

**ELECTRICAL AND COMPUTER ENGINEERING****www.ece.neu.edu**

ALI ABUR, PhD  
*Professor and Chair*

---

**WILLIAM LINCOLN SMITH PROFESSOR OF ELECTRICAL AND COMPUTER ENGINEERING**  
 Vincent Harris, PhD

**ROBERT BLACK PROFESSOR OF ENGINEERING AND COLLEGE OF ENGINEERING DISTINGUISHED PROFESSOR**  
 Michael B. Silevitch, PhD

**INTERNATIONAL TEST CONFERENCE PROFESSOR**  
 Fabrizio Lombardi, PhD

**COLLEGE OF ENGINEERING DISTINGUISHED PROFESSORS**  
 Anthony J. Devaney, PhD  
 Carmine Vittoria, PhD

**DENNIS PICARD TRUSTEE PROFESSOR**  
 Mario Sznaier, PhD

**PROFESSORS**  
 Octavia Camps, PhD  
 David R. Kaeli, PhD  
 Hanoch Lev-Ari, PhD  
 Nicol E. McGruer, PhD  
 Stephen W. McKnight, PhD  
 Sarma S. Mulukutla, PhD  
 Carey M. Rappaport, ScD  
 Philip E. Serafim, ScD  
 Bahram Shafai, ScD  
 Aleksandar M. Stankovic, PhD  
 Gilead Tadmor, PhD

**ASSOCIATE PROFESSORS**  
 David P. Brady, PhD  
 Dana H. Brooks, PhD  
 Charles DiMarzio, PhD  
 Jeffrey A. Hopwood, PhD  
 Vinay K. Ingle, PhD  
 Mieczyslaw M. Kokar, PhD  
 Miriam E. Leaser, PhD  
 Bradley M. Lehman, PhD  
 Elias S. Manolakos, PhD  
 Waleed Meleis, PhD  
 Eric Miller, PhD  
 Masoud Salehi, PhD

**ASSISTANT PROFESSORS**  
 Stefano Basagni, PhD  
 Mehmet R. Dokmeci, PhD  
 Jennifer G. Dy, PhD

Yong-Bin Kim, PhD  
 Edwin Marengo, PhD  
 A. Bruce McDonald, PhD  
 Hossein Mosallaei, PhD  
 Demetrios P. Papageorgiou, PhD  
 Purmina Ratilal, PhD  
 Nian-Xiang Sun, PhD  
 Medhi Tahoori, PhD  
 Xinping Zhu, PhD

**LECTURERS**  
 Zainalebedin Navabi, PhD  
 Jacob Shekel, ScD

**PROFESSORS EMERITI**  
 Arvin Gabel, ScD  
 Sheila Prasad-Hinchey, PhD  
 John G. Proakis, PhD  
 Harold Raemer, PhD  
 Martin E. Schetzen, ScD

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 (BSCoPE). 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 be able to 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, circuit 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 Linux-based 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. See pages 319–325 for course descriptions.

## 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.

## BSEE—Bachelor of Science in Electrical Engineering

### MATHEMATICS/SCIENCE REQUIREMENT

Complete 35 semester hours in mathematics and science as indicated below.

#### Required Mathematics/Science

CHM U151	General Chemistry for Engineers	4 SH
MTH U241	Calculus 1 for Science and Engineering	4 SH
MTH U242	Calculus 2 for Science and Engineering	4 SH
MTH U341	Calculus 3 for Science and Engineering	4 SH
MTH U343	Differential Equations and Linear Algebra for Engineering	4 SH
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

#### Further Credit

2 semester hours from the following course count toward the mathematics/science requirement:

ECE U468	Noise and Stochastic Processes	4 SH
----------	--------------------------------	------

2 semester hours from the following lecture/lab combination count toward the mathematics/science requirement:

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

1 semester hour from the following course counts toward the mathematics/science requirement:

GE U111	Engineering Problem Solving and Computation	4 SH
---------	---	------

### ENGINEERING REQUIREMENT

Complete 59 semester hours in engineering as indicated below.

#### Required Engineering

ECE U322	Digital Logic Design	4 SH
with ECE U323	Lab for ECE U322	1 SH
ECE U400	Linear Circuits	4 SH
with ECE U401	Introduction to Electrical and Computer Engineering Lab	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
ECE U464	Linear Systems	4 SH
ECE U572	Communications Systems	4 SH
ECE U790	Electrical and Computer Engineering Capstone 1	4 SH
ECE U792	Electrical and Computer Engineering Capstone 2	4 SH

#### Electrical Engineering Technical Electives

Complete 16 semester hours from the following list:

ECE U301 to ECE U699

**Further Credit**

Three semester hours from the following course count toward the engineering requirement:

GE U110	Engineering Design	4 SH
---------	--------------------	------

Two semester hours from each of the following courses count toward the engineering requirement:

ECE U468	Noise and Stochastic Processes	4 SH
GE U111	Engineering Problem Solving and Computation	4 SH

**RESTRICTED ELECTIVES**

Complete four semester hours from the “Historical Perspective Elective” list in the “College of Engineering Arts, Humanities, and Social Sciences Electives” on page 228.

Complete four semester hours from the “Social/Cultural Perspective Elective” list in the “College of Engineering Arts, Humanities, and Social Sciences Electives” on page 228.

Complete four semester hours from the “Social Sciences/Humanities Elective” list in the “College of Engineering Arts, Humanities, and Social Sciences Electives” on page 229.

**GENERAL ELECTIVES**

Complete four 4-SH-equivalent academic, nonremedial, nonrepetitive courses.

**OTHER REQUIRED COURSE WORK**

Complete 16 semester hours as indicated below.

**Writing**

Complete the following two courses with a grade of C or higher in both courses:

ENG U111	College Writing	4 SH
ENG U302	Advanced Writing in the Technical Professions	4 SH

**Professional Development**

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

**Further Credit**

Three semester hours from the following lecture/lab combination count toward other required course work:

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

One semester hour from each of the following courses counts toward other required course work:

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

**RESIDENCY REQUIREMENT**

Thirty-two of your final 40 semester hours must be taken at Northeastern University.

**MAJOR GPA REQUIREMENT**

2.000 minimum 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 designed for students who would like a coherent background in the theory and laboratory practice of electrical engineering, particularly for majors in math, science, computer engineering, or other engineering departments. The completion of a minor in electrical engineering will be recognized by a notation on the student’s transcript.

**Minor in Electrical Engineering**

Students must file a petition with the coordinator of undergraduate services in 404 Dana to declare the minor prior to taking any course work.

A minimum of 20 semester hours of ECE courses is required.

**CORE COURSES**

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 CORE 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

**ELECTRICAL ENGINEERING TECHNICAL ELECTIVES**

Complete 5 semester hours of electrical engineering technical electives from the following list:

ECE U440	Electromagnetic Fields and Waves	4 SH
with ECE U441	Lab for ECE U440	1 SH
ECE U464	Linear Systems	4 SH
ECE U468	Noise and Stochastic Processes	4 SH
ECE U524	VLSI Design	4 SH
with ECE U525	Lab for ECE U524	1 SH
ECE U572	Communications Systems	4 SH
ECE U574	Wireless Communication Circuits	4 SH
ECE U576	Wireless Personal Communications Systems	4 SH

ECE U580	Classical 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 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 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

### 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 a full-featured multimedia phone, design the next-generation microprocessor, program computer-guided cameras to inspect nanomanufacturing facilities, 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, computer networks, 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.

### BSCompE—Bachelor of Science in Computer Engineering

#### MATHEMATICS/SCIENCE REQUIREMENT

Complete 37 semester hours in mathematics and science as indicated below.

##### Required Mathematics/Science

Complete each of the following courses:

CHM U151	General Chemistry for Engineers	4 SH
MTH U230	Discrete Mathematics	4 SH
MTH U241	Calculus 1 for Science and Engineering	4 SH
MTH U242	Calculus 2 for Science and Engineering	4 SH
MTH U343	Differential Equations and Linear Algebra for Engineering	4 SH

MTH U481	Probability and Statistics	4 SH
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

#### Further Credit

Two semester hours from the following lecture/lab combination count toward the mathematics/science requirement:

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

One semester hour from the following course counts toward the mathematics/science requirement:

GE U111	Engineering Problem Solving and Computation	4 SH
---------	---	------

### ENGINEERING

Complete 57 semester hours in engineering as indicated below.

#### Required Engineering

Complete each of the following courses:

ECE U322	Digital Logic Design	4 SH
with ECE U323	Lab for ECE U322	1 SH
ECE U324	Computer Architecture and Organization	4 SH
ECE U326	Optimization Methods	4 SH
ECE U400	Linear Circuits	4 SH
with ECE U401	Introduction to Electrical and Computer Engineering Lab	1 SH
ECE U402	Electronics	4 SH
with ECE U403	Lab for ECE U402	1 SH
ECE U628	Computer and Telecommunication Networks	4 SH
with ECE U629	Internetworking Design Lab	1 SH
ECE U790	Electrical and Computer Engineering Capstone 1	4 SH
ECE U792	Electrical and Computer Engineering Capstone 2	4 SH

#### Electrical and Computer Engineering Technical Electives

Complete 16 semester hours from the following list, of which at most four semester hours may be from the CS department:

ECE U301 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

#### Further Credit

Three semester hours from the following course count toward the engineering requirement:

GE U110	Engineering Design	4 SH
---------	--------------------	------

Two semester hours from the following course count toward the engineering requirement:

GE U111	Engineering Problem Solving and Computation	4 SH
---------	---	------

### RESTRICTED ELECTIVES

Complete four semester hours from the “Historical Perspective Elective” list in the “College of Engineering Arts, Humanities, and Social Sciences Electives” on page 228.

Complete four semester hours from the “Social/Cultural Perspective Elective” list in the “College of Engineering Arts, Humanities, and Social Sciences Electives” on page 228.

Complete four semester hours from the “Social Sciences/Humanities Elective” list in the “College of Engineering Arts, Humanities, and Social Sciences Electives” on page 229.

### GENERAL ELECTIVES

Complete four 4-SH-equivalent academic, nonremedial, non-repetitive courses.

### OTHER REQUIRED COURSE WORK

Complete 16 semester hours as indicated below.

#### Writing

Complete the following two courses with a grade of C or higher in both courses:

ENG U111	College Writing	4 SH
ENG U302	Advanced Writing in the Technical Professions	4 SH

#### Professional Development

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

#### Further Credit

One semester hour from each of the following courses counts toward other required course work:

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

Three semester hours from the following lecture/lab combination count toward other required course work:

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

### RESIDENCY REQUIREMENT

32 of your final 40 semester hours must be taken at Northeastern University.

### MAJOR GPA REQUIREMENT

2.000 minimum 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 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

Students must file a petition with the coordinator of undergraduate services in 404 Dana to declare the minor prior to taking any course work.  
A minimum of 18 semester hours is required.

### CORE COURSE

Complete the following course with corresponding lab:

CS U215	Algorithms and Data Structures for Engineering	4 SH
with CS U216	Lab for CS U215	1 SH
Computer science majors may substitute the following course with corresponding lab:		
CS U211	Fundamentals of Computer Science 1	4 SH
with CS U212	Lab for CS U211	1 SH

### MAJOR CORE COURSES

Complete the following two courses with corresponding labs:

ECE U322	Digital Logic Design	4 SH
with ECE U323	Lab for ECE U322	1 SH
ECE U324	Computer Architecture and Organization	4 SH

Computer science majors may substitute the following two courses for ECE U324:

CS U380	Computer Organization	4 SH
ECE U230	Computer Architecture for Computer Scientists	4 SH

### COMPUTER ENGINEERING TECHNICAL ELECTIVES

Complete four semester hours of course work from the following list (computer science majors should complete eight semester hours):

ECE U326	Optimization Methods	4 SH
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 U526	High-Speed Digital Design	4 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 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 U694	Numerical Methods and Computer Applications	4 SH

**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**

Students must file a petition with the coordinator of undergraduate services in 404 Dana to declare the minor prior to taking any course work.

A minimum of 26 semester hours is required.

**REQUIRED CORE COURSES**

Complete the following three courses and corresponding labs:

BIO U117	Integrated Anatomy and Physiology 1	4 SH
with BIO U118	Lab for BIO U117	1 SH
ECE U401	Introduction to Electrical and Computer Engineering Lab	1 SH
ECE U512	Biomedical Electronics	4 SH
or ECE U664	Biomedical Signal Processing and Medical Imaging	4 SH

**REQUIRED CAPSTONE-DESIGN COURSE**

Complete the following two courses on a biologically oriented project:

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

**ELECTIVE COURSES**

Complete eight semester hours of course work from the following list:

**Electrical Engineering**

ECE U210	Electrical Engineering	4 SH
----------	------------------------	------

**Biology**

BIO U119	Integrated Anatomy and Physiology 2	4 SH
with BIO U120	Lab for BIO U119	1 SH
BIO U319	Regulatory Cell Biology	4 SH
with BIO U320	Lab for BIO U319	1 SH
BIO U321	Microbiology	4 SH
with BIO U322	Lab for BIO U321	1 SH
BIO U551	Principles of Animal Physiology	4 SH
with BIO U552	Lab for BIO U551	1 SH
BIO U573	Medical Microbiology	4 SH
with BIO U574	Lab for BIO U573	1 SH
BIO U587	Comparative Neurobiology	4 SH

**Physics**

PHY U621	Biological Physics 1	4 SH
PHY U623	Medical Physics	4 SH
PHY U651	Medical Physics Seminar 1	4 SH

**Psychology**

PSY U452	Introduction to Sensation and Perception	4 SH
PSY U458	Psychobiology	4 SH

**Cardiopulmonary and Exercise Sciences**

CES U300	Cardiopulmonary Physiology and Pathophysiology	4 SH
CES U301	Cardiopulmonary Assessment	4 SH
CES U302	Cardiopulmonary Disease	4 SH
CES U500	Exercise Physiology 1	4 SH
with CES U501	Lab for CES U500	1 SH
CES U504	Clinical Kinesiology	4 SH
with CES U505	Lab for CES U504	1 SH
CES U508	Echocardiography	4 SH
with CES U509	Lab for CES U508	1 SH

**Physical Therapy**

PTH U308	Neuroscience	4 SH
with PTH U309	Lab for PTH U308	1 SH
PTH U400	Motor Control	3 SH

**Speech-Language Pathology and Audiology**

SLA U103	Anatomy and Physiology of the Vocal Mechanism	4 SH
SLA U202	Neurological Bases of Communication	4 SH
SLA U203	Introduction to Audiology	4 SH
SLA U205	Speech and Hearing Science	4 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 leading to a Bachelor of Science in Electrical Engineering or Bachelor of Science in Computer Engineering. 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 or BSCompE—Bachelor of Science in Electrical/Computer Engineering

### MATHEMATICS/SCIENCE REQUIREMENT

Complete 39 semester hours in mathematics and science as indicated below.

#### Required Mathematics/Science

Complete each of the following courses:

CHM U151	General Chemistry for Engineers	4 SH
MTH U230	Discrete Mathematics	4 SH
MTH U241	Calculus 1 for Science and Engineering	4 SH
MTH U242	Calculus 2 for Science and Engineering	4 SH
MTH U341	Calculus 3 for Science and Engineering	4 SH
MTH U343	Differential Equations and Linear Algebra for Engineering	4 SH
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

#### Further Credit

Two semester hours from the following lecture/lab combination count toward the mathematics/science requirement:

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

two semester hours from the following course count toward the mathematics/science requirement:

ECE U468	Noise and Stochastic Processes	4 SH
----------	--------------------------------	------

One semester hour from the following course counts toward the mathematics/science requirement:

GE U111	Engineering Problem Solving and Computation	4 SH
---------	---	------

### ENGINEERING REQUIREMENT

Complete 72 semester hours in engineering as indicated below.

#### Required Engineering

Complete each of the following courses:

ECE U322	Digital Logic Design	4 SH
with ECE U323	Lab for ECE U322	1 SH
ECE U324	Computer Architecture and Organization	4 SH
ECE U326	Optimization Methods	4 SH
ECE U400	Linear Circuits	4 SH
with ECE U401	Introduction to Electrical and Computer Engineering Lab	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

ECE U464	Linear Systems	4 SH
ECE U572	Communications Systems	4 SH
ECE U628	Computer and Telecommunication Networks	4 SH
with ECE U629	Internetworking Design Lab	1 SH
ECE U790	Electrical and Computer Engineering Capstone 1	4 SH
ECE U792	Electrical and Computer Engineering Capstone 2	4 SH

#### Electrical and Computer Engineering Technical Electives

Complete 16 semester hours from the following list, of which at most 4 semester hours may be from the CS department:

ECE U301 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

#### Further Credit

3 semester hours from the following course count toward the engineering requirement:

GE U110	Engineering Design	4 SH
---------	--------------------	------

2 semester hours from each of the following courses count toward the engineering requirement:

ECE U468	Noise and Stochastic Processes	4 SH
GE U111	Engineering Problem Solving and Computation	4 SH

### RESTRICTED ELECTIVES

Complete four semester hours from the "Historical Perspective Elective" list in the "College of Engineering Arts, Humanities, and Social Sciences Electives" on page 228.

Complete 4 semester hours from the "Social/Cultural Perspective Elective" list in the "College of Engineering Arts, Humanities, and Social Sciences Electives" on page 228.

Complete four semester hours from the "Social Sciences/Humanities Elective" list in the "College of Engineering Arts, Humanities, and Social Sciences Electives" on page 229.

### OTHER REQUIRED COURSE WORK

Complete 16 semester hours as indicated below.

#### Writing

Complete the following two courses with a grade of C or higher in both courses:

ENG U111	College Writing	4 SH
ENG U302	Advanced Writing in the Technical Professions	4 SH

**Professional Development**

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

**Further Credit**

1 semester hour from each of the following courses counts toward other required course work:

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

Three semester hours from the following lecture/lab combination count toward other required course work:

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

**RESIDENCY REQUIREMENT**

Thirty-two of your final 40 semester hours must be taken at Northeastern University.

**MAJOR GPA REQUIREMENT**

2.000 minimum 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

**Integrated Dual Major in Electrical Engineering and Physics**

This intercollege dual major serves students who would like to explore their interest in physics while earning the benefit of an accredited Bachelor of Science degree in engineering. The dual major combines a major in physics from the Department of Physics in the College of Arts and Sciences with the Bachelor of Science in Electrical Engineering degree from the Department of Electrical and Computer Engineering.

Because of the large body of shared knowledge between electrical engineering and physics, an integrated dual major between these two disciplines is a logical course of study and can be accomplished within a student's usual five-year program (including three co-op placements) without requiring course overloading in any semester. A student graduating from this program will have studied both the physical fundamentals and the applications of electronic devices and systems. The program is a particularly appropriate course of study for students who wish to pursue a career in solid-state devices, micro-electromechanical systems, or nanotechnology.

Students interested in this program should contact the Electrical and Computer Engineering department or the

Physics department as early as possible, preferably prior to registering for freshman courses.

**BS in Electrical Engineering and Physics****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 credit or course substitutions must meet with an academic adviser to plan appropriate course work to assure that these requirements are fully satisfied.

**ELECTRICAL ENGINEERING AND PHYSICS GENERAL EDUCATION****Mathematics and Science****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

**PHYSICS 1 AND 2**

Complete the following two courses with corresponding labs:

PHY U161	Physics 1	4 SH
with PHY U162	Lab for PHY U161	1 SH
or PHY U151	Physics for Engineering 1	4 SH
with PHY U152	Lab for PHY U151	1 SH
PHY U165	Physics 2	4 SH
with PHY U166	Lab for PHY U165	1 SH
or PHY U155	Physics for Engineering 2	4 SH
with PHY U156	Lab for PHY U155	1 SH

**CHEMISTRY**

Complete the following course:

CHM U151	General Chemistry for Engineers	4 SH
----------	---------------------------------	------

**DIFFERENTIAL EQUATIONS/LINEAR ALGEBRA**

Complete the following course:

MTH U343	Differential Equations and Linear Algebra for Engineering	4 SH
or MTH U345	Ordinary Differential Equations	4 SH
and MTH U371	Linear Algebra	4 SH

**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 with corresponding lab:

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

**Arts and Humanities****HISTORICAL PERSPECTIVE ELECTIVE**

Complete one course from the “Historical Perspective Elective” list in the “College of Engineering Arts, Humanities, and Social Sciences Electives” on page 228.

**SOCIAL/CULTURAL PERSPECTIVE ELECTIVE**

Complete one course from the “Social/Cultural Perspective Elective” list in the “College of Engineering Arts, Humanities, and Social Sciences Electives” on page 228.

**SOCIAL SCIENCES/HUMANITIES ELECTIVE**

Complete one course from the “Social Sciences/Humanities Elective” list in the “College of Engineering Arts, Humanities, and Social Sciences Electives” on page 229.

**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
----------	---	------

**Linear Circuits**

Complete the following course:

ECE U400	Linear Circuits	4 SH
----------	-----------------	------

**Electronics**

Complete the following course with corresponding lab:

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

**Digital Logic Design**

Complete the following course with 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 with 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
----------	--------------------------------	------

**Communications Systems**

Complete the following course:

ECE U572	Communications Systems	4 SH
----------	------------------------	------

**Electrical Engineering Technical Electives**

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

ECE U301 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

**PHYSICS MAJOR REQUIREMENTS****Required Physics**

Complete the following five courses:

PHY U303	Modern Physics	4 SH
PHY U305	Thermodynamics and Statistical Mechanics	4 SH
PHY U600	Advanced Physics Laboratory 1	4 SH
PHY U602	Electricity and Magnetism	4 SH
PHY U617	Quantum Mechanics	4 SH

**Advanced Physics Elective**

Complete one physics course from the following list:

PHY U600 to PHY U799

**GPA REQUIREMENT**

2.000 minimum required in ECE courses

**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

**BS/MS in Applied Physics and Engineering**

See page 141.

**MECHANICAL AND INDUSTRIAL ENGINEERING**

[www.mie.neu.edu](http://www.mie.neu.edu)

HAMEED METGHALCHI, SCD

*Professor and Chair*

EMANUEL S. MELACHRINOUDIS, PHD

*Associate Professor, Associate Chair, and Director of Industrial Engineering*

**WILLIAM LINCOLN SMITH PROFESSOR OF MECHANICAL ENGINEERING**

Ahmed A. Busnaina, PhD

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

John W. Cipolla Jr., PhD

**COLLEGE OF ENGINEERING DISTINGUISHED PROFESSOR**

George G. Adams, PhD

**PROFESSORS**

Teiichi Ando, PhD  
 Thomas P. Cullinane, PhD  
 Surendra M. Gupta, PhD  
 Yiannis A. Levendis, PhD  
 Ronald R. Mourant, PhD  
 Hamid Nayeb-Hashemi, PhD  
 John N. Rossettos, PhD  
 Allen L. Soyster, PhD  
 Mohammad E. Taslim, PhD  
 Yaman Yener, PhD  
 Ibrahim Zeid, PhD

**ASSOCIATE PROFESSORS**

James C. Benneyan, PhD  
 Nasser S. Fard, PhD  
 Jacqueline A. Isaacs, PhD  
 Sagar V. Kamarthi, PhD  
 Gregory J. Kowalski, PhD  
 Constantinos Mavroidis, PhD  
 Sinan Muftu, PhD  
 Uichiro Narusawa, PhD  
 Ronald F. Perry, PhD  
 Jeffrey W. Ruberti, PhD

**ASSISTANT PROFESSORS**

Yung Joon Jung, PhD  
 Yingzi Lin, 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. In addition, the department offers the following minors: (a) minor in industrial engineering, (b) minor in mechanical engineering, and (c) minor in biomechanical engineering.

Our overall mission is to educate persons for professional and technical excellence; to perform research to advance the science and practice of engineering; to engage in service activities that advance the department, the University, and the profession; and to instill in ourselves and our students habits and attitudes that promote ethical behavior, professional responsibility, and careers that advance the well-being of society.

Graduates from our undergraduate programs will demonstrate technical excellence in their chosen fields, anticipate and respond to societal changes, and develop careers with depth

and flexibility, while retaining a professional and intellectual thrust throughout.

Specifically, we have established the following educational objectives for our undergraduate programs:

- 1a. *Mechanical engineers* will show proficiency in the analysis, modeling, and design of thermal and mechanical systems.
- 1b. *Industrial engineers* will show proficiency in the design, analysis, optimization, and improvement of integrated systems that include people, materials, information, equipment, and energy.
2. Graduates will successfully integrate their academic preparation with engineering practice.
3. Graduates will effectively utilize management skills to design projects and/or programs, to lead their implementation, and to present technical information, as appropriate to their field.
4. Graduates will engage in continuing education for professional development and career planning, including success in graduate education and research for those who choose to do so.

See pages 400–405 for course descriptions.

**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 work design, human-machine systems, probability, statistics, and engineering economy, while emphasizing such contemporary areas as digital simulation, computer information systems, quality control, supply chain management, operations research, and facilities planning.

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, facilities planning for a variety of industries, design of a robotics system in a manufacturing environment, long-range corporate planning, development and implementation of a quality-control system, simulation analyses to improve processes and make operation decisions, 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.

## BSIE—Bachelor of Science in Industrial Engineering

### MATHEMATICS/SCIENCE REQUIREMENT

Complete 39 semester hours in mathematics and science as indicated below.

#### Required Mathematics/Physics

Complete each of the following courses:

CHM U151	General Chemistry for Engineers	4 SH
MTH U241	Calculus 1 for Science and Engineering	4 SH
MTH U242	Calculus 2 for Science and Engineering	4 SH
MTH U341	Calculus 3 for Science and Engineering	4 SH
MTH U343	Differential Equations and Linear Algebra for Engineering	4 SH
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

#### Further Credit

3 semester hours from the following course count toward the mathematics/science requirement:

MIM U412	Engineering Probability and Statistics	4 SH
----------	--	------

2 semester hours from each of the following courses count toward the mathematics/science requirement:

MIM U515	Operations Research	4 SH
MIM U520	Stochastic Modeling	4 SH

1 semester hour from each of the following courses counts toward the mathematics/science requirement:

GE U111	Engineering Problem Solving and Computation	4 SH
MIM U512	Engineering Economy	4 SH

### ENGINEERING REQUIREMENT

Complete 61 semester hours in engineering as indicated below.

#### Required Engineering

Complete each of the following courses:

MIM U310	Introduction to Industrial Engineering	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 U516	Quality Assurance	4 SH
MIM U522	Human Machine Systems	4 SH
with MIM U523	Lab for MIM U522	1 SH
MIM U525	Logistics and Supply Chain Management	4 SH
MIM U530	Manufacturing Systems and Techniques	4 SH
with MIM U531	Lab for MIM U530	1 SH
MIM U701	Capstone Design 1	1 SH
MIM U702	Capstone Design 2	5 SH

#### Engineering Elective 1

Complete 4 semester hours from one of the following departments: MIM, CHE, CIV, or ECE.

#### Engineering Elective 2

Complete 4 semester hours from one of the following departments: MIM, CHE, CIV, or ECE.

#### Further Credit

3 semester hours from each of the following courses count toward the engineering requirement:

GE U110	Engineering Design	4 SH
MIM U512	Engineering Economy	4 SH

2 semester hours from each of the following courses count toward the engineering requirement:

GE U111	Engineering Problem Solving and Computation	4 SH
MIM U515	Operations Research	4 SH
MIM U520	Stochastic Modeling	4 SH

1 semester hour from the following course counts toward the engineering requirement:

MIM U412	Engineering Probability and Statistics	4 SH
----------	--	------

### RESTRICTED ELECTIVES

Complete 4 semester hours from the “Historical Perspective Elective” list in the “College of Engineering Arts, Humanities, and Social Sciences Electives” on page 228.

Complete 4 semester hours from the “Social/Cultural Perspective Elective” list in the “College of Engineering Arts, Humanities, and Social Sciences Electives” on page 228.

### GENERAL ELECTIVES

Complete four 4-SH-equivalent academic, nonremedial, nonrepetitive courses.

### OTHER REQUIRED COURSE WORK

Complete 13 semester hours as indicated below.

#### Writing

Complete the following two courses with a grade of C or higher in both courses:

ENG U111	College Writing	4 SH
ENG U302	Advanced Writing in the Technical Professions	4 SH

#### Professional Development

Complete the following three courses:

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

#### Further Credit

1 semester hour from each of the following courses counts toward other required course work:

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

**RESIDENCY REQUIREMENT**

32 of your final 40 semester hours must be taken at Northeastern University.

**MAJOR GPA REQUIREMENT**

2.000 minimum 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 Industrial Engineering****REQUIRED COURSES**

Complete the following three courses:

MIM U310	Introduction to Industrial Engineering	4 SH
MIM U412	Engineering Probability and Statistics or equivalent	4 SH
MIM U515	Operations Research	4 SH

**TECHNICAL ELECTIVE**

Complete one course from the following list (see mechanical and industrial engineering academic adviser for additional electives):

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.

**BSME—Bachelor of Science in Mechanical Engineering****MATHEMATICS/SCIENCE REQUIREMENT**

Complete 36 semester hours in mathematics and science as indicated below.

**Required Mathematics/Physics**

Complete each of the following courses:

BIO U111	General Biology 1	4 SH
with BIO U112	Lab for BIO U111	1 SH
CHM U151	General Chemistry for Engineers	4 SH
MTH U241	Calculus 1 for Science and Engineering	4 SH
MTH U242	Calculus 2 for Science and Engineering	4 SH
MTH U341	Calculus 3 for Science and Engineering	4 SH
MTH U343	Differential Equations and Linear Algebra for Engineering	4 SH
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

**Further Credit**

1 semester hour from the following course counts toward the mathematics/science requirement:

GE U111	Engineering Problem Solving and Computation	4 SH
---------	--	------

**ENGINEERING REQUIREMENT**

Complete 68 semester hours in engineering as indicated below.

**Required Engineering**

Complete each of the following courses:

ECE U210	Electrical Engineering	4 SH
with ECE U211	Lab for ECE U210	1 SH
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
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 and Design	4 SH
MIM U550	Mechanical Engineering Design	4 SH
MIM U555	System Analysis and Control	4 SH
MIM U570	Thermal Systems Analysis and Design	4 SH
MIM U701	Capstone Design 1	1 SH
MIM U702	Capstone Design 2	5 SH

**Mechanical and Industrial Engineering Technical Elective**

Complete one technical elective from the MIM department.

**Further Credit**

3 semester hours from the following course count toward the engineering requirement:

GE U110	Engineering Design	4 SH
---------	--------------------	------

2 semester hours from the following course count toward the engineering requirement:

GE U111	Engineering Problem Solving and Computation	4 SH
---------	---	------

**RESTRICTED ELECTIVES**

Complete 4 semester hours from the “Historical Perspective Elective” list in the “College of Engineering Arts, Humanities, and Social Sciences Electives” on page 228.

Complete 4 semester hours from the “Social/Cultural Perspective Elective” list in the “College of Engineering Arts, Humanities, and Social Sciences Electives” on page 228.

**GENERAL ELECTIVES**

Complete four 4-SH-equivalent academic, nonremedial, nonrepetitive courses.

**OTHER REQUIRED COURSE WORK**

Complete 13 semester hours as indicated below.

**Writing**

Complete the following two courses with a grade of C or higher in both courses:

ENG U111	College Writing	4 SH
ENG U302	Advanced Writing in the Technical Professions	4 SH

**Professional Development**

Complete the following three courses:

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

**Further Credit**

1 semester hour from each of the following courses counts toward other required course work:

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

**RESIDENCY REQUIREMENT**

32 of your final 40 semester hours must be taken at Northeastern University.

**MAJOR GPA REQUIREMENT**

2.000 minimum 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**

141 total semester hours required  
Minimum 2.000 GPA required

**Minor in Mechanical Engineering****REQUIRED COURSES**

Complete the following two courses:

MIM U350	Engineering Mechanics and Design	4 SH
MIM U380	Thermodynamics	4 SH

**MECHANICAL ENGINEERING TECHNICAL ELECTIVES**

Complete two courses from the following list:

MIM U340	Introduction to Material Science	4 SH
MIM U355	Mechanics of Materials	4 SH
MIM U455	Dynamics and Vibrations	4 SH
MIM U475	Fluid Mechanics	4 SH
MIM U508	Mechanical Engineering Computation and Design	4 SH
MIM U550	Mechanical Engineering Design	4 SH
MIM U555	System Analysis and Control	4 SH
MIM U570	Thermal Systems Analysis and Design	4 SH

**GPA REQUIREMENT**

2.000 GPA required in the minor

**Minor in Biomechanical Engineering****REQUIRED BIOLOGY**

Complete the following two courses with corresponding labs:

BIO U111	General Biology 1	4 SH
with BIO U112	Lab for BIO U111	1 SH
BIO U117	Integrated Anatomy and Physiology 1	4 SH
with BIO U118	Lab for BIO U117	1 SH

**REQUIRED MECHANICAL ENGINEERING**

Complete the following three courses:

MIM U665	Musculoskeletal Biomechanics	4 SH
MIM U701	Capstone Design 1	1 SH
MIM U702	Capstone Design 2	5 SH

**TECHNICAL ELECTIVE**

Complete one technical elective from the following list

(additional electives may be approved by the program adviser):

CHE U630	Biochemical Engineering Fundamentals	4 SH
MIM U520	Stochastic Modeling	4 SH
MIM U522	Human Machine Systems	4 SH
MIM U640	Mechanical Behavior and Processing of Materials	4 SH
MIM U650	Advanced Strength and Applied Elasticity	4 SH
MIM U655	Analytical Dynamics and Advanced Vibrations	4 SH
PHY U621	Biological Physics 1	4 SH

**GPA REQUIREMENT**

2.000 GPA required in the minor