ELECTRICAL ENGINEERING, BACHELOR OF SCIENCE

The Department of Electrical and Computer Engineering offers a complete electrical engineering undergraduate program to students on the City (Lincoln) and Scott (Omaha) campuses of the University of Nebraska. Curriculum requirements are nearly identical on both campuses and students can complete all degree requirements on either campus.

Electrical engineering is concerned with the production, transmission, and utilization of electrical energy and the creation, transmission and processing of information. This includes power generation and transmission systems, motors, batteries and control systems, as well as radio frequency (RF) systems, telecommunications, remote sensing, signal processing, digital circuits, instrumentation, audio, video and opto-electronics. Employment opportunities for electrical engineers cover a wide spectrum of activities including design, development, research, sales, and management. These activities are carried on in industrial organizations, public and private utilities, the communications and computer industry, governmental and educational institutions, and consulting engineering firms. The objective of this major is to offer students an education to become productive electrical engineers and be active, contributing citizens of the nation and the world.

This department has over 40 faculty involved in research related to electronic materials, nanotechnology, optical systems, communications, biomedical applications, signal processing, microelectronics design, energy systems, and electromagnetics. Students are encouraged to participate in research activities, and have opportunities to travel and present their research results.

The department has extensive research facilities for all areas including state of the art computing facilities, integrated circuits and systems research facilities, communications and signal processing laboratories, applied electromagnetics research, solid state laboratories, nanostuctures research, electro-optics research and energy systems laboratories.

The curriculum is designed to provide a broad education in fundamental principles and laboratory applications, and an awareness of the socioeconomic impact of technology. Technical electives are normally selected from advanced courses in electrical engineering to provide for specialization in selected areas. However, technical electives can also be selected from courses offered by other departments of the College of Engineering or from appropriate physics, chemistry, mathematics, and biological sciences courses.

Accreditation

The Electrical and Computer Engineering (ECE) department’s Electrical Engineering Program (EE) is accredited by the Engineering Accreditation Commission of ABET (http://www.abet.org)

Program Educational Objectives

The Program Educational Objectives (PEOs) for the electrical engineering program are a statement of what its graduates are doing or are capable of doing three to five years after graduation. Electrical engineering is concerned with the production, transmission, and utilization of electrical energy and the transmission and processing of information. Employment opportunities for electrical engineers cover a wide spectrum of activities including design, development, research, sales, and management. These activities are carried on in industrial organizations, public and private utilities, the communications and computer industry, governmental and educational institutions, and consulting engineering firms. Careers may encompass electronic materials, nanotechnology, optical systems, communications, biomedical applications, signal processing, microelectronics design, energy systems, and electromagnetics. The objective of this program is to offer students an education to become productive electrical engineers and be active, contributing citizens of the nation and the world.

The Program Educational Objectives for the electrical engineering program are that graduates will be:

- Employed in business, academia, or government.
- Successful engineers who have established productive careers in their field and have contributed to improve and provide innovative and effective solutions in electrical engineering or related fields.
- Demonstrating technical and decision-making processes and the human interactions necessary to produce viable, responsible, and sustainable technological solutions.
- Engaging in lifelong learning, which may include postgraduate education, to successfully adapt to technological, industry specific, and cultural changes and to foster adept functioning in society.
- Performing engineering practice in a context that reflects awareness of the ethics of their profession and of the impacts of their work on the profession and society at large.

These Program Educational Objectives were developed with input from the program’s educational objectives constituency, consisting of employers (including the Industry Advisory Board), graduates of the program, and faculty of the department.

Learning Outcomes

Learning Outcomes are those abilities that a graduate of the Electrical Engineering program will have attained so that he/she can meet the educational objectives established for the program.

At the time of graduation, students in the ECE Electrical Engineering program will have:

a. An ability to apply knowledge of mathematics, science, and engineering.

b. An ability to design and conduct experiments, as well as to analyze and interpret data.

c. An ability to design a system, component, or process to meet desired needs within realistic constraints, such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

d. An ability to function on multidisciplinary teams.

e. An ability to identify, formulate, and solve engineering problems.

f. An understanding of professional and ethical responsibility.

g. An ability to communicate effectively.

h. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

i. A recognition of the need for, and an ability to, engage in lifelong learning.

j. A knowledge of contemporary issues.

k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
NOTE: Letters are references to ABET Engineering Accreditation Commission outcomes (a through k).

Admission to the electrical engineering program will be granted if the student has maintained a cumulative GPA of at least 2.4 and is in good standing in the College of Engineering, and completed ECEN 2130 Electrical Circuits I or ECEN 2150 Electronics and Circuits I and ECEN 2140 Electrical Circuits II or ECEN 2160 Electronics and Circuits II with a grade of C or better.

A transfer student will be admitted if he/she has completed courses equivalent to ECEN 2130 or ECEN 2150 and ECEN 2140 or ECEN 2160 at other institutions with acceptable transfer grades of C or better, and earned a GPA of 2.4 or better during their first 12 credit hours in electrical engineering course work at UNL.

Transfer students will be able to appeal to the College’s Academic Appeals Committee for admission for an additional semester if they fail to meet the GPA requirement.

See the College of Engineering section of the catalog for details on admission to the college.

Students graduating with a Bachelor of Science in Electrical Engineering degree must successfully complete 125 credit hours as follows:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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<tr>
<td>Required electrical engineering courses</td>
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<td>41</td>
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<td>Required math and science courses</td>
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<tr>
<td>Technical electives</td>
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1 Of the 27 credit hours of technical electives, at least 12 credit hours must be taken as electrical engineering (ECEN) courses, which are referred to as “EE Technical Electives.” The remaining 15 credit hours of technical electives which are referred to as “EE or Other Technical Electives” may be taken from any 300 or 400 level course offering (with some exceptions) in the department of Electrical and Computer Engineering or in any other engineering department within the College of Engineering, or in the departments of Biological Sciences, Chemistry, Computer Science and Engineering, Mathematics, Statistics, or Physics and Astronomy at UNL or UNO.

### Requirements

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<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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<tr>
<td>ECEN 1030</td>
<td>ELECTRICAL AND COMPUTER ENGINEERING FUNDAMENTALS</td>
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<tr>
<td>MATH 1950</td>
<td>CALCULUS I</td>
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<td>CIST 1400</td>
<td>INTRODUCTION TO COMPUTER SCIENCE I</td>
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<td>ECEN 1060</td>
<td>MICROPROCESSOR APPLICATIONS</td>
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<td>ECEN 2250</td>
<td>ELECTRICAL AND COMPUTER ENGINEERING SEMINAR</td>
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<td>ECEN 3040</td>
<td>SIGNALS AND SYSTEMS I</td>
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<td>ELECTROMAGNETIC FIELD THEORY</td>
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<td>ECEN 4940</td>
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<td>Total Credits</td>
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1 Choose one course from not yet satisfied ACE outcomes 5,6,7,8 or 9.
2 ENGR 1000 may be substituted for CMST 1110.
3 The department maintains of approved list of technical electives (within and outside of ECE) on the department website.
4 Can substitute ENGR 3000 for ENGL 3980.
5 Students may substitute ECEN 3050 for STAT 3800.
Total Credit Hours Required for Graduation - **125 Hours**

**Technical Electives**

Each EE undergraduate student must choose one of the emphasis areas listed below for the EE technical electives.

**Electrical Engineering Emphasis Areas**

Communications and Signal Processing
Electromagnetic Fields and Optics
Electronics
Energy and Power Systems
Materials and Devices
Bioengineering
Modeling and Simulation
Telecommunications

**Electives**

There are 27 credit hours of technical electives required. Of these 27 credit hours, at least 12 credit hours must be taken in one of the electrical engineering (ECEN) emphasis areas. Below is a list of courses in each emphasis area.

**Communications & Signal Processing**

- ECEN 4100
- ECEN 3250/ECEN 4620 core
- ECEN 4630 core
- ECEN 4610/ECEN 4640
- ECEN 4650

**Electromagnetic Fields and Optics**

- ECEN 4080 core
- ECEN 4670
- ECEN 4680
- ECEN 4790
- ECEN 4800 applications
- ECEN 4860

**Electronics**

- ECEN 3100/ECEN 4740 core
- ECEN 3520/ECEN 3610 core
- ECEN 3620 Transceivers

**Energy and Power Systems**

- ECEN 4060
- ECEN 4280 core
- ECEN 4300
- ECEN 4360
- ECEN 4440
- ECEN 4980 X

**Materials and Devices**

- ECEN 4170
- ECEN 4200
- ECEN 4210 core
- ECEN 4220
- ECEN 4240
- ECEN 4360

**Bioengineering**

- ECEN 4500 core
- ECEN 4600
- ECEN 4980 E
- ECEN 4980 S

**Modeling and Simulation**

- ECEN 3980 M core
- ECEN 4480
- ECEN 4980 core
- ECEN 3620
- ECEN 4610/ECEN 4640 core

**Telecommunications**

- ECEN 4170
- ECEN 4200
- ECEN 4210 core
- ECEN 4220
- ECEN 4660 core

Of the 12 credit hours required in an emphasis area, 6 credit hours must be taken from one of the eight EE emphasis areas listed. This must include at least one Core Course in that area.

In addition, at least one 3 credit hour course from a different EE emphasis area must be taken. The remaining 3 credits may be satisfied by any course.
non-required 3000- or 4000-level ECEN course except ECEN 3990
Undergraduate Research.

The remaining 15 credit hours of technical electives which are referred
to as "EE or other technical electives" may be taken from any 3000- or
4000-level course offering (with the exception of those listed below) in
the Department of Electrical and Computer Engineering or in any other
engineering department within the College of Engineering at UNL, or in the
UNO Departments of Biology, Chemistry, Computer Science, Mathematics,
or Physics or in the UNL Departments of Biological Sciences, Chemistry,
Computer Science and Engineering, Mathematics, Statistics, or Physics and
Astronomy.

Not Allowed 300- and 400-Level Technical Electives
ENGR 4690 Technology, Science and Civilization
UNL BIOS 310 School of Biological Sciences Seminar
UNL IMSE 305 Introduction to Engineering Management
UNL MATH 495 (http://bulletin.unl.edu/undergraduate/courses/MATH/495)
Seminar
UNL MATH 496 (http://bulletin.unl.edu/undergraduate/courses/MATH/496)
Seminar in Mathematics
or any other seminar-type courses.

Allowed 100 and 200 Level Technical Electives
UNL AGEN 225 (http://bulletin.unl.edu/undergraduate/courses/AGEN/225)
Engineering Properties of Biological Materials (BSEN 225 (http://
bulletin.unl.edu/undergraduate/courses/BSEN/225))
PHYS 4350 Astrophysics or ASTR 204 Introduction to Astronomy &
Astrophysics
UNL ASTR 224 (http://bulletin.unl.edu/undergraduate/courses/ASTR/224)
Astronomy & Astrophysics Lab
BIOL 2140 Genetics or UNL BIOS 206 (http://bulletin.unl.edu/
undergraduate/courses/BIOS/206) General Genetics
BIOL 2740 Human Physiology and Anatomy I or UNL BIOS 213 (http://
bulletin.unl.edu/undergraduate/courses/BIOS/213) Human Physiology
CHEM 1190 General Chemistry II and CHEM 1194 General Chemistry II
Laboratory or UNL CHEM 110 (http://bulletin.unl.edu/undergraduate/
courses/CHEM/110) General Chemistry II
CHEM 1190 General Chemistry II or UNL CHEM 114 (http://
bulletin.unl.edu/undergraduate/courses/CHEM/114) Fundamental
Chemistry II
Any 2000 level chemistry course or UNL CHEM 2xx
CSCI 1620 Introduction to Computer Science II or UNL CSCE 156 (http://
bulletin.unl.edu/undergraduate/courses/CSCE/156) Computer Science II
CSCI 2030 Mathematical Foundations of Computer Science or MATH 2030
Discrete Mathematics or UNL CSCE 235 (http://bulletin.unl.edu/
undergraduate/courses/CSCE/235) Introduction to Discrete Structures
UNL CSCE 251 (http://bulletin.unl.edu/undergraduate/courses/CSCE/251)
Unix Programming Environment
UNL MATL 260 (http://bulletin.unl.edu/undergraduate/courses/MATL/260)
Elements of Materials Science
UNL MATL 262 (http://bulletin.unl.edu/undergraduate/courses/MATL/262)
Materials Lab I
MENG 2230 or UNL MECH 200 Engineering Statics
MENG 2500 or UNL MECH 250 Mechanics
MENG 2000 or UNL MECH 200 Engineering Thermodynamics
No more than a total of 3 credit hours may be taken in ECEN 3990 or
similar offerings from other departments.

However, students can choose a “Research Option.” The purpose of
research option is to provide research experiences and offer opportunities
for students to work with a faculty advisor on a specific research topic.
A certificate of completion of thesis will be awarded to the students,
and outstanding thesis awards will be presented at the end of semester
functions. Requirements for the research option are listed below.

Research Option
1. Selection of a faculty advisor (ECE department faculty), research topic,
and thesis committee (at least one other faculty).
2. Registration for 6 credit hours of undergraduate research (ELEC 399
(http://bulletin.unl.edu/undergraduate/courses/ELEC/399) or at least
two consecutive semesters on the same research topic.
3. GPA of above 3.0.
4. Write an undergraduate thesis or report and make an oral presentation
be graded by thesis committee members.

Science Electives
BIOL 1450 BIOLOGY I (5 cr) or UNL LIFE 120 and LIFE 120L
FUNDAMENTALS OF BIOLOGY I
CHEM 1180 (3 cr) and CHEM 1184 (1 cr) or UNL CHEM 109 or CHEM 111
or CHEM 113
PHYS 2130 (4 cr) or UNL PHYS 213