisite: C01.

**325-C61-0 Television News Editing** Writing and producing a television news program using the appropriate computer and editing equipment, news wires, and video feeds. Emphasis on the editorial decision-making process. Prerequisite: C60.

**325-C65-0 Teaching Television:Broadcast News** (2 units) Gathering television news from the field; writing scripts, readers, voiceovers, vosots, packages, and on-camera news for reporters and anchors. Taken in a television newsroom under close professional supervision. Prerequisite: C61. Taken with C66.

**325-C66-0 Teaching Television:Editing** Gaining exposure to the television assignment process by working with the assignment desk; editing voiceovers, sound bites, and packages. Taken in a television newsroom under close professional supervision. Prerequisite: C61. Taken with C65.

**325-C70-0 Law and Ethics of Journalism** The legal and ethical framework defining media freedoms and constraints in the United States. Historical context and focus on the evolution of constitutional, statutory, judicial, and ethical standards. Prerequisite: senior standing.

### Elective Courses

Two courses are required from this list. Students may take both C03 and C04 only if one is as an optional 12th journalism unit. Students may take C40, C41, C50, C51, C60, or C61 as electives if they have not taken them as required courses.

**320-C03-0 Advertising** Orientation to advertising in the economy and society. Introduction to theory and practice of marketing, research, copywriting, media planning, direct marketing; how advertising works; advertising agencies and other organizations; role of advertising in the society and economy; legal aspects.

**320-C04-0 Direct Marketing** Fundamental principles of direct marketing, including marketing, promotion, and business considerations; survey of database, media, and creative techniques used by traditional and nontraditional marketers.

**325-C67-0 Broadcast Reporting** Basics of reporting for broadcast and preparation of broadcast stories. Emphasis on interviewing, packaging a story, and analyzing techniques. Prerequisites: senior standing and C60.

**325-C68-0 Television News Documentary** Formats used in documentary production, with emphasis on transforming a major research effort into a half-hour program or a multipart series. Prerequisites: senior standing and C66 or C67.

**325-C73-0 Investigative Journalism** The news media in their adversarial role in public affairs reporting, including investigative and interpretative reporting and advocacy journalism; the impact of the news media on public opinion and policy making. Prerequisite: senior standing.

**325-C74-0 Analytical Reporting** Development of an in-depth reporting/writing project, including researching the subject; analyzing the appropriate interviews, computer data, and/or surveys; writing and editing; and preparing information graphics. Prerequisite: senior standing.

**325-C75-0 Literary Journalism** A survey of the work of several print and broadcast journalists to explore the intersection of journalism and literature; analysis of the relationships between form and content within the historical contexts in which pieces were produced. Prerequisite: senior standing.

**325-C88-0 Internship** (noncredit) Student-initiated internships in journalism. Supervised by Medill faculty. Prerequisites: sophomore standing and consent of instructor.

**325-C90-0 Special Topics** Specialized, experimental courses offered from time to time by faculty. Prerequisites: vary depending on the course.

**325-C99-0 Independent Study** Academic work sponsored and supervised by a faculty member working one-on-one with a student. Prerequisite: consent of Medill Academic Standards Committee.

# School of Music

Since its establishment in 1895, the Northwestern University School of Music has ranked among the most prestigious music schools in the nation, providing an environment in which young musicians can dedicate themselves to their art. The school offers students a variety of musical experiences, enabling them to develop into highly proficient performers and scholars. It is a professional school within the University—students accepted into the school are also accepted into the University and consequently have the advantage of academic study in a variety of courses with distinguished faculty. As part of a private institution, the School of Music has developed distinctive programs to meet the artistic and professional needs of its students, preparing them for careers as instrumentalists, singers, teachers, composers, conductors, theorists, historians, critics, managers, and others requiring a specialized knowledge of music. These programs are responsive to new directions, recognizing that a great institution of musical learning preserves the riches of past practices while it encourages its students to explore the practices that will produce the music of the future.

The faculty believe that each undergraduate should be given a comprehensive musical background, that the education should be centered on performance founded on scholarly studies in music theory and history, and that all musical training should be accompanied by a broad cultural background in the humanities. In addition to providing instruction in voice and all principal instruments, composition, and music technology, the school supports orchestras, bands, choral ensembles, opera, and a wide variety of small ensembles that give students experience in all avenues of musical expression.

The graduate division of the School of Music is open to students who are deemed capable of advanced study. Graduate courses emphasize scholarly performance and include concentrated work and research in students' major fields of interest. The ultimate aim is to develop informed musicians, independent scholars, and inspired teachers.

Although the excellence of any school depends mainly on the quality of its faculty and students and the soundness of its curriculum, distinguished musicians are brought to the campus from time to time to enrich the regular programs and to give a special impetus to study. In past years, guests have included Dmitri Shostakovich, Witold Lutoslowsky, John Cage, Sherrill Milnes, James Galway, Pierre Boulez, Erich Leinsdorf, and Sir Georg Solti. A performing arts series annually presents concert artists in performance and master classes for students.

In addition to outstanding instruction and significant platform experience at the University, the school offers students excellent opportunities for participating in metropolitan Chicago's rich musical life. While studying toward a degree, students can gain valuable performing experience and enhance their education as developing musicians.

## Mission Statement

We affirm that music is a universally treasured art and an essential component of culture.

The mission of the School of Music is to provide the highest order of education in all major aspects of music. We endeavor also to expand the musical experiences and understandings of students throughout the University and to enhance the quality of our community's musical life. While continuing to animate the vital traditions of music's past, we encourage creative and dynamic visions of its future.

The School of Music pursues this mission through professional undergraduate and graduate programs for a selective student body of highly qualified musicians who also meet competitive academic standards. We attempt to integrate the artistic and intellectual aspects of our students' education and to provide a depth and breadth of musical study that equips them with a continuing capacity to grow in their musicianship and to adapt to changing professional demands. Our faculty members strive to be inspiring teachers as well as musical and intellectual leaders. They are actively engaged in expanding knowledge about

music through their research and scholarship; in preparing students to be performers, composers, teachers, scholars, and informed audiences; and in enriching their community's culture through their own artistry.

## Academic Policies

### Programs of Study

The School of Music offers programs leading to the professional degrees of bachelor of music, master of music, graduate certificate in music, and doctor of music. While these programs are designed to prepare the individual for a professional life in music, the setting of the school within a university of Northwestern's quality provides special benefits to students for broadening their education in related disciplines. The school also offers a nonprofessional degree, the bachelor of arts in music. The School of Music is a founding member of the National Association of Schools of Music, which fully accredits all its degree programs.

The curriculum allows flexibility for students while providing an education that is basic for all musicians. Applicants in all areas who are accepted by the School of Music enter directly into a program of specialization that begins in the freshman year. The core studies, taken by all students, require the acquisition of minimum competencies and provide fundamental and essential experiences that complement the specialized studies in the declared major. Students are also required to complete studies in a number of allied subjects throughout the University and are given significant opportunities to explore other interests with free electives.

#### *Bachelor of Music*

Courses of study leading to the bachelor of music degree include music theory, music composition, musicology, music education, and performance in piano, organ, string instruments, winds, percussion, and voice.

Through the use of electives, it is possible in the final two years of study leading to the bachelor's degree, with the adviser's help and the faculty's approval, to design an ad hoc program that cuts across specializations to meet a particular student's needs and career ambitions. Students interested in a specially designed and approved program that most fits their interests and abilities may petition for such a program. The program is designed in consultation with faculty and area professionals with expertise in the particular area of interest. Ad hoc specializations have included arts administration, music criticism, jazz studies, conducting, ethnomusicology, music theater production, and music industry.

Graduates of the bachelor of music with specialization in the music education program meet all requirements for teacher certification in the state of Illinois (and most other states). In addition to the core program common to all School of Music students, music education majors take a structured sequence of courses in general education, a basic set of courses in music education, and special courses in the chosen music education specialization.

#### *Bachelor of Arts in Music*

In addition to the professional curricula just described, the School of Music offers a nonprofessional degree program leading to the bachelor of arts in music. Featuring an opportunity for substantially wider explorations in the liberal arts and fewer music requirements, the bachelor of arts in music is intended for students who have strong ability in music but are not necessarily interested in a musical vocation. Students who are interested in this program may petition for it at any time after they have been admitted to the School of Music.

#### *Five-Year BA/BMus*

Students accepted into the combined College of Arts and Sciences–School of Music program may simultaneously earn a BA degree from the College of Arts and Sciences and a BMus degree from the School of Music. They must complete all CAS degree requirements, including at least 30 CAS courses, as well as all School of Music bachelor of music degree requirements, including at least 30 music courses. Fulfilling both music and CAS requirements usually takes five years of full-time study, and a University Enrollment Requirement of 15 quarters is obligatory (see Financial Regulations).

Participants in this combined program must be accepted by both the School of Music and the College of Arts and Sciences. The entrance requirements and structure of the program are currently

## Degree Requirements

### Bachelor of Arts in Music (48 course units)

| *Music* | *Nonmusic* |
|---|---|
| **Core Studies** (11–15 units)<br>Musicology (3 units)<br>Music theory (3 units)<br>Aural skills (1 unit)<br>Keyboard skills (1 unit; optional)<br>Ensembles (1 unit)<br>Performance study (3–6 units): includes private instruction and related course work on principal instrument or voice. A second year of instruction may be taken.<br>**Electives**<br>C-level musicology (3 units)<br>C-level music theory (3 units) | **General Education Distribution** (14 units)<br>One English composition course (1 unit)<br>One freshman seminar or one general education elective (1 unit)<br>Two courses from each of the six CAS distribution areas: natural sciences, formal studies, social and behavioral sciences, historical studies, values, literature and fine arts (12 units)<br>**Foreign Language** (6 units)<br>May be satisfied by completing the third quarter of an intermediate (second-year college) course in a classical or modern language or by passing an examination to demonstrate equivalent proficiency<br>**Electives** (10 units)<br>A maximum of three elective units may be taken as additional courses in music. |

### Bachelor of Music (49.5–51 course units)

| *Music* | *Nonmusic* |
|---|---|
| **Core Studies** (12 units)<br>Musicology (3 units)<br>Music theory (3 units)<br>Aural skills (3 units)<br>Keyboard skills (1.5 units)<br>Ensembles (1.5 units)<br>**Major Studies** (19.5–21 units)<br>Major Studies Requirement: See specific department and program. Majors in one of the following areas: principal instrument, voice, music education, musicology, music theory, music composition, music technology, academic studies, or an ad hoc major. | **General Education Distribution** (12 units)<br>Basic or intermediate English composition (1 unit)<br>One course from each of the following CAS distribution areas: natural sciences, social and behavioral sciences, historical studies, values, literature and fine arts (5 units)<br>General education electives (6 units)<br>**Free electives** (6 units) |

### Bachelor of Music with Major in Music Education (48–53 units)

| *Music* | *Nonmusic* |
|---|---|
| **Core Studies** (12 units)<br>Musicology (3 units)<br>Music theory (3 units)<br>Aural skills (3 units)<br>Keyboard skills (1.5 units)<br>Ensembles (1.5 units)<br>**Core Studies in Music Education** (22–28 units)<br>See program description for requirements.<br>**Specialization** (5–8 units)<br>Students in the undergraduate music education program must choose one of the three specialization tracks: instrumental, choral, or general. See program description for requirements. | **General Education Distribution** (7 units)<br>General education course requirements (see program decription for specific courses)<br>**General Electives** (4 units)<br>One course each in biological sciences, an additional science, an additional social science, and English literature |

**Five-Year Bachelor of Arts and Bachelor of Music (60 course units)**

| *Music* | *Nonmusic* |
|---|---|
| **Core Studies** (12 units)<br>Musicology (3 units)<br>Music theory (3 units)<br>Aural skills (3 units)<br>Keyboard skills (1.5 units)<br>Ensembles (1.5 units)<br>**Major Studies** (19.5–21 units)<br>Major Studies Requirement: See specific department and program. Majors in one of the following areas: principal instrument, voice, music education, musicology, music theory, music composition, music technology, academic studies, or an ad hoc major. | **Arts and Sciences** (minimum of 30 units)<br>CAS distribution requirements<br>CAS departmental major<br>Foreign language proficiency<br>Writing proficiency |

**Five-Year Bachelor of Science and Bachelor of Music or Bachelor of Arts in Music (68 course units)**

| *Music* | *Nonmusic* |
|---|---|
| **BMus:Core Studies** (12 units)<br>Musicology (3 units)<br>Music theory (3 units)<br>Aural skills (3 units)<br>Keyboard skills (1.5 units)<br>Ensembles (1.5 units)<br>**BMus:Major Studies** (19.5–21 units)<br>Major Studies Requirement: See specific department and program. Majors in one of the following areas: principal instrument, voice, music education, musicology, music theory, music composition, music technology, academic studies, or an ad hoc major.<br>**BAMus:** See Music requirements under Bachelor of Arts in Music above. | **Engineering and Applied Science** (36 units)<br>General education (BMus: 5 units; BAMus: 17 units)<br>Mathematics (6 units)<br>Basic sciences (5 units)<br>Basic engineering (6 units)<br>Computer programming (1 unit)<br>Department program (16 units) |

undergoing revision; interested students should consult with the associate dean for undergraduate studies in the College of Arts and Sciences and the director of admissions in the School of Music for up-to-date information.

***Five-Year BS/BMus or BS/BAMus***

Students accepted into the combined McCormick School of Engineering and Applied Science–School of Music program may simultaneously earn a BS degree from the McCormick School and a BMus or BAMus degree from the School of Music. They must complete all McCormick School degree requirements, including at least 36 McCormick courses, as well as all School of Music bachelor of music or bachelor of arts in music degree requirements, including at least 32 music courses. Fulfilling both music and engineering requirements usually takes five years of full-time study, and a University Enrollment Requirement of 15 quarters is obligatory (see Financial Regulations).

Participants in this combined program must be accepted by both the School of Music and the McCormick School. The entrance requirements and structure of the program are currently undergoing revision; interested students should consult with the Undergraduate Engineering Office in the McCormick School and the director of admissions in the School of Music for up-to-date information.

## Degree Requirements

Candidates for the degree of bachelor of music in performance, music composition, music theory,

musicology, music technology, or an ad hoc area must complete 49.5 course units. A bachelor of music with specialization in music education may require as many as 53 units but can be completed within four years.

All freshmen in the School of Music must participate in band, choir, or orchestra, as appropriate to their principal auditioned instrument. Freshmen and sophomores may not participate in more than two ensembles. All students in the Department of Music Performance Studies must enroll in 510-C89 Convocation for at least four quarters. For specific requirements, see the Degree Requirements chart and the professional studies requirements of each program.

For their last 24 units, all students must be registered at Northwestern; for their last 12 units, they must be registered in the School of Music. Credit toward graduation is generally not granted for summer work taken at other colleges or universities as part of the last 24 units.

The work offered to meet the requirements for a degree may not average lower than C. Not more than one-fifth of this work may be of grade D. A maximum of six quarter-courses in nonmusic subjects taken under the P/N grade option may be counted toward the degree. Music students may *not* take music courses under the P/N grade option, except for those courses graded solely with P/N grades.

If students interrupt their program of study for an extended period of time and degree requirements are changed during this period, they will normally be held to the new requirements.

Every candidate for a degree must file an application for the degree a year in advance of the date of graduation.

Students coming to Northwestern University for a second undergraduate degree must transfer at least 9 units of credit in music, audition for admission at the C level, complete the general education distribution requirement with transfer credit, and comply with the 24-unit residency requirement.

In addition to and independent of the requirements set by the School of Music, all students must satisfy the University Enrollment Requirement (see Financial Regulations).

### Music Performance Study

The School of Music offers instruction in piano, organ, string instruments, winds, percussion, and voice. Students should consult their adviser or program coordinator for the assignment of an instructor. Consent of the instructor and department chair as well as concurrent registration in ensemble are required.

Elective performance study assignments are made by the appropriate department chair as space is available.

### Faculty Advisers

Each student is assigned to an adviser who approves the student's program each quarter. Each student has a conference with the adviser during each quarter. Students may not make a change of registration without their adviser's approval.

### Attendance Policy

Students are expected to attend all sessions of courses and ensembles for which they are registered. It is the responsibility of students enrolled in the School of Music to acquaint themselves and comply with the attendance policy of their departments, class instructors, and ensemble conductors.

In addition, students who are absent from classes for three or more consecutive days because of illness are required to notify the Office of the Associate Dean. Students who know they will be absent from classes or performing organizations for three or more consecutive days for such professional or personal commitments as auditions or off-campus performances or for any other nonemergency reasons are required to prepare a petition requesting permission to be absent from their academic and performance responsibilities in the School of Music. This petition must be submitted to the Office of the Associate Dean for approval.

Failure to comply with these regulations can be cause for failure in the courses or ensembles for which a student is registered during that quarter.

## Academic Options

### Double Major

Students may earn a double major in four years with proper academic planning and by fulfilling the requirements of both majors.

Bachelor of music candidates may double major only within the School of Music. In certain cases the curriculum may require enrolling in more than four courses per quarter. Typically, the double major combines a specialization in a performance area with one in the academic area or composition, although double majors within the academic area are possible also. A double major in two performance areas is generally not permitted.

Bachelor of arts in music candidates may double major with any major offered in the College of Arts and Sciences.

## Interdisciplinary Certificates

School of Music students may elect to complete one of the interdisciplinary certificates developed by the School of Music faculty and representing disciplines often used in the music profession. These certificates cross the normally established disciplines to enable students to combine the study of music with another area in an interdisciplinary fashion. Each includes a minimum of six and a maximum of nine courses. Students applying for School of Music interdisciplinary certificates must present records showing a minimum of five courses not double-counted in their specializations.

Students who complete all required courses will receive a notation on their Northwestern transcripts. Applications to receive the certificate are available from the Office of Undergraduate Studies and should be completed along with the Application for a Bachelor's Degree.

### *Commercial Music*

The Certificate in Commercial Music requires nine courses:

- Conducting C26 Conducting and Score Reading
- Conducting C30 Writing for Jazz Ensembles
- Music C98 Internship
- Radio/Television/Film C83 Radio/Audio Production
- Two courses chosen from
  Conducting C20 Band Arranging
  Conducting C21 Writing for Choral Ensembles
  Conducting C31 Advanced Jazz Writing
  Composition C14-2 Orchestration
  Composition C14-3 Advanced Orchestration
- Two courses chosen from music technology
- One elective in a related area

### *Jazz Studies*

The Certificate in Jazz Studies requires six courses:

- One improvisation course chosen from
  Conducting C36 Jazz Improvisation
  Conducting C37 Advanced Jazz Improvisation
  Musicology C37 Improvisation and World Musicianship
- One jazz writing course chosen from
  Conducting C30 Writing for Jazz Ensembles
  Conducting C31 Advanced Jazz Writing
- One jazz history, theory, or literature course chosen from
  African American Studies B40 Survey of African American Music (spring quarter)
  Musicology C34 Jazz: Its Roots and Elements
- Three electives chosen from improvisation; jazz writing; jazz history, theory, or literature; or jazz piano for the nonkeyboard player courses
- Jazz performance (no credit)
- Large ensemble (University Jazz Ensemble, University Jazz Lab Band, Vocal Jazz Ensemble) and chamber ensemble (Chamber Jazz Ensemble) for six quarters.

### *Music Business*

The Certificate in Music Business requires eight courses:

- Advertising B03 Basic Advertising (University College)
- Economics B60 Accounting and Business Finance (prerequisites: Economics B01, B02)
- Marketing B01 Marketing I: Principles of Marketing (University College)
- Music C35 Selected Topics: Entrepreneurship for the Performing Artist
- Organization Behavior C09 Human Resource Management (University College)
- Organization Behavior C67 Strategic Planning and Management (University College)
- Business-related elective
- Music C98 Internship

### *Music Criticism*

The Certificate in Music Criticism requires nine courses:

- Musicology C24 History and Practice of Criticism
- Musicology C99 Independent Study (with Professor Willis)
- Three musicology electives

- Journalism B01 Editing and Writing the News
- Journalism C01 Newswriting and Reporting (prerequisite: B01)
- Journalism C40 Newspaper Editing and Writing (prerequisite: C01)
  or C70 Law and Ethics of Journalism
- Journalism C41 News and New Media (prerequisite: C40, C55, or C65)
  or C50 Magazine Writing (prerequisite: C01)

### Interschool Programs

For information about the interschool programs listed below, see the Other Undergraduate Programs section of this catalog.

***Integrated Arts Program***
The interschool Integrated Arts Program offers courses leading to a minor that explore the creative process from the perspective of the artist in the disciplines of theater, visual arts, music, dance, and media arts.

***International Studies Program***
International studies, an undergraduate interschool adjunct major that is taken in conjunction with a traditional major, is open to students in the School of Music.

***Music Theatre Program***
The Certificate in Music Theatre provides the opportunity for School of Music students majoring in voice and School of Speech students majoring in theater to create a second area of specialization.

***Undergraduate Leadership Program***
The Undergraduate Leadership Program, an interschool certificate program open to all undergraduates, helps students understand the nature of leadership and prepares them to become leaders.

### Graduate Studies

The Graduate Division of the School of Music offers programs of study leading to the master of music degree, the graduate certificate in performance, and the doctor of music degree. Information concerning these programs is available from the Office of the Associate Dean for Academic Affairs, School of Music. For information about the requirements for the doctor of philosophy degree in music, write to the Graduate School.

## Resources

### Musical Organizations

Music majors are required to participate in those musical organizations for which they are qualified as a part of their program of study. Students from all other schools of the University are encouraged to participate in any organizations for which they qualify.

***Symphony Orchestra***
This large ensemble provides experience in the concert presentation of representative symphonic repertoire as well as operas and concertos.

***Chamber Orchestra***
The Chamber Orchestra performs works of all periods. Repertoire is limited to the music of chamber and small symphony orchestras.

***Philharmonia***
This orchestra is open upon audition to interested and qualified students from any school in the University and performs a wide-ranging repertoire.

***Symphonic Wind Ensemble***
Flexibility and thorough musicianship mark the programs of the Symphonic Wind Ensemble. This is the smallest and most select of the University wind ensembles. Its objectives are to perform literature of the highest aesthetic value with emphasis on major original works for band and to attain perfection in balanced performance through rigid requirements for individual musicianship and advanced playing technique.

***Symphonic Band***
Made up of 85 outstanding wind and percussion performers, the Symphonic Band seeks to perform the finest works available for large band or wind orchestra at the highest possible level.

***Concert Band***
The 90-member Concert Band provides an excellent performing experience for interested and qualified students from any school in the University. The Concert Band performs fine literature, including both original and transcribed works.

***Wildcat Marching Band***
The Wildcat Marching Band is a 150-piece all-University organization that combines marching precision and exceptional playing ability in a finely polished and spirited unit. The band performs for all football games at home and one or more out-of-town games each season.

***University Brass Ensemble***
The University Brass Ensemble provides performance challenges and learning opportunities for serious brass players interested in literature for ensembles of various sizes and compositional styles.

***Jazz Groups***
The Jazz Ensemble, Jazz Band, Jazz Lab, and a variety of small combo groups enable students to gain experience in the jazz idiom and to improve improvisation skills. They also offer student composers and arrangers the chance to write for various jazz instrumental combinations.

***Percussion and Mallet Ensembles***
The Percussion and Mallet Ensembles offer students an opportunity to perform percussion chamber works representative of diverse musical styles from Renaissance transcriptions through avant-garde theater pieces. The ensembles maintain active performance schedules both on and off campus and are open to all percussion students.

***Contemporary Music Ensemble***
The Contemporary Music Ensemble provides experience for student performers and composers in the performance of contemporary unpublished works. The ensemble annually presents a concert featuring a complete program of student compositions.

***University Chorale***
The University Chorale is a 40-voice ensemble that is the most select of the University choruses. Its personnel are chosen on the basis of their musicianship and their interest in the performance of both a cappella and accompanied literature.

***University Singers***
The University Singers is a larger choral ensemble of 60 to 80 singers with high performance standards. This ensemble frequently combines with other choral organizations in the performance of important choral-orchestral works.

***University Chorus***
The University Chorus is made up of singers from the School of Music, other qualified students, University faculty and staff, and interested residents of the community. It is organized for the purpose of performing large-scale choral works.

***Vocal Jazz Ensemble***
The Vocal Jazz Ensemble is a select 12- to 16-voice ensemble that provides an excellent opportunity for singers to perform jazz and commercial music. Special emphasis is placed on sound-reinforcement techniques, scat singing, improvisation, and the creation of new works.

***Chapel Choir***
School of Music students participate in the Chapel Choir at the weekly worship services held in the Alice Millar Chapel. This choir also presents at least three evening concerts during the year.

***Early Music Ensemble***
The Early Music Ensemble provides study and performance of music written before 1800. Workshops are conducted in early instruments, including recorders, crumhorns, sackbuts, viols, and continuo, and in vocal genres. Any student may request an interview/audition for this ensemble. At least one performance is given each quarter.

***Chamber Music Ensembles***
Chamber ensembles include piano trio; string trio, quartet, quintet, sextet, and octet; harp ensemble; brass quintet, choir, and band; woodwind quintet; trombone quartet and ensemble; and tuba, saxophone, mixed winds, trumpet, horn, and flute ensembles.

## Facilities

The School of Music occupies five buildings. The Music Administration Building houses administrative offices, classrooms, studios, and practice rooms. The faculty of the Department of Academic Studies and Composition as well as the faculty of the Voice and Opera Program and the Piano, Organ, and Church Music Program have offices in this building. Regenstein Hall houses rehearsal facilities, practice rooms, a 200-seat lecture/recital room, and the library and offices for the University bands. The Department of Music Performance Studies office

and studios for faculty of the Conducting and Ensembles, String Instruments, and Wind and Percussion Instruments Programs also are located in Regenstein Hall. Practice Hall contains 35 practice rooms. Lutkin Hall, seating 400, is used for student and faculty recitals and lecture classes. Pick-Staiger Concert Hall provides a 1,000-seat concert hall, rehearsal facilities, and offices and library for the University Symphony Orchestra. The School of Music maintains two computer labs and an electronic music studio.

### Music Library

The Music Library, internationally recognized for its collection of contemporary music, is one of the country's finest academic music libraries. It has spacious, aesthetically pleasing facilities, including a multidimensional listening center. Holdings include 149,000 books, music, journals, and microforms and the Recorded Sound Collection, consisting of 56,000 disks and tapes. The library's special collections include a manuscript collection documenting contemporary notation compiled by John Cage for use in his book, *Notations;* additional holograph scores, sketches, and letters of musicians; the Fritz Reiner Library; rare printed resources; and a portion of the Moldenhauer Archive. The Music Library is also a leader in library automation.

### Eckstein Bequest

The School of Music is the beneficiary of an endowment from the estate of Mrs. Louis Eckstein, the Chicago arts patron whose husband founded the Ravinia Music Festival. The Eckstein bequest is used to support all facets of the School of Music, particularly its financial aid and scholarship programs. The Eckstein Endowment has provided the financial resources to support the school's pursuit of excellence.

In recognition of the Eckstein bequest, the school has established the Eckstein Scholars Program for outstanding entering freshmen.

### Collection of Artist Instruments

The Northwestern University special collection of string instruments provides an exposure to a concept of sound available only through instruments with special resources of beauty and sonority. It has been formed over a period of years through the generosity of many friends. Seniors and graduate students may use these instruments when they appear as recitalists or soloists with University orchestras.

### Pi Kappa Lambda

Pi Kappa Lambda, national music honor society, was founded at Northwestern University in 1918 for the recognition and encouragement of the highest level of musical achievement and academic scholarship among music majors not eligible for Phi Beta Kappa. Alpha chapter elected as its first member Peter Christian Lutkin, the first dean of the School of Music, and his initials in their Greek equivalents were adopted for the name of the society. The national office has been housed in the Northwestern University School of Music since 1984. Two deans and one faculty member from Northwestern have served as national president, and the society has grown to 176 chapters in colleges, conservatories, and university schools of music.

## Music Studies for Nonmajors

Students registered in other schools of the University are encouraged to continue their development as instrumentalists or vocalists through ensemble participation, class instruction, or private study. Ensembles and music performance instruction require an audition. Information about auditions is available in the *Class Schedule* and in the School of Music office of undergraduate music studies. For additional information about instruction, inquire in person at the office of undergraduate music studies.

### University Ensembles

Students from all schools of the University are encouraged to audition for the following ensembles: Philharmonia, Concert Band, Wildcat Marching Band, University Chorus, and Early Music Ensemble. Nonmusic majors may occasionally be placed in other ensembles based on their audition.

### Class Instruction

Any Northwestern student may take 570-A02 Beginning Voice (class instruction in voice) for course credit. A limited number of students in any Northwestern school may take class instruction in beginning piano without credit.

### Private Lessons for Credit

Nonmusic majors may take half-hour private music lessons once a week for .5 course credit in P01-0. Students are accepted for private lessons based on an audition and the availability of an instructor; a $100 registration fee is billed to the student's tuition and fees account.

### Courses Open to Undergraduates

The following courses were designed to meet the needs of any students interested in studying music. Students with a basic music foundation are encouraged to register for Harmony, followed by Form and Analysis and/or Composition. The music literature sequence is designed to permit students with limited background to start with A70. Students may then enroll in certain C-level musicology and music theory courses when space is available.

**501-A70-0 Introduction to Music** Principles of musical organization through the conceptual understanding of the elements of music. Score study and recognition of what is heard in all music, including classic, jazz, rock, and popular. (VI. Literature and fine arts)

**501-A75-0 Selected Topics** Topics vary; announced before registration. May be repeated.

**482-A90-0 Art Process** See Integrated Arts Program in Other Undergraduate Programs. (VI. Literature and fine arts)

**501-B20-0 History of the Symphony** History of music written for the symphony orchestra from the 17th century to the modern period. Instrumentation, development of the orchestra as an institution, court and public ensembles, associated musical forms. Focus on representative works from the standard repertoire by composers such as Mozart, Beethoven, Brahms, Strauss, Mahler, and Shostakovich. (VI. Literature and fine arts)

**501-B30-0 Masterpieces of Opera** History of opera from its origins in Italy at the end of the 16th century to the modern period. Focus on representative works by composers such as Monteverdi, Handel, Mozart, Rossini, Wagner, Verdi, and Strauss. Dramatic and musical elements common to the genre. (VI. Literature and fine arts)

**501-B41-0 Beginning Guitar** Group lessons in guitar techniques for beginners.

**501-B52-0 Harmony** Harmonic materials and tonal structures. Analysis of harmonic structures; harmonization of melodies. Musical materials from pieces employing tertian harmonies. Prerequisite: A70 or consent of instructor. (II. Formal studies)

**501-B53-0 Form and Analysis** Nature of musical form; typical forms found in musical literature from the Renaissance to the present; analysis of aural examples and musical scores. Prerequisite: B52 or music-reading skills and some understanding of harmony.

**501-B70-1 The Western Musical Tradition** Baroque, classic, and early romantic periods; major genres and composers from 1600 to 1825. Brief background of 17th-century music by composers such as Monteverdi, Schütz, Lully, and Purcell. Primary emphasis on composers of the generations of Bach and Handel, Haydn and Mozart, Beethoven and Schubert. Prerequisite: A70 or equivalent. (VI. Literature and fine arts)

**501-B70-2 The Western Musical Tradition** Romantic and modern periods; major genres and composers from 1825 to the present. Figures such as Schumann, Chopin, Liszt, Wagner, Brahms, Verdi, Mahler, Bruckner, Strauss, Wolf, Stravinsky, Schoenberg, Berg, Webern, Debussy, Ravel. Prerequisite: A70 or equivalent. (VI. Literature and fine arts)

**482-B91-3 Modes of Music** See Integrated Arts Program in Other Undergraduate Programs. This course will not satisfy the distribution requirement for music majors. (VI. Literature and fine arts)

**482-C90-1 Performance Seminar** See Integrated Arts Program in Other Undergraduate Programs. (VI. Literature and fine arts)

**482-C90-2 Toward a Theory of the Arts** See Integrated Arts Program in Other Undergraduate Programs. (VI. Literature and fine arts)

## Interdepartmental Courses for Majors

The music theory, musicology, aural skills, keyboard skills, and ensembles sequences are required for all undergraduates in the School of Music. Ensembles listed in 540 are available by audition to all students in the University.

### Courses Open to Undergraduates

**510-A10-0 Introduction to Theory (.5)**

**510-A11-1,2,3 Music Theory I (.5)** Music as sound in time. Analytical studies in forms, media, textures, and harmonic and melodic materials. Prerequisite: preceding quarters of A11.

**510-A26-1,2,3 Aural Skills I,II,III (.33)** Sight-singing and ear-training; drill in recognition of melodic, rhythmic, and harmonic patterns and aural analysis through listening and dictation. Progresses through six levels of proficiency.

**510-A27-0 Keyboard Skills (.33)** Class instruction, in electronic piano classroom; six levels of proficiency. Separate sections for pianists and nonpianists.

**510-B11-1,2,3 Music Theory II (.5)** Continuation of A11. Prerequisite: A11-1,2,3 or consent of instructor.

**510-B15-1,2,3 Music History** Principles, materials, and concepts of the historical study of Western art traditions.

**510-B26-1,2,3 Aural Skills IV,V,VI (.33)** Continuation of A26.

**510-B27-0 Keyboard Skills (.33)** Continuation of A27.

**510-C15-0 Ethnomusicology (.5)** Methods and principles of ethnomusicology and study of popular music. Prerequisite: B15-1,2,3.

**510-C26-0 Advanced Aural Skills (.5)** Advanced literature-based aural skills using materials from Western art music of all style periods, world music, and popular musics. Error detection, rhythmic skills, aural analysis of harmony and form, refinement of other listening skills.

**510-C27-1 Advanced Keyboard Skills VII (.33)** Advanced score-reading. Continues skills development begun in level VI with three- and four-part choral scores. Reading various voice parts in combination and harmonically reducing four-part textures.

**510-C27-2 Advanced Keyboard Skills VIII (.33)** Techniques of accompanying by reducing and rewriting accompaniments to make initial performances more effective. Prepared accompaniments, score-reading, and sight-reading materials.

**510-C27-3 Advanced Keyboard Skills IX (.33)** Advanced accompanying. Adding accompaniments to a given vocal line. Improvising accompaniments in various styles, including "swing." Transposition of individual lines.

**510-C48-0 Recital Preparation (.5)**

**510-C89-0 Convocation (0)** Attendance at the five School of Music convocations held each quarter.

**510-C50-0 Alexander Technique (.5)** Introduction to Alexander Technique, a method of using the body efficiently to reduce unnecessary stress and tension. Application of technique to instrumental and vocal performance. Sections: 20, piano; 21, strings; 22 and 23, wind and percussion; 24 and 25, voice.

**510-C98-0 Internship** Field experience as an intern.

## Academic Studies and Composition

This department consists of the Music Composition, Music Education, Musicology, Music Technology, and Music Theory Programs.

Bachelor of music specializations are available in music composition, music education, musicology, music technology, and music theory. These five specializations are described on the following pages. A sixth specialization option, involving general academic studies, requires one course from each of the five programs and seven C-level courses selected from any of the Department of Academic Studies and Composition offerings. Most C-level courses in this department require junior standing.

### *Music Composition Program*

Composition students pursue a course of study that develops analytical and creative skills and enjoy many opportunities to hear their works performed. Students have access to the electronic and computer music studios, which provide the latest technology for experimentation and experience with 20th-century compositional materials. Students intending to major in composition may substitute composition for applied studies during their freshman and sophomore years.

**Major Studies Requirement**

For a major in composition, 19.5 course units are required:

- A12, B12 Composition (6 units) (some credit may be given for applied instrument or voice lessons)
- C12 Composition (6 units)
- C14-1 Instrumentation (1 unit)
- C14-2 Orchestration (1 unit)
- C16 Baroque Counterpoint (1 unit)
- C17 Renaissance Counterpoint (1 unit)
- C22-1,2,3 Materials of Modern Music (1 unit)
- Music theory courses in analysis (2 units) (1 unit must be in 20th-century analysis)
- Keyboard skills (.5 unit)
- C90 Composition Colloquium (0 units)

### Courses Open to Undergraduates

**537-A12-0,B12-0,C12-0 Composition** Original composition; individual instruction.

**537-B78-0 Contemporary Music Ensemble** Performance of contemporary works: avant-garde music, new notation systems, electronic music.

**537-C11-1,2,3 Class Composition** Class instruction in techniques of composition. Open to nonmusic majors. **1.** Writing for solo instruments. **2.** Writing for two to four instruments. **3.** Writing for instruments and/or voices. Prerequisite: preceding quarters of C11 or consent of instructor.

**537-C14-1 Instrumentation** Instruments of the orchestra; scoring techniques; analysis of instrumental combinations. Prerequisite: 510-B11-3 or consent of instructor.

**537-C14-2 Orchestration** Stylistic scoring projects; analysis of orchestral and chamber scores. Prerequisite: C14-1 or consent of instructor.

**537-C14-3 Advanced Orchestration** Contemporary scoring techniques; creative projects; analysis of orchestral and chamber scores. Prerequisite: C14-2, graduate standing, or consent of instructor.

**537-C16-0 Baroque Counterpoint** Baroque dance suite, chorale prelude, invention, fugue, chiefly involving the music of J. S. Bach. Melodic, harmonic, structural characteristics; contrapuntal techniques.

**537-C17-0 Renaissance Counterpoint** Contrapuntal textures from two to four voices. Cadence and form, melodic line and motive, rhythm, simple and complex imitation, and treatment of dissonance in the sacred music of Lassus, Josquin, and Palestrina.

**537-C22-1,2,3 Materials of Modern Music** Writing projects; analysis of scores. **1.** Pre-1950 20th-century stylistic techniques. **2.** Post-1950 20th-century stylistic techniques. **3.** Performers and composers. Contemporary materials; original writing projects; in-class performances of original work. Prerequisite: preceding quarters of C22 or consent of instructor.

**537-C35-0 Selected Topics in Music Composition** Topics vary; announced before registration. May be repeated for credit.

**537-C40-0 Composing with Computers** Development of techniques for composing with computers through hands-on experience and analysis. New technologies for real-time interactive music and nonreal-time synthesis. Computer music repertoire. Prerequisite: entry-level course or equivalent experience.

**537-C41-0 Advanced Computer Composition** Advanced instruction in the use of computers to create musical compositions. Composition projects of several etudes and at least one larger composition. Prerequisite: C38.

**537-C90-0 Composition Colloquium (0)** Discussion of contemporary compositional techniques.

**537-C99-0 Independent Study (.5–1)**

## *Music Education Program*

Graduates with a major in music education meet all requirements for teacher certification in the state of Illinois as well as most other states. Students take the core program required of all music students, a structured sequence of courses in general education, a basic set of courses in music education, and special courses in the chosen music education specialization. The combination results in a program that prepares professionals with a broad understanding of music and education as well as the skills to be effective music teachers.

Students in the undergraduate music education program must take all the core studies in music and music education, general education, and electives. They must also choose one of the three specialization tracks: instrumental, choral, or general.

**Core Studies in Music Education (22–28 units)**
- Private lessons (6–9 units)
- Additional keyboard skills (as needed by track) (0–3 units)
- Additional large ensemble (eight quarters) (4 units)
- B58 Problems in the Philosophy of Education: Aesthetic Education
- 533-B59 Introduction to Music Technology
- B60 The Music Teacher as Communicator
- B79 Clinical Experience (2 units)
- 533-C35 Selected Topics in Music Technology: Physics of Sound
- 540-C26 Conducting and Score Reading
- C68 Teaching Composition in the Schools
- C69 Research and Evaluation in Music
- C80–87 Student Teaching (3 units)

**Instrumental Track (8 units)**
- B30 Flute Class (.5 unit)
- B33 Clarinet Class (.5 unit)
- B34 Woodwinds Class (.5 unit)
- B35 Trumpet Class (.5 unit)
- B36 Brass Class (.5 unit)
- B37 Violin Class (.5 unit)
- B38 Strings Class (.5 unit)
- B39 Percussion Class (.5 unit)
- 540-C40-1 Advanced Conducting
- C33 Teaching High School Nonperformance Courses
- C64 Teaching Instrumental Music I
- C65 Teaching Instrumental Music II

**Choral Track (5.5 units)**
- B32 Voice Class (.5 unit)
- 540-C40-2 Advanced Conducting
- C33 Teaching High School Nonperformance Courses
- C62 Teaching General Music II
- C66 Teaching Choral Music I
- C67 Teaching Choral Music II

**General Track (5 units)**
- B31-1,2 Guitar Class I, II
- B32 Voice Class (.5 unit)
- B40 Recorder Class (.5 unit)
- C61 Teaching General Music I
- C62 Teaching General Music II
- C66 Teaching Choral Music I

**General Education (7 units)**
- English A05 Expository Writing or B05 Intermediate Composition
- History B10 History of the United States (may not be taken P/N)
- Political Science B20 American Government and Politics (may not be taken P/N)
- Psychology A10 Introduction to Psychology
- Counseling Psychology C90 Health and Physical Development
- Human Development and Social Policy C01 Human Development: Childhood and Adolescence
- Teacher Education C27 Educating Exceptional Children or Speech and Language Pathology C36 The Field of Special Education

**General Electives (4 units)**
- Biological sciences
- Additional science
- Additional social science
- English literature

### Courses Open to Undergraduates

**525-B30-0 Flute Class (.5)**

**525-B31-1,2 Guitar Class I,II (.5)**

**525-B32-0 Voice Class (.5)**

**525-B33-0 Clarinet Class (.5)**

**525-B34-0 Woodwinds Class (.5)** Performance characteristics and pedagogical strategies most strongly associated with teaching flute, saxophone, oboe, and bassoon to beginning and intermediate instrumentalists. Prerequisite: B33.

**525-B35-0 Trumpet Class (.5)**

**525-B36-0 Brass Class (.5)** Performance characteristics and pedagogical strategies most strongly associated with

teaching horn, trombone, euphonium, and tuba to beginning and intermediate instrumentalists. Prerequisite: B35.

**525-B37-0 Violin Class (.5)**

**525-B38-0 Strings Class (.5)** Performance characteristics and pedagogical strategies most strongly associated with teaching viola, cello, and string bass to beginning and intermediate instrumentalists. Prerequisite: B37.

**525-B39-0 Percussion Class (.5)**

**525-B40-0 Recorder Class (.5)**

**525-B41-0 Guitar Techniques (.5)**

**525-B58-0 Problems in the Philosophy of Education: Aesthetic Education** Philosophical issues in music education relating to the teaching and learning of music in schools. Development of a philosophy of music education that may serve as a basis for professional responsibilities.

**525-B60-0 The Music Teacher as Communicator** For all students considering a specialization in music education. Discussion and observation of school music programs and effective presentational skills.

**525-B79-1,2,3 Clinical Experience I (.5 each)** Field placement, two hours weekly. Sophomore: fall, elementary; winter, junior high; spring, high school. One-hour seminar meets alternate weeks.

**525-C33-0 Teaching High School Nonperformance Courses** Planning and teaching high school music, arts, humanities courses. Present practices; development of exemplary course plans.

**525-C35-0 Selected Topics in Music Education** Topics vary; announced before registration. May be repeated.

**525-C61-0 Teaching General Music I** For grades K–5, curriculum materials and strategies for developing musical growth. Laboratory experiences; developing creativity in the music classroom. Open only to music majors or with consent of instructor.

**525-C62-0 Teaching General Music II** For grades 6–8, effective teaching of general music classes in the middle school. Available curriculum materials; innovative approaches.

**525-C64-0 Teaching Instrumental Music I** Development and application of teaching and administrative principles for school instrumental music programs. Rehearsal dynamics, conducting, rehearsal room management, and pedagogy for secondary school instrumentalists.

**525-C65-0 Teaching Instrumental Music II** Application of teaching concepts consistent with aesthetic education to the instrumental music program. Jazz pedagogy and pedagogy for young instrumentalists. Prerequisite: C64.

**525-C66-0 Teaching Choral Music I** Development and application of skills, knowledge, and understandings for teaching choral music in elementary and middle school.

**525-C67-0 Teaching Choral Music II** Further development of skills, knowledge, and understandings developed in C66. High school choral program, curriculum model, repertoire, sight-reading, rehearsal techniques, programming, administration.

**525-C68-0 Teaching Composition in the Schools** Practical and research literature in teaching composition in the schoolroom. Design of curricular materials for teaching sequences dealing with composition. Hardware and software in school settings.

**525-C69-0 Research and Evaluation in Music Education** Various procedures and issues associated with excellence in research and evaluation in music teaching. Practical application of research findings to decision making in music teaching and learning.

**525-C99-0 Independent Study (.5–1)**

### Student Teaching Courses

Students are assigned to specific classes in cooperating schools under joint University/school supervision.

**525-C80-0 Student Teaching in the Elementary School:General Music (1–4 units)**

**525-C81-0 Student Teaching in the Middle School/ Junior High School:General Music, Choral (1–4 units)**

**525-C83-0 Student Teaching in the Senior High School:Choral and Nonperformance Courses (1–4 units)**

**525-C85-0 Student Teaching in the Elementary School:Instrumental (1–4 units)**

**525-C86-0 Student Teaching in the Middle School/ Junior High School:Instrumental (1–4 units)**

**525-C87-0 Student Teaching in the Senior High School:Instrumental and Nonperformance Courses (1–4 units)**

## *Musicology Program*

An undergraduate major in musicology is available within the bachelor of music degree or as a concentration within the bachelor of arts. The 12 courses required for this specialization are selected from musicology, analysis, and the departmental core. As some of the courses are offered on a two-year alternating schedule, certain courses may not be available during a given academic year.

**Major Studies Requirement**

For a major in musicology, 19.5 course units are required:

- Musicology (6 units) selected from C50–C55
- Music theory (3 units) selected from 535-C21, C31, C52
- Keyboard skills (3 units)
- 510-C26 Advanced Aural Skills (.5 unit)
- German (3 units)
- Instrumental or vocal applied lessons (3 units)
- Senior project or thesis (1 unit) by fall quarter of senior year

### Courses Open to Undergraduates

**530-B99-0 Early Music Ensemble** Performance of choral, solo, and instrumental music of the Middle Ages through the early baroque.

**530-C23-0 Proseminar in Ethnomusicology** Ethnomusicology; its history, bibliographical resources, methods, and theories.

**530-C24-0 History and Practice of Criticism** Concepts and practice of present-day critical and descriptive writing about music; aesthetics and technique. Open to nonmusic students with consent of instructor.

**530-C26-1,2 Music of the World's Peoples** Music systems in their broad cultural contexts: religious, social, historical, learning processes. **1.** Folk and traditional music of the Western continents: Africa, North and South America, Europe. Emphasis on African music. **2.** Music cultures of the Pacific, the Near East, and Asia. Emphasis on music of India.

**530-C34-0 Jazz:Its Roots and Elements** The basic elements of jazz from its roots in African and early African American music to the present. Emphasis on the music's social and historical aspects as well as stylistic analysis. Prerequisite: consent of instructor.

**530-C35-0 Selected Topics in Musicology** Topics vary; announced before registration. May be repeated.

**530-C36-0 Learning and Creativity among Improviser/Composer** Interdisciplinary and cross-cultural perspective of the American jazz community. Analysis of improvisation as a compositional process. Prerequisites: Integrated Arts A90 and B91-3 or consent of instructor.

**530-C37-0 Improvisation and World Musicianship** Improvisation in music systems such as Western art music, jazz, Indian, and African music; performance workshops in African drumming, Indian solfeggio, and rhythmic mnemonics.

**530-C38-0 African Mbira Music** The mbira, one of the most popular and ancient melodic instruments in black Africa. Construction; development of basic playing skills. Prerequisite: consent of instructor.

**530-C50-0 History of Music—Middle Ages** Gregorian and medieval chant, secular monophony, and the development of polyphony from the earliest records through the music of Ockeghem and Busnois.

**530-C51-0 History of Music—Renaissance** Middle and late Renaissance and early manifestations of the baroque, from Josquin through the Gabrielis.

**530-C52-0 History of Music—Baroque** The baroque from Monteverdi through Bach and Handel.

**530-C53-0 History of Music—Classic** Classic period from the early Italian symphonists through Beethoven.

**530-C54-0 History of Music—Romantic** Romantic period from Schubert through Wolf and other late romantics.

**530-C55-0 History of Music—20th Century** The 20th century from its roots in late romanticism to the present.

**530-C99-0 Independent Study (.5–1)**

## *Music Technology Program*

The major in music technology offers a unique professional preparation for a career combining music and technology. Students engage in creating and using technology for artistic purposes. They develop skills in applying technology to musical tasks and acquire knowledge of the technical and musical foundations of the field.

**Major Studies Requirement**

For a major in music technology, 19.5 course units are required:

- 525-B59 Introduction to Music Technology (1 unit)
- C25 Introduction to MIDI Music Systems (1 unit)
- C38 Programming I (1 unit)
- C40 Composing with Computers (1 unit)
- C-level courses in music technology (4 units)
- C75 Terminal Project (1 unit)
- Courses related to terminal project (3 units)
- Departmental distribution (3 units)
  One C-level course from three of the following programs: 525, 530, 535, 537
- Instrumental, vocal, and/or composition lessons and/or additional ensemble (4.5 units)

### Courses Open to Undergraduates

**533-B59-0 Introduction to Music Technology** Computers and the music experience. Computer-aided instruction; music printing; MIDI sequencing; software development; word processing and other nonmusic topics.

**533-C25-0 Introduction to MIDI Music Systems** Theory and practical application of MIDI synthesizer and recording systems. Creative use of MIDI music systems. Prerequisite: consent of instructor.

**533-C26-0 Advanced MIDI Systems and Composition** Theory and practical application of advanced MIDI systems, including various synthesizers/samplers, computers, and MIDI programs. Composition, analysis, and creative use of the equipment. Prerequisite: entry-level course or equivalent experience.

**533-C27-0 Advanced MIDI Systems and Composition II** Theory and practical application of MIDI equipment used to control analog and digital devices. Individual composition instruction. Prerequisite: C26.

**533-C35-0 Selected Topics in Music Technology** Topics vary; announced before registration. May be repeated with change of topic.

**533-C37-0 Multimedia Software Development**
Software design in scripting languages such as HyperCard and other multimedia support systems. Extensive integration of CD-ROM, MIDI, music printing, digitized video and sound. Prerequisite: entry-level courses or equivalent experience.

**533-C38-0 Programming I** Programming of musical applications. Syntax of programming language, program development, user interfaces, and music-specific algorithms. May be repeated when programming language changes. Prerequisite: entry-level course or equivalent experience.

**533-C39-0 Programming II** Music programming techniques for creating musical applications; music-specific algorithms and programming techniques, music and sound representation. May be repeated when programming language changes. Prerequisite: C38.

**537-C40-0 Composing with Computers** See Music Composition Program.

**537-C41-0 Advanced Computer Composition** See Music Composition Program.

**533-C42-0 Computer Sound Processing** Techniques of computer sound synthesis: simulation of musical instruments, the voice, room acoustics; digital filtering, effects processing; digital recording, mixing, editing. Prerequisite: entry-level course or equivalent experience.

**533-C44-0 Advanced Projects in Music Technology**
Individual instruction in projects related to music technology. Prerequisite: consent of instructor.

**533-C75-0 Terminal Project** Independent project in music technology. Prerequisite: consent of program director.

**533-C99-0 Independent Study (.5–1)**

## *Music Theory Program*

Undergraduates majoring in theory receive training in a variety of advanced analytical methods, including rhythmic analysis, tonal and atonal analysis, and Schenkerian analysis. Courses in perception and music technology are encouraged.

**Major Studies Requirement**
For a major in music theory, 19.5 course units are required:
- 537-C16 Baroque Counterpoint (1 unit)
- 537-C17 Renaissance Counterpoint (1 unit)
- C53 Schenkerian Analysis (1 unit)
- C56 Atonal Analysis (1 unit)
- D32 Rhythmic Analysis (1 unit)
- 510-C27-1,2,3 Advanced Keyboard Skills (1 unit)
- Instrumental, vocal, and/or composition lessons (6 units)
- Music technology (1 unit)
- Senior document (1.5 units)
- Departmental distribution (2 units)
  One C-level course from two of the following programs: 525, 530, 533, 537
- Cognate areas (3 units)
- C90 Theory Colloquium (0 units)

### Courses Open to Undergraduates

**535-C21-1,2 Analytical Techniques** Detailed analysis of all parameters of selected musical examples; compositional procedures as a means of developing an intelligent rationale for interpretation. Prerequisite: 510-B15 or consent of instructor.

**535-C31-0 Analytical Studies** Extension and refinement of concepts and techniques acquired in 510-A15, B15.

**535-C35-0 Selected Topics in Music Theory** Topics vary; announced before registration. May be repeated.

**535-C51-0 Music Cognition** Survey of issues and research methods in music cognition. Music listening, memory for music, development of skills.

**535-C52-0 Score Analysis Skills** Development of facility for recognizing quickly the character and succession of tonalities in compositions for a variety of media. Exploration of the expressive potentials residing in the conventional tonal system.

**535-C53-1,2 Schenkerian Analysis** Heinrich Schenker's theories of musical structure and analysis of musical works. **1.** Techniques of Schenkerian analysis applied to compositions by Bach, Beethoven, Chopin, Mozart, Schubert, and others. Prerequisite: 510-B11 or equivalent. **2.** Advanced study in Schenkerian analysis focusing both on techniques of graphic analysis and on large-scale compositions. Extensions of Schenker's theories by post-Schenkerian theorists. Prerequisite: C53-1 or equivalent.

**535-C54-0 Music Perception** Literature and methods of research in the perception of musical sound. Fundamentals of acoustics and psychoacoustics, timbre of musical instruments, singing voice, spatial hearing and room acoustics, organization of hearing systems, formation of auditory images, musical pitch, consonance and dissonance, scales, tuning.

**535-C56-1,2 Atonal Analysis** Techniques for analysis of atonal and nonfunctional tonal music, including set-theoretic, serial, and parametric approaches. **1.** Emphasis on music of Schoenberg, Webern, Berg, Stravinsky, and Debussy. Selected readings in analytic literature. Prerequisite: 510-B11 or equivalent. **2.** Advanced atonal analysis. Analysis of coherent posttonal repertoire; readings in analytic literature. Prerequisite: C56-1 or equivalent.

**535-C85-0 Senior Project (1)**

**535-C90-0 Theory Colloquium (0)** Discussion of current research in music theory.

**535-C99-0 Independent Study (.5–1)**

**535-D32-0 Rhythmic Analysis** Designed for theory or composition majors. Recent theoretical work on rhythm; analytical methodologies dealing with music primarily as a temporal process. Prerequisite: consent of instructor.

## Music Performance Studies

This department consists of the Conducting and Ensembles; Piano, Organ, and Church Music; String Instruments; Voice and Opera; and Wind and Percussion Instruments Programs.

### *Conducting and Ensembles Program*

Courses in the Conducting and Ensembles Program are available to all majors. While an ad hoc major in conducting is available to undergraduates, students are urged to consider majoring in conducting at the graduate level. Courses for the ad hoc major are selected in consultation with the department chair.

#### Courses Open to Undergraduates

**540-C20-0 Band Arranging** Transcriptions, arrangements, and composition for concert and symphonic bands. Editing, rescoring, and arranging for performance, at various levels and from both keyboard and instrumental resources.

**540-C21-0 Writing for Choral Ensembles** Composing and arranging for choral ensembles; selected choral repertoire; techniques and resources.

**540-C23-0 Marching Band Techniques** Writing for marching and pep bands; rehearsing for the marching band.

**540-C26-0 Conducting and Score Reading** Team-taught minisubjects in conducting; fundamentals in both instrumental and choral conducting; transpositions, ranges, and podium technique. Extensive laboratory experience with videotaped evaluation.

**540-C30-0 Writing for Jazz Ensembles** Composing and arranging for jazz ensemble. Score study and rehearsal techniques with jazz groups and stage bands.

**540-C31-0 Advanced Jazz Writing** Continuation of C30. Emphasis on creative scoring, composition, and commercial writing.

**540-C35-0 Selected Topics in Conducting** Topics relevant to the professional needs of conducting majors.

**540-C36-0 Jazz Improvisation** Basic elements of jazz improvisation, including harmony, modes, and basic progressions.

**540-C37-0 Advanced Jazz Improvisation** Continuation of development of jazz improvisation skills. Prerequisite: C36 or consent of instructor.

**540-C40-1,2,3 Advanced Conducting** Separate quarters of band, orchestral, and choral conducting that emphasize the techniques of score preparation and analysis, repertoire, and rehearsal methods. Prerequisite: C26 or equivalent. May be repeated.

**540-C41-0 Advanced Choral Literature I** A comprehensive knowledge of choral music literature from the Renaissance, baroque, and classical periods.

**540-C42-0 Advanced Choral Literature II** A comprehensive knowledge of choral music literature from the 19th and 20th centuries.

**540-C64-0 Choral Organizations** University Chorale, University Singers, University Chorus, Vocal Jazz Ensemble, and Women's Chorus. Open to all qualified students.

**540-C68-0 Chapel Choir** Open to all qualified students.

**540-C74-0 Band Organizations** Marching Band, Concert Band, Symphonic Band, Symphonic Wind Ensemble. Open to all qualified students.

**540-C77-0 Jazz Ensembles** Membership by audition in jazz ensembles.

**540-C80-0 Senior Recital (0)**

**540-C93-0 Orchestral Organizations** Membership by audition in Symphony Orchestra, Chamber Orchestra, or Philharmonia.

**540-C99-0 Independent Study (.5–1)**

### *Piano, Organ, and Church Music Program*

A major in piano performance combines a strong musical basis for a professional career with the broad humanistic interests embodied in a liberal arts education. The course of instruction focuses on the studio and includes private lessons, studio classes, a thorough course in piano repertoire, piano pedagogy, and accompanying classes. Electives are available in chamber music and other areas, allowing students to tailor a program to their individual needs. Frequent performances as a soloist and as an assisting musician develop skills in public presentation. Solo recitals, required in both the junior and senior years, are considered an integral part of the programs.

For a major in organ performance or a concentration in church music, consult the department cochair.

**Major Studies Requirement**

For a major in piano performance, 20 course units are required:

- 555-A61 Piano Performance (3 units)
- 555-B61 Piano Performance (3 units)
- 555-C61 Piano Performance (6 units)
- 555-C13 Piano Repertoire (3 units)
- 555-C15 Piano Pedagogy (3 units)
- 555-C91 or C92 Chamber Music (.5 unit)
- 510-C89 Convocation (4 quarters) (0 units)
- 555-C28 Accompanying/Recital Preparation (1.5 units)
- Junior Recital (0 units)
- 555-C80 Senior Recital (0 units)

Students enrolled in a five-year double-degree program may substitute three C-level musicology and/or music theory electives for the pedagogy requirement.

For a major in organ performance or a concentration in church music, consult the department cochair.

### Courses Open to Undergraduates

**555-A61-0,B61-0,C61-0 Piano Performance**

**539-A63-0,B63-0,C63-0,D63-0 Organ Performance**

**555-B30-0 Class Organ (0)** Primarily for sophomore pianists.

**539-C10-0 Keyboard Harmony/Improvisation I,II,III**

**539-C11-0 Professional Concerns (.5)**

**539-C12-0 Voice**

**539-C13-0 Harpsichord**

**555-C13-1,2,3 Piano Repertoire** Analytical and historical study of piano solo and concerto repertoire from early keyboard literature to the present.

**539-C15-0 Organ Maintenance**

**555-C15-1,2,3 Piano Pedagogy** Lecture/demonstration/laboratory course in piano teaching at all levels. Principles and techniques of group and individual instruction; survey of teaching materials. Seniors and graduate students.

**539-C16-0 Organ Pedagogy (.5)** Comparative methods, practice techniques; repertoire for various levels.

**555-C28-0 Accompanying/Recital Preparation (.5)** Piano students work with a singer and instrumentalist in the preparation and performance of mainstream recital repertoire.

**539-C35-0 Selected Topics in Organ and Church Music** Topics vary; announced before registration. May be repeated.

**555-C35-0 Selected Topics in Piano** Topics vary; announced before registration. May be repeated.

**539-C71-0 German Organ Literature** The German organ school pre–J. S. Bach to present.

**539-C72-0 French Organ Literature** The French organ school from 1600 to present.

**539-C80-0 Senior Recital (0)** For organists.

**555-C80-0 Senior Recital (0)** For pianists.

**555-C91-0 Chamber Music (.5)** For juniors and seniors.

**555-C92-0 Chamber Music: Trios**

**555-C99-0 Independent Study (.5–1)**

## *String Instruments Program*

Majors in string instruments prepare for professional performance and teaching as well as for advanced study. The curriculum is built around individual performance study and ensemble participation, including chamber music and orchestra, with orchestral studies and string pedagogy available to qualified juniors and seniors. A junior recital and a senior recital are required. Students in this program may major in violin, viola, cello, string bass, harp, or classical guitar.

**Major Studies Requirement**

For a major in string performance, 19.5 to 21 course units are required:

***Violin, viola, cello, string bass performance***

- A-level performance study (3 units)
- B-level performance study (3 units)
- C-level performance study (6 units)
- C91 Chamber Music (1.5 units)
- C19-1,2,3 Orchestral Studies (1.5 units)
- C-level string pedagogy (1.5 units)
- C80 Senior Recital (0 units)
- 540-C93 Orchestral Organizations (nine quarters) (4.5 units)
- 510-C89 Convocation (4 quarters) (0 units)

***Harp Performance***

- A-level performance study (3 units)
- B-level performance study (3 units)
- C-level performance study (6 units)
- Additional large ensemble (nine quarters) (4.5 units)
- C18-1,2,3 Harp Pedagogy and Maintenance (1.5 units)
- C19-1,2,3 Orchestral Studies (1.5 units)
- C80 Senior Recital (0 units)
- 510-C89 Convocation (4 quarters) (0 units)

***Guitar Performance***

- A-level performance study (3 units)
- B-level performance study (3 units)
- C-level performance study (6 units)
- C74 Guitar Ensemble (nine quarters) (4.5 units)
- C75-1,2,3 Lute and Guitar Literature (1.5 units)
- C76-1,2,3 Guitar Pedagogy (1.5 units)
- C80 Senior Recital (0 units)
- 510-C89 Convocation (4 quarters) (0 units)

### Courses Open to Undergraduates

**560-A41-0,B41-0,C41-0 Violin Performance**

**560-A42-0,B42-0,C42-0 Viola Performance**

**560-A43-0,B43-0,C43-0 Cello Performance**

**560-A44-0,B44-0, C44-0 String Bass Performance**

**560-A51-0,B51-0,C51-0 Harp Performance**

**560-A71-0,B71-0,C71-0 Classical Guitar Performance**

**560-C11-0 Suzuki Pedagogy** Introduction and detailed study of fundamental principles of Suzuki philosophy and materials. Available to violin, viola, cello, and double bass players with emphasis on application to violin and cello.

**560-C12-0 String Class Pedagogy** Teaching strings in heterogeneous groups. Group teaching strategies, program administration, materials and techniques, and pedagogy for violin, viola, cello, and double bass. Offered for performance and pedagogy majors to learn about secondary instruments and pedagogical applications to school settings and/or college-level techniques classes.

**560-C13-0 History of String Pedagogy** Historical survey of the major violin, viola, cello, and double bass

pedagogues from the early baroque through the 20th century; study of publications and contributions of contemporary schools. Lecture and seminar format.

**560-C14-0 Comprehensive String Pedagogy** Comparative study and application of the principles of successful string teaching. Communication skills, observations, comparison of contemporary approaches of Suzuki, Rolland, Havas, et al. Lecture, discussion, and demonstration format. Open to violin, viola, cello, and double bass players.

**560-C15-1,2,3 Beginning Violin and Viola Pedagogy** Developmental approach to individual and group teaching of elementary-level violin and viola students. Includes Rolland and Suzuki approaches, apprenticeship teaching, and observations. Open to all string players.

**560-C16-1,2,3 Beginning Cello and Double Bass Pedagogy** Developmental approach to individual and group teaching of elementary-level cello and double bass students. Open to all string players.

**560-C17-0 Principles of Studio and Master Class Teaching** Principles of advanced and college-level studio teaching. Observation and interview format individually scheduled with artist faculty. Preparation of a journal and annotated bibliography of recommended technical, etude, and performance repertoires for the major instrument.

**560-C18-1,2,3 Harp Pedagogy and Maintenance** **1.** Guests and master classes related to playing and teaching. **2.** Instrument maintenance and repair clinic with hands-on experience in routine maintenance and common repairs. **3.** Pedagogical instruction and demonstration of teaching techniques for all levels and ages.

**560-C19-1,2,3 Orchestral Studies (Violin,Viola,Cello, String Bass,Harp)**

**555-C35-0 Selected Topics in Strings** Topics vary; announced before registration. May be repeated.

**560-C72-0 Guitar Literature and Ensemble** Concurrent registration in C74 and C75-1,2,3 required for three consecutive quarters. Alternates yearly with C73.

**560-C73-0 Guitar Pedagogy and Ensemble** Concurrent registration in C74 and C76-1,2,3 required for three consecutive quarters. Alternates yearly with C72.

**560-C74-0 Guitar Ensemble** Performance of the chamber literature for guitar: guitar duos, trios, and quartets; flute and guitar; voice and guitar; chamber works with strings; other instrumental combinations.

**560-C75-1,2,3 Lute and Guitar Literature** Analytical and historical survey of the literature for plucked instruments from the 16th through the 20th centuries. The study of tablatures, instrument construction and tuning, performance practice, and style.

**560-C76-1,2,3 Guitar Pedagogy** Principles of individual and group study. Survey of development of right- and left-hand technique from 16th-century lute and vihuela tutors through modern classical guitar methods. Interaction between musical texture and technical innovations; influence of fingering on stylistic inflection and ornamentation.

**560-C80-0 Senior Recital (0)**

**560-C91-0 Chamber Music** Performance of string quartet literature with the addition of some works for piano and strings. For freshmen and sophomores.

**560-C99-0 Independent Study (.5–1)**

## *Voice and Opera Program*

Students majoring in voice take a concentrated program of courses designed to prepare them for professional performance. In addition to individual instruction, students take courses in musicology, vocal science, conducting, opera workshop, repertoire, and foreign language. A senior recital is required, and students are urged to take advantage of the numerous other performance opportunities offered by the school.

The Northwestern Opera Center is supported by a generous endowment in memory of the famous American soprano Edith Mason Ragland. The internationally acclaimed Edith Mason and William E. Ragland Opera Theater presents scene recitals and full-scale productions.

**Major Studies Requirement**

For a major in voice performance, 21 course units are required:

- A10 Voice Performance (3 units)
- B10 Voice Performance (3 units)
- C10 Voice Performance (6 units)
- Major choral ensemble (nine quarters) (4.5 units)
- C23 Study of the Vocal Mechanism (.5 unit)
- 540-C26 Conducting and Score Reading (1 unit)
- C51-1,2,3 Acting Techniques for the Opera Singer (1.5 units)
- C52-1,2,3 Opera Laboratory (1.5 units)
- A11-1,2,3 Phonetics and Diction (0 units)
- B11-1,2,3 Introduction to Acting for the Singer (0 units)
- Nine quarters of vocal solo class (0 units)
- 510-C89 Convocation (4 quarters) (0 units)
- C80 Senior Recital (0 units)

It is recommended that voice performance majors take three units of one foreign language and achieve a level-five competency in Keyboard Skills. See the voice coordinator concerning the honors program in voice performance.

### Courses Open to Undergraduates

**570-A02-0 Beginning Voice** Class instruction for non-music majors. Basic music skills required. Consult self-evaluation questionnaire in Undergraduate Music Office before registration.

**570-A10-0,B10-0,C10-0 Voice Performance** Lessons consist of private and group instruction (studio class), with each student receiving the equivalent of 50 minutes of instruction weekly.

**570-A11-1,2,3 Phonetics and Diction (0)** Required of freshman and transfer students majoring in voice. Three quarters: Italian, German, French.

**570-B02-0 Voice Performance:Musical Theatre** Private instruction for theater majors seeking a Certificate in Music Theatre. Prerequisite: admission to the Music Theatre Program and A02 or equivalent.

**570-B11-1,2,3 Introduction to Acting for the Singer (0)** **1.** Basics of stage movement, relaxation and focusing techniques, creativity and imagination exercises, exercises in physicalizing a character. **2.** Backstage production elements, including set, costume, lighting, and sound design; crew requirement. **3.** Movement and improvisation. Sophomores only. Must be taken sequentially.

**570-C23-0 Study of the Vocal Mechanism** Lectures, readings, discussions, and demonstrations of basic vocal physiology, common vocal problems, and use of exercises and songs for vocal improvement. For junior or senior voice students. Prerequisite for other students: consent of instructor.

**570-C35-0 Selected Topics in Voice (.5–1)** Topics vary; announced before registration. May be repeated.

**570-C51-1,2,3 Acting Techniques for the Opera Singer (.5)** Advanced techniques for the performance of arias and songs; methods of text and character analysis; audition techniques; study of opera and musical theater repertoire. Juniors only. Must be taken sequentially.

**570-C52-1,2,3 Opera Laboratory (.5)** Performance and audition techniques of operatic repertoire; character analysis and scene study. Repertoire ranges from baroque opera through contemporary opera and musical theater. Seniors and graduate students only. Prerequisite: C51-1,2,3, or consent of instructor. Must be taken sequentially.

**570-C57-0 The German Lied (.5)** Study and singing of Schubert and Schumann song cycles and Brahms, Berg, Mahler, Strauss, and Wagner songs. Incorporation of chamber music and study of original poetry.

**570-C58-0 Is Technique Enough? (.5)** The relationship between repertoire choice and vocal technique development.

**570-C63-0 Opera Performance** Preparation and performance of a major operatic role.

**570-C80-0 Senior Recital (0)**

**570-C99-0 Independent Study (.5–1)** Permission of instructor and department required.

## *Wind and Percussion Instruments Program*

Designed to prepare students for professional performance and teaching as well as for advanced study, the major in wind and percussion instruments offers a concentrated curriculum emphasizing performance studies, frequent master classes, required participation in large and small ensembles, and a required senior recital. Students anticipating graduate study in wind or percussion performance are advised to elect additional courses in C-level theory and history.

**Major Studies Requirement**

For a major in wind and percussion performance, 19.5 course units are required:

- A11–31 Performance study (3 units)
- B11–31 Performance study (3 units)
- C11–31 Performance study (6 units)
- Additional large ensemble (nine quarters) (4.5 units)
- C91 Chamber Music (3 units)
- 510-C89 Convocation (4 quarters) (0 units)
- C80 Senior Recital (0)

### Courses Open to Undergraduates

**565-A11-0,B11-0,C11-0 Flute Performance**

**565-A12-0,B12-0,C12-0 Oboe Performance**

**565-A13-0,B13-0, C13-0 Clarinet Performance**

**565-A14-0,B14-0,C14-0 Saxophone Performance**

**565-A15-0,B15-0,C15-0 Bassoon Performance**

**565-A21-0,B21-0,C21-0 Trumpet Performance**

**565-A22-0,B22-0,C22-0 French Horn Performance**

**565-A23-0,B23-0,C23-0 Euphonium Performance**

**565-A24-0,B24-0,C24-0 Trombone Performance**

**565-A25-0,B25-0,C25-0 Tuba Performance**

**565-A31-0,B31-0,C31-0 Percussion Performance**

**565-C35-0 Selected Topics in Winds and Percussion** Topics vary; announced before registration. May be repeated.

**565-C36-0 Woodwind Orchestral Repertoire** Wind section performance practices and performance techniques in the standard orchestra literature.

**565-C37-0 Interpretation of Instrumental Chamber Music** Coaching in the preparation and rehearsal of chamber music for strings, winds, keyboard, and voice.

**565-C38-0 Brass Orchestral Repertoire** Study of brass section performance practice and performance techniques in the 19th- and 20th-century orchestral repertoire. Limited to junior, senior, and graduate students. May be repeated once.

**565-C39-0 Performance Practices and Criticism** Performance and criticism of woodwind, brass, and percussion repertoire in a master class setting. Team-taught.

**565-C42-0 Brass Instrument Repertoire** Brass literature and performance practices; solos, pedagogical materials, and chamber music for various levels of performance.

**565-C47-0 Percussion Pedagogy and Performance** Methods, materials, and writings related to percussion playing and teaching. Prerequisite: C-level standing in percussion performance or consent of instructor.

**565-C52-0 Preparing for an Audition**

**565-C53-0 Introduction to the Harp**

**565-C54-0 Woodwind Instrument Repair**

**565-C55-0 Freelance Musician**

**565-C56-0 Making Musicianship Audible**

**565-C57-0 Reedmaking for Single Reed Instruments**

**565-C59-0 Brass Teaching Techniques**

**565-C61-0 Jazz Piano for the Nonkeyboard Player** Jazz voicing, harmonization, analysis, and technique through keyboard instruction. Prerequisite: basic keyboard proficiency, jazz performance and harmonic background.

**565-C80-0 Senior Recital (0)**

**565-C91-0 Chamber Music** Percussion and mallet ensembles, brass ensembles, woodwind quintets, saxophone quartets, and clarinet quartets.

**565-C99-0 Independent Study (.5–1)**

# School of Speech

Speech is the primary mode of communication, the principal means by which people exchange ideas and feelings. It is a means of inquiry and reporting. It is a means of persuasion. And it is a means of appreciation, inspiration, and entertainment. Students of speech study the nature of such communication and the conditions, circumstances, and properties affecting it. They may concentrate on speech as a scientific phenomenon, as a fine art, or as a rhetorical art.

Speech is conversation, discussion, debate, and public address. It is the performance of prose, poetry, and dramatic literature. It is theatre—acting, directing, and exploring the many facets of the physical theatre and dramatic production. It is radio, television, and film—the media of mass communication. It is the study of language and the analysis and improvement of speech and hearing disabilities. And it is the preparation of teachers, directors, clinicians, and other professionals in these fields. It is study and research in all these areas.

Founded by Robert Cumnock in 1878, the School of Speech is now the third largest of Northwestern's six undergraduate divisions. It annually enrolls more than 1,100 undergraduate majors and 300 graduate students.

Originally, the curriculum and its related activities were concerned with public speaking and interpretative reading as performing arts. As the field and the school grew, the faculty added instruction in theatre, speech pathology, audiology, radio, television, film, and other specialties in oral communication. The five departments of instruction indicate the scope of the modern curriculum: performance studies; communication studies; radio/television/film; communication sciences and disorders; and theatre (including dance). In addition to the specialized program presented by each department, the five departments of the School of Speech combine to offer the undergraduate degree program in interdepartmental studies. All departments offer graduate courses. The School of Speech sponsors six divisions of Northwestern's National High School Institute: creative media writing, dance, debate, Lincoln-Douglas debate, radio/television/film, and theatre arts.

This wide range of educational activities is currently housed not only in the school's original building, Annie May Swift Hall, but also in Harris Hall; two former residences on Chicago Avenue; the Communication Sciences and Disorders complex, which includes the Frances Searle Building and the medical and dental clinical facilities in Chicago; the Theatre and Interpretation Center; and John J. Louis Hall, a state-of-the-art studio production facility.

## Academic Policies

### Requirements for the Degree of Bachelor of Science in Speech

The School of Speech grants the degree of bachelor of science in speech upon (1) the satisfactory completion of 45 course units; (2) the fulfillment of the distribution requirement of the student's major department; and (3) the completion of an approved program of study in speech and related fields suited to the student's special interests and needs. If students interrupt the program of study for an extended period of time and degree requirements are changed during this period, they are normally held to the new requirements.

In addition to and independent of the requirements set by the School of Speech, students must satisfy the University Enrollment Requirement (see Financial Regulations).

#### *General Requirements*

Of the required 45 courses, the last 23 courses must be taken while the student is enrolled as an undergraduate in Northwestern University, and the student must be enrolled in the School of Speech for the last three quarters preceding the granting of the degree. Credit for summer work taken at other colleges or universities as part of the last 23 courses requires approval by petition.

Thirty-five of the required 45 units must be completed with grades of A, B, or C. A minimum of 18 courses must be taken outside the School of Speech. No more than 18 of the 45 courses offered for the degree may be taken in the major department.

A transfer student will be required to complete at least 11 courses in the School of Speech at Northwestern. A speech placement interview is required at the time of first registration for all transfer students.

***Distribution Requirements***

All major programs in speech require 18 courses outside the major department in the following areas:

- Science, mathematics, and technology
- Individual and social behavior
- Humanities and fine arts

Students should consult the department concerned for the range of disciplines within each category and the number of courses required.

***Major Programs in Speech and Related Requirements***

All students in the School of Speech must meet the requirements of one of the following major programs: interdepartmental studies, performance studies, communication studies, radio/television/film, communication sciences and disorders, or theatre (including dance). Basic speech courses are required in all programs, and provisions are made for study in other divisions of the University to complement the major program.

### Student Conduct in Speech Courses

All undergraduate students enrolled in School of Speech courses are held accountable to the University's standards of academic integrity (see Academic Regulations in the Undergraduate Education section of this catalog). They also are responsible for compliance with the following standards:

- Attendance is required in all courses, and excessive absence is cause for failure
- Credit will not be given for two courses that meet at the same time
- All assigned work must be completed to receive course credit
- Assignments must be turned in on time, and examinations must be taken as scheduled; assignments cannot be made up or grades of incomplete given without prior approval from the instructor

### Teaching Certification

The Department of Communication Sciences and Disorders offers a program leading to public school certification.

### Faculty Advisers

Each new student is assigned a faculty adviser in the chosen major field within speech. This adviser is available for consultation, especially for the purpose of planning for the next registration. Freshmen have a separate advising period before the fall registration. Ultimate responsibility for meeting degree requirements rests with the student.

## Academic Options

### Interdepartmental Studies

This program provides an interdisciplinary opportunity within speech for students whose special interests are not satisfied by one of the established programs. Majors in interdepartmental studies may seek a general education with exposure to a broad range of disciplines or a professional preparation from two closely related areas of speech.

***Requirements for a Major in Interdepartmental Studies***

- A minimum of 3 courses distributed among at least three departments and selected from the following: 601-A01, A02, A03, A08; 630-A40-1, A40-2
- A minimum of 3 courses at the B level distributed among at least three departments
- An additional 10 courses in speech distributed among at least two departments, including at least 8 courses at the C or D level. It is the student's responsibility to take all courses prerequisite for C- and D-level courses. Eligible students are urged to elect C99 during their senior year; this independent study should be arranged to correlate two of the speech areas the student has studied.
- Six courses at the B level or above outside speech, including at least three C-level courses. If they apply, courses taken to meet the distribution requirement may be used to satisfy this requirement.
- Major programs for undergraduate work must be approved by the associate dean for undergraduate affairs

### Interschool Certificates and Adjunct Major

For information about the interschool programs listed below, see the Other Undergraduate Programs section of this catalog.

***Integrated Arts Program***

The interschool Integrated Arts Program offers courses leading to a minor that explore the creative process from the perspective of the artist in the disciplines of theatre, visual arts, music, dance, and media arts.

***International Studies Program***

International studies, an undergraduate interschool adjunct major that is taken in conjunction with a traditional major, is open to School of Speech students.

***Music Theatre Program***

The Certificate in Music Theatre provides the opportunity for School of Music students majoring in voice and School of Speech students majoring in theatre to create a second area of specialization.

***Undergraduate Leadership Program***

The Undergraduate Leadership Program, an interschool certificate program open to all undergraduates, helps students understand the nature of leadership and prepares them to become leaders.

### Graduate Study

The School of Speech has been a national center for graduate study and research in the field of speech for many years. Programs for the master of arts, master of fine arts, and doctor of philosophy degrees with majors in speech are administered by the Graduate School of Northwestern University. All candidates for these degrees must satisfy the Graduate School requirements. The school itself offers a master of science in communication.

The School of Speech offers departmental and thesis sequences leading to the master's degree as well as a program leading to the degree of master of science in communication with emphasis in communication management or communication systems. Requirements for the departmental and thesis master's degrees, the master of fine arts, and the doctor of philosophy degrees in any division of the School of Speech are described in the Graduate School catalog. Requirements for the master of science in communication degree are available from the School of Speech.

All departments of the School of Speech participate in graduate studies and research. Graduate programs may be relatively specialized in the offerings of one department or arranged to represent the offerings of two or more departments.

## Introductory and Related Courses

**601-A01-0 Interpersonal Communication** Laboratory experience in human interaction. Analysis of communication within groups.

**601-A02-0 Public Speaking** Theory, composition, delivery, and criticism of public speeches.

**601-A03-0 Analysis and Performance of Literature** Critical reading, written analysis, and performance of literary texts; general introduction to performance studies. Individual conferences.

**601-A04-0 Argumentation and Debate** Theories of argumentation and debate, with many opportunities for practice. Analysis and evaluation of the discourse related to public controversies. Recommended for students planning to participate in intercollegiate debate.

**601-A05-0 Improving Voice and Articulation** Study of basic communication processes for students wishing to improve their own speaking skills. Self-evaluation of articulation and voice; directed practice based on principles of normal speech production and elementary phonetics. Prerequisite: consent of instructor.

**601-A08-0 Processes and Pathologies of Human Communication** Human communication and its disorders. Listening, speaking, reading, and writing. Introduction to clinical approaches. Clinical observation required.

**601-A10-0 Voice for Performance** Intensive individual development and use of voice for performance.

**601-B04-0 Paradigms and Strategies of Leadership** Theoretical models of leadership. Group vision, change, and decision making. Weekly student-led small groups discuss case studies. Meetings videotaped, followed by feedback sessions.

## Communication Sciences and Disorders

The Department of Communication Sciences and Disorders is the locus at Northwestern of basic science and research in human communication and its disorders. It offers clinical training programs in audiology and hearing sciences, learning disabilities, and speech and language pathology. Undergraduate and graduate curricula emphasize the study of normal human communication and cognition, thereby providing a foundation for the study of disorders of hearing, speech, language, and learning. Classroom, clinical, and research facilities of the department are located in the Frances Searle Building on the Evanston campus, with the opportunity to do further clinical work at the Medical School on the Chicago campus.

## Programs of Study for Departmental Majors

The undergraduate program in communication sciences and disorders is designed to provide a thorough background of information about human communication and its disorders. Basic science principles that underlie all human communication and cognition are emphasized. Students also are introduced to clinical issues that pertain to disorders of communication and learning.

Undergraduate majors in communication sciences and disorders may choose among four areas of concentration: human communication sciences, audiology and hearing sciences, learning disabilities, and speech and language pathology. Many courses in the department are taken as electives by students from many departments and schools of the University. Undergraduates may select their area of concentration any time after entering the department. However, they are encouraged to make this decision by the spring quarter of their sophomore year and are required to decide no later than the beginning of their junior year. (Students may always petition to change the area of concentration.)

An honors program is also available for students in their senior year who have maintained an outstanding undergraduate record through their junior year. Upon successful completion of an honors project, they will graduate with honors in communication sciences and disorders. Also see Honors and Prizes in the Undergraduate Education section of this catalog.

Upperclass students in the department may register for units of independent study, in which they work closely with a faculty member on a topic of mutual interest. Students interested in independent study should select courses that may lead to more advanced library or laboratory research.

### *Human Communication Sciences*

This area of concentration is particularly well suited to students who plan to attend graduate or professional school in fields such as medicine, dentistry, psychology, biomedical engineering, or neuroscience. It also provides excellent preparation for students who plan to pursue graduate study in audiology and hearing sciences, learning disabilities, or speech and language pathology to conduct research in these areas or to engage in professional practice. In addition to taking a number of basic science courses in the Department of Communication Sciences and Disorders, students in this program take a minimum of 12 science, mathematics, engineering, and/or psychology courses outside the department.

Students admitted to the seven-year Honors Program in Medical Education with an emphasis in human communication sciences meet the C- and D-level course requirements of the department (see following description). However, because they spend only three years on the Evanston campus, they take fewer A- and B-level courses in the department and the School of Speech than some four-year undergraduates.

### *Audiology and Hearing Sciences*

This area of concentration encompasses the study of hearing, hearing disorders, and the treatment of hearing disorders. Undergraduate course work in this program provides the scientific undergirding necessary for clinical practice and/or auditory research. Emphasis is on basic communication science, including study of the anatomical, physiological, and physical bases of hearing. Information on normal communication processes is presented. An introduction to audiologic assessment and hearing loss management is provided, with the opportunity for supervised clinical experience for advanced undergraduate students.

The master's degree program in audiology and hearing sciences is a professional program designed to prepare students for the clinical practice of audiology. Students interested in careers in auditory research may emphasize the development of research skills in the master's program to prepare for continued study at the doctoral level.

Students completing master's study in audiology and hearing sciences may qualify for clinical certification by the American Speech-Language-Hearing Association (ASHA), Illinois state licensure in audiology, and registration with the Illinois Department of Public Health in the area of hearing aid dispensing. Audiology professionals may be employed in hospitals, community and university clinics, industry, schools, rehabilitation centers, and research laboratories. Advanced professionals may be self-employed in private practice.

### *Learning Disabilities*

The undergraduate concentration in learning disabilities provides academic preparation for graduate study leading to the MA and PhD degrees in learning disabilities and related fields. The field of learning disabilities is concerned with learning processes and their dysfunctions, including disorders of perception, memory, language, and conceptualization. Such disorders lead to problems in the acquisition and use of oral language, reading, writing, and math skills that require specialized remediation. Undergraduate course work stresses theoretical, scientific, clinical, and educational issues as a foundation for advanced training. Students also may create an interdisciplinary program by combining learning disabilities with such ancillary fields as audiology, education, linguistics, neuroscience, psychology, or speech and language pathology.

The first two years of the undergraduate curriculum emphasize the psychological, linguistic, and biological bases of normal language and cognitive development. Clinical examples and observations in the program's clinics and in area schools are incorporated into these courses. Advanced undergraduate courses are focused more directly on disorders in basic processes and on clinical applications of basic theory, including some supervised clinical teaching.

Graduates of the program may enter MA or MA/PhD programs at Northwestern or elsewhere to pursue

advanced work and certification as a specialist in learning disabilities or as a researcher. Learning disabilities specialists with master's or PhD degrees may work in public or private schools, universities, hospitals, or private practice.

***Speech and Language Pathology***

The undergraduate emphasis in speech and language pathology combines academic instruction with laboratory activities and supervised clinical experiences to give students a background for graduate study in the field. The first two years of the undergraduate curriculum emphasize the psychological, linguistic, neurological, acoustical, anatomical, and physiological bases of normal auditory and oral language behavior. As knowledge of normal speech, language, learning, and hearing processes increases, students are introduced to the communicative disorders that result from the disruption of these processes.

Advanced undergraduate courses are concerned with the nature, recognition, and management of common communicative disorders, such as problems of speech sound production, language development, fluency, and voice. This program also offers courses of study leading to the MA and PhD degrees as well as postdoctoral study in speech and language pathology. Graduate courses are concerned with the neurophysiologic and structural disorders affecting communication and with a more detailed study of disorders of language, fluency, articulation, and voice. Students study the theory, evaluation, and management of aphasia, cerebral palsy, cleft palate, laryngeal pathologies including laryngectomy, and other complex disorders.

Students completing graduate programs of study in speech and language pathology may qualify for teaching certification by the Illinois State Board of Education, Illinois state licensure, and certification by the American Speech-Language-Hearing Association (ASHA). Professional speech and language pathologists work in schools, child development programs, specialized educational settings, universities, hospital clinics, rehabilitation centers, and private practice.

### Requirements for a Major in Communication Sciences and Disorders

- Introductory courses: 601-A08 or 620-A01 and at least 2 of the following: 601-A01, A02, A03
- B-level courses: B01, B02, B03, B-level statistics course in psychology or education
- C- and D-level courses in communicative disorders: 9 courses (excluding practicum courses), including at least 1 in audiology and hearing sciences, learning disabilities, and speech and language pathology
- Electives: 14 courses, at least 8 of which must be outside the department

  (Students who plan to work at the elementary or secondary level are advised to include courses in education and other areas that apply toward the requirements for a teaching certificate in their special field.)
- Courses taken in the department: 22 are the maximum number that can be counted toward the BSSp degree
- Writing proficiency requirement: All students must meet the writing proficiency requirement as described under Academic Policies in the CAS section of this catalog
- Residence requirement: enrollment in the department for the last five quarters preceding the granting of the degree

Also see the description of requirements for students admitted to the seven-year Honors Program in Medical Education under Programs of Study for Departmental Majors, Human Communication Sciences, earlier in this section.

## *Basic Science*

### Courses Primarily for Undergraduates

**620-A01-0 Seminar in Communication Sciences and Disorders** Major topics of research interest in communicative disorders. Principles of research in communicative disorders.

**601-A05-0 Improving Voice and Articulation** See Introductory and Related Courses.

**601-A08-0 Processes and Pathologies of Human Communication** See Introductory and Related Courses.

**620-B01-0 Phonetics** Training in transcription of English speech sounds. Introduction to distinctive feature analysis, phonological rules, prosodic features, dynamics of articulation, American dialectal variants.

**620-B02-0 Biological Foundations of Human Communication** Human anatomy, physiology, and neurology in relation to communicative behavior. Sensory, perceptual, cognitive, and motor processes.

**620-B03-0 Acoustics of Speech** Nature of sound, acoustics, and acoustic composition of speech. Contributions of acoustical research to the theory of speech production and perception.

**620-B05-0 Introduction to the Study of Learning and Learning Problems in Children** Application of three theories—stimulus-response, cognitive development, and psychoanalytic—to learning and learning problems in classrooms. Field placement in a classroom; supervised observations of a child with learning problems and a normal achieving classmate.

**620-C01-0 Anatomy and Physiology of the Vocal Mechanism** Lectures, readings, and laboratory dissections presenting the structure and function of the neuromuscular system involved in breathing, phonation, and articulation. Prerequisite: junior standing or above.

**620-C02-0 Anatomy and Physiology of the Hearing Mechanism** Gross and fine structure, development, and function of the peripheral and central auditory system. Prerequisites: junior standing or above, B02 and B03, or consent of instructor.

**620-C03-0 Brain and Cognition** Brain anatomy and physiology, neuropsychological techniques, sensory physiology, and neural development. The brain's role in language, attention, learning and memory, thinking, intelligence, and reading.

**620-C04-0 Introduction to Research Methods** Introduction to research design and data analysis in communication sciences and disorders; statistical inference.

**620-C05-1 Electronic Laboratory Instrumentation** Basic analog and digital electronic theory for the use, modification, and design of behavioral laboratory equipment. Applications in speech and hearing.

**620-C05-2 Computer Laboratory Instrumentation** Computer use in the laboratory for equipment control and data acquisition. Real-time programming and networking between computers and laboratory equipment. Prerequisites: C05-1 and proficiency in any computer language.

**620-C06-0 Introduction to Psychoacoustics** Introduction to principles underlying perception of pitch, loudness, auditory space, speech; psychophysical procedures for studying psychoacoustics.

**620-C09-0 Culture, Language, and Learning** Language and culture; transmission of culture through language; effects of cultural variety on perception, cognition, and learning; implications of cultural and linguistic diversity in communicative disorders.

**620-C11-0 Principles of Electronics and Acoustics** Parallel development of concepts in electronics and acoustics that are useful for advanced laboratory research in communicative disorders and related fields.

**620-C12-0 Applied Research Methods in Human Communication Science** Survey, experimental, and clinical case-review methods pertinent to hearing, speech, language, and learning; discussion of research strategies. Laboratory.

**620-C20-0 Physiologic Instrumentation** Fundamentals of physiological measurement and analysis. Use of physiological instrumentation for the transduction and measurement of speech articulator movement. Design of experiments and interpretation of data. Prerequisite: C01.

**620-C50-0 Cognitive Development in Atypical Learners** Introduction to theories of cognitive development; implications for the study of atypical learners; review of research on the impact of perceptual and language impairments on cognitive growth. Laboratory, with cognitive assessment procedures.

**620-C51-0 Development and Disorders of Memory** Scientific models and evidence for the development of memory. Memory disorders in relation to developmental and life span issues.

**620-C99-0 Independent Study** Prerequisite: consent of associate dean after submission of petition.

## *Audiology and Hearing Sciences*

### Courses for Undergraduates and Graduates

**621-C18-0 Introduction to Audiology** Introduction to the measurement of hearing in humans. Basic anatomy of the ear, measurement of hearing, potential disorders of hearing. Lecture/laboratory.

**621-C19-0 Pediatric Audiology** Etiological factors, assessment, and implications of hearing impairment, selection of hearing aids, remedial programs, counseling of parents. Emphasis on hard-of-hearing infants and children. Prerequisite: C23 or consent of instructor.

**621-C20-0 Pathologies of the Auditory System** Physiologic abnormalities of the auditory system that result in hearing impairments. Prerequisite: C02, C23, or equivalent.

**621-C21-0 Evaluation and Use of Amplification Systems** Electroacoustic characteristics of the hearing aid, clinical selection of wearable amplification and group auditory training systems, and patient management. Lecture/laboratory. Prerequisite: C23 or consent of instructor.

**621-C23-0 Measurement of Hearing I** Basic audiometric and immittance techniques; interpretation of test results. Introduction to amplification systems. Lectures/laboratories. Prerequisite: junior standing or above.

**621-C24-0 Measurement of Hearing II** Audiometric techniques used in differential evaluation of cochlear, retrocochlear, and functional hearing loss. Calibration techniques. Prerequisite: C23 or equivalent.

**621-C25-0 Central Auditory Neurophysiology:Evoked Potentials** Electrophysiologic evaluation of auditory, visual, and somatosensory systems, emphasizing electric response measures. Theoretical and practical considerations in clinical application; interpretation of test results. Prerequisite: C24 or equivalent.

**621-C26-0 Vestibular Evaluation** Electrophysiological evaluation of the auditory system; consideration in the measurement of caloric nystagmus. Integration of electrophysiologic test findings with audiometric and immittance test results in clinical case studies of auditory and vestibular disorders. Prerequisite: C25 or consent of instructor.

**621-C66-0 Introduction to Aural Rehabilitation** Principles and strategies in hearing loss management in children and adults. Information about speech reading and auditory training. Prerequisite: C23 or equivalent.

**621-C67-0 Advanced Aural Rehabilitation** Current research and theory in aural rehabilitation.

**621-C68-0 Theory and Practice in Rehabilitation of Hearing-Impaired Children and Adults** Theories of methods of designing and implementing individual and group rehabilitation programs for the hearing-impaired. Lectures, discussions, demonstrations relating to clinical practice. Prerequisites: C66 and consent of instructor.

## *Learning Disabilities*

### Courses Primarily for Undergraduates

**623-C69-0 Special Topics in Learning Disabilities** Current scientific and professional problems in learning disabilities.

**623-C73-0 Introduction to Learning Disabilities** Psychological, neurological, and linguistic theories of language and learning as related to learning disabilities. Prerequisite: junior standing or above.

**623-C75-0 Diagnostic Procedures for Exceptional Children** Principles and procedures for differential diagnosis. Characteristics of children with major disabling conditions.

**623-C76-0 Remedial Education for Children with Learning Disabilities** Remedial programs for children with learning disabilities. Teaching techniques for aphasia, dyslexia, and related disorders. Educational planning and placement. Prerequisite: junior standing or above or consent of instructor.

**623-C77-0 Learning Disabilities in Early Childhood** Theoretical issues, assessment, and educational principles for young children with learning disabilities. Problems of language, cognition, and preacademic learning. Instruction and home management.

**623-C80-0 Introduction to Clinical Procedures in Learning Disabilities** Practicum experience in clinical settings. Learning processes and application of instructional approaches. Field studies, reading, and weekly seminars. Prerequisites: C75, C76.

**623-C81-0 Social Development in Normal and Learning-Disabled Children** Current theories of and empirical research on social-emotional development from infancy through adolescence; identification and treatment of social deficits in learning-disabled children.

## *Speech and Language Pathology*

### Courses Primarily for Undergraduates

**624-C30-0 Multicultural Perspectives on Speech and Language Disorders** Nonbiased diagnosis and remediation of language, fluency, voice, and neurogenic disorders among culturally and linguistically diverse groups.

**624-C34-0 Delivery Systems in Speech and Language Pathology** Organization, administration, and implementation of speech-language pathology services in public, private, and special schools; clinics, rehabilitation agencies, hospitals; private practice.

**624-C36-0 The Field of Special Education** Organization of special education programs; criteria for selection and educational management of pupils in special programs. Prerequisite: junior standing or above or consent of instructor.

**624-C69-0 Special Topics in Speech and Language Pathology** Summer only.

**624-C91-0 Speech Sound Learning and the Modification of Articulation** Development of speech production skills in children. Factors affecting phonological development. Assessment and modification of atypical articulatory patterns. Prerequisite: B01 or equivalent.

**624-C92-0 Language Development and Usage** Language learning and its relation to other aspects of child development. Patterns of normal language development as a guide for evaluation and treatment of developmental language disorders. Prerequisite: junior standing or above or consent of instructor.

**624-C93-0 Vocal Physiology and Pathology** Normal and abnormal adaptations of respiration, phonation, and resonance to production of voice in speech. Techniques, materials, and instrumentation for voice diagnostics and therapy applicable to children and adults. Prerequisites: B02, C01.

**624-C94-0 Fluency, Disfluency, and Stuttering** Normal development of fluency and factors that may disrupt it. Introduction to the nature, etiologies, development, and treatment of stuttering. Prerequisite: B01 or consent of instructor.

**624-C95-0 Introduction to Neurogenic Communication Disorders** Neurological correlates and behavioral symptomatology associated with developmental and acquired neurogenic communication disorders. Clinical observation required.

**624-C96-0 Diagnostic Procedures in Speech and Language Pathology** Clinical examination of persons with oral language problems; evaluation of sensory and motor processes of speech; assessment of speech and language maturity levels. Prerequisites: senior standing or above, C91 and C92, or consent of instructor.

**624-C97-0 Introduction to Clinical Procedures in Speech and Language Pathology** Beginning practicum experience in a clinical setting. Emphasis on planning and executing a remedial program for individuals with problems of speech sound production and language usage. Prerequisite: consent of instructor.

**624-C98-1,2 School Practicum in Speech and Language Pathology 1.** Application of academic background to clinical teaching in the schools. Organizing, executing, evaluating a speech and language pathology program. For each course unit, 50 hours of supervised teaching. **2.** Continuation of C98-1. Prerequisites: C34, C91, C92, C94, and consent of instructor.

## Communication Studies

The Department of Communication Studies offers liberal arts–oriented course work focused on the most fundamental and pervasive of human activities. The study of human communication ranges from interpersonal processes such as persuasion and relationship formation to organizational processes such as group leadership and dispute resolution, as well as to the strategies and styles of public deliberation and debate and the political and cultural processes involving mass media and telecommunications systems. At the same time, the study of human communication encompasses the scholarly traditions of both the humanities and social sciences. The intellectual foundations for this study range from classical rhetoric to cognitive science, from the economics of computer-mediated communication networks to the ethics of public argument.

### Course Concentrations for Departmental Majors

The department has organized the wealth of theory and research on human communication—as well as the real-world applications of that theory and research—into six course concentrations. These are interrelated sets of courses that can help students coordinate their choice of classes with their intellectual interests, postgraduate educational plans, and career goals. Students who major in communication studies are encouraged, though not required, to organize their course work within one or two of these concentrations as described below.

#### *Organizational Communication*

The success of all organizations—whether small neighborhood groups or giant multinational corporations—depends on effective communication. Organizations must have members who are skilled in the basic communication activities of persuasion, group leadership and decision making, bargaining and negotiation, and team problem solving. And in the contemporary world, organizations also demand the knowledge necessary to analyze and act on information gathered from surveys and other research methods, to harness the resources of communication technology, and to thrive in an environment of diverse individuals. This concentration includes courses that develop basic communication skills as well as courses that examine communication processes in such contexts as task-oriented groups and professional-client relationships. It also includes courses that focus on the organizational challenges associated with technology, information management, cultural diversity, and image building. This concentration will be of interest to students who wish to work—and who will seek to lead—in either business or not-for-profit organizations. To complete this concentration, students must take B01 and B60 and choose a minimum of four courses from the following: B05, B29, B50, B75, C29, C41, C50, C61, C62, C63, C64, C65, C71, C91, C92, and C93.

#### *Communication Industries and Technologies*

Mass communication and telecommunications are reshaping the culture, commerce, and politics of the United States and the world. Media firms are merging into ever-larger organizations that produce film, television, music, books, magazines, newspapers, and software for audiences worldwide. At the same time, technology is breaking down the old distinctions among computers, telephones, video, and print to create new networks that integrate video, voice, and data. These changes present new and sometimes unanticipated challenges to managers in business as well as to leaders in government, education, the arts, and the professions. This course concentration is intended for students who wish to prepare for these challenges by developing an understanding of the social, economic, legal, and technical aspects of mass communication and telecommunications. It will be of interest to students who seek careers in such communication fields as advertising and public relations, management of entertainment and information industries, and public policy making. To complete this concentration, students must select a minimum of six courses from the following: B01, B29, B75, B87, C30, C50, C70, C76, C77, C85, and C93.

#### *Rhetoric, Media, and Public Culture*

Citizens of the 21st century must understand the communication opportunities, obligations, and risks that emerge in an era of cultural diversification and conflict. This course concentration examines the relationship between communication and culture from a rhetorical and critical perspective—that is, from a point of view emphasizing the use of language and image to characterize social reality, create forums for deliberation and debate, and confront controversial issues and cultural differences. The concentration includes courses that engage the issues raised by differences of race, class, gender, nationality, and political conviction. It also includes courses that examine such cultural processes as the legitimization of social authority, the construction of personal as well as national identity, and the articulation of national purpose and international obligation. The role of the mass media in these issues and processes is of particular concern. This course concentration is intended for students interested in positions of civic leadership, such as in community-based organizations, social reform movements, and cultural, political, and educational institutions. To complete this concentration, students must take B10 and one other B-level course from the following: B25, B71, and B75. They must also select a minimum of four C-level courses from the following: C10, C11, C15, C20, C25, C27, C28, C29, C30, C70, C71, C75, C76, C77, C78, and C92.

#### *Relational Communication*

Our lives are spent in relationships with others. Most people are born into a family, form friendships, join work groups, and begin romantic attachments that sometimes

turn into new family units. Interpersonal communication is the means by which we develop, maintain, and terminate these relationships. The relational communication concentration focuses on these processes. It has four components: courses examining the psychological variables that affect how people create and interpret the communication behaviors that occur during social interaction; courses examining the contexts in which relational communication occurs, such as the family and the work group; courses focusing on strategies and processes of interpersonal influence; and courses focusing on the impact of gender, culture, and other factors on the processes of relational communication. This concentration is intended for students interested in the psychological foundations of human communication as well as students interested in the helping professions (e.g., therapy, counseling). To complete this concentration, students must take two core courses, B01 and B41, and select a minimum of four courses from the following: B05, B40, B50, B60, C40, C41, C43, C44, C45, C50, and C82.

### *Media and Politics*

Communication is essential to both effective leadership and citizen participation. Leaders must employ the arts and sciences of communication to negotiate policy, move public opinion, maintain relations with other nations, and, of course, win votes. Citizens must understand these arts and sciences if they are to maintain self-government. This course concentration focuses on the role of communication in the political processes of modern democracies, especially on how government officials, candidates, and citizens interact with the mass media in the realm of public affairs. The concentration is intended for students interested in political organizing and consulting, opinion polling, policy analysis, and research work in public interest groups and other not-for-profit organizations. To complete this concentration, students must take B-72 and a minimum of three courses from each of two groups: the political leadership group, focusing on the rhetoric and strategies of political persuasion, consisting of C15, C21, C25, C28, C80, and C91; and the citizen participation group, concerning Americans' beliefs and the ways they respond to political information, consisting of B01, B05, B71, C70, C71, C72, C80, and C93.

### *Argumentation and Advocacy*

Lawyers, policy makers, and indeed all citizens must be able to put forward and defend their views when matters of common concern are debated. This course concentration is based on the conviction that the skills of advocacy can best be cultivated in the liberal arts tradition by uniting intensive practice in the arts of argumentation with theory-based understanding of advocacy and deliberation. In this concentration, courses emphasizing practice require students to think critically about their positions, plan their communicative strategies effectively, and argue their cases forcefully. Courses emphasizing understanding enlarge students' views of the traditions and institutions—especially the law—that shape the processes of advocacy and deliberation on vital issues. Thus prepared, students can take their places as articulate citizens in the various communities to which they belong. The perspectives and skills offered in this concentration are particularly appropriate for students interested in law careers. To complete this concentration, students must select three practice-oriented courses from B14, B20, B21, and B50 as well as three theory-oriented courses from B05, B10, C11, C21, C25, C30-1, C63, C64, C72, C91, and C93.

## General Requirements for a Major in Communication Studies

- Two of the following: 601-A01, A02, A03, A04
- An additional 12 courses in speech, at least 9 of which must be in the department. At least 5 courses within the department must be at the C level. Not more than one unit of C93 Field Study in Communication and not more than two units of C99 Independent Study may be applied toward the total of 12 courses in speech.
- A field of concentration in an area other than speech (normally one of the disciplines of the College of Arts and Sciences), consisting of at least 6 courses with half or more of this study at the C or D level. Courses taken to satisfy the distribution requirement may be applied to the field of concentration if they fall within the discipline in which the student chooses to concentrate.
- Electives in speech and other areas

## Four-Year BSSp/MA

The department offers a four-year BSSp/MA program for outstanding undergraduate majors. Departmental approval is required before application to the Graduate School, which should be made during the junior year. By the end of the junior year, students should have completed all requirements for the undergraduate major, the field of concentration, and the distribution requirements, with a total of at least 38 units of credit. During the fourth year, students enroll in 9 graduate-level courses to complete work on the master's degree and 3 undergraduate electives to complete work on the bachelor's degree. See Four-Year Master's Programs in the Undergraduate Education section of this catalog.

## Departmental Honors Program

The Undergraduate Honors Program in Communication Studies offers an opportunity for highly motivated students to conduct original scholarly research. Selected on the basis of overall grade point average, a small number of students in the department are invited to apply for the program at the end of winter quarter of their junior year. Through the senior year, each student works closely with faculty to produce an original research project in an interest area determined by the student. Seniors who complete

the program graduate with departmental honors. Also see Honors and Prizes in the Undergraduate Education section of this catalog.

### Courses Primarily for Freshmen and Sophomores

**601-A01-0 Interpersonal Communication** See Introductory and Related Courses.

**601-A02-0 Public Speaking** See Introductory and Related Courses.

**601-A04-0 Argumentation and Debate** See Introductory and Related Courses.

**610-B01-0 Research Methods in Communication Studies** Foundations of knowledge in many areas of the field, including the nature of interpersonal interaction and the impact of mass media. How communication researchers do their work; how to judge the quality of research products. Prerequisite for many other courses in the department.

**610-B05-0 Theories of Persuasion** Survey of major theories that explain how to change another person's attitudes and behaviors. Applications to persuasion within a variety of contexts, including relationships, organizations, legal campaigns, and the mass culture.

**610-B10-0 The Arts of Controversy:An Introduction to Rhetorical Thinking** Controversy as a rhetorical practice essential to healthy political culture. Use of rhetoric to appreciate different (and frequently conflicting) approaches to issues. Examination of real-life controversies.

**610-B14-0 Legal Argumentation** Argumentation practices in the legal forum. Nature and procedures of legal controversies about what is just; modes of reasoning about fact and law; history and ethics of legal advocacy.

**610-B15-0 Principles of Rhetorical Criticism** Introduction to the critical study of political, legal, and ceremonial rhetoric. Development of skills in analyzing and assessing such rhetoric and appreciating how it reflects and shapes basic social and cultural values.

**605-B16-0 Performance and Culture** See Performance Studies.

**610-B20-0 Theories of Argumentation** Fundamental principles and practice of critical reasoning and public argument. For students interested in legal, academic, or political realms of communication and advocacy.

**610-B21-0 Speech Writing** Theory and practice in the principles of composition and in the preparation and delivery of manuscript speeches.

**610-B25-0 Forms of Public Address** Selected genres of public address, including the eulogy, the censure, the inaugural, the apology, and the dedication.

**610-B29-0 Communication Technology, Community, and Personal Identity** Philosophical, critical, and scientific analysis of how the intensification of technology in cultural, professional, and recreational domains is affecting our social relations and personal identities.

**610-B35-0 Philosophy of Language and Communication** Relationship between language and human communication behavior. How language structures individual world views; the process of meaning formation; therapeutic communication; the experience of creativity.

**610-B40-0 Theories of Interpersonal Communication** Introduction to the major theories about what goes on in conversations. Message interpretation, conversational management, nonverbal communication.

**610-B41-0 Theories of Relational Communication** An overview of communication theories and research dealing with developing, sustaining, and terminating interpersonal relationships. Direct application to friendship, work, and romantic relationships.

**610-B50-0 Small Group Processes** Theories and research relating to communication in small groups and group decision making.

**610-B60-0 Theories of Organizational Communication** Theories and research dealing with communication in formal organizations and institutions.

**610-B70-0 Theories of Mass Communication** Introductory survey of current issues in mass communication research. Workings and effects of media industries. Impact of media violence, effect of political news coverage and advertising, media effectiveness in public education.

**610-B71-0 Race, Gender, and the Mass Media** How race and gender are constructed by the American mass media; how social groups use the media for their own purposes. News coverage of minorities, images of women and minorities in advertising, social effects of pornography.

**610-B72-0 Communication and American Democracy** Central role of communication processes in democratic governance. Importance of communication in civic life (voter participation, deliberation, conflict resolution, social movements) as illustrated in survey of democracies worldwide. Multiple forms of communication, including speeches, debates, negotiation, news coverage, and computer-mediated interaction. Lecture/laboratory.

**610-B75-0 Persuasive Images:Rhetoric of Contemporary Culture** Analysis of image-making in all forms of popular culture—in film and television but also shopping malls, supermarkets, car dealers, and doctors' offices. Images in situations ranging from corporate crises to buying an ice cream cone.

**610-B87-0 Communication Technology and Society** Basic introduction to communication technologies, both new and old. Societal and economic issues they raise, examined from a variety of disciplinary perspectives.

**610-B90-0 Forensics** Independent research and analysis in conjunction with participation in intercollegiate forensics. Credit may not be earned for B90 more than once.

## Courses Primarily for Juniors, Seniors, and Graduates

**610-C10-0 Greek Rhetorical Theory** Survey of the history of Greek rhetoric from its origins in the fifth century BC through the Byzantine period. The main concentration is the classical period, with special attention to Gorgias, Protagoras, Isocrates, Plato, and Aristotle.

**605-C11-0 Performance in Everyday Life** See Performance Studies.

**610-C11-0 Latin Rhetorical Theory** Survey of the history of Latin rhetoric from Cicero through Bacon. Cicero's rhetorical works serve as the foundation, but attention is also paid to Quintilian and Augustine's major work on rhetoric.

**610-C12-0 Modern Rhetorical Theory** Survey of the history and fate of late-Enlightenment rhetorical theory, ranging from the works of Campbell and Whately to 20th-century rhetoricians, such as Richards, Weaver, and Burke, and the rebirth of rhetorical studies.

**610-C15-0 Rhetoric of Social Movements** Study of traditional theories of opposition derived from sociological and rhetorical analyses of mass movements. Examines new social movements as groups contesting abortion, animal rights, feminism, and other local and national issues.

**605-C16-0 Folklore and Oral Traditions** See Performance Studies.

**610-C20-0 Advanced Argumentation** Theories of argument drawn from classical and contemporary sources, with application to practice; making, judging, and appreciating forms of argument; consideration of their logical, ethical, and persuasive force. Prerequisite: B14 or B20.

**610-C21-0 Public Argumentation** Training in the arts of public argument through examination of contemporary controversies over social policies, foreign affairs, cultural events, and trials of public character. Enables students to become more effective civic advocates. Sequel to B10.

**610-C25-1,2,3 Rhetorical History of the United States** History of the United States, as studied through key rhetorical texts. Focus on moments of political crisis and cultural change. **1.** Colonial period to the outbreak of the Civil War. **2.** Civil War to World War I. **3.** World War I to the present.

**610-C27-0 Contemporary Rhetorical Practice** Contemporary history from a rhetorical perspective. Analysis of public communications and rhetorical study of nonoratorical events; emphasis on social movements and political controversy in the United States since 1960.

**610-C28-0 The Rhetoric of War** The genre of war rhetoric. Examination of the American experience in the 20th century using speeches, diaries, newspaper reports, government documents, films, and poetry.

**610-C29-0 Rhetoric, Science, and Technology** Contemporary debates on the standing and production of scientific argument. Current controversies over the social constitution and consequences of science and technology.

**610-C30-1,2 Contemporary Problems in Freedom of Speech** Personal freedom and public communication under the U.S. Constitution. **1.** Principles, forms of reasoning, and court decisions governing conflicts between freedom of speech and public order, property rights, personal security, morality, and racial and gender equality in traditional, mass, and new electronic media. **2.** Analysis of selected issues introduced in C30-1. Prerequisite: C30-1.

**610-C40-0 Communication and Socialization** Communication processes involved in the socialization of children. Communication with major socializing agencies. Prerequisites: B01 and B70.

**610-C41-0 Communication and Aging** Relationship between adult developmental processes and changes in communication behavior. Prerequisite: B01.

**610-C43-0 Social Cognition and Communication** In-depth analysis of theories examining the cognitive processes that occur before, during, and after interactions. Issues related to person perception, self-presentation, scripts, and schemas. Prerequisites: B01 and B40.

**610-C44-0 Interpersonal Conflict** In-depth analysis of theories and research examining conflict within relationships. Special emphasis on conflict within friendships, dating relationships, and family. Prerequisites: B01 and B41.

**610-C45-0 Theories of Nonverbal Communication** In-depth analysis of theories explaining the enactment and interpretation of nonverbal cues within interpersonal communication. Prerequisites: B01 and B40.

**610-C50-0 Computer-Mediated Communication and Information Systems** Examination and analysis of the tools of and issues in computer-mediated communication and networked information systems; effects of new communication technologies at the interpersonal, group, organizational, and societal levels.

**610-C60-0 Current Perspectives in Organizational Communication Research** Selected micro- and macrolevel theories of communication behavior in organizational settings. Prerequisites: B01 and B60.

**610-C61-0 Intergroup Communication and Urban Change** The small group as an agent of social change in urban society; internal and external communication in such change. Prerequisites: any two of B50, B60, and B70.

**610-C62-0 Professional-Client Communication** Communication between professionals and clients in medicine, law, education, psychotherapy, and social services. Alternatives to the professional-client model of problem solving. Prerequisites: B01 and B60.

**610-C63-0 Bargaining and Negotiation** Communication in bargaining and negotiation in organizational settings. Cognitive and motivational theories emphasizing bargaining and negotiation strategies. Prerequisites: B01, B05, and B60.

**610-C64-0 Collective Decision Making and Communication in Organizations** Research on how organizations make, communicate, and implement collective decisions. Assessing decision effectiveness, group decision making, leadership in organizations, and organizational design. Prerequisite: B60 or equivalent.

**610-C65-0 Solving Problems in Applied Organizational Communication** Advanced concepts and techniques for defining and analyzing organizational problems. Preparation for recognizing and working with problems in business organizations. Prerequisites: B01 and B60.

**610-C70-0 Current Perspectives in Mass Communication Research** In-depth study of theories currently applied to the study of mass communication. Prerequisites: B01 and B70.

**610-C71-0 Public Opinion** Nature of public opinion; history of techniques for expressing and assessing public opinion. Theories about the relationships among media, public opinion, and policy. Prerequisites: B01 and B70.

**610-C72-0 Mass Communication and Campaign Strategies** Communication components of political campaigns, including broadcast advertising, direct mail, candidate speeches, debates, and news coverage. Campaign professionals share their expertise; students critically examine the effectiveness and appropriateness of campaign strategies and tactics. Prerequisites: B01 and B72.

**610-C75-0 Rhetoric and the Arts** Public impact of art forms such as theatre, music, dance, film, and television. Critiquing of guest artists by students. Prerequisite: B75.

**610-C76-0 The Rhetoric of Popular Criticism** How critics communicate their ideas and values to the public. Prerequisite: B75.

**610-C77-0 Marketing Popular Culture** The invention and packaging of popular culture products, including film, music, television, and celebrities. Prerequisite: B75.

**610-C78-0 Rhetoric and Aesthetic Theory** Interpretation and critique of the impact of major movements in aesthetic theory on the theory and practice of rhetorical communication. Prerequisite: B10, B15, or an equivalent course in interpretation or criticism.

**610-C80-0 Political Communication** Nature and functions of communication within established political institutions; decision-making strategies, deliberative discourse, and electoral campaigns; field study of advocacy and interest groups. Prerequisite: B05, B10, or B70.

**610-C81-0 Classroom Communication Behavior** The classroom as a communication system; verbal and nonverbal patterns of interaction. Systematic analysis of teacher-student behavior according to interpersonal and group processes.

**610-C82-0 Family Communication Behavior** An overview of the family as a communication system. Intergenerational interaction patterns, intimacy and conflict patterns, decision making, environmental and cultural factors, and enrichment efforts. A wide range of family types and research methods are considered.

**610-C85-0 Mass Media Economics** An economic framework for analyzing factors influencing economic organization of media industries and behavior of media firms. Framework applied to policy issues such as network regulations and limits to First Amendment freedoms.

**610-C89-0 Practicum in Mass Communication Research** Collaboration with a faculty member on design and execution of a communication research project. Students learn how to complete a research project and write a report. Prerequisite: B01.

**610-C91-0 Ethical Issues in Communication** Ethical problems in public, group, and interpersonal communication; criteria for their resolution.

**610-C92-0 Intercultural Communication** Designed to integrate theory and practice in heightening student's awareness of the impact of culture on one's perception, beliefs, meanings, and verbal/nonverbal communication.

**610-C93-0 Field Study in Communication** Enrollment only by petition in advance. Arrangements for winter quarter must be made by November 1 and for spring quarter by February 1.

**610-C95-0 Topics in Communication Studies** Reading, research, and discussion in areas of significance. Topics vary.

**610-C98-0 Undergraduate Seminar** Student- or faculty-initiated seminars to consider special topics. Credit for C98 may be earned more than once. No more than two units of such credit may be applied toward fulfillment of the major requirements.

**610-C99-0 Independent Study** Enrollment only by petition in advance.

## Performance Studies

The Department of Performance Studies integrates artistic and analytical approaches to a wide range of performance texts, events, and processes. The courses explore an interdisciplinary range of literary, cultural, and personal texts in performance. The department has particular strengths in the study of literature through solo performance; the ensemble adaptation and staging of poetic, narrative, and nonfictional texts; intercultural performance; performance art; cultural studies and the ethnography of performance; performance theory and criticism. Internships and field study for performance studies majors extend and deepen their classroom work with experiential learning. Extracurricular work provides students with a variety of opportunities to perform, adapt, and direct, enabling their creative work to reach an audience outside the classroom.

Performance studies majors have been successful in many professions that require intelligence and imagination

as well as critical and creative skills. In addition to pursuing careers in professional theatre and arts development, many graduates teach literature, theatre, humanities, and performance studies. Majors have found performance studies an excellent preparation for law school and complementary to their interests in creative writing, communication, media, anthropology, dance, literature, or social work. Performance studies can be thought of as a major that bridges artistic expression and conceptual analysis, theory and practice. Performance, in its manifold forms, is the subject and the method of study.

### Requirements for a Major in Performance Studies

- Introductory courses: one quarter of either 601-A01 or A02; 601-A03
- B-level courses: a minimum of 3 courses in speech, including at least two quarters of B-level courses in the department
- Production courses in theatre: two units selected from 630-A40-1,2; 630-B40-1,2,3; 630-B41-1,2,3; or one unit selected from preceding courses and one registration for 630-A19
- An additional 10 courses in speech, including at least 6 courses at the C level or above in the department; courses should be distributed among the various forms and media
- Six courses at the B level or above outside speech, including at least 3 C-level courses in literature; if they apply, courses taken to meet the distribution requirement may be used to satisfy this requirement
- Electives in speech and other areas

### Courses Primarily for Freshmen and Sophomores

**601-A03-0 Analysis and Performance of Literature** See Introductory and Related Courses.

**605-B10-1 Performance of Poetry** Introduction to the analysis and performance of poetry. Prerequisite: 601-A03 or equivalent.

**605-B10-2 Performance of Narrative Fiction** Introduction to the study of narrative performance. Prerequisite: 601-A03 or equivalent.

**605-B10-3 Performance of Drama** Introduction to the analysis and performance of dramatic literature. Prerequisite: 601-A03 or equivalent.

**605-B16-0 Performance and Culture** Performative bases of culture; ritual, festival, and ceremony.

**605-B24-0 Adapting Narrative for Group Performance** Introduction to theories and methods of adapting narrative for the stage, with special emphasis on chamber theatre. Prerequisite: 601-A03 or equivalent.

### Courses Primarily for Juniors, Seniors, and Graduates

Unless otherwise indicated, one B-level course in the department is a prerequisite.

**605-C07-1,2 Studies in Gender and Performance** Exploration of recent research on the social and political background of gender, particularly women's access to performative expressions. **1.** Women in the interstices of culture: evidence of women's performance traditions in paratheatrical cultural practices. **2.** Feminist theories of performance: feminist critiques of performance and production in the contemporary context. 630-C07 is the third course in this series.

**605-C08-0 Performing Modern and Contemporary Poetry** Use of performance in the analysis and criticism of modern and contemporary poetry.

**605-C09-1,2,3 Performance of Black Literature** Exploration and performance of contemporary literature by black writers in three major genres. **1.** Drama. **2.** Novel. **3.** Poetry.

**605-C11-0 Performance in Everyday Life** Conceptual view of human beings as actors. Dramatism and the perspective of life as theatre.

**605-C15-0 Nonfiction Studies** Exploration of the dramatic impulse in nonfiction texts. Emphasis on autobiographical one-person shows.

**605-C16-0 Folklore and Oral Traditions** Genres of oral literature and an introduction to the methods and aims of folklore research. The nature of verbal art as performance and the importance of cultural context.

**605-C18-0 Shakespeare: Performance and Criticism** Use of performance in the analysis and criticism of selected plays by Shakespeare.

**605-C20-0 Languages of the Body** Exploration of nonverbal body movement and gestural vocabularies in theatre, dance, and performance art, with reference to television and film and productions of the body in visual and commercial media and popular cultural styles.

**605-C21-0 Performing the American '50s** Use of performance in the analysis and criticism of selected postwar American literature.

**605-C22-0 Performing the Psychological Novel** Use of performance in the analysis and criticism of selected 19th- and 20th-century novels.

**605-C24-1,2 Presentational Aesthetics 1.** Theatrical convention, presentational mode, and conscious artifice in the performance of dramatic literature, poetry, and nonfiction. **2.** Theory and practice of chamber theatre, its conventions and presentational modes; adaptation, staging, and performance of prose fiction. Choice of performer's or director's perspective. Prerequisite: B24-0.

**605-C26-1,2 Performance Art 1.** History, development, and theories of performance art as a live-art genre from the modernist avant-garde to contemporary cross-cultural forms. Media in all forms, with emphasis on performance process and audience relationship. **2.** Further theoretical and laboratory exploration of compositional processes and political strategies of performance, media, and event/audience contexts.

**605-C27-0 Field Methods in Performance Studies** Theory and practice of fieldwork on performance; practical fieldwork experience.

**605-C28-0 Studies in James Joyce** Primary emphasis on extensive critical study and performance of Joyce's *Ulysses,* resulting in either a lecture-performance, a recital, or a research paper.

**605-C29-0 Performing Individual Poetic Styles** Content varies. Major poems of a significant writer or writers, permitting in-depth encounter with the writer, cultural context, and performance-related issues.

**605-C30-0 Topics in Performance Studies** Readings, discussion, and creative work in performance studies research and artistic practice. Topics vary. May be repeated for credit.

**605-C31-0 Field Study/Internship in Performance Studies** Intensive participation in off-campus production and/or field research experience. Departmental approval required.

**605-C32-0 Urban Festivity** Ethnographic study of festivals, parades, exhibitions, civic celebrations, and other genres of urban cultural performance. Multiethnic expressions of Chicago identity. Field research methods.

**605-C99-0 Independent Study** Prerequisite: consent of associate dean after submission of petition.

## Radio/Television/Film

The Department of Radio/Television/Film takes a broad-based approach to the study of modern media, encompassing their function both as modes of social communication and as artistic, expressive forms. The department is committed to the integration of theory and practice in both its undergraduate and graduate curriculum. All students take courses covering media history, theory, and criticism; media policy; and the techniques of media production.

The scholarly and critical side of the curriculum investigates the historical, social, political, and aesthetic aspects of modern media, including their intersection with economic, industrial, legal, and governmental institutions. On the production side, students are encouraged to work within a range of genres (narrative, documentary, and experimental work), all supported by the curriculum. Production courses also include conceptual, aesthetic, and ethical issues as well as the integration of material from scholarly and critical courses whenever possible.

Production facilities include 16mm film equipment, sound stage, and editing; field video and multiple-camera television studio facilities; linear and nonlinear video editing; advanced audio postproduction; and state-of-the-art computer graphics. Students operate the 7200-watt FM radio station WNUR, which serves the Chicago area. The School of Speech funds three active student-run cocurricular production groups and offers juniors and seniors numerous opportunities for internships at Chicago-area television and radio station and production companies. Frequent guest lectures are offered by alumni with careers in media and other well-known professionals.

### Requirements for a Major in Radio/Television/Film

- Introductory courses: A12; a minimum of 3 courses at the A or B level in speech outside the department
- B-level courses: B01; B20; B80-1,2; B80-3 is prerequisite for all C-level production courses
- An additional 8 courses in speech at the C and D levels, including at least 6 courses in the department at the C and D levels; not more than one unit of C49 Internship in Radio/Television/Film and C99 Independent Study may be applied toward the 6 courses required in the department; the remaining internship and C99 units count as elective credits
- Six courses at the B level or above outside speech, including at least 3 courses at the C level or above; courses taken to meet the distribution requirement may be used to fulfill this requirement
- Language requirement: proficiency in a modern foreign language equal to four quarters of college study; proficiency may be established by placement exam or by completion of the fourth quarter
- Electives in speech and other areas

### Courses Primarily for Freshmen and Sophomores

**615-A12-0 Creative Processes in Sight and Sound** Introduction to media production and aesthetics, examining concepts of media literacy through the analysis and production of images.

**615-B01-0 Mass Media and Society** Media industries as social and cultural forces; economic and political dimensions of the global media. Prerequisite for all C-level courses in the department.

**615-B02-0 Introduction to Popular Culture:The Mass Media** Cultural meanings of narrative and commercial forms in radio, television, and film. Historical and contemporary theories of popular culture.

**615-B15-0 Media Literacy** Production/criticism for nonmajors; new radio/television/film majors may enroll. Grammar of still and moving images: photography, television, film, radio, computer graphics.

**615-B20-0 Introduction to Film** Film as art, entertainment, and industry; focus on the narrative fiction film but also attention to documentary and experimental traditions. Film criticism, authorship, genre, film theory. Prerequisite to all C-level courses in the department.

**615-B80-1,2,3 Production Arts** Media production practices in audio, writing, film, television, video, and computer graphics. B80-1,2 are major requirements; B80-3 is prerequisite for all C-level production courses.

**615-B98-0 Studies in Media Topics** Theoretical or practical or both; emphasis on evolving trends.

### Courses Primarily for Juniors,Seniors, and Graduates

**615-C01-0 Broadcast News** Survey of existing research and critical analysis of the process, content, impact, and utilization of broadcast news.

**615-C10-0 History of Broadcasting** Global evolution of radio and television, with events in United States as a central historical factor; programming and audiences, trends, cultural influences, issues. Survey of literature and research.

**615-C12-1,2 History of Film** International survey of motion pictures as a distinctive medium of expression from its prehistory to the present.

**615-C13-1 Documentary Film:History and Criticism** Survey of the schools, styles, and purposes of documentary film as a unique form of artistic expression and sociopolitical persuasion.

**615-C13-2 Documentary Film and Video** Contemporary work and issues in documentary film and video.

**615-C21-0 Radio/Television/Film Authorship** Idea of authorship in the media and an examination of different uses of author theory related to the work of particular artists.

**615-C22-0 Radio/Television/Film Genre** Concept of genre in the media, with reference to popular American forms.

**615-C23-1 Experimental Film: History and Criticism** Films and theories of experimentalists since the 1920s; contemporary underground movement.

**615-C23-2 Experimental Film and Video** Contemporary work in experimental film and video.

**615-C25-0 Feminism and Film/Video** Introduction to feminist film theory, the feminist critique of mainstream cinema, and film and video work by women offering alternatives to the mainstream.

**615-C26-0 Mass Media Criticism** Contemporary critical methods applied to mass communication media. Critical literature supplemented by written analyses of selected films, television programs, and other appropriate material.

**615-C30-0 Electronic Media Management** Organization and management of the television station and other electronic media organizations and facilities; functions and interrelationships of various departments.

**615-C31-0 Regulation of Broadcasting** Government regulation and industry self-regulation; historical perspective and examination of current issues.

**615-C33-0 Cable Communications** Legal, technical, and programming aspects of cable and satellite communications. Services offered by existing systems and the complexities of developing systems.

**615-C34-0 Television in Education** Uses, potentialities, current developments in educational media, including noncommercial educational media stations and media in the schools.

**615-C41-0 Technological Innovations** How technology develops and is assimilated into mass media.

**615-C42-0 Program Planning and Programming** Programming the broadcast station in relation to audiences, markets, coverage, station policies, facilities.

**615-C43-0 Political Economy of Mass Media** Issues related to media industries, market structure and power, ownership and control, global dimensions and public policy.

**615-C44-0 Program Distribution and Promotion** Analysis of network program distribution, syndication, cable distribution, and how series are promoted; how a station programmer makes decisions.

**615-C45-0 Film As Business** American film industry's structure, policies, and relations with foreign governments and other segments of the entertainment business, including financing, distribution, and exhibition.

**615-C49-1,2 Internship in Radio/Television/Film** (1–3 units) Selected students work in production departments of radio and television stations and film studios. Guided research and reading.

**615-C51-0 National Cinema** Historical aspects of cinema in a culture outside the United States or a social/cultural/intellectual movement within the general evolution of cinema.

**615-C53-0 National Mass Media** The problem of creating a distinct national cultural identity through mass media; specific nations as case studies.

**615-C55-0 Audience Analysis** Methods used to analyze electronic media audiences, with emphasis on quantitative research techniques.

**615-C60-0 Radio/Television/Film Dramatic Writing I** Introduction to forms, techniques, and types of dramatic screenplay and television writing. Lecture/workshop.

**615-C61-0 Radio/Television/Film Dramatic Writing II** Workshop in dramatic writing for the media, culminating in completion of full-length script. Prerequisite: C60.

**615-C79-0 Topics in Film/Video/Audio Production** In-depth study and practice of one area of film, video, or television. May be taken more than once for credit, depending on changes in topic. Prerequisites: C80 and C81.

**615-C80-0 Film Production** Techniques and technologies of 16mm filmmaking from initial conception to completed motion picture. Lecture/laboratory.

**615-C81-0 Video Production** Techniques and technologies of professional video; single-camera shooting and multisource editing. Lecture/laboratory.

**615-C83-0 Radio/Audio Production** Techniques and technologies of audio production, emphasizing location recording. Survey of techniques used for film, video, experimental audio, and radio production. Postproduction includes work with a digital audio workstation. Lecture/laboratory.

**615-C85-0 Integrated Media Arts** Introduction to theory and practice of media using microcomputers. For nonmajors; an elective in the Integrated Arts Program.

**615-C90-0 Dramatic Directing** Introduction to film and video single camera directing techniques. Emphasis on the technical aspects of directing. Prerequisites: C80 and C81.

**615-C91-0 Television Studio Directing** Directing, crewing, and technical skills for multiple camera live-on-tape television production in narrative and non-narrative genres; preproduction, directorial communication, blocking, pacing, visualization. Prerequisite: C80 or C81.

**615-C92-0 Documentary Production** Techniques for film and video, emphasizing preproduction planning, documentary techniques, and ethics. Prerequisites: C13-1 and C80 or C81.

**615-C93-0 Computer Animation** Study and practice of two-dimensional computer graphics and animation.

**615-C94-0 Experimental Film and Video Production** Production experience in the making of art film or video; tapes, films, or installations that work outside established genres. Prerequisites: C23-2 and C80 or C81.

**615-C98-0 Symposium:Issues in Radio/Television/Film** Special issues and topics in the analysis of radio, television, film, and popular culture.

**615-C99-0 Independent Study** Prerequisite: consent of associate dean after submission of petition.

## Theatre

Students who major in theatre at Northwestern combine a liberal arts education with intensive training in the theories and arts of the theatre. At the heart of the theatre program lies the idea that the best theatre artist is the one who combines a broad knowledge of the literature and theory of the field with highly developed skills in its practice. With the aid of an adviser, theatre majors select courses from three general areas of theatrical training: acting/directing/dance, design/technical, and history/literature/criticism. On completion of the introductory courses, students proceed to more intensive and more highly specialized courses, continually supplementing scholarly training with the discipline and challenge of performance.

The principal laboratories for student work are the Theatre and Interpretation Center presentations during the academic year and the Summer Theatre Festival. Both offer subscription seasons to a large and demanding audience. The Theatre and Interpretation Center mounts a series of plays, usually three each quarter, during the regular term. Children's Theatre productions are offered also during the academic year and in the summer. Many plays, including studio theatre productions, are produced each quarter—directed, designed, and performed by students.

A major in dance is also available within the Department of Theatre. The dance major prepares students for further advanced academic work or apprentice-level positions in professional dance. The major's comprehensive curriculum emphasizes the study of dance as well as the act of dancing. Students are prepared for lifetime involvement in dance and for continued development intellectually, artistically, and professionally within the dance world. The program provides students with opportunities to write about, research, and analyze the field and to study choreography and technique. The major presents a well-integrated view of dance while also providing sound technical training. The students are exposed to a variety of forms, with modern dance and jazz as the foundation techniques. The department supports the Dance Ensemble and DanceWorks as well as self-produced dance concerts.

### Requirements for a Major in Theatre

- Introductory courses
  630-A40-1,2; 630-A19 (three quarters, no credit); 2 courses from the following: 601-A01, 601-A02, 601-A03, 601-A10
- Noncredit dance or physical education courses: three quarters from a selected list
- B- and C-level courses: a minimum of 5 courses at the B level and 5 courses at the C level or above in theatre, with at least 3 courses from each of the following groups:

**Performance**

630-B10 Training the Actor's Voice
630-B43-1,2,3 Acting I: Principles of Characterization
630-C39 Advanced Acting (see Summer Session catalog)
630-C40-1,2 Stage Directing
630-C41-1,2,3 Acting II: Analysis and Performance
630-C59 Directing for the Open Stage (see Summer Session catalog)

**Design/Technology**

630-B40-1,2,3 Stagecraft
630-B41-1,2,3 Design Process
630-B49 Stage Management
630-C53 Topics in Stagecraft

630-C54-1,2,3 History of Costume and Decor (1 unit only)
630-C55 Scene Painting
630-C63 Theatre Sound

**History, Literature, and Criticism**

Two courses from one of the following sequences:
630-B44-1,2 Development of Contemporary Theatre
630-C45-1,2,3 History of Western Theatrical Practice
Comparative Literary Studies C62-1,2,3 Modern Drama
630-C67 History of the Lyric Theatre
631-B30 History of the Dance
631-C30 Dance Criticism
630-C65 American Theatre and Drama
605-C07-1,2 Studies in Gender and Performance
630-C07 Studies in Gender and Performance

- One additional course from sequences above or from the following:
  630-C66; Comparative Literary Studies B03, C12; Hispanic Studies 463-C21, C42; German B10-1; Slavic Languages and Literatures C18
- Courses outside speech: 6 courses at the B level or above, including at least 3 courses at the C level or above (courses taken to meet the distribution requirement may be used)
- Electives: note the School of Speech 18-unit requirement (see General Requirements)

### Requirements for a Major in Dance

- Introductory courses: A30-1,2,3; A19 (two quarters, no credit); 1 course from the following: 601-A01, A02, A03, A10
- B- or C-level Speech courses: 3 courses
- Noncredit technique course: at least 1 course/quarter
- At least 9 courses chosen from the following categories, with a minimum of 3 courses from each category:

**Performance**

631-A33 Movement for the Stage
631-B32 Dance Composition
631-B33 Choreography for the Musical Stage
631-C32 Improvisation for Dance, Music, and Theatre
631-C33 Dance and Music: Studies in Collaboration
631-C34 Advanced Choreographic Study

**History, Theory, and Criticism**

631-B30 History of the Dance
631-B31 Period Dance and Historical Movement Styles
631-C30 Dance Criticism
631-C35 Special Topics in Dance Research (methods or history topics)
CAS dance history/theory courses

**Professional Studies**

631-C31 Summer Dance Institute (see Summer Session catalog)
631-C35 Special Topics in Dance Research (dance science/medicine, design for dance)
631-C36 Labanotation, Elementary Level
631-C37 Dance and Expressive Arts Therapies
631-C71 Dance in Education
Crew: three units following A19

## *Theatre*

### Courses Primarily for Freshmen and Sophomores

**630-A19-0 Production Laboratory** Registration for students fulfilling production requirements.

**630-A40-1,2 Theatre in Context 1.** Combination of lecture, discussion, workshop, assignments, production lab, and play viewing. Text analysis taught with a view toward stage production. Opportunities for students to try different roles (acting, directing, technical). **2.** Seminar in three sections emphasizing theatre history, literature, and criticism; research; and writing skills.

**630-A43-0 Acting:Basic Techniques** For nonmajors. Sensory and spatial awareness, concentration, relaxation, basic stage action. Prerequisite: consent of instructor.

**630-B10-0 Training the Actor's Voice** Three actions—structural, tonal, and consonant. Individual practice sessions. Script analysis and discovery of subtext through use of actions. Prerequisites: A40-1,2 or equivalent.

**630-B40-1,2,3 Stagecraft** Craft and technology used in mounting a theatrical production. Participation in department productions. **1.** Lighting: mechanics, physics, and practices of the stage lighting technician. **2.** Scenery: construction, rigging, and handling. **3.** Costumes: sewing techniques, fitting, tools, and fabrics. Prerequisite: sophomore standing or consent of instructor.

**630-B41-1,2,3 Design Process** Responsibilities of the theatrical designer, from initial reading of the script to production realization. Participation in department productions. **1.** Scene design I. **2.** Costume design I. **3.** Lighting design I. Prerequisite: sophomore standing or consent of instructor.

**630-B42-0 Stage Makeup** Theory and practice of stage makeup. Lecture/laboratory. Prerequisite: consent of instructor.

**630-B43-1,2,3 Acting I:Principles of Characterization** **1.** Basic concepts. **2.** Characterization in scene study. **3.** Ensemble and advanced scene study. Prerequisites: A40-1,2 or equivalent; consent of instructor.

**630-B44-1,2 Development of Contemporary Theatre** Critical study of major dramatists, theories, and production styles. **1.** 1870–1920. **2.** 1920–present.

**630-B49-0 Stage Management** Organization and coordination of the theatrical production; role of the stage manager.

**630-B53-0 Mime** Art of mime; theory and practice. Physical and mental conditioning of the performer, progressing to intensive work in performance concepts. Summer only.

## Courses Primarily for Juniors, Seniors, and Graduates

Unless otherwise noted, these courses are open only to students who have completed the departmental B-level requirements or their equivalents.

**630-C07-0 Studies in Gender and Performance** Exploration of recent research on the social and political background of gender, particularly women's access to performative expressions. Historical aesthetics: changing debates on women's participation in the public theatre and the significance of the body in performance. 605-C07-1,2 are the first two courses in this series.

**630-C10-0 Advanced Voice/Styles** Advanced vocal techniques of the stage actor; dramatic language analysis; scanning and speaking Shakespearean verse. Prerequisites: A10 or equivalent and consent of instructor.

**630-C11-0 Dialects for the Stage** Dialects most frequently used by the American stage actor; systematic approach to dialect acquisition. Prerequisites: 601-A10 or equivalent; consent of instructor.

**630-C40-1,2 Stage Directing 1.** Staging fundamentals: blocking, movement, business, tempo, script selection and analysis, casting, and rehearsal planning. **2.** Special problems: exposition, suspense, surprise, marking of climaxes, and the creation of mood. Prerequisite: consent of instructor.

**630-C41-1,2,3 Acting II: Analysis and Performance** Theory, principles, and techniques of interpretation of drama from the point of view of the actor. **1.** Greek drama. **2.** Elizabethan drama. **3.** Contemporary drama. Prerequisite: consent of instructor.

**630-C42-1,2,3 Stage Lighting II 1.** Lighting methodologies and elements of lighting design, composition, and orchestration. Electrical practice and instrumentation. **2.** Design problems and their graphic notation. Light plots, hookups, and cueing. **3.** Advanced problems in lighting design and execution of nontraditional forms. Control and color. Participation in departmental productions. Prerequisite: B40-1, B41-3, or consent of instructor.

**630-C43-1,2,3 Scene Design II 1.** Design concept and traditional modes of presentation; linear composition, light and shade, rendering. **2.** Composition; elements of design and historical source material. **3.** Mechanics; spatial design and contemporary materials. Participation in departmental productions.

**630-C44-1,2,3 Costume Design II 1.** Design elements and principles; color, form, line, and fabric. **2.** Personal technique and theatrical style. **3.** Developing large projects and sustaining a style. Participation in departmental productions. Prerequisites: B40-3 and B41-2.

**630-C45-1,2,3 History of Western Theatrical Practice** History and theory of theatre and drama. **1.** Theatre and culture in the classical period. **2.** Theatre and culture in the Middle Ages and Renaissance. **3.** Cultural crosscurrents from the Restoration.

**630-C46-1,2 Playwriting** Fundamental techniques of playwriting. **1.** Beginning projects. **2.** Advanced projects. Prerequisite: consent of instructor; C46-1 prerequisite for C46-2.

**630-C47-0 Children's Theatre** Selection, direction, and production of plays for children.

**630-C48-1,2 Creative Drama** Principles and practices of improvised drama as a teaching method and a means of learning for the elementary school child. **1.** Basic theory through reading, discussion, film, observation, and teamteaching project. **2.** Comparison of philosophies and practices of creative drama teachers in England and the United States. Culminates in teaching project. Prerequisite: consent of instructor; C48-1 prerequisite for C48-2.

**630-C49-1,2,3 Acting III: Problems in Style** Advanced problems in acting theories and styles. **1.** Methods of comic technique. **2.** Contemporary drama. **3.** Special projects in scene study. Prerequisite: consent of instructor.

**630-C50-1,2,3 Problems in Advanced Technical Planning** Planning, organization, and materials in mounting productions based on contemporary theatrical practice. **1.** Engineering drawing techniques; skill development for technicians and designers. **2.** Coordination of personnel and material in production. **3.** Materials, methods, and equipment employed in contemporary scenic construction. Participation in departmental productions. Prerequisite: junior standing or consent of instructor.

**630-C51-0 Staging of Contemporary Drama** Production problems peculiar to directing of plays for contemporary theatre. Prerequisite: C40 or equivalent.

**630-C52-1,2 Music Theatre Techniques** Various performance styles of musical theatre. **1.** Early works from the turn of the century through the classical musicals of Rodgers and Hammerstein. **2.** Integrated musicals through the development of concept and rock musicals. Prerequisites: junior standing; B43-1,2,3.

**630-C53-0 Topics in Stagecraft** Seminars with guest or resident faculty on topics in stagecraft.

**630-C54-1,2,3 History of Costume and Decor** History of costume, accessory, architecture, furniture, and ornamentation. **1.** Ancient times to Renaissance. **2.** Renaissance to 19th century. **3.** 19th century. Participation in departmental productions. Prerequisite: junior standing or consent of instructor.

**630-C55-0 Scene Painting** Advanced scenic artists' techniques and procedures. Color use for the stage. Approaches established by professional scenic artists. Lab fee; students supply own brushes. Prerequisite: consent of instructor.

**630-C56-1,2,3 Graphic Arts for the Stage Designer** Projects in the use of calligraphy, color, and styles for

the theatre artist. **1.** Drawing and painting. **2.** Color, calligraphy, model making; art techniques and practical application of color and material theories. **3.** Scene painting; traditional and contemporary theory. Participation in departmental productions. Prerequisite: junior standing or consent of instructor.

**630-C57-1,2 Freehand Drawing for the Stage Designer** Drawing for scenery, costume, and lighting designers; principles of drawing and composition using a variety of drawing materials. Lecture and studio. Prerequisite: consent of instructor.

**630-C61-0 Makeup, Masks,and Wigs** Design principles and construction methods used in creating visual accessories to costume design. Participation in departmental productions. Prerequisite: B41-2 or equivalent.

**630-C62-0 20th-Century Stage Design** Major stylistic developments in 20th-century scenography and scene, costume, and lighting design. Emphasis on the American artist in context of the major influences that have shaped the craft.

**630-C63-0 Theatre Sound** Planning and execution of sound for the theatrical production; design of the actor's acoustical environment. Prerequisite: junior standing or consent of instructor.

**630-C64-0 Period Pattern Drafting and Draping** Techniques of flat pattern drafting and advanced construction required for creating historical garment patterns for the stage. Participation in departmental productions. Prerequisite: junior standing or consent of instructor.

**630-C65-0 American Theatre and Drama** Major movements and significant dramatists in the history, form, and practice of the American theatre.

**630-C66-0 Studies in Individual Dramatic Styles** Intensive reading and discussion of selected works of major dramatists; the work's unique character, imparted by the dramatist's personal style. Prerequisites: two units of either B44 or C45.

**630-C67-0 History of the Lyric Theatre** Three-part course, covering the major movements in the histories of dance, opera, and musical comedy. Examination of artists and their works.

**630-C68-0 African Theatre and Drama** Theatrical and dramaturgic practices outside Western canon; reinterpretations of that canon by African playwrights. Major practices in African theatre and drama, with focus on Nigerian and South African artists. Festival practices, traveling and popular theatres, drama in English, development of appropriate terminology. Prerequisite: C45-1, 2, or 3 or African American Studies B59 or consent of instructor.

**630-C73-0 Computer Graphics for the Theatre Artist** Computer graphics for the stage designer. Participation in center productions. Investigation of available software programs and strategies for use in the theatre. Lecture/laboratory.

**630-C74-0 Text Analysis for Theatrical Production** Seminar in analysis of dramatic and nondramatic texts as it relates to the problems of realized theatrical production.

**630-C76-0 Participation Theatre for Young Audiences** Participation and story theatre, incorporating improvisation into the structure of a scripted play for the child audience. Prerequisite: consent of instructor.

**630-C80-0 Internship in Theatre Practice** (3 units for undergraduates; 2 units for graduates) Full-time participation in production and/or management activities in a theatre company. Prerequisite: consent of department.

**630-C99-0 Independent Study** Prerequisite: consent of associate dean after submission of petition.

## *Dance*

### Courses Primarily for Freshmen and Sophomores

**631-A30-1,2,3 Introduction to the Dance Experience** Technique, improvisation, lecture, and discussion on dance history and cultural studies. **1.** Movement analysis and theories of dance **2.** Studies in dance. **3.** Anatomy and kinesiology. Prerequisite: consent of instructor.

**631-A33-0 Movement for the Stage** Movement/body awareness. Improvisational techniques using time, space, weight, and effort as the performer's instrument of expression.

**631-B30-0 History of the Dance** Movement concepts in the major developmental periods of Western ballet and modern dance.

**631-B31-0 Period Dance and Historical Movement Styles** Body carriage, use of gesture, and dance of the preclassic period. Practical and theoretical understanding of movement styles of the Middle Ages and Renaissance and Baroque periods.

**631-B32-0 Dance Composition** The choreographic process. Fundamental choreographic elements: time, space, shape, form, dynamics, and design.

**631-B33-0 Choreography for the Musical Stage** Setting movement/dance for vocalists and actors. Teaching choreography to nondancers and working with large numbers (chorus) on stage.

### Courses Primarily for Juniors,Seniors, and Graduates

Unless otherwise noted, these courses are open only to students who have completed the departmental B-level requirements or their equivalents.

**631-C30-0 Dance Criticism** Critical and theoretical thought of writers on Western theatrical dance.

**631-C31-0 Summer Dance Institute** Choreography workshop exploring various dance forms with guest artists. Summer only.

**631-C32-0 Improvisation for Dance, Music, and Theatre** Improvisation as a source for performance and composition. Interrelationships of the performing arts. For musicians and actors to expand their knowledge of the vocabulary of dance and for dancers to investigate the musical and theatrical dimensions of their art. Prerequisite: consent of instructor.

**631-C33-0 Dance and Music:Studies in Collaboration** Music and dance collaborations from historical and theoretical perspectives. Seminar, practicum.

**631-C34-0 Advanced Choreographic Study** Lecture-laboratory investigation of advanced choreographic concepts; abstraction, style, use of music, group work, humor in dance. Prerequisite: B32 or consent of instructor.

**631-C35-0 Special Topics in Dance Research** Research methodologies, dance scholarship, criticism, historical reconstruction. Critical issues and contemporary problems. Content varies. Prerequisite: consent of instructor.

**631-C36-0 Labanotation,Elementary Level** Scientific system of notating movement; observation, analysis, accurate recording.

**631-C37-0 Dance and Expressive Arts Therapies** Dance and the creative arts therapies in the treatment of the disabled and emotionally ill. Symbolic meaning, group dynamics, and the language of movement as it relates to personality, body image, and expression. Prerequisite: consent of instructor.

**631-C71-0 Dance in Education** Organizing and teaching dance for children and adolescents. Creative play, movement exploration, acquisition of basic motor skills. Lecture, laboratory, field experiences.

# Other Undergraduate Programs

## Integrated Arts Program

The interschool Integrated Arts Program offers courses that explore the creative process from the perspective of the artist in the disciplines of theater, visual arts, music, dance, and media arts. Students participate in lecture/discussion and studio courses crossing the boundaries of the traditional arts and involving collaboration between different art forms. They work in this program with a faculty of artists and scholars from the College of Arts and Sciences, the School of Music, and the School of Speech.

The curriculum also features courses in different disciplines that take art as their subject, e.g., sociology and the arts, philosophy and the arts, communication studies and the arts. Many courses are team-taught to provide the double perspective of practitioner and scholar. Integrated arts courses examine the creative process in relation to the artist, media, artwork, and audience. The program's goals are to create a climate conducive to the making and understanding of art and to enhance the general liberal arts education of its students.

Additional information about the Integrated Arts Program is available from the office of the Integrated Arts Program, the CAS Office of Studies, and the dean's offices in the Schools of Music and Speech.

### Minor in Integrated Arts

Students who satisfactorily complete seven courses qualify for the minor in integrated arts. Five of the seven are the program's core courses; two are drawn from a list of electives. Core courses cannot be taken for P/N credit. No background in visual arts, music, theater, or dance is required. Some Integrated Arts Program courses satisfy distribution requirements of the College of Arts and Sciences, the School of Music, and the School of Speech. Students applying for the minor in integrated arts must show a minimum of five courses not double-counted in any other major(s).

**Core courses:** A90; two chosen from B91-1, B91-2, B91-3, B91-4; and (to be taken after completing two C-level electives) C90-1 and C90-2.

**Elective courses:** Art History C95; Art Theory and Practice C72; Communication Studies C78; Comparative Literary Studies C65; English C12; Musicology C36; Performance Studies C26-1,2; Radio/Television/Film C85; Sociology C50; Dance C32, C33. A list of other approved elective courses is available in the program office.

### Courses

**482-A90-0 Art Process** Team-taught foundational introduction to common concerns in the arts (theater, art, music), using the analytic paradigm of artist/media/artwork/audience to understand the creative process. Lecture/discussion and studio format. Visits to theaters, concerts, and galleries.

**482-B91-1 Modes of Theater** Introduces the modes of theater and tools for their analysis through studio exercises and assignments. Performance from dramatic and nondramatic texts. Lecture/studio format. Prerequisite: A90 or permission of instructor.

**482-B91-2 Modes of Art** Team-taught. Introduces the elements of visual perception through thematic study of important examples of world art combined with related creative work in varied media. Lecture/studio format. Prerequisite: A90 or permission of instructor.

**482-B91-3 Modes of Music** Introduces the basic vocabulary of music so that students can analyze, create, and compose music in significant musical forms. Prerequisite: A90 or permission of instructor.

**482-B91-4 Modes of Dance** Team-taught. Introduces dance, the elements of choreography, and dance literacy; develops skills in oral and written communication about dance; and analyzes dance works in their unique contexts. Lecture/discussion and studio format with readings, videos, and films. Prerequisite: A90 or permission of instructor.

**482-C90-1 Performance Seminar** Team-taught. Culmination of experiences and study of the previous courses in the Integrated Arts Program. Creates a final ensemble presentation integrating theater, art, and music and examines its design, direction, and production outside conventional institutional boundaries. Prerequisites: two B91 courses and two C-level electives or permission of instructor.

**482-C90-2 Toward a Theory of the Arts** Investigates the theoretical implication of the Integrated Arts Program paradigm of artist/media/artwork/audience. Examines fundamental texts and aesthetic issues; the arts and symbolic structures; and art and audience. Prerequisite: C90-1 or permission of instructor.

## International Studies Program

International studies is an undergraduate major with two special features: it is not situated in any one school but is open to students in all schools, and it does not replace any other major but complements it as an adjunct major that may be taken only in conjunction with a departmental major.

Through an integrated combination of area studies, comparative studies, and international relations, the international studies major describes our interconnected world system and addresses such issues as how the contemporary world is politically structured and economically organized; what social problems, policy issues, and ethical choices confront us as individual and collective participants in the world system; and how cultural diversity, conflict, diffusion, and exchange characterize the world system and shape responses to it. In addition to inquiring into larger conceptual issues, students focus on the history, art, literature, music, beliefs, and social systems of one particular geographical/cultural region.

### Program of Study

Eleven quarter-courses are required for the major as well as proficiency in a language other than English at a level equivalent to two full years of instruction. Three of the courses are a yearlong core sequence; three are core electives; four are regional (area studies) electives; and one is an upper-level seminar or research project.

**Core sequence:** B01-1,2,3

**Core electives** (one from each of the following three groups):

- International politics and economics: Political Science B40, C40, C42, C45, C72; Economics C05, C06, C25
- Approaches to culture: Anthropology B11, B15; Performance Studies B16; Linguistics B09, C10; Religion A10
- Approaches to international ethics and cooperation: B02

**Regional electives:** four quarter-courses concerning either one geographical area listed below or a comparative category with designated courses. Students choose one course from each of the thematic groups, also listed below; if no course is available for a combination of area and group, students may, in consultation with a program adviser, substitute a course from another thematic group. Advisers have the lists of appropriate courses.

- Geographical areas: Africa, Asia, Europe, Latin America, Middle East, and the nongeographical comparative area
- Thematic groups: historical studies, literature, the arts, and beliefs and social systems

**Upper-level seminar or research project:** Each year several options are offered through International Studies or other departments. Students may do an independent research project (C99) based on a proposal approved in advance by their international studies adviser.

**Advising:** Each student's major has a different combination of courses. Because international studies majors must show a minimum of nine courses not double counted in any other major(s), students should see an international studies adviser when designing their program.

### Courses

**495-B01-1,2,3 Introduction to the World System** Three-quarter sequence investigating the origins and nature of contemporary global economic, political, and cultural interdependence. The first two quarters concern the historical evolution of the international system with focus on state formation, the rise of markets, and the creation of the interstate system. The third quarter highlights 20th-century problems. **1.** Origins of the global system. **2.** International system in the 18th and 19th centuries. **3.** International system in the 20th century.

**495-B02-0 International Ethics** Components of the naval organization, its use and function in the Department of the Navy and Armed Forces of the United States.

**495-C99-0 Independent Research** Advanced research carried out under the supervision of a professor in a department related to the area of study. Consent of the director of the undergraduate's major required, following submission of a written proposal.

## Military Studies Programs

The military studies programs are not departments of any school; they are administered by the Office of the Provost.

### *Naval Science*

The Northwestern University Naval Reserve Officers Training Corps (NROTC) Unit was established in 1926 by congressional authorization when Northwestern became one of the original six universities to create a naval science department. The professor of naval science (PNS), who chairs Northwestern's Department of Naval Science, and department faculty members are commissioned officers serving on active duty in the United States Navy or Marine Corps. They are selected and nominated by their respective services and screened and approved by the University. The unit is located at 617 Haven Street, Evanston, Illinois 60208-4140, phone 847/491-3324.

### Naval ROTC Programs

The Naval Reserve Officers Training Corps offers young men and women the opportunity to obtain leadership and management experience as commissioned officers in the United States Navy (Navy option) or Marine Corps (Marine Corps option) after graduation from Northwestern, through either the Scholarship Program or the nonscholarship College Program.

At Northwestern, NROTC midshipmen lead essentially the same campus life as other students. They make

their own arrangements for room and board and participate in campus activities of their choice. There are no prescribed academic majors for NROTC students, although scientific and technical studies are encouraged. NROTC students are required to complete the naval science curriculum, attend a weekly two-hour laboratory, and participate in four to six weeks of active duty for summer training at sea or ashore. NROTC students are required to abide by the Midshipmen Regulations issued by the unit. Under certain conditions, students may enroll in the NROTC Program at any time from the beginning of their freshman year until the end of their sophomore year.

### Courses

In addition to the required courses listed below, participants in the NROTC program must satisfactorily complete a number of other courses prescribed by the Department of the Navy, which are offered by other departments of the University. Current information on those course requirements is available from the NROTC unit.

With the exception of A10, Northwestern credit is granted for the successful completion of naval science courses subject to limitations imposed by the responsible University faculty committee and by the undergraduate schools. For more information on credit availability, consult the dean of each school. Naval science courses are open to non-NROTC students with department approval. Courses with an asterisk (*) are not required for Marine Corps option students.

**937-A10-0 Introduction to Naval Science** Components of the naval organization, its use and function in the Department of the Navy and Armed Forces of the United States.

**937-A20-0 Seapower and Maritime Affairs** A survey of U.S. naval and maritime history in the context of world maritime development, including the historical evolution of sea power and the role of U.S. naval forces in an era of geopolitical change.

***937-B10-0 Marine Navigation** The theory underlying marine navigation. Basic piloting; dead reckoning, terrestrial lines of position, set and drift, extensive chart work; elements of celestial navigation; solution of the navigational triangle; use of the sun, moon, stars, and planets in position finding at sea; actual sextant observations of the sun/moon (weather permitting).

***937-B20-0 Naval Ship Systems II (Naval Weapons Systems)** Theory and concepts of naval weapons systems. Ballistics of both powered and free-flight modes in single or multiple environments; theory of target acquisition, identification and tracking; command and control systems. Development of ability to analyze, synthesize, and critically evaluate representative naval weapons systems.

***937-C31-0 Naval Operations** Consists of several distinct segments. Students examine or practice rules of the nautical road, use of the maneuvering board, deck seamanship, basic shiphandling theory, and weather systems.

**937-C36-0 Evolution of Warfare** (Marine option only) Evolution of warfare from the Alexandrian period to the present; broad coverage of history of warfare. Actions and decisions of opposing commanders evaluated in terms of classic theoretical principles of war.

**937-C41-0 Naval Leadership and Management** Final development of students' managerial, professional, and ethical competencies. Preparation for personal and professional responsibilities in human resources management, personnel management, materiel management, division discipline, and administrative responsibilities of the junior officer.

***937-C45-0 Naval Ship Systems I (Naval Engineering)** Introduction to thermodynamics and basic power cycles used in naval propulsion and nonpropulsion auxiliary systems. Basics of electrical theory and shipboard electrical systems. Elements of ship design to achieve safe operations and ship stability characteristics.

**937-C46-0 History of Amphibious Warfare** (Marine option only) Evolution of amphibious warfare; development of amphibious concepts and principles. Major amphibious operations from Gallipoli to present.

**937-C50-0 Naval Science Laboratory** One two-hour lab weekly, required each quarter for all midshipmen. Emphasizes professional development and skills as well as drill and physical fitness.

## *Aerospace Studies*

Northwestern students may participate in the programs of the Air Force Reserve Officers Training Corps through a cross-enrollment agreement with the Illinois Institute of Technology (IIT). Within the limits of the Northwestern school in which the student is registered, credits earned in approved aerospace studies courses at IIT may be counted toward the degree requirements at Northwestern. Further information can be obtained from Air Force ROTC Detachment 195, Illinois Institute of Technology, 10 West 31st Street, Chicago, Illinois 60616, phone 312/567-3525.

## *Military Science*

Northwestern students may participate in the programs of the Army Reserve Officers Training Corps through a cross-enrollment agreement with the University of Illinois at Chicago (UIC). Within the limits of the Northwestern school in which the student is registered, credits earned in approved military science courses at UIC may be counted toward the degree requirements at Northwestern. Further information can be obtained from the Department of Military Science, University of Illinois at Chicago, 115 South Sangamon Street, Chicago, Illinois 60607, phone 312/996-3451.

## Music Theatre Program

The Certificate in Music Theatre provides the opportunity for School of Music students majoring in voice and School of Speech students majoring in theater to create a second area of specialization that is important to their development as musical theater artists. For voice majors, the program provides training in acting and other theater courses. Theater majors have weekly voice classes and exposure to other music offerings.

The prescribed sequence of courses is only open to students accepted into the program through audition. The auditions are held annually in the spring quarter and are limited to freshman and sophomore theater and voice majors. Auditioners are required to perform a vocal selection and a monologue and to participate in a dance audition.

### Certificate Requirements for Voice Majors

Voice majors must take seven units of credit and four noncredit courses:

- Theatre B43-1,2,3 Acting I: Principles of Characterization (3 units)
- Theatre C52-1,2 Music Theatre Techniques (2 units)
- Theatre C67 History of the Lyric Theatre (1 unit)
- Design or dance elective (1 unit)
- Theatre A19 Production Laboratory (one quarter, no credit)
- Dance (3 classes, no credit)

### Certificate Requirements for Theatre Majors

Theatre majors must take seven units of credit and six noncredit courses:

- Music 570-A02 Beginning Voice (1.5 units)
- Music 510-A27 Keyboard Skills (1 unit)
- Music 570-B02 Voice Performance: Musical Theatre (1.5 units)
- Theatre C52-1,2 Music Theatre Techniques (2 units)
- Theatre C67 History of the Lyric Theatre (1 unit)
- Dance (minimum of 6 classes, no credit)

## Undergraduate Leadership Program

The Undergraduate Leadership Program is an interschool certificate program open to all Northwestern undergraduates. The program helps students understand the nature of leadership and prepares them to become leaders on campus, in the community, and in their professions. Through course work, small group activities, seminar discussions, lectures, off-campus retreats, and involvement in campus and community organizations, participants learn the theories of leadership, experience the challenge of leading others, and create a sense of community with each other and members of participating organizations.

### Certificate Requirements

The program combines theoretical, historical, practical, and experiential knowledge into a two-phase course of study. In the first phase, freshmen and sophomores begin the program by first attending an experiential leadership retreat and then taking two required courses on leadership. After successfully completing both courses, students apply to enter the second phase. The activities in the second phase are primarily extracurricular and include a community connections retreat, seminars, lectures, mentoring, and externships.

The Office of the Provost awards a certificate to each student who successfully completes both phases of the Undergraduate Leadership Program, usually by the end of the junior year. Beyond the formal program, certificate holders may draw on their course work and experiences to enrich community life at Northwestern and in the surrounding community, fulfilling the program's goal of engaging constructively in civic and professional leadership activities.

### Courses

The following courses are required for the first phase of the Undergraduate Leadership Program. Speech B04 offers conceptual models of leadership and experience in leading group analyses of case studies, which are videotaped and reviewed by group members. History B95 begins with the view that leaders and leadership are uniquely related to their constituency and their historical context. The course illustrates the consequences of the success or failure of leadership.

**601-B04-0 Paradigms and Strategies of Leadership** See Introductory and Related Courses in the School of Speech.

**427-B95-0 Leaders in History** See History in the College of Arts and Sciences.

## Writing Arts, Center for the

The Center for the Writing Arts was established in 1994 to highlight Northwestern's strengths in the teaching of writing and to provide a focal point for continuing efforts to fulfill the University's commitment to excellence in writing. The center sponsors a number of programs, including courses for advanced creative writers taught by distinguished visiting writers-in-residence, innovative writing-intensive courses for freshmen, and a variety of colloquia for the entire campus community on topics related to writing.

### Courses

Writing arts courses C01, C02, and C03 are taught by a visiting writer-in-residence. For more information about writing arts courses and admission requirements, consult with a member of the Center for the Writing Arts.

**486-A10-1,2 Modes of Writing:Social Order and the Right to Dissent** Moral problem of dissent in society from classical to modern times; writing skills developed through discussion, analysis, and extensive writing assignments. Must take A10-2 in the quarter following A10-1; P/N not allowed. Prerequisite for A10-1: freshman standing; prerequisite for A10-2: A10-1.

**486-A11-1,2 Modes of Writing:Self-Sacrifice: The Martyr in History and Fiction** Moral problem of self-sacrifice, ranging from true altruism to that which is a camouflage for self-service and pride. Writing skills developed through discussion, analysis, and extensive writing assignments. Must take A11-2 in the quarter following A11-1; P/N not allowed. Prerequisite for A11-1: freshman standing; prerequisite for A11-2: A11-1.

**486-C01-0 The Art of Fiction** Fundamental skills of narrative in the creation of fictional works. Extensive writing exercises. Prerequisites: background in writing, a writing-intensive course, and submission of a manuscript of 5–15 pages.

**486-C02-0 The Art of Poetry** Writing of poetry in the light of the poetic, linguistic, and historical tradition. Extensive writing exercises. Prerequisites: serious interest in poetry, a writing-intensive course, and submission of sample poems.

**486-C03-0 The Art of Expository Prose** Writing as a fundamental skill in a particular field such as science, law, journalism, literature, or political commentary. Extensive writing exercises. Prerequisites: background in writing, a writing-intensive course, and submission of a manuscript of 5–15 pages.

# Administration and Faculty

## University Administration

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Steve D. Acuña, BA, *Assistant Registrar for Records Management*

David Klopfenstein, BA, *Assistant Registrar for Scheduling and Registration*

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Adina Andrews, MS, *Senior Assistant Director*

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Judy H. Lefferdink, BA, *Assistant Director*

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Sandy Jackson, BA, *Financial Aid Counselor*

Peggy Bryant, *Financial Aid Counselor*

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Adele W. Combs, MA, *Assistant University Librarian for General Services*

Laurel Minott, AMLS, *Assistant University Librarian for Public Services*

Diane Perushek, MA, *Assistant University Librarian for Collection Management*

Harry E. Samuels, MS, *Acting Assistant University Librarian for Information Technology*

Roxanne J. Sellberg, MLS, *Assistant University Librarian for Technical Services*

## Undergraduate Schools

Each faculty listing that follows shows the highest academic or professional degree and the institution granting the degree. *University and College* are usually omitted; familiar abbreviations and short forms are used when appropriate. Faculty rank within the department is given. The word *also* indicates a joint appointment at the same rank in another department. An asterisk (*) before a name indicates a part-time faculty member.

### College of Arts and Sciences

#### *Administration*

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*Dean of the College of Arts and Sciences and Professor of English and African American Studies*

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*Associate Dean and Lecturer in English*

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*Associate Dean and Professor of Mathematics*

Christopher C. Herbert, PhD
*Associate Dean and Professor of English*

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*Associate Dean and Lecturer in Political Science*

Frank Safford, PhD
*Associate Dean and Professor of History*

Michael R. Stein, PhD
*Associate Dean for Undergraduate Studies and Professor of Mathematics*

Marvin J. Lofquist, PhD
*Assistant Dean and Senior Lecturer in Chemistry*

Gerald L. Mead, PhD
*Assistant Dean and Associate Professor of French and Italian*

Michael S. Sherry, PhD
*Assistant Dean for Freshmen and Professor of History*

Richard P. Weimer, MA
*Assistant Dean*

#### *African American Studies*

Charles M. Payne (PhD Northwestern)
*Associate Professor and Chair; also Sociology, Education and Social Policy*

Leon Forrest (Chicago)
*Professor; also English*

Michael Hanchard (PhD Princeton)
*Associate Professor; also Political Science*

Aldon D. Morris (PhD SUNY Stony Brook)
*Professor; also Sociology, Institute for Policy Research*

Sandra L. Richards (PhD Stanford)
*Associate Professor; also Performance Studies, Theatre*

Fannie T. Rushing (PhD Chicago)
*Lecturer*

Diana T. Slaughter-Defoe (PhD Chicago)
*Professor; also Education and Social Policy, Institute for Policy Research*

Eric J. Sundquist (PhD Johns Hopkins)
*Professor; also English; Dean, College of Arts and Sciences*

#### *African and Asian Languages Program*

Richard Lepine (PhD Wisconsin)
*Lecturer and Director*

Muhammad S. Eissa (PhD Al-Azhar)
*College Lecturer*

Edna G. Grad (PhD Texas)
*College Lecturer*

Li-Cheng Gu (PhD Oregon)
*Lecturer*

Wen-hsiung Hsu (PhD Chicago)
*College Lecturer*

Hong Jiang (MEd Cincinnati)
*Lecturer*

Kiyomi Kagawa (MA Illinois)
*Lecturer*

Eunmi Lee (BA Konkuk)
*Lecturer*

Phyllis I. Lyons (PhD Chicago)
*Associate Professor*

Junko Sato (MEd Massachusetts)
*Lecturer*

Yumi Shiojima (MEd Pennsylvania)
*Lecturer*

Noriko Taira (BA Massachusetts)
*Lecturer*

### *Anthropology*

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Caroline H. Bledsoe (PhD Stanford)
*Professor*

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*Professor*

Michael F. Dacey (PhD Washington)
*Professor; also Geological Sciences; Senior Associate Dean, College of Arts and Sciences*

Micaela diLeonardo (PhD Calif Berkeley)
*Associate Professor; also Women's Studies*

Malcolm Dow (PhD Calif Irvine)
*Professor*

Jane I. Guyer (PhD Rochester)
*Professor; also Director, Program of African Studies*

William Hanks (PhD Chicago)
*Professor*

Karen T. Hansen (PhD Washington)
*Associate Professor; also Institute for Policy Research*

John C. Hudson (PhD Iowa)
*Professor*

William Irons (PhD Michigan)
*Professor*

Robert G. Launay (PhD Cambridge)
*Professor*

Helen B. Schwartzman (PhD Northwestern)
*Professor*

Brian T. Shea (PhD Duke)
*Associate Professor; also Medical School*

Gil J. Stein (PhD Pennsylvania)
*Assistant Professor*

Oswald Werner (PhD Indiana)
*Professor; also Education and Social Policy*

### *Art History*

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S. Hollis Clayson (PhD UCLA)
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Whitney Davis (PhD Harvard)
*Arthur Andersen Teaching and Research Professor; Director, Alice Berline Kaplan Center for the Humanities*

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Sarah Fraser (PhD Calif Berkeley)
*Assistant Professor*

David Mickenberg (MA Wisconsin Milwaukee)
*Lecturer; Director, Mary and Leigh Block Gallery*

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*Professor*

Michael Stone-Richards (PhD London)
*Assistant Professor*

David T. Van Zanten (PhD Harvard)
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Otto K. Werckmeister (PhD Berlin)
*Mary Jane Crowe Distinguished Professor of Art History*

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Daniel J. Devening (MFA Illinois)
*Lecturer*

Judy Ledgerwood (MFA Art Institute Chicago)
*Assistant Professor*

Ed Paschke (MFA Art Institute Chicago)
*Professor*

James R. Valerio (MFA Art Institute Chicago)
*Professor*

James Yood (MA Chicago)
*Lecturer*

### *Biochemistry, Molecular Biology, and Cell Biology*

Richard I. Morimoto (PhD Chicago)
*Professor and Chair*

Amy Bejsovec (PhD Wisconsin)
*Assistant Professor*

Lawrence B. Dumas (PhD Wisconsin)
*Professor; Provost, Northwestern University*

J. Douglas Engel (PhD Oregon)
*Owen L. Coon Professor of Molecular Biology*

Richard F. Gaber (PhD Wisconsin)
*Associate Professor*

Erwin Goldberg (PhD Iowa)
*Professor*

Linda Hicke (PhD Calif Berkeley)
*Assistant Professor*

Brian M. Hoffman (PhD Caltech)
*Professor; also Chemistry*

Robert A. Holmgren (PhD Harvard)
*Associate Professor; also Neurobiology and Physiology; Director, Undergraduate Program in Biological Sciences*

Theodore S. Jardetzky (PhD Basel)
*Assistant Professor*

Robert C. King (PhD Yale)
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Robert A. Lamb (PhD Cambridge)
*John Evans Professor of Molecular and Cellular Biology; Investigator, Howard Hughes Medical Institute*

Daniel Linzer (PhD Princeton)
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Paul A. Loach (PhD Yale)
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Robert C. MacDonald (PhD UCLA)
*Professor*

Eric Marsh (PhD Northwestern)
*Lecturer and Assistant Chair*

Andreas Matouschek (PhD Cambridge)
*Assistant Professor*

Kelly E. Mayo (PhD Washington)
*Professor*

Alfonso Mondragón (PhD Chicago)
*Associate Professor*

Scott A. Ness (PhD UCLA)
*Assistant Professor*

Francis C. Neuhaus (PhD Duke)
*Professor*

Thomas V. O'Halloran (PhD Columbia)
*Professor; also Chemistry*

Susan K. Pierce (PhD Pennsylvania)
*Professor*

Amy Rosenzweig (PhD MIT)
*Assistant Professor*

Richard B. Silverman (PhD Harvard)
*Professor; also Chemistry*

Angela U. Wandinger-Ness (PhD UCLA)
*Assistant Professor*

Neil E. Welker (PhD Case Western Reserve)
*Professor; also Biological Sciences, Chemistry*

*Edwin M. Westbrook (MD, PhD Chicago)
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Jonathan Widom (PhD Stanford)
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Tai Te Wu (PhD Harvard)
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### *Biological Sciences, Undergraduate Program in*

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Roberta W. Ellington (BA Barat)
*Lecturer*

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*Clare Hamilton Hall Professor of Chemistry*

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*Professor*

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SonBinh Nguyen (PhD Caltech)
*Assistant Professorr*

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*Charles E. and Emma H. Morrison Professor of Chemistry*

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*Professor (Argonne National Laboratory)*

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Pheng Cheah (MA Cornell)
*Visiting Instructor*

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*Lecturer*

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*Lecturer*

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*Assistant Professor*

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*Professor; also Religion*

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*Assistant Professor*

Catharine Regan (PhD Illinois)
*Associate Professor*

Regina Schwartz (PhD Virginia)
*Associate Professor*

Carl S. Smith (PhD Yale)
*Charles Deering McCormick Professor of Teaching Excellence; also Institute for Policy Research*

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*Assistant Professor*

Eric J. Sundquist (PhD Johns Hopkins)
*Professor, also African American Studies; Dean, College of Arts and Sciences*

Wendy Wall (PhD Pennsylvania)
*Assistant Professor*

### *French and Italian*

Michal Ginsburg (PhD Yale)
*Professor and Chair; also German*

Albert Ascoli (PhD Cornell)
*Associate Professor*

Marie-Thérèse Cunningham (MA Grenoble III)
*Lecturer*

Scott Durham (PhD Yale)
*Assistant Professor*

Bernadette Fort (Doctorat du Troisième Cycle Paris)
*Professor; also German*

Phyllis Horn-Lipparini (MA Northwestern)
*Lecturer*

Anne Landau (PhD Northwestern)
*Lecturer*

Françoise Lionnet (PhD Michigan)
*Associate Professor*

Gerald L. Mead (PhD Yale)
*Associate Professor; Assistant Dean, College of Arts and Sciences*

William D. Paden (PhD Yale)
*Professor*

Concettina Pizzuti (PhD Harvard)
*Senior Lecturer*

Christiane Rey (Licence en Droit, Liège)
*Lecturer*

Alessia Ricciardi (PhD Yale)
*Assistant Professor*

Sylvie Romanowski (PhD Yale)
*Associate Professor*

Tilde A. Sankovitch (PhD Northwestern)
*Harold and Virginia Anderson Professor*

Janine W. Spencer (PhD Northwestern)
*Senior Lecturer*

Claude Tournier (PhD Northwestern)
*Senior Lecturer*

Jane Bradley Winston (PhD Duke)
*Assistant Professor*

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William M. Pinsof (PhD York)
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Bruce D. Spencer (PhD Yale)
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Sandra R. Waxman (PhD Pennsylvania)
*Wender-Lewis Research and Teaching Professor; also Psychology*

Anne T. Wells (PhD Chicago)
*Senior Lecturer*

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*Lecturer*

Oswald Werner (PhD Indiana)
*Professor; also Anthropology*

John W. Wick (PhD Iowa)
*Professor*

David E. Wiley (PhD Wisconsin)
*Professor*

Carol Wilk (PhD Northwestern)
*Senior Lecturer*

Jeremy R. Wilson (PhD Northwestern)
*Professor; Associate Provost, Northwestern University*

Janice Witzel (PhD Northwestern)
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*Dean of the McCormick School, McCormick School Professor, and Frank C. Engelhart Professor of Materials Science*

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*Associate Dean for Undergraduate Engineering and Professor of Biomedical Engineering, Chemical Engineering, and Materials Science and Engineering*

Marla Dwyer, MS
*Assistant Dean for Undergraduate Engineering*

Geraldine O. Garner, EdD
*Associate Dean; Director, Murphy Cooperative Engineering Education Program; Associate Professor of Cooperative Engineering Education*

Joseph Holtgreive, EdM
*Assistant Dean for Undergraduate Engineering*

Joann S. Mete
*Assistant Dean for Administration*

Joel D. Meyer, MS
*Senior Assistant Dean for Administration*

John M. Torkelson, PhD
*Associate Dean for Graduate Studies and Research, Bette and Neison Harris Professor of Teaching Excellence, Professor of Chemical Engineering and Materials Science and Engineering*

### *Biomedical Engineering*

Robert A. Linsenmeier (PhD Northwestern)
*Professor and Chair; also Neurobiology and Physiology*

Ernest Byrom (PhD Northwestern)
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Dudley S. Childress (PhD Northwestern)
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Thomas K. Goldstick (PhD Calif Berkeley)
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Lyle F. Mockros (PhD Calif Berkeley)
*Professor; also Chemical Engineering*

David J. Mogul (PhD Northwestern)
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Barry W. Peterson (PhD Rockefeller)
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Joseph T. Walsh (PhD MIT)
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Christopher M. Waters (PhD Vanderbilt)
*Assistant Professor; also Anesthesia*

Hans U. Wessel (MD Albert Ludwigs, Germany)
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Harvey Wigdor (DDS Illinois)
*Adjunct Associate Professor*

Tai Te Wu (PhD Harvard)
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*Walter P. Murphy Professor and Chair*

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Linda J. Broadbelt (PhD Delaware)
*Donald and June Brewer Assistant Professor*

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Buckley Crist Jr. (PhD Duke)
*Professor; also Materials Science and Engineering*

Joshua S. Dranoff (PhD Princeton)
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*Professor; also Biomedical Engineering*

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*Professor; also Chemistry*

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William M. Miller (PhD Calif Berkeley)
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*Professor; also Biomedical Engineering*

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Gregory Ryskin (PhD Caltech)
*Associate Professor*

Randall Q. Snurr (PhD Berkeley)
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Joseph L. Schofer (PhD Northwestern)
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*Walter P. Murphy Professor of Civil Engineering; McCormick School Professor; also Engineering Sciences and Applied Mathematics, Mechanical Engineering; Director, Center for Quality Engineering and Failure Prevention*

Zdenek P. Bazant (PhD Czech Acad of Sciences)
*Walter P. Murphy Professor of Civil Engineering; also Materials Science and Engineering*

Ted B. Belytschko (PhD IIT)
*Walter P. Murphy Professor of Civil and Mechanical Engineering; also Mechanical Engineering*

Isaac M. Daniel (PhD IIT)
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Mark S. Daskin (PhD MIT)
*Professor; also Industrial Engineering and Management Sciences, Transportation Center*

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*James N. and Margie M. Krebs Professor*

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Robert S. Gemmell (PhD Harvard)
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*Associate Professor*

Takeru Igusa (PhD Calif Berkeley)
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*Professor; also Materials Science and Engineering*

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*Walter P. Murphy Professor; also Mechanical Engineering*

Frank S. Koppelman (PhD MIT)
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*Professor; also Policy and Environment, Transportation Center*

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*Associate Professor; also Mechanical Engineering*

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*John Evans Professor of Computer Science, Psychology, and Education and Social Policy and Chair; also Education and Social Policy, Psychology; Director, Institute for the Learning Sciences*

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Eric Domeshek (PhD Yale)
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*Assistant Professor; also Education and Social Policy*

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Louis M. Gomez (PhD Calif Berkeley)
*Associate Professor; also Education and Social Policy*

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Robert P. H. Chang (PhD Princeton)
*Professor; also Materials Science; Director, Materials Research Center*

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*Professor; Vice President for Information Technology, Northwestern University*

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*Associate Professor*

Bruce W. Wessels (PhD MIT)
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Chi-Haur Wu (PhD Purdue)
*Associate Professor*

Horace P. Yuen (ScD MIT)
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*McCormick School Professor; also Walter P. Murphy Professor of Civil Engineering, Mechanical Engineering; Director, Center for Quality Engineering and Failure Prevention*

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*Walter P. Murphy Professor; also Mechanical Engineering*

William L. Kath (PhD Caltech)
*Associate Professor*

Moshe Matalon (PhD Cornell)
*Professor; also Mechanical Engineering*

Michael J. Miksis (PhD NYU)
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W. Edward Olmstead (PhD Northwestern)
*Professor of Applied Mathematics; also Mathematics*

Hermann Riecke (PhD Bayreuth)
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Mary Silber (PhD Berkeley)
*Assistant Professor*

Vladimir A. Volpert (PhD Chernogolovka)
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*Adjunct Assistant Professor*

### *Industrial Engineering and Management Sciences*

Mark S. Daskin (PhD MIT)
*Professor and Chair; also Civil Engineering, Transportation Center*

Bruce Ankenman (PhD Wisconsin)
*Morris E. Fine Junior Professor of Materials and Manufacturing*

Collette R. Coullard (PhD Northwestern)
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Barry Nelson (PhD Purdue)
*Associate Professor*

David Simchi-Levi (PhD Tel Aviv)
*Professor*

Ajitkumar C. Tamhane (PhD Cornell)
*Professor; also Statistics*

Charles W. N. Thompson (PhD Northwestern, LLB Harvard)
*Professor*

Mark P. Van Oyen (PhD Michigan)
*Assistant Professor*

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Yip-Wah Chung (PhD Calif Berkeley)
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Scott A. Barnett (PhD Illinois)
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Zdenek P. Bazant (PhD Czech Academy of Science)
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Buckley Crist Jr. (PhD Duke)
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*Walter P. Murphy Professor*

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*Professor*

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*James N. and Margie M. Krebs Professor*

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*John Evans Professor of Materials Science*

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Julia R. Weertman (ScD Carnegie)
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Bruce W. Wessels (PhD MIT)
*Professor; also Electrical and Computer Engineering*

### *Mechanical Engineering*

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*Walter P. Murphy Professor of Civil and Mechanical Engineering and Chair; also Civil Engineering*

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Jian Cao (PhD MIT)
*Assistant Professor*

Herbert S. Cheng (PhD Pennsylvania)
*Walter P. Murphy Professor*

James E. Colgate (PhD MIT)
*Associate Professor*

James G. Conley (PhD Northwestern)
*Pentair–D. Eugene and Bonnie L. Nugent Associate Professor*

Isaac M. Daniel (PhD IIT)
*Professor; also Civil Engineering*

Stephen H. Davis (PhD Rensselaer)
*Walter P. Murphy Professor; also Engineering Sciences and Applied Mathematics*

Kornel H. Ehmann (PhD Wisconsin)
*Professor*

Leon M. Keer (PhD Minnesota)
*Professor; also Walter P. Murphy Professor of Civil Engineering*

Alan L. Kistler (PhD Johns Hopkins)
*Professor*

Arthur A. Kovitz (PhD Princeton)
*Professor*

Sridhar Krishnaswamy (PhD Caltech)
*Associate Professor*

Elmer E. Lewis (PhD Illinois)
*Professor*

Seth Lichter (PhD MIT)
*Professor*

Wing Kam Liu (PhD Caltech)
*Professor; also Civil Engineering*

Richard M. Lueptow (PhD Michigan State)
*Associate Professor*

Moshe Matalon (PhD Cornell)
*Professor; also Engineering Sciences and Applied Mathematics*

Bernard J. Matkowsky (PhD NYU)
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Brian Moran (PhD Brown)
*Associate Professor; also Civil Engineering*

Michael A. Peshkin (PhD Carnegie Mellon)
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*Professor; also Civil Engineering, Geological Sciences*

Siavash H. Sohrab (PhD Calif San Diego)
*Associate Professor*

Henry W. Stoll (PhD Illinois)
*Professor*

Richard S. Tankin (PhD Harvard)
*Professor*

John A. Walker (PhD Texas)
*Professor*

William R. D. Wilson (PhD Belfast)
*James N. and Nancy J. Farley Professor of Manufacturing and Entrepreneurship*

Man-C. Yuen (PhD Harvard)
*Professor*

### *McCormick School At Large*

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*Associate Professor of Cooperative Engineering Education; Associate Dean and Director of Cooperative Engineering Education*

## Medill School of Journalism

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*Associate Dean and Associate Professor of Journalism*

Roger C. Boye, MSJ
*Assistant Dean, Director of Undergraduate Studies, and Associate Professor of Journalism*

Clarke L. Caywood, PhD
*Chair of Integrated Marketing Communications Program and Associate Professor*

Jonathan Ziomek, MSJ
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Jean E. Shedd, MM
*Assistant Dean, Finance and Planning*

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*Associate Professor*

Roger C. Boye (MSJ Northwestern)
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Neil Chase (BA Michigan)
*Assistant Professor*

Mary B. Coffman (MA Bowling Green)
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Susan Mango Curtis (BFA Virginia Commonwealth)
*Assistant Professor*

Patricia K. Dean (MSC Northwestern)
*Associate Professor; Chair of Broadcast News Program*

Mary L. Dedinsky (MSJ Northwestern)
*Associate Professor; Director of Teaching Media Program; Associate Dean, Medill School of Journalism*

Jack C. Doppelt (JD Chicago)
*Associate Professor; Associate Dean, Medill School of Journalism*

Sharon Downey (BA Cleveland State)
*Senior Lecturer*

Marda Dunsky (MA University of Chicago)
*Assistant Professor*

Ava Greenwell (MSJ Northwestern)
*Assistant Professor; Director of Teaching Television Program*

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*Associate Professor; Chair of Newspaper Program*

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Carolyn Kitch (MA Penn State)
*Assistant Professor*

John Kupetz (MSJ Northwestern)
*Assistant Professor; Director of Placement*

Craig LaMay (MA North Carolina Chapel Hill)
*Assistant Professor; Director of Project on Curricular and Program Development*

John M. Lavine (BA Carleton)
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Donna M. Leff (PhD Calif Berkeley)
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Robert J. McClory (MSJ Northwestern)
*Associate Professor*

David L. Nelson (MSJ Northwestern)
*Associate Professor*

Abe Peck (BA NYU)
*Professor; Chair of Magazine Program*

David Protess (PhD Chicago)
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*Assistant Professor*

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*Professor*

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*Assistant Professor*

Mindy S. Trossman (JD Loyola)
*Senior Lecturer*

Mary Ann Damme Weston (MSJ Northwestern)
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*Lecturer*

Jonathan Ziomek (MSJ Illinois)
*Associate Professor; Director of Graduate Editorial Programs; Assistant Dean, Medill School of Journalism*

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Clarke L. Caywood (PhD Wisconsin)
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Lisa Fortini-Campbell (PhD Washington)
*Associate Professor*

Edward Malthouse (PhD Northwestern)
*Assistant Professor*

Francis J. Mulhern (PhD Texas Austin)
*Assistant Professor*

Don E. Schultz (PhD Michigan State)
*Professor*

Edward J. Spiegel (MBA Dartmouth)
*Associate Professor*

Stanley I. Tannenbaum (BS Temple)
*Associate Professor*

Paul Wang (PhD Northwestern)
*Associate Professor*

## School of Music

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Frederick L. Hemke, AMusD
*Associate Dean and Professor of Saxophone*

Brennetta Simpson, EdD
*Assistant Dean, Director of Undergraduate Studies, and Assistant Professor of Music Education*

Robert Barris, MMus
*Cochair of Music Performance Studies and Associate Professor of Bassoon*

John S. Buccheri, PhD
*Chair of Academic Studies and Composition and Associate Professor of Music Theory*

Heather A. Landes, MMus
*Director of Music Admissions and Financial Aid*

Marcia Bosits Norrman, DMus
*Cochair of Music Performance Studies and Associate Professor of Piano*

Thomas L. Willis, PhD
*Executive Assistant to the Dean and Associate Professor of Musicology*

Sara Martin Rosheger, MA
*Assistant to the Dean and Lecturer in Music*

### *Academic Studies and Composition*

**Music Composition Program**

M. William Karlins (PhD Iowa)
*Professor*

Michael Pisaro (DMus Northwestern)
*Senior Lecturer*

Stephen L. Syverud (PhD Iowa)
*Associate Professor; Coordinator of Music Composition Program; also Music Technology*

Amnon Wolman (DMusA Stanford)
*Associate Professor; also Music Technology*

Jay Alan Yim (PhD Harvard)
*Associate Professor*

**Music Education Program**

Paul A. Aliapoulios (MusAd Boston)
*Professor*

James Kjelland (PhD Texas)
*Associate Professor; also String Instruments*

*Margaret W. Mistak (BMusEd Northwestern)
*Lecturer in Guitar*

Stephen Peterson (DMus Northwestern)
*Associate Professor; Coordinator of Conducting and Ensembles Program; Associate Director of Bands*

Brennetta Simpson (EdD Columbia)
*Assistant Professor; Assistant Dean and Director of Undergraduate Studies, School of Music*

Peter R. Webster (PhD Eastman)
*Associate Professor; Coordinator of Music Education Program; also Music Technology*

Nancy Whitaker (EdD Illinois)
*Assistant Professor*

**Musicology Program**

Thomas Bauman (PhD Calif Berkeley)
*Professor*

Paul F. Berliner (PhD Wesleyan)
*Professor of Ethnomusicology*

Richard D. Green (PhD Illinois)
*Associate Professor; Associate Dean, School of Music*

William V. Porter (PhD Yale)
*Professor*

Judith L. Schwartz (PhD NYU)
*Associate Professor*

Thomas L. Willis (PhD Northwestern)
*Associate Professor; Executive Assistant to the Dean*

**Music Technology Program**

Gary S. Kendall (PhD Texas)
*Associate Professor; Coordinator of Music Technology Program; also Music Theory*

Stephen L. Syverud (PhD Iowa)
*Associate Professor; Coordinator of Music Composition Program*

Peter R. Webster (PhD Eastman)
*Associate Professor; Coordinator of Music Education Program*

Amnon Wolman (DMusA Stanford)
*Associate Professor; also Music Composition*

**Music Theory Program**

Richard Ashley (DMusA Illinois)
*Associate Professor*

Candice Brower (MMus SUNY Stony Brook)
*Assistant Professor*

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*Associate Professor; Chair of Academic Studies and Composition*

Robert Gjerdingen (PhD Pennsylvania)
*Associate Professor*

Kevin Holm-Hudson (DMusA Illinois)
*Lecturer*

Gary S. Kendall (PhD Texas)
*Associate Professor; Coordinator of Music Technology Program*

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Antonio García (MMus Eastman)
*Associate Professor of Jazz Studies and Integrated Arts*

Robert A. Harris (PhD Michigan State)
*Professor; Director of Choral Organizations*

Frederick Ockwell (MA Washington)
*Associate Professor; also Voice and Opera; Opera Conductor*

Don L. Owens (MMus Illinois)
*Associate Professor; Director of Jazz Studies and Contemporary Music Ensemble*

Stephen Peterson (DMus Northwestern)
*Associate Professor; Coordinator of Conducting and Ensembles Program; Associate Director of Bands; also Music Education*

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