

College of Engineering

www.coe.neu.edu

ALLEN L. SOYSTER, PHD, *Professor and Dean*

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David Navick, PhD, *Assistant Dean for Engineering Enrollment*

Lisa Koch, PhD, *Assistant Dean for Educational and Computer Technology*

Candace A. Martel, MEd, *Director of Engineering Student Services*

The mission of the College of Engineering is to provide a teaching, learning, and research environment that results in the highest-quality education for our students. Consistent with our goal of providing the highest-quality, practice-oriented program, the College of Engineering prepares students to contribute to the accumulation and application of technical knowledge. The college helps students master the fundamental mathematical and scientific principles underlying a particular branch of engineering; develop and demonstrate competence in analysis and design appropriate to an engineering specialization; reason clearly and communicate effectively; and recognize the need to continue professional development.

Through laboratory exercises, senior design projects, professional association activities, and cooperative work assignments, students put theory into practice and clarify their professional goals.

The college offers a Bachelor of Science degree with specializations in chemical, civil, computer, electrical, industrial, and mechanical engineering. The five-year Bachelor of Science degree program, which includes eighteen months of cooperative education work experience, is the standard and most popular program. Four-year programs with and without co-op experience are also available.

The college encourages students to study the arts, sciences, business, and other areas outside of engineering, for they provide an awareness of the social, economic, political, aesthetic, and philosophical influences that shape the world in which graduates will practice their professions. Students may complete a minor in areas such as business, computer science, biomedical engineering, math, or music. In many cases, the minor can be completed without course overloads.

In addition to a full array of University services, special advising and other support services (including tutoring) are provided. Students may qualify to participate in honors sections of many courses. Active student chapters of many national professional engineering organizations and honor societies are supported by the college as an enriching addition to academic studies and co-op experience.

The Bachelor of Science degree programs with specification in chemical, civil, electrical, industrial, and mechanical engineering are accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (EAC/ABET).

Bachelor of Science/Master of Science Joint-Degree Program

The departments of electrical and computer engineering and mechanical and industrial engineering offer programs leading to both the bachelor's and master's degrees in five years. All students begin with the common first-year engineering program. Upon successful completion, students may petition to enter the BS/MS Program. Degree candidates must maintain a 3.200 cumulative grade-point average, carry extra courses, and reduce the number of cooperative education semesters to complete the course requirements.

Academic Standards

(Effective September 8, 2004)

The faculty of the College of Engineering has set the following minimum academic standards, which students must meet to continue their programs of study in good standing:

Academic Progression Standards

It is expected that full-time engineering students take four courses per semester with appropriate labs. Part-time engineering students are expected to complete two courses per semester with appropriate labs. Any exceptions to the course load requirement must be approved by the student's academic adviser, in writing, prior to the start of each semester.

Grade-Point Average (GPA) Requirements for Graduation

A minimum cumulative GPA requirement of 2.000 in major (department) courses is required for graduation. A minimum cumulative GPA requirement of 2.000 overall is required for graduation.

Criteria for Academic Probation

Full-time students in the College of Engineering will be placed on academic probation effective for the following academic semester for any of the following reasons:

- Not maintaining an overall cumulative GPA of at least 1.800 at the end of the two semesters of the first-year curriculum, or
- Not maintaining an overall cumulative GPA of at least 2.000 at the end of each academic semester thereafter, or
- Not maintaining a GPA of at least 2.000 in the major at the end of the fourth academic semester of the curriculum and at the end of each semester thereafter, or
- Not maintaining satisfactory progress through the curriculum by:
 - Accumulating three outstanding course deficiencies (grades of F, I, W, NE, U,* or missing grades), or
 - Earning a current semester GPA of 1.600 or lower, or
 - Not following a program of study approved by the student's academic adviser.

A notation of the academic probation action will appear on the internal record, but not on the transcript.

Criteria for Academic Dismissal

Students who remain on probation for two semesters will be dismissed from the University. Notation of this academic dismissal action will appear on the transcript.

Graduation Requirements

The college reserves the right to amend programs, courses, and degree requirements to fulfill its educational responsibility to respond to relevant changes in the field.

Students must complete all of the requirements in the degree program in which they are candidates. Degree requirements are based upon the year of graduation, determined by the date of entry or reentry into the College of Engineering. Degree requirements and the year of graduation for a degree candidate who fails to make normal academic progress will be subject to review and possible change.

Students transferring from another college or university must complete 32 of the last 40 semester hours at Northeastern University immediately preceding graduation to be eligible to receive the Bachelor of Science degree.

College of Engineering Arts and Humanities Requirements

Each College of Engineering degree program below references the following arts and humanities requirements:

HISTORICAL PERSPECTIVE ELECTIVE

Complete any one HST course or any course from the following list:

| | | |
|----------|---|------|
| AFR U312 | Black History of Boston | 4 SH |
| AFR U350 | History of Blacks in the Media and the Press | 4 SH |
| ASL U350 | Deaf History and Culture | 4 SH |
| ECN U293 | European Economic History | 4 SH |
| ECN U470 | American Economic History | 4 SH |
| INT U305 | Maritime History of New England | 4 SH |

SOCIAL/CULTURAL PERSPECTIVE ELECTIVE

Complete any one course from the AFR, LNA, LNC, LNF, LNG, LNH, LNI, LNJ, LNL, LNM, LNR, LNS, or SOA departments or any one course from the following list:

| | | |
|----------|---|------|
| ARC U223 | American Architecture | 4 SH |
| ART U305 | Renaissance Art | 4 SH |
| ART U310 | Nineteenth-Century Art | 4 SH |
| ART U319 | Gender and the Visual Arts | 4 SH |
| ART U320 | American Art | 4 SH |
| ASL U150 | Deaf People in Society | 4 SH |
| ECN U240 | Economics of Crime | 4 SH |
| ECN U270 | Economic Status of Ethnic Minorities | 4 SH |
| ENG U226 | Backgrounds in English and American Literature | 4 SH |
| ENG U409 | The Modern Novel | 4 SH |
| ENG U425 | Literature and Law | 4 SH |
| ENG U427 | The Literature of Science | 4 SH |
| ENG U454 | History of English | 4 SH |
| ENG U520 | American Novels 2 | 4 SH |
| ENG U611 | Shakespeare | 4 SH |

| | | | | | | | |
|----------|--|---|----|----------|--|---|----|
| ENG U671 | Multiethnic Literature of the U.S. | 4 | SH | POL U450 | Government and Politics in Russia | 4 | SH |
| ENG U687 | Modern Poetry | 4 | SH | POL U460 | Government and Politics in Africa | 4 | SH |
| ENG U688 | Contemporary Poetry | 4 | SH | POL U465 | Government and Politics in the Middle East | 4 | SH |
| GEO U112 | Environmental Geology | 4 | SH | POL U470 | Arab-Israeli Conflict | 4 | SH |
| GEO U510 | Environmental Planning | 4 | SH | POL U475 | Government and Politics in Latin America | 4 | SH |
| HRM U201 | Organizational Behavior | 4 | SH | POL U480 | Government and Politics in Japan | 4 | SH |
| HST U110 | Introduction to World History | 4 | SH | POL U485 | Government and Politics in China | 4 | SH |
| HST U204 | Third World Women | 4 | SH | POL U487 | Politics of Developing Nations | 4 | SH |
| HST U242 | Women in America | 4 | SH | SOC U215 | Society and Culture in Russia | 4 | SH |
| HST U261 | The Modern Caribbean | 4 | SH | SOC U246 | Environment and Sociology | 4 | SH |
| HST U270 | Ancient Greece | 4 | SH | SOC U280 | Sociology of Work | 4 | SH |
| HST U272 | The Invention of Europe | 4 | SH | SOC U402 | Feminist Perspectives on Society | 4 | SH |
| HST U286 | History of the Soviet Union | 4 | SH | SOC U440 | Sociology of Human Service Organizations | 4 | SH |
| HST U290 | Modern Middle East | 4 | SH | SOC U485 | Environment, Technology, and Society | 4 | SH |
| HST U311 | Colonialism/Imperialism | 4 | SH | SOC U528 | Computers and Society | 4 | SH |
| HST U322 | Work and Leisure | 4 | SH | THE U210 | Theatre and Society | 4 | SH |
| HST U330 | Colonial and Revolutionary America | 4 | SH | | | | |
| HST U337 | African-American History before 1900 | 4 | SH | | | | |
| HST U340 | Cultural History of the U.S. | 4 | SH | | | | |
| HST U342 | Environmental History of North America | 4 | SH | | | | |
| HST U344 | U.S. Urban History | 4 | SH | | | | |
| HST U370 | Renaissance to Enlightenment | 4 | SH | | | | |
| HST U376 | The British Empire | 4 | SH | | | | |
| HST U391 | Modern African Civilization | 4 | SH | | | | |
| HST U392 | African Diaspora | 4 | SH | | | | |
| HST U394 | Islamic Nationalism | 4 | SH | | | | |
| HST U432 | Latin America in Boston | 4 | SH | | | | |
| HST U475 | The Culture of Europe | 4 | SH | | | | |
| INT U240 | War and Conflict in the Nuclear Age | 4 | SH | | | | |
| INT U310 | Water Resources Policy and Management | 4 | SH | | | | |
| JRN U150 | Interpreting the Day's News | 4 | SH | | | | |
| MTH U201 | History of Mathematics | 4 | SH | | | | |
| MUS U103 | Music as a Social Expression | 4 | SH | | | | |
| MUS U121 | Medieval and Renaissance Music | 4 | SH | | | | |
| PHL U135 | Philosophical Problems of Law and Justice | 4 | SH | | | | |
| PHL U137 | Philosophical Problems of War and Peace | 4 | SH | | | | |
| PHL U145 | Technology and Human Values | 4 | SH | | | | |
| PHL U150 | Understanding the Bible | 4 | SH | | | | |
| PHL U160 | Philosophical Problems of Economic Justice | 4 | SH | | | | |
| PHL U165 | Moral Problems in Medicine | 4 | SH | | | | |
| PHL U180 | Environmental Ethics | 4 | SH | | | | |
| PHL U265 | Latin American Religions | 4 | SH | | | | |
| PHL U275 | Eastern Religions | 4 | SH | | | | |
| PHL U280 | Islam | 4 | SH | | | | |
| PHL U325 | Ancient Philosophy | 4 | SH | | | | |
| PHL U330 | Modern Philosophy | 4 | SH | | | | |
| POL U307 | Public Policy and Administration | 4 | SH | | | | |
| POL U375 | Gender and Politics | 4 | SH | | | | |
| POL U380 | Latino Politics in the United States | 4 | SH | | | | |
| POL U390 | Science, Technology, and Public Policy | 4 | SH | | | | |
| POL U415 | Ethnic Conflict in Comparative Politics | 4 | SH | | | | |
| POL U420 | War and Political Violence | 4 | SH | | | | |
| POL U425 | U.S. Foreign Policy | 4 | SH | | | | |
| POL U435 | Politics in Western Europe | 4 | SH | | | | |
| POL U440 | Politics in Northern Ireland | 4 | SH | | | | |
| POL U445 | Politics in Central and Eastern Europe | 4 | SH | | | | |

CHEMICAL ENGINEERING

www.coe.neu.edu/Depts/CHE/chemical/chemeng.html

ERIC J. THORGERSON, PHD

Departmental Officer and Visiting Professor

GEORGE A. SNELL PROFESSOR OF ENGINEERING

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PROFESSOR

Ronald J. Willey, PhD

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Gilda A. Barabino, PhD

ASSISTANT PROFESSORS

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Rebecca L. Carrier, PhD

Carolyn W. T. Lee-Parsons, PhD

Katherine S. Ziemer, PhD

ASSOCIATE PROFESSORS EMERITI

Ralph A. Buonopane, PhD

Bernard M. Goodwin, ScD

Richard R. Stewart, PhD

The chemical engineering program offers students a broad education built on fundamentals in science, mathematics, and engineering, which are then applied to a variety of contemporary problems using modern tools, such as computational software and computer-aided design. Chemical engineers have traditionally been employed in chemical, petrochemical, agricultural chemicals, pulp and paper, plastics, cosmetics, and textiles industries and in consulting and design firms. Today, chemical engineers also play an integral role in emerging biological and advanced material fields. For example, chemical engineers are creating new materials needed for space exploration, alternate

energy sources, and faster, self-powered computer chips. In biotechnology and bioengineering, chemical engineers are working to understand human diseases, developing new therapies and drug delivery systems, and producing new medicines through cell culture systems. Chemical engineers are also using nanotechnology to revolutionize sensors, security systems, and medical diagnostics and treatments. In addition to creating important products, chemical engineers are also involved in protecting our environment by exploring ways to reduce acid rain and smog, to recycle and reduce wastes, to develop new sources of environmentally clean energy, and to design inherently safe, efficient, and “green” processes. The role of chemical engineers is to develop new products and to design the processes while reducing costs, increasing production, and improving the quality and safety of new products.

The faculty of the chemical engineering program is committed to providing a practice-oriented education through an academic environment that encourages active learning and that draws connections between co-op experiences and classroom theory. A professional component includes thorough groundwork in mathematics, physical sciences, and engineering science as well as real-world design and laboratory experiences. This component prepares students to apply rigorous chemical engineering principles to a variety of contemporary problems. A liberal arts component is included to provide students with the general education skills necessary to identify the impact of engineering decisions in a broad societal context. The cooperative education component provides an integrated educational experience that enables students to gain practical workplace knowledge, which is supported by an academic curriculum designed to integrate theoretical concepts and practical applications. This combination of academic and cooperative education opportunities enables students to gain more knowledge, with increasing challenges and responsibilities, while progressing toward fully professional careers in chemical engineering. As a result, the chemical engineering program also prepares students for graduate school, medical school, law school, or business school.

Through faculty expertise and scholarship, a rigorous set of academic courses, and real-world cooperative education experiences, the chemical engineering program meets the following educational objectives: Students will be able to (1) identify and solve chemical engineering problems; (2) understand, analyze, and design chemical processes; (3) be proficient in the use of modern engineering tools; (4) be proficient in oral and written communication of their work and ideas; (5) become independent learners and workers; (6) participate effectively in intradisciplinary and interdisciplinary groups; (7) design and perform laboratory experiments to acquire data and evaluate theories; (8) understand the environmental and safety impact of their work as chemical engineers; (9) understand the global and societal impact of engineering problems and solutions; (10) conduct themselves in accordance with the highest ethical and professional standards; and (11) be prepared for lifelong learning and continuing education.

The chemical engineering curriculum shown below is designed to meet the above objectives and is periodically evaluated and revised to ensure that graduates of the program achieve these objectives. See pages 242–244 for course descriptions.

BSCHE—Bachelor of Science in Chemical Engineering

ENGLISH REQUIREMENT

Complete the following course:

| | | |
|----------|-----------------|------|
| ENG U111 | College Writing | 4 SH |
|----------|-----------------|------|

and one approved Advanced Writing in the Disciplines course for the major. A grade of C or higher is required in both courses.

ENGINEERING CATEGORICAL REQUIREMENT

Students must complete a minimum of semester hours in the categories of math/science and engineering topics. Completing all courses in the prescribed curriculum satisfies these requirements without any additional consideration. However, any student with transfer credits or course substitutions must meet with an academic adviser to plan appropriate course work to ensure that these requirements are fully satisfied.

CHEMICAL ENGINEERING GENERAL EDUCATION

Mathematics and Science

PHYSICS

Complete the following two courses and corresponding labs:

| | | |
|---------------|---------------------------|------|
| PHY U151 | Physics for Engineering 1 | 4 SH |
| with PHY U152 | Lab for PHY U151 | 1 SH |
| PHY U155 | Physics for Engineering 2 | 4 SH |
| with PHY U156 | Lab for PHY U155 | 1 SH |

CHEMISTRY

Complete the following four courses and corresponding labs and one advanced-level chemistry elective as approved by the department (CHM U152 does not become a requirement until fall 2005):

| | | |
|---------------|---------------------------------|------|
| CHM U151 | General Chemistry for Engineers | 4 SH |
| with CHM U152 | Lab for CHM U151 | 1 SH |
| CHM U311 | Organic Chemistry 1 | 4 SH |
| with CHM U312 | Lab for CHM U311 | 1 SH |
| CHM U313 | Organic Chemistry 2 | 4 SH |
| with CHM U314 | Lab for CHM U313 | 1 SH |
| CHM U403 | Physical Chemistry 2 | 4 SH |
| with CHM U404 | Lab for CHM U403 | 1 SH |

ELECTIVE

| | | |
|----------------------|------------------|------|
| CHM U500 to CHM U999 | | |
| BIO U323 | Biochemistry | 4 SH |
| with BIO U324 | Lab for BIO U323 | 1 SH |
| GEO U410 | Geochemistry | 4 SH |

CALCULUS 1 AND 2 FOR SCIENCE AND ENGINEERING

Complete the following two courses:

| | | |
|----------|--|------|
| MTH U241 | Calculus 1 for Science and Engineering | 4 SH |
| MTH U242 | Calculus 2 for Science and Engineering | 4 SH |

DIFFERENTIAL EQUATIONS AND LINEAR ALGEBRA

Complete the following course:

MTH U343 Differential Equations and Linear Algebra 4 SH
for Engineering

CALCULUS 3 FOR SCIENCE AND ENGINEERING

Complete the following course:

MTH U341 Calculus 3 for Science and Engineering 4 SH

Arts and Humanities

Complete two courses from the “College of Engineering Arts and Humanities Requirements” on page 178.

CHEMICAL ENGINEERING MAJOR REQUIREMENTS**First-Year Engineering**

Complete the following two courses:

GE U110 Engineering Design 4 SH

GE U111 Engineering Problem Solving 4 SH
and Computation

General Engineering

Complete the following three courses:

GE U100 Introduction to the Study of Engineering 1 SH

CHE U300 Introduction to Engineering Co-op 1 SH
Education

or GE U300 Introduction to Engineering Co-op 1 SH
Education

CHE U500 Professional Issues in Engineering 1 SH

or GE U500 Professional Issues in Engineering 1 SH

Chemical Engineering Fundamentals

Complete the following course and corresponding lab:

CHE U308 Chemical Engineering Calculations 4 SH

with CHE U309 Lab for CHE U308 1 SH

Transport Processes and Operations

Complete the following two courses:

CHE U310 Transport Processes and Operations 1 4 SH

CHE U312 Transport Processes and Operations 2 4 SH

Thermodynamics

Complete the following two courses:

CHE U320 Chemical Engineering Thermodynamics 1 4 SH

CHE U322 Chemical Engineering Thermodynamics 2 4 SH

Process

Complete the following three courses and corresponding lab:

CHE U510 Chemical Engineering Kinetics 4 SH

CHE U512 Chemical Engineering Process Control 4 SH

CHE U520 Unit Operations and Separation 3 SH
Processes

with CHE U521 Lab for CHE U520 2 SH

Chemical Process Design

Complete the following two courses and corresponding labs:

CHE U701 Chemical Process Design 1 4 SH

with CHE U702 Lab for CHE U701 1 SH

CHE U703 Chemical Process Design 2 3 SH

with CHE U704 Lab for CHE U703 2 SH

Chemical Engineering Technical Electives

Complete one course from the following list:

CHE U616 Mass Transfer Operations 4 SH

CHE U619 Polymer Science 4 SH

CHE U620 Pollution Control in Chemical Industries 4 SH

CHE U624 Chemical Process Safety 4 SH

CHE U630 Biochemical Engineering Fundamentals 4 SH

CHE U634 Nanomaterials: Thin Films and Structures 4 SH

CHE U699 Special Topics in Chemical Engineering 4 SH

CHE U721 Projects 1 4 SH

CHE U722 Projects 2 4 SH

CHE U970 Junior/Senior Project 1 4 SH

CHE U971 Junior/Senior Project 2 4 SH

CHEMICAL ENGINEERING GENERAL ELECTIVE REQUIREMENTS

Complete four 4-SH-equivalent, nonremedial, nonrepetitive courses from the following list:

CBA U101 Introduction to Business 4 SH

or any courses from the following departments: ACC, AFR, ARC, ART, ASL, BIO, CHE, CHM, CIN, CIV, CJ, CMN, CS, ECE, ECN, ED, ENG, ENT, ENV, FIN, GEO, HRM, HS, HST, IAF, INB, INT, IS, JRN, LIN, LNA, LNC, LNF, LNG, LNH, LNI, LNJ, LNL, LNM, LNR, LNS, MGT, MIM, MKT, MMS, MSC, MTH, MUS, PHL, PHY, POL, PSY, SCM, SOA, SOC, or THE.

GPA REQUIREMENT

Minimum 2.000 GPA required in the major

GENERAL ELECTIVES

Additional courses taken beyond college and major course requirements to satisfy graduation credit requirements.

COOPERATIVE EDUCATION**UNIVERSITY-WIDE REQUIREMENTS**

140 total semester hours required

Minimum 2.000 GPA required

CIVIL AND ENVIRONMENTAL ENGINEERING

www.coe.neu.edu/Depts/civil

PETER G. FURTH, PhD

Professor and Chair

CAMP, DRESSER & MCKEE, INC. PROFESSOR OF ENGINEERING

Vladimir Novotny, PhD

COLLEGE OF ENGINEERING DISTINGUISHED PROFESSOR

Mishac K. Yegian, PhD

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Ali Touran, PhD

Sara Wadia-Fascetti, PhD

Irvine W. Wei, PhD

ASSISTANT PROFESSORS

Mehrdad Sasani-Kolori, PhD
James Y. Wang, PhD

PROFESSORS EMERITI

Paul H. King, PhD
Kenneth M. Leet, ScD

Civil engineers judiciously apply their knowledge of mathematics and physical sciences to improve and protect the environment and to provide facilities and structures for community living, industry, and transportation. Civil engineering encompasses several disciplines, including structural engineering, environmental engineering, transportation planning and engineering, and geotechnical engineering. They supervise the construction of bridges, tunnels, buildings, dams, and aqueducts. Civil engineers also plan, design, construct, and manage highways, railroads, canals, and airports; regulate rivers and control floods; design and build systems for water distribution, wastewater treatment, refuse disposal, and environmental remediation.

The civil engineering program has four educational objectives. The first is that our students gain an understanding of the natural and cultural world. Mathematics, physics, and chemistry are the foundation of civil engineering. Such a foundation enables students to properly understand and apply engineering principles, and makes the Northeastern education one that can keep pace with the advances in this dynamic field. Likewise, it is important for students to understand the historical and cultural context in which engineering takes place and to understand the social and environmental impact of engineering projects.

The second objective is that our students become technically prepared for engineering practice. Students acquire a common base of knowledge in the engineering sciences, including mechanics and environmental science. In more advanced courses, students learn to analyze and design building frames and bridges, water and wastewater treatment systems, highways and traffic systems, hydraulic systems, earth dams, building foundations, and construction management systems. Our program is designed to give students proficiency in at least four areas of civil engineering. Students may also earn an optional concentration in structural engineering or environmental engineering.

The third program objective is that our students develop skills in critical thinking, communication, information literacy, and aesthetics. These subjects are integrated into courses throughout the program. Particular emphasis is placed on the importance of effective writing and public speaking.

The fourth program objective is that our students develop a personal and professional ethic—that is, an understanding of the profession, its ethical codes, history, contemporary issues, and the need for lifelong learning. Course work, cooperative education, and participation in the activities of the college's award-winning student chapter of the American Society of Civil Engineers help students meet this goal.

The civil engineering program provides students with a broad education appropriate for a variety of career choices and lifelong learning. Experience tells us that civil engineering graduates will enter almost every field imaginable. The knowledge and skills acquired—understanding science, critical thinking, effective communication, and understanding the social context, among them—form an excellent foundation for a host of careers, as well as for a fulfilling life outside the world of work. The civil engineering program has been designed with four general electives that permit students to explore or acquire further depth in other fields of interest. Students can use these electives to earn a minor in business, architectural history, music, computer science, or any number of other fields.

The co-op program parallels the academic program in level of responsibility and sophistication. A beginning job might involve layout at a construction site or laboratory testing; in senior-level co-op assignments, students are often working alongside engineers on design teams. See pages 252–255 for course descriptions.

BSCE—Bachelor of Science in Civil Engineering**ENGLISH REQUIREMENT**

Complete the following course:

| | | |
|----------|-----------------|------|
| ENG U111 | College Writing | 4 SH |
|----------|-----------------|------|

and one approved Advanced Writing in the Disciplines course for the major. A grade of C or higher is required in both courses.

ENGINEERING CATEGORICAL REQUIREMENT

Students must complete a minimum of semester hours in the categories of math/science and engineering topics. Completing all courses in the prescribed curriculum satisfies these requirements without any additional consideration. However, any student with transfer credits or course substitutions must meet with an academic adviser to plan appropriate course work to ensure that these requirements are fully satisfied.

CIVIL ENGINEERING GENERAL EDUCATION*Mathematics and Science***PHYSICS**

Complete the following two courses and corresponding labs:

| | | |
|---------------|---------------------------|------|
| PHY U151 | Physics for Engineering 1 | 4 SH |
| with PHY U152 | Lab for PHY U151 | 1 SH |
| PHY U155 | Physics for Engineering 2 | 4 SH |
| with PHY U156 | Lab for PHY U155 | 1 SH |

CHEMISTRY

Complete the following course (CHM U152 does not become a requirement until fall 2005):

| | | |
|---------------|---------------------------------|------|
| CHM U151 | General Chemistry for Engineers | 4 SH |
| with CHM U152 | Lab for CHM U151 | 1 SH |

CALCULUS 1 AND 2 FOR SCIENCE AND ENGINEERING

Complete the following two courses:

| | | |
|----------|--|------|
| MTH U241 | Calculus 1 for Science and Engineering | 4 SH |
| MTH U242 | Calculus 2 for Science and Engineering | 4 SH |

DIFFERENTIAL EQUATIONS AND LINEAR ALGEBRA

Complete the following course:

| | | |
|----------|---|------|
| MTH U343 | Differential Equations and Linear Algebra for Engineering | 4 SH |
|----------|---|------|

CALCULUS 3 FOR SCIENCE AND ENGINEERING

Complete the following course:

| | | |
|----------|--|------|
| MTH U341 | Calculus 3 for Science and Engineering | 4 SH |
|----------|--|------|

ECONOMICS

Complete one of these courses:

| | | |
|-------------|------------------------------|------|
| ECN U115 | Principles of Macroeconomics | 4 SH |
| or ECN U116 | Principles of Microeconomics | 4 SH |

MATH AND SCIENCE ELECTIVES

Complete one course from the following list with corresponding labs as applicable:

| | | |
|---------------|-------------------------------------|------|
| BIO U121 | Basic Microbiology | 4 SH |
| BIO U151 | Introduction to Marine Biology | 4 SH |
| CHM U311 | Organic Chemistry 1 | 4 SH |
| with CHM U312 | Lab for CHM U311 | 1 SH |
| CHM U321 | Analytical Chemistry | 4 SH |
| with CHM U322 | Lab for CHM U321 | 1 SH |
| CHM U401 | Physical Chemistry 1 | 4 SH |
| with CHM U402 | Lab for CHM U401 | 1 SH |
| GEO U400 | Field Geology | 4 SH |
| GEO U410 | Geochemistry | 4 SH |
| GEO U418 | Geophysics | 4 SH |
| GEO U520 | Applied Hydrogeology | 4 SH |
| GEO U582 | Groundwater Geochemistry | 4 SH |
| MIM U380 | Thermodynamics | 4 SH |
| MIM U455 | Dynamics and Vibrations | 4 SH |
| MIM U515 | Operations Research | 4 SH |
| MTH U581 | Statistics and Stochastic Processes | 4 SH |

Arts and Humanities

Complete two courses from the “College of Engineering Arts and Humanities Requirements” on page 178.

CIVIL ENGINEERING MAJOR REQUIREMENTS**First-Year Engineering**

Complete the following two courses:

| | | |
|---------|---|------|
| GE U110 | Engineering Design | 4 SH |
| GE U111 | Engineering Problem Solving and Computation | 4 SH |

General Engineering

Complete the following three courses:

| | | |
|------------|---|------|
| GE U100 | Introduction to the Study of Engineering | 1 SH |
| CIV U300 | Introduction to Engineering Co-op Education | 1 SH |
| or GE U300 | Introduction to Engineering Co-op Education | 1 SH |
| CIV U500 | Professional Issues in Engineering | 1 SH |
| or GE U500 | Professional Issues in Engineering | 1 SH |

Materials

Complete the following three courses:

| | | |
|----------|-----------------------------------|------|
| CIV U221 | Statics and Strength of Materials | 4 SH |
| CIV U260 | Civil Engineering Materials | 3 SH |
| CIV U261 | Materials and Measurements Lab | 2 SH |

Structural Analysis and Design

Complete the following two courses:

| | | |
|----------|----------------------------|------|
| CIV U320 | Structural Analysis 1 | 4 SH |
| CIV U324 | Reinforced Concrete Design | 4 SH |

Fluid Mechanics

Complete the following course:

| | | |
|----------|-----------------|------|
| CIV U331 | Fluid Mechanics | 4 SH |
|----------|-----------------|------|

Environmental Engineering and Soil Mechanics

Complete the following two courses and corresponding lab:

| | | |
|---------------|-----------------------------|------|
| CIV U334 | Environmental Engineering 1 | 4 SH |
| CIV U340 | Soil Mechanics | 4 SH |
| with CIV U341 | Lab for CIV U340 | 1 SH |

Probability and Engineering Economy

Complete the following course:

| | | |
|----------|---|------|
| CIV U464 | Probability and Engineering Economy for Civil Engineering | 4 SH |
|----------|---|------|

Civil Engineering Technical Electives

Complete three courses from the following list:

| | | |
|---------------|---------------------------------|------|
| CIV U425 | Steel Design | 4 SH |
| CIV U522 | Structural Analysis 2 | 4 SH |
| CIV U534 | Environmental Engineering 2 | 3 SH |
| with CIV U535 | Lab for CIV U534 | 1 SH |
| CIV U542 | Foundation Engineering | 4 SH |
| CIV U553 | Transport Analysis and Planning | 4 SH |
| CIV U556 | Traffic Engineering | 4 SH |
| CIV U575 | Construction Management | 3 SH |

Civil Engineering Project Elective

Complete one of these courses:

| | | |
|----------|------------------------|------|
| CIV U536 | Hydrologic Engineering | 4 SH |
| CIV U554 | Highway Engineering | 4 SH |

Capstone

Complete the following course:

| | | |
|----------|-----------------------|------|
| CIV U769 | Senior Design Project | 5 SH |
|----------|-----------------------|------|

CIVIL ENGINEERING GENERAL ELECTIVE REQUIREMENTS

Complete four 4-SH-equivalent, nonremedial, nonrepetitive courses from the following list:

| | | |
|----------|--------------------------|------|
| CBA U101 | Introduction to Business | 4 SH |
|----------|--------------------------|------|

or any courses from the following departments: ACC, AFR, ARC, ART, ASL, BIO, CHE, CHM, CIN, CIV, CJ, CMN, CS, ECE, ECN, ED, ENG, ENT, ENV, FIN, GEO, HRM, HS, HST, IAF, INB, INT, IS, JRN, LIN, LNA, LNC, LNF, LNG, LNH, LNI, LNJ, LNL, LNM, LNR, LNS, MGT, MIM, MKT, MMS, MSC, MTH, MUS, PHL, PHY, POL, PSY, SCM, SOA, SOC, or THE.

GPA REQUIREMENT

Minimum 2.000 GPA required in the major

GENERAL ELECTIVES

Additional courses taken beyond college and major course requirements to satisfy graduation credit requirements.

COOPERATIVE EDUCATION**UNIVERSITY-WIDE REQUIREMENTS**

136 total semester hours required

Minimum 2.000 GPA required

ELECTRICAL AND COMPUTER ENGINEERING

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FABRIZIO LOMBARDI, PhD

ITC Professor and Chair

WILLIAM LINCOLN SMITH PROFESSOR OF ELECTRICAL AND COMPUTER ENGINEERING

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The Department of Electrical and Computer Engineering offers two distinct Bachelor of Science programs: Bachelor of Science in electrical engineering (BSEE) and Bachelor of Science in computer engineering (BSCompE). An integrated dual major is available in electrical and computer engineering for students who complete the requirements of both majors. In addition, a minor in electrical engineering, a minor in computer engineering, and a minor in biomedical engineering are available to qualified students throughout the University, including majors within the department.

Successful engineers need to organize and adapt information to solve problems. They also must work effectively in teams and communicate well. The electrical engineering and computer engineering programs develop these skills and provide the appropriate technical background for a successful career. The objectives of the Bachelor of Science programs are that every student will develop and apply in an engineering context, (1) mathematical, scientific, computational, and experiential knowledge and skills; (2) the technical skills necessary for engineering practice; (3) the communications and interpersonal skills necessary as engineering professionals; (4) a personal and professional ethic appropriate to the practice of engineering; and (5) an awareness of the social, cultural, and historical context of engineering solutions.

The curricula are continuously assessed to ensure that graduates can achieve these goals and go on to succeed as professional electrical or computer engineers. The Bachelor of Science programs allow students sufficient flexibility within the standard eight academic semesters to earn a minor in nearly any department in the University. Typical minors might include electrical engineering, computer engineering, physics, math, computer science, or business, but students might also organize their course of study to earn a minor in economics, English, or music.