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,renewable energy,electric transportation,automated vehicle systems, control systems, and power electronics as well as radio frequency (RF) systems, telecommunications, remote sensing, bioinformatics, computer vision ,biomedical engineering,signal processing, analog & 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, integrated circuit 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, nanostructures 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 Engineering Program (BS) is accredited by the Engineering Accreditation Commission of ABET: https://www.abet.org, under the commission's General Criteria and Program Criteria for Electrical, Computer, Communications,Telecommunication(s) and Similarly Named Engineering programs.

Program Educational Objectives

The Program Educational Objectives (PEOs) for the electrical engineering program are a statement of what its graduates are 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, integrated circuit 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.

Student Outcomes

Student 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 Electrical Engineering program will have:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze, and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Professional Admission Requirements

Pre-professionally admitted College of Engineering students majoring in electrical engineering will be granted profession admission into the electrical engineering program if the students have:

- maintained a cumulative GPA of at least 2.4 and is in good standing in the College of Engineering, and
- completed ECEN 215 Electronics and Circuits I and ECEN 216 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 215 and ECEN 216 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/UNO.

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 124 credit hours as follows:

Code	Title	Credits
Required electrical engineering courses		46
Required math and science courses		32
Technical electives		25
ACE (15) and Written/Oral Communication (6)		21

Requirements

Course	Title	Credits
First Year		
First Semester		
ECEN 102	INTRODUCTION TO ELECTRICAL ENGINEERING	2
ECEN 155E	COMPUTER SCIENCE I: SYSTEMS ENGINEERING FOCUS	3
ENGR 100	INTERPERSONAL SKILLS FOR ENGINEERING LEADERS [1]	3
ENGR 10	FRESHMAN ENGINEERING SEMINAR	0
MATH 1950	CALCULUS I	5
	Credits	**13**
Second Semester		
ECEN 103	ELECTRICAL AND COMPUTER ENGINEERING FUNDAMENTALS	4
ENGL 1160	ENGLISH COMPOSITION II	3
MATH 1960	CALCULUS II	4
PHYS 2110	GENERAL PHYSICS I - CALCULUS LEVEL	4
	Credits	**15**
Second Year		
First Semester		
ECEN 215	ELECTRONICS AND CIRCUITS I [2]	3
ECEN 235	INTRODUCTORY ELECTRICAL LABORATORY I [3]	1
ENGR 20	SOPHOMORE ENGINEERING SEMINAR	0
ECEN 313	SWITCHING CIRCUITS THEORY	4
MATH 1970	CALCULUS III	4
PHYS 2120	GENERAL PHYSICS-CALCULUS LEVEL	4
PHYS 1164	GENERAL PHYSICS LABORATORY II	1
	Credits	**17**
Second Semester		
ECEN 220	INTRODUCTION TO EMBEDDED SYSTEMS	4
ECEN 216	ELECTRONICS AND CIRCUITS II [4]	3
ECEN 222	ELECTRONIC CIRCUITS I [5]	4
MATH 2050	APPLIED LINEAR ALGEBRA	3
MATH 2350	DIFFERENTIAL EQUATIONS	3
	Credits	**17**
Third Year		
First Semester		
ECEN 304	SIGNALS AND SYSTEMS I	3
ECEN 305	PROBABILITY THEORY AND STATISTICS FOR ELECTRICAL AND COMPUTER ENGINEERS	3
ECEN 307	ELECTRICAL ENGINEERING LABORATORY I	2
Electrical Engineering Option Technical Elective [6]		3
Electrical Engineering or Other Technical Electives [6]		3
ACE Elective [7]		3
	Credits	**17**
Second Semester		
ECEN 306	ELECTROMAGNETIC FIELD THEORY	3
ECEN 347	ELECTRICAL ENGINEERING LABORATORY II	1
Electrical Engineering or Other Technical Electives [6]		4
Science Elective		4
ACE Elective [7]		3
	Credits	**15**
Fourth Year		
First Semester		
ECEN 481	ELECTRICAL ENGINEERING CAPSTONE I	3
Electrical Engineering Option Technical Elective [6]		6
Electrical Engineering or Other Technical Electives [6]		3
ACE Elective [7]		3
	Credits	**15**
Second Semester		
ECEN 495	ELECTRICAL ENGINEERING CAPSTONE II	3
Electrical Engineering Option Technical Elective [6]		3
Electrical Engineering or Other Technical Electives [6]		3
ACE Elective [7]		6
	Credits	**15**
	Total Credits	**124**

1. CMST 1110 may be substituted for ENGR 100
2. ECEN 213 may be substituted for ECEN 215
3. ECEN 218 may be substituted for ECEN 235
4. ECEN 214 may be substituted for ECEN 216
5. ECEN 316 and ECEN 236 may be substituted for ECEN 222
6. The department maintains an approved list of technical electives (within and outside of ECE) on the department website

[7] ACE electives: Choose one course from not yet satisfied ACE outcomes 5,6,7, 8 or 9

Total Credit Hours Required for Graduation - 124 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 25 credit hours of technical electives required. Of these 25 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 410	Multivariate Random Processes
ECEN 325	Communication and Networking
ECEN 462 core	Communications Systems
ECEN 424/ECEN 463 core	Digital Signal Processing/Digital Signal Processing
ECEN 464	Digital Communication Systems
ECEN 465	Intro Data Compression

Electromagnetic Fields and Optics

ECEN 408 core	Engineering Electromagnetics
ECEN 468	Microwave Engineering
ECEN 479	Optical Fiber Communications
ECEN 480	Introduction to Lasers and Laser applications
ECEN 486	Applied Photonics

Electronics

ECEN 310/ ECEN 474 core	Digital Design and Interfacing/ Digital Systems
ECEN 352/ECEN 361 core	Electronic Circuits II/Advanced Electronics and Circuits
ECEN 362	Data and Telecommunications Transceivers
ECEN 469	Analog Integrated Circuits
ECEN 470	Digital and Analog VLSI Design

Energy and Power Systems

ECEN 338 core	Intro Power and Energy Systems
ECEN 406	Power Systems Analysis
ECEN 428 core	Power Electronics
ECEN 430	Wind Energy
ECEN 436	Electric Machines
ECEN 444	Linear Control Systems
ECEN 498	Solar Energy

Materials and Devices

ECEN 417	Semiconductor Fundamentals II
ECEN 420	Plasma Processing of Semiconductors
ECEN 421 core	Principles of Semiconductor Materials and Devices I
ECEN 422	Introduction to Physics and Chemistry of Solids

Bioengineering

ECEN 450 core	Bioinformatics
ECEN 460	Labview Programming
ECEN 453	Computational and Systems Biology
ECEN 498	Bioengineering Image and Signal Processing

Modeling and Simulation

ECEN 398	Computational Modeling and Simulation: Discrete Systems
ECEN 448	Decision Analysis
ECEN 498	Computational Modeling and Simulation: Continuous Systems

Telecommunications

ECEN 362	Data and Telecommunications Transceivers
ECEN 464 core	Digital Communication Systems
ECEN 466 core	Telecommunications Engineering I

Of the 12 credit hours required in an emphasis area which are referred to as "EE Option Technical Electives", 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 non-required 3000- or 4000-level ECEN course except ECEN 399 Undergraduate Research.

The remaining 13 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 469 Technology, Science and Civilization

BIOL 3500 Biological Principles of Aging

CSCI 3710 Introduction to Digital Design and Computer Organization

STAT 3000 Statistical Methods I

UNL BIOS 310 School of Biological Sciences Seminar

UNL IMSE 305 Introduction to Engineering Management

MATH 4980 Seminar or 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

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

MECH 223 Engineering Statics

MECH 200 Engineering Thermodynamics

No more than a total of 3 credit hours may be taken in ECEN 399 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 (ECEN 399)over 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 to 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