

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

www.ece.neu.edu

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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.

The academic program is supported by extensive laboratory facilities for study and experimentation in computing, circuits analysis, electronics, digital systems, microwaves, control systems, semiconductor processing, VLSI design, and digital signal processing. Students have access to state-of-the-art computing facilities, including numerous UNIX-based Sun and Compaq workstations, and Windows-based personal computers, all connected to the Internet. Many courses are taught in one of the four computer-based teaching classrooms, where students work online and practice the theory presented in lecture while still in the classroom.

More than 90 percent of department undergraduates take advantage of the cooperative education program. During the cooperative work phase of the program, the students' levels of responsibility grow as they gain theoretical and technical knowledge through academic work. A sophomore might begin cooperative work experience as an engineering assistant and progress by the senior year to a position with responsibilities similar to those of entry-level engineers.

A senior-year design course caps the education by drawing on everything learned previously. Teams of students propose, design, and build a functioning electrical or computer engineering system—just as they might in actual practice.

Electrical Engineering

The components of the Information Age—global communication systems, computers and computer chips, and the software that runs them, as well as pacemakers, magnetic resonance imaging, and interplanetary space missions—are possible because of the efforts of electrical engineers. Today, electrical engineers are developing concepts and working to translate these ideas into the next generation of products, from computers and safe, energy-efficient vehicles, to radar that can detect unexploded land mines from the air, to microrobots that diagnose disease from inside the body.

Many electrical engineers work in the traditional areas of communications, computation, and control, and components required to realize such systems. They are involved in design and product development, testing and quality control, sales and marketing, and manufacturing. Others use their problem-solving skills in diverse areas such as bioengineering, health care, electronic music, meteorology, and experimental psychology. Some graduates draw on their electrical engineering backgrounds to launch successful careers as physicians, financial analysts, attorneys, and entrepreneurs.

As specified below, the BSEE degree requires a sequence of core courses and advanced study in one or more technical elective areas: electronic circuits and devices; signals and systems; fields, waves, and optics; power engineering; or computer engineering. Electives in historical perspective, social/cultural perspective, and social science/humanities are also required. See pages 267–273 for course descriptions.

BSEE—Bachelor of Science in Electrical Engineering

ENGLISH REQUIREMENT

Complete the following course:

ENG U111	College Writing	4 SH
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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.

ELECTRICAL ENGINEERING GENERAL EDUCATION

Mathematics and Science

CALCULUS 1 AND 2 FOR SCIENCE/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

PHYSICS 1 AND 2

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

DIFFERENTIAL EQUATIONS AND LINEAR ALGEBRA

Complete the following course:

MTH U343	Differential Equations and Linear Algebra for Engineering	4 SH
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CALCULUS 3 FOR SCIENCE AND ENGINEERING

Complete the following course:

MTH U341	Calculus 3 for Science and Engineering	4 SH
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ALGORITHMS AND DATA STRUCTURES

Complete the following course and corresponding lab:

CS U215	Algorithms and Data Structures for Engineering	4 SH
with CS U216	Lab for CS U215	1 SH

Arts and Humanities

Complete two courses from the “College of Engineering Arts and Humanities Requirements” on page 178. Also, choose one additional humanities/social science elective from the following departments: ARC, ART, CJ, ECN, ENG, MUS, PHL, POL, PSY, SOC, or THE.

ELECTRICAL 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
ECE U300	Introduction to Engineering Co-op Education	1 SH
ECE U500	Professional Issues in Engineering	1 SH

Electrical Engineering Lab

Complete the following course:

ECE U401	Introduction to Electrical and Computer Engineering Lab	1 SH
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Linear Circuits

Complete the following course:

ECE U400	Linear Circuits	4 SH
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Electronics

Complete the following course and corresponding lab:

ECE U402	Electronics	4 SH
	with ECE U403 Lab for ECE U402	1 SH

Digital Logic Design

Complete the following course and corresponding lab:

ECE U322	Digital Logic Design	4 SH
	with ECE U323 Lab for ECE U322	1 SH

Linear Systems

Complete the following course:

ECE U464	Linear Systems	4 SH
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Electromagnetic Fields and Waves

Complete the following course and corresponding lab:

ECE U440	Electromagnetic Fields and Waves	4 SH
	with ECE U441 Lab for ECE U440	1 SH

Noise and Stochastic Processes

Complete the following course:

ECE U468	Noise and Stochastic Processes	4 SH
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Communication Systems

Complete the following course:

ECE U572	Communications Systems 1	4 SH
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Electrical Engineering Technical Electives

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

ECE U300 to ECE U699

Capstone Design

Complete the following two courses:

ECE U790	Electrical and Computer Engineering Capstone 1	4 SH
ECE U792	Electrical and Computer Engineering Capstone 2	4 SH

ELECTRICAL ENGINEERING GENERAL ELECTIVE REQUIREMENTS

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

CBA U101	Introduction to Business	4 SH
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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**

138 total semester hours required

Minimum 2.000 GPA required

Minor in Electrical Engineering

A minor in electrical engineering is open to all students in the University with the prerequisite calculus and physics background. The minor is particularly designed for majors in math, science, computer engineering, or other engineering departments, students who would like a coherent background in the theory and laboratory practice of electrical engineering. The completion of a minor in electrical engineering will be recognized by a notation on the student's transcript.

Minor in Electrical Engineering**REQUIRED COURSE**

Complete one of the following courses with corresponding lab:

ECE U210	Electrical Engineering	4 SH
	with ECE U211 Lab for ECE U210	1 SH
ECE U400	Linear Circuits	4 SH
	with ECE U401 Introduction to Electrical and Computer Engineering Lab	1 SH

ELECTIVE COURSES

Complete two of the following courses with corresponding labs:

ECE U322	Digital Logic Design	4 SH
	with ECE U323 Lab for ECE U322	1 SH
ECE U402	Electronics	4 SH
	with ECE U403 Lab for ECE U402	1 SH
ECE U440	Electromagnetic Fields and Waves	4 SH
	with ECE U441 Lab for ECE U440	1 SH

TECHNICAL ELECTIVES

Complete 5 semester hours of electrical engineering technical electives.

GPA REQUIREMENT

2.000 GPA required in the minor

Computer Engineering

The use of computer technology is exploding, driven by applications in wireless communications, multimedia, portable devices, and Internet computing. At the core of these technological advances are computer engineers who research, design, and develop hardware and software. With a degree in computer engineering you might develop an e-business Web site, design the next-generation microprocessor, write an embedded real-time operating system, or start your own software company.

The computer engineering major acquires a strong foundation in engineering principles and the physical sciences in addition to a powerful mix of theory and practice in hardware and software design. The core of the computer engineering curriculum comprises courses in computer organization and architecture, operating systems, computer-aided design, programming languages, optimization theory, and software design.

As specified below, the BSCompE degree requires a sequence of core courses, technical electives, general (free) electives, and electives in historical perspective, social/cultural perspective, and social science/humanities. See pages 267–273 for course descriptions.

BSCompE—Bachelor of Science in Computer Engineering

ENGLISH REQUIREMENT

Complete the following course:

ENG U111	College Writing	4 SH
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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.

COMPUTER ENGINEERING GENERAL EDUCATION

Mathematics and Science

PHYSICS 1 AND 2

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
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DISCRETE MATHEMATICS

Complete the following course:

MTH U230	Discrete Mathematics	4 SH
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PROBABILITY AND STATISTICS

Complete the following course:

MTH U481	Probability and Statistics	4 SH
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ALGORITHMS AND DATA STRUCTURES

Complete the following course and corresponding lab:

CS U215	Algorithms and Data Structures for Engineering	4 SH
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with CS U216	Lab for CS U215	1 SH
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Arts and Humanities

Complete two courses from the “College of Engineering Arts and Humanities Requirements” on page 178. Also, choose one additional humanities/social science elective from the following departments: ARC, ART, CJ, ECN, ENG, MUS, PHL, POL, PSY, SOC, or THE.

COMPUTER 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
ECE U300	Introduction to Engineering Co-op Education	1 SH
ECE U500	Professional Issues in Engineering	1 SH

Electrical Engineering Lab

Complete the following course:

ECE U401	Introduction to Electrical and Computer Engineering Lab	1 SH
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Linear Circuits

Complete the following course:

ECE U400	Linear Circuits	4 SH
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Electronics

Complete the following course and corresponding lab:

ECE U402	Electronics	4 SH
with ECE U403	Lab for ECE U402	1 SH

Digital Logic Design

Complete the following course and corresponding lab:

ECE U322	Digital Logic Design	4 SH
with ECE U323	Lab for ECE U322	1 SH

Computer Architecture/Organization

Complete the following course:

ECE U324 Computer Architecture and Organization 4 SH

Optimization Methods

Complete the following course:

ECE U326 Optimization Methods 4 SH

Computer Networks

Complete the following course and corresponding lab:

ECE U628 Computer and Telecommunication Networks 4 SH

with ECE U629 Internetworking Design Lab 1 SH

Computer Engineering Technical Electives

Complete four 4-SH-equivalent courses from the following list.

Only one course may be from computer science:

ECE U300 to ECE U699

CS U370 Object-Oriented Design 4 SH

CS U390 Theory of Computation 4 SH

CS U430 Database Design 4 SH

CS U480 Systems and Networks 4 SH

CS U520 Artificial Intelligence 4 SH

CS U540 Computer Graphics 4 SH

CS U660 Programming Languages 4 SH

CS U665 Compilers 4 SH

CS U680 Topics in Operating Systems 4 SH

Capstone Design

Complete the following two courses:

ECE U790 Electrical and Computer Engineering Capstone 1 4 SH

ECE U792 Electrical and Computer Engineering Capstone 2 4 SH

COMPUTER 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**

137 total semester hours required

Minimum 2.000 GPA required

Minor in Computer Engineering

The minor in computer engineering is open to all students in the University. The minor is designed for students who would like a coherent background in the theory and laboratory practice of computer engineering. The completion of a minor in computer engineering will be recognized by a notation on the student's transcript.

Minor in Computer Engineering**REQUIRED COURSES**

Complete the following three courses with two corresponding labs:

CS U215 Algorithms and Data Structures for Engineering 4 SH

with CS U216 Lab for CS U215 1 SH

ECE U322 Digital Logic Design 4 SH

with ECE U323 Lab for ECE U322 1 SH

ECE U324 Computer Architecture and Organization 4 SH

ELECTIVES

Complete 4 semester hours of computer engineering technical electives.

GPA REQUIREMENT

2.000 GPA required in the minor

Minor in Biomedical Engineering

Medical imaging and biomedical electronics are important areas of biomedical engineering that are within the province of electrical engineering. The minor in biomedical engineering is open to all students in the University with the prerequisite calculus and physics background. The minor is particularly designed for majors in electrical or computer engineering, biology, health science fields, or other engineering departments who would like a background in relevant aspects of biology and electrical engineering, with the opportunity to complete an interdisciplinary biomedical engineering (capstone) design project. Course work in anatomy and physiology and other health science topics is combined with technical engineering courses related to biomedical imaging and instrumentation. Specific curriculum information about the biomedical engineering minor may be obtained from the Department of Electrical and Computer Engineering office, 411 Dana, from the department Web site, or by calling 617.373.2165.

Minor in Biomedical Engineering**REQUIRED ECE COURSES**

Complete the following three courses:

ECE U401 Introduction to Electrical and Computer Engineering Lab 1 SH

ECE U790 Electrical and Computer Engineering Capstone 1 4 SH

ECE U792 Electrical and Computer Engineering Capstone 2 4 SH

BIOMEDICAL ECE COURSE

Complete one course from the following list:

ECE U512	Biomedical Electronics	4 SH
or ECE U664	Biomedical Signal Processing and Medical Imaging	4 SH

TECHNICAL ELECTIVE

Complete one technical elective from the following list:

ECE U520	Software Engineering 1	4 SH
ECE U522	Software Engineering 2	4 SH
ECE U524	VLSI Design	4 SH
with ECE U525	Lab for ECE U524	1 SH
ECE U528	CAD for Design and Test	4 SH
ECE U530	Hardware Description Languages and Synthesis	4 SH
ECE U534	Microprocessor-Based Design	4 SH
with ECE U535	Lab for ECE U534	1 SH
ECE U574	Wireless Communication Circuits	4 SH
ECE U576	Wireless Personal Communications Systems	4 SH
ECE U580	Control Systems	4 SH
with ECE U581	Lab for ECE U580	1 SH
ECE U600	Electronic Design	4 SH
with ECE U601	Lab for ECE U600	1 SH
ECE U604	Semiconductor Device Theory	4 SH
ECE U606	Integrated Circuit Fabrication	4 SH
ECE U622	Parallel and Distributed Processing	4 SH
ECE U626	Image Processing and Pattern Recognition	4 SH
ECE U628	Computer and Telecommunication Networks	4 SH
with ECE U629	Internetworking Design Lab	1 SH
ECE U630	Robotics	4 SH
ECE U638	Special Topics in Computer Engineering	4 SH
ECE U642	Antennas	4 SH
ECE U644	Microwave Networks	4 SH
ECE U646	Optics	4 SH
ECE U666	Digital Signal Processing	4 SH
with ECE U667	Lab for ECE U666	1 SH
ECE U672	Communication Systems 2	4 SH
ECE U680	Electric Drives	4 SH
ECE U682	Power Systems Analysis	4 SH
with ECE U683	Power Systems Lab	1 SH
ECE U684	Power Electronics	4 SH
ECE U686	Electrical Machines	4 SH
ECE U692	Subsurface Sensing and Imaging	4 SH
ECE U694	Numerical Methods and Computer Applications	4 SH

REQUIRED BIOLOGY

Take one of the following groups of courses:

Anatomy and Physiology

BIO U117	Integrated Anatomy and Physiology 1	4 SH
with BIO U118	Lab for BIO U117	1 SH
BIO U119	Integrated Anatomy and Physiology 2	4 SH
with BIO U120	Lab for BIO U119	1 SH

Animal Physiology

BIO U551	Principles of Animal Physiology	4 SH
with BIO U552	Lab for BIO U551	1 SH

GPA REQUIREMENT

2.000 GPA required in the minor

Integrated Dual Major in Electrical and Computer Engineering

Students may choose to major in both electrical and computer engineering by following the integrated dual-major program. Students take the required courses for both majors along with technical electives distributed among the areas of computer engineering; fields, waves, and optics; signals and systems; power engineering; and electronic circuits and devices.

BSEE Bachelor of Science in Electrical/Computer Engineering**ENGLISH REQUIREMENT**

Complete the following course:

ENG U111	College Writing	4 SH
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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.

DUAL ELECTRICAL/COMPUTER ENGINEERING GENERAL EDUCATION**Mathematics and Science****PHYSICS 1 AND 2**

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

DISCRETE MATHEMATICS

Complete the following course:

MTH U230	Discrete Mathematics	4 SH
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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

ALGORITHMS AND DATA STRUCTURES

Complete the following course and corresponding lab:

CS U215 Algorithms and Data Structures 4 SH
for Engineering

with CS U216 Lab for CS U215 1 SH

Arts and Humanities

Complete two courses from the “College of Engineering Arts and Humanities Requirements” on page 178. Also, choose one additional humanities/social science elective from the following departments: ARC, ART, CJ, ECN, ENG, MUS, PHL, POL, PSY, SOC, or THE.

ELECTRICAL/COMPUTER 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

ECE U300 Introduction to Engineering Co-op 1 SH
Education

ECE U500 Professional Issues in Engineering 1 SH

Electrical Engineering Lab

Complete the following course:

ECE U401 Introduction to Electrical and Computer 1 SH
Engineering Lab

Linear Circuits

Complete the following course:

ECE U400 Linear Circuits 4 SH

Electronics

Complete the following course and corresponding lab:

ECE U402 Electronics 4 SH

with ECE U403 Lab for ECE U402 1 SH

Digital Logic Design

Complete the following course and corresponding lab:

ECE U322 Digital Logic Design 4 SH

with ECE U323 Lab for ECE U322 1 SH

Linear Systems

Complete the following course:

ECE U464 Linear Systems 4 SH

Electromagnetic Fields and Waves

Complete the following course and corresponding lab:

ECE U440 Electromagnetic Fields and Waves 4 SH
with ECE U441 Lab for ECE U440 1 SH

Computer Architecture/Organization

Complete the following course:

ECE U324 Computer Architecture and Organization 4 SH

Optimization Methods

Complete the following course:

ECE U326 Optimization Methods 4 SH

Computer Networks

Complete the following course and corresponding lab:

ECE U628 Computer and Telecommunication 4 SH
Networks

with ECE U629 Internetworking Design Lab 1 SH

Noise and Stochastic Processes

Complete the following course:

ECE U468 Noise and Stochastic Processes 4 SH

Communication Systems

Complete the following course:

ECE U572 Communications Systems 1 4 SH

Dual Electrical/Computer Engineering Technical Electives

Complete four 4-SH-equivalent courses from the following list.

Only one course may be from computer science:

ECE U300 to ECE U699

CS U370 Object-Oriented Design 4 SH

CS U390 Theory of Computation 4 SH

CS U430 Database Design 4 SH

CS U480 Systems and Networks 4 SH

CS U520 Artificial Intelligence 4 SH

CS U540 Computer Graphics 4 SH

CS U660 Programming Languages 4 SH

CS U665 Compilers 4 SH

CS U680 Topics in Operating Systems 4 SH

Capstone Design

Complete the following two courses:

ECE U790 Electrical and Computer Engineering 4 SH
Capstone 1

ECE U792 Electrical and Computer Engineering 4 SH
Capstone 2

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**

139 total semester hours required

Minimum 2.000 GPA required

MECHANICAL AND INDUSTRIAL ENGINEERING

www.coe.neu.edu/Depts/MIME

MOHAMAD METGHALCHI, ScD

Professor and Interim Chair

**WILLIAM LINCOLN SMITH PROFESSOR
OF MECHANICAL ENGINEERING**

Ahmed A. Busnaina, PhD

**DONALD W. SMITH PROFESSOR
OF MECHANICAL ENGINEERING**

John W. Cipolla Jr., PhD

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Surendra M. Gupta, PhD

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Hamid Nayeb-Hashemi, PhD

John N. Rossettos, PhD

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Yaman Yener, PhD

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Emanuel S. Melachrinoudis, PhD

Sinan Muftu, PhD

Uichiro Narusawa, PhD

Ronald F. Perry, PhD

ASSISTANT PROFESSORS

James C. Benneyan, PhD

Grant Warner, PhD

**SENIOR RESEARCH SCIENTIST
AND PROFESSOR EMERITUS**

Welville B. Nowak, PhD

PROFESSORS EMERITI

Alexander M. Gorlov, PhD

Thomas E. Hulbert, MS

Richard J. Murphy, PhD

The Department of Mechanical and Industrial Engineering offers two accredited programs leading to a Bachelor of Science in industrial engineering or a Bachelor of Science in mechanical engineering.

The overarching mission of the department is to organize the faculty, staff, curricula, facilities, and research programs to provide the highest-quality education for our students. At the undergraduate level, our goal is to provide rigorous, theoretically based but practice-oriented programs that effectively integrate classroom and laboratory instruction with the cooperative work experience. The educational objectives for both of our undergraduate degree programs are to: (1) educate students through a broad, theoretically based mechanical or industrial engineering curriculum; (2) support students in developing practical work skills involving current technology and technical tools, as well as an awareness of manufacturing, management and economic issues, and commonly accepted norms for professional conduct; (3) integrate academic learning with practice-oriented experience to promote professional development and career planning; (4) provide students with learning experiences that instill a passion for lifelong learning; (5) involve students in leadership and contributing roles in interactive team environments; (6) instruct students to be effective communicators with good interpersonal skills; and (7) integrate students' engineering course work with industrial, ethical, cultural, historical, and societal perspectives, leading to an appreciation of the broad educational objectives (as specified in the University's Academic Common Experience [ACE] goals).

Mechanical engineers will achieve the ability to work professionally in both thermal and mechanical systems areas, including the design and realization of such systems. Industrial engineers will demonstrate the ability to design, analyze, improve, and optimize integrated systems that include people, materials, information, equipment, and energy.

Industrial Engineering

Industrial engineering involves the design and analysis of systems that include people, equipment, and materials and their interactions and performance in the workplace. The industrial engineer collects this information and evaluates alternatives to make decisions that best advance the goals of the enterprise.

The program in industrial engineering offers students a base of traditional engineering courses such as production systems, work design, probability, statistics, and engineering economy, while emphasizing such contemporary areas as simulation, material handling, computer software, quality control, and operations research.

To gain the skills they need to make informed managerial and professional decisions, students take courses in management, economics, and technical subjects, as well as in the humanities and social sciences.

Industrial engineers work in manufacturing firms, hospitals, banks, public utilities, government agencies, insurance companies, and construction firms. Among the projects they undertake are design and implementation of a computer-integrated manufacturing system, design of a robotics system in a manufacturing environment, long-range corporate planning, development and implementation of a quality-control system, design of workstations to enhance worker safety and productivity, and development of computer systems for information control.

Co-op jobs generally increase in level of responsibility as students gain theoretical and technical knowledge through their academic work. A sophomore might begin as a computer analyst evaluating the performance of a manufacturing system and progress to designing manufacturing engineering workstations by the senior year. See pages 346–351 for course descriptions.

BSIE—Bachelor of Science in Industrial 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.

INDUSTRIAL 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 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.

INDUSTRIAL 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

MIM U300 Introduction to Engineering Co-op 1 SH
Education

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

MIM U500 Professional Issues in Engineering 1 SH

or GE U500 Professional Issues in Engineering 1 SH

Industrial Engineering Fundamentals

Complete the following two courses:

MIM U310 Introduction to Industrial Engineering 4 SH

MIM U412 Engineering Probability and Statistics 4 SH

Information and Technology

Complete the following two courses:

MIM U420 Computers and Information Systems 4 SH

MIM U425 Engineering Database Systems 4 SH

Advanced Industrial Engineering

Complete the following eight courses with corresponding labs:

MIM U510 Digital Simulation Techniques 4 SH

MIM U512 Engineering Economy 4 SH

MIM U515 Operations Research 4 SH

MIM U516 Quality Assurance 4 SH

MIM U520 Stochastic Modeling 4 SH

MIM U522 Human Machine Systems 4 SH

with MIM U523 Lab for MIM U522 1 SH

MIM U525 Logistics and Supply Chain 4 SH
Management

MIM U530 Manufacturing Systems 4 SH
and Techniques

with MIM U531 Lab for MIM U530 1 SH

Engineering Science/Design Electives

Complete two science/design engineering courses. See adviser for an approved list.

Capstone

Complete the following two courses:

MIM U701 Capstone Design 1 1 SH

MIM U702 Capstone Design 2 5 SH

INDUSTRIAL 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**

138 total semester hours required

Minimum 2.000 GPA required

Minor in Industrial Engineering**REQUIRED COURSES**

Complete the following three courses:

MIM U310	Introduction to Industrial Engineering	4 SH
MIM U412	Engineering Probability and Statistics	4 SH
or MIM U522	Human Machine Systems	4 SH
MIM U515	Operations Research	4 SH

TECHNICAL ELECTIVE

Complete from the following list one course not already taken as a requirement:

MIM U412	Engineering Probability and Statistics	4 SH
MIM U420	Computers and Information Systems	4 SH
MIM U425	Engineering Database Systems	4 SH
MIM U510	Digital Simulation Techniques	4 SH
MIM U512	Engineering Economy	4 SH
MIM U516	Quality Assurance	4 SH
MIM U520	Stochastic Modeling	4 SH
MIM U522	Human Machine Systems	4 SH
MIM U525	Logistics and Supply Chain Management	4 SH
MIM U530	Manufacturing Systems and Techniques	4 SH

GPA REQUIREMENT

2.000 GPA required in the minor

Mechanical Engineering

Mechanical engineering involves the design, development, and manufacture of machinery and devices to transmit power or to convert energy from thermal to mechanical form in order to power the modern world and its machines. Its current practice has been heavily influenced by recent advances in computer hardware and software.

Mechanical engineers use computers to formulate preliminary and final designs of systems or devices, to perform calculations that predict the behavior of the design, and to collect and analyze performance data from system testing or operation.

Traditionally, mechanical engineers have designed and tested such devices as heating and air-conditioning systems, machine tools, internal-combustion engines, and steam power plants. Today they also play primary roles in the development of new technologies in a variety of fields—energy conversion, solar energy utilization, environmental control, prosthetics, transportation, manufacturing, and new materials development.

The curriculum in mechanical engineering focuses on three areas: applied mechanics, thermofluids engineering, and materials science. Applied mechanics is the study of the motion and deformation of structural elements acted on by forces in devices that range from rotating industrial dynamos to dentists' drills. Thermofluids engineering deals with the motion of fluids and the transfer of energy, as in the cooling of electronic components or the design of gas turbine engines. Materials science is concerned with the relationship between the structure and properties of materials and with the control of structure, through processing, to achieve the desired properties. Practical applications are in the development of composite materials and in metallurgical process industries.

Courses in each area form the foundation for advanced analytical and creative design courses that culminate in a two-semester capstone design project. Faculty encourage students throughout the curriculum to use computer-aided design tools and high-performance computer workstations.

Cooperative education assignments increase in responsibility and technical challenge as students progress through the program. Initial positions may involve computer-intensive CAD/CAM assignments or programming tasks, while more advanced jobs will place students in charge of quality-control systems and performance testing of equipment. See pages 346–351 for course descriptions.

BSME—Bachelor of Science in Mechanical Engineering**ENGLISH REQUIREMENT**

Complete the following course:

ENG U111	College Writing	4 SH
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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.

MECHANICAL 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 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.

MECHANICAL 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

MIM U300 Introduction to Engineering Co-op 1 SH
Education

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

MIM U500 Professional Issues in Engineering 1 SH

or GE U500 Professional Issues in Engineering 1 SH

Electrical Engineering

Complete the following course and corresponding lab:

ECE U210 Electrical Engineering 4 SH

with ECE U211 Lab for ECE U210 1 SH

Mechanical Engineering Fundamentals

Complete the following five courses and corresponding labs:

MIM U315 Statistical and Economical Analyses 4 SH
in Engineering

MIM U340 Introduction to Material Science 4 SH

with MIM U341 Lab for MIM U340 1 SH

MIM U350 Engineering Mechanics and Design 4 SH

MIM U355 Mechanics of Materials 4 SH

with MIM U356 Lab for MIM U355 1 SH

MIM U380 Thermodynamics 4 SH

Advanced Mechanical Engineering

Complete the following seven courses and corresponding labs:

MIM U455 Dynamics and Vibrations 4 SH

with MIM U456 Lab for MIM U455 1 SH

MIM U475 Fluid Mechanics 4 SH

MIM U505 Measurement and Analysis 4 SH

with Thermal Science Application

with MIM U506 Lab for MIM U505 1 SH

MIM U508 Mechanical Engineering Computation 4 SH
and Design

MIM U550 Mechanical Engineering Design 4 SH

MIM U555 System Analysis and Control 4 SH

MIM U570 Thermal Systems Analysis and Design 4 SH

Information Technology

Complete one course from the following list:

MIM U420 Computers and Information Systems 4 SH

MIM U425 Engineering Database Systems 4 SH

MIM U430 Object-Oriented Engineering Applications 4 SH

MIM U660 Computer-Aided Design 4 SH

Capstone

Complete the following two courses:

MIM U701 Capstone Design 1 1 SH

MIM U702 Capstone Design 2 5 SH

MECHANICAL 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