

Electrical Engineering

Department Information

- **Department Web Site:**
www.ndsu.edu/ece/ (<http://www.ndsu.edu/ece/>)
- **Credential Offered:**
B.S.E.E.
- **Official Program Curriculum:**
catalog.ndsu.edu/undergraduate/program-curriculum/electrical-engineering/ (<http://catalog.ndsu.edu/undergraduate/program-curriculum/electrical-engineering/>)

Electrical engineers create products and services for society out of materials that exist in nature using principles of science and common sense. The profession is broad, encompassing products valued by society in many technical specialties from electric power and energy utilization to our current information age.

The Program

The Bachelor of Science in Electrical Engineering program 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. It has the largest enrollment in the Dakotas. The department faculty, many of whom have years of experience in industry and teaching, give considerable attention to the individual student. Major components of the undergraduate program are basic science and mathematics, humanities and social sciences, communication, engineering science, engineering design and ethics, and both breadth and depth in electrical and computer engineering.

Areas Of Specialization

The Electrical Engineering program is designed to reflect the broad nature of the field, and students may tailor their studies within broad parameters. Students are encouraged to develop an individual program of study in close consultation with their advisers. Examples are available to illustrate how specialization may be obtained in a number of different technical areas. Students may mix and match from the examples to suit their particular interests. Technical areas include the following:

- **Biomedical Engineering** is firmly based in engineering and the life sciences. The integration of medicine and engineering serves to provide appropriate products, tool, and techniques for research diagnosis and treatment by health care professionals. Some important products are artificial hearts, medical imaging (MRI, ultrasound, CT scans), prosthetic devices, and computer aids for diagnosis. Biomedical engineers help identify the problems and needs that can be solved using engineering technology and systems methodology to provide high-quality health care at reasonable cost.
- **Communication and Signal Processing** are closely related fields within electrical engineering. Communication is the process of transferring information from one point in time and space to another point. Signal processing involves signal representation, as well as signal design and filtering. Students with this specialization find challenging opportunities worldwide to meet the need for more convenient, inexpensive, and reliable communication and signal processing.
- **Control Engineering** deals with the design and implementation of algorithms for controlling physical systems. Examples include active suspension for cars, autopilots for aircraft, and robot motion control.
- **Electromagnetics** includes electromagnetic compatibility, fiber optics, antennas, microwave devices, radar, sonar, satellite systems, power and communication transmission lines, grounding, shielding and propagation.
- **Electronics and Microelectronics** deal with integrated circuits, VLSI, transistors, lasers, consumer electronics, defense electronics, power electronics, and electronic materials.
- **Nanotechnology** deals with the study of electric materials at the nanoscale level for applications such as solar cells and sensors.
- **Optical Engineering**, developed jointly with the Department of Physics, prepares future engineers in such areas as quantum theory; coherent/incoherent polarized/non-polarized light; geometric, physical, and Fourier optics; holography; and image processing and acquisition.
- **Power Systems** deals with generation, transmission, distribution and utilization of electric energy subject to safety, environmental and economic concerns.

Cooperative Education Program

The Cooperative Education Program allows students to alternate classroom study with a series of paid professional work experiences related to electrical engineering. These experiences increase in complexity as the student's background increases. The program provides opportunity for pre-graduation experience in the profession, exploration of several career opportunities, money for education, an enriched degree and enhanced opportunities for employment following graduation.

High School Preparation

High school students are recommended to take one unit of physics, four units of mathematics and one unit of chemistry.

The Facilities

The Electrical and Computer Engineering building is part of an eight building engineering complex. The building contains specialized laboratories and equipment. Numerous grants and donations from the National Science Foundation and private industry have provided valuable equipment. Laboratories along with department and university computer capabilities support education and research.

Career Opportunities

NDSU electrical engineering graduates are working all over the world in a variety of exciting jobs at excellent salaries. They work in research, design, sales, manufacturing, testing, installation, development and teaching. Many graduates find an engineering education provides excellent training for fields other than engineering such as business, medicine or law. Since engineers are problem solvers, there is a constant demand for engineers to solve problems outside typical engineering fields.

Research and Graduate Study

Departmental faculty members are currently active in several areas of research including biomedical, nanotechnology, communication and signal processing, controls, electromagnetics, electronics and power engineering. Graduate studies leading to the master's and doctoral degrees are offered in the department. Further details are available in the *Graduate Bulletin*.

Selective Admission

Transfer students from international institutions must have a 3.00 GPA.

Further, the department policy is that transfer courses equivalent to ECE 173 (or CSCI 160), ECE 275, EE 206 and all required Math must have a "C" or better before enrolling in ECE courses listed in the curriculums for Junior & Senior years."

Sample Program Guide

IMPORTANT DISCLAIMER: This guide is not an official curriculum. This guide is a sample four-year degree plan of how students might plan this major with other degree requirements to complete their education in four years. Student plans will vary from this sample due to a variety of factors, such as, but not limited to, start year, education goals, transfer credit, and course availability. To ensure proper degree completion, enrolled students should utilize Degree Map (<https://www.ndsu.edu/registrar/degreemap/>) and Schedule Planner (<https://www.ndsu.edu/onestop/degree-map-and-planning/>) in Campus Connection and consult regularly with academic advisors to ensure graduation requirements are being met.

First Year			
Fall	Credits	Spring	Credits
MATH 098 ¹		3 MATH 103 ¹	3
ENGL 110		3 ENGL 120	3
COMM 110		3 CHEM 121	3
GEN ED Wellness		2 GEN ED Social/Behavioral Science	3
GEN ED Social/Behavioral Science and Global Perspective		3 GEN ED Humanities/Fine Arts and Cultural Diversity	3
		14	15
Second Year			
Fall	Credits	Spring	Credits
MATH 105 ¹		3 MATH 165 ¹	4
ECE 173 ¹		4 PHYS 251	4
ECE 275 ¹		4 ECE 111	3
MATH 129 ¹		3 GEN ED Science Lab (CHEM 121, PHYS 251, or PHYS 252)	1
		Tech Elective ²	
		14	12
Third Year			
Fall	Credits	Spring	Credits
MATH 166 ¹		4 MATH 265 ¹	4

EE 206 ¹	4	ECE 311	4
PHYS 252	4	ECE 320	3
ECE 351	4	ECE 321	2
GEN ED Upper Level English	3	ECE 376	4
		ECE 401	1
19		18	

Fourth Year			
Fall	Credits	Spring	Credits
MATH 266 ¹		3 ECE 405	3
ECE 343		4 ECE 341	3
ECE 331		4 ECE Elective	3
ENGR 327		3 ECE Elective	3
ECE 403		2 ECE Elective	3
16		15	

Fifth Year			
Fall	Credits		
ECE 405		3	
Tech Elective ²		3	
Tech Elective ²		3	
Tech Elective ²		3	
12			

Total Credits: 135

¹

This course requires the student to earn a "C" or better, in order to take upper level ECE courses.

²

Choose from the approved Tech Elective List

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First Year			
Fall	Credits	Spring	Credits
MATH 103 ¹		3 MATH 105 ¹	3
ENGL 110		3 ENGL 120	3
COMM 110		3 ECE 173 ¹	4
CHEM 121		3 GEN ED Social/Behavioral Science	3
GEN ED Wellness		2 ECE 111	3
14		16	

Second Year			
Fall	Credits	Spring	Credits
MATH 165 ¹		4 MATH 166 ¹	4
MATH 129 ¹		3 EE 206 ¹	4
ECE 275 ¹		4 PHYS 251	4

GEN ED Humanities/Fine Arts and Cultural Diversity	3 GEN ED Science Lab (CHEM 121L, PHYS 251L or PHYS 252L)	1
GEN ED Social/Behavioral Science and Global Perspective	3 Tech Elective ²	3

17 **16**

Third Year			
Fall	Credits	Spring	Credits
MATH 265 ¹		4 ECE 401	1
PHYS 252		4 MATH 266 ¹	3
ECE 311		4 ECE 320	3
GEN ED Upper Level English		3 ECE 351	4
Tech Elective ²		3 ECE 321	2
		ECE 376	4

18 **17**

Fourth Year			
Fall	Credits	Spring	Credits
ECE 403		2 ECE 405	3
ECE 343		4 ECE 341	3
ECE 331		4 Tech Elective ²	3
ENGR 327		3 ECE Elective	3
Tech Elective ²		3 ECE Elective	3
		ECE Elective	3

16 **18**

Total Credits: 132

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2

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First Year			
Fall	Credits	Spring	Credits
MATH 105 ¹		3 MATH 165 ¹	4
CHEM 121		3 MATH 129 ¹	3
ENGL 110		3 ECE 111	3
COMM 110		3 ECE 173 ¹	4
GEN ED Wellness		2 ENGL 120	3
GEN ED Social/Behavioral Sciences		3	

17 **17**

Second Year			
Fall	Credits	Spring	Credits
MATH 166 ¹		4 MATH 265 ¹	4

PHYS 251	4	EE 206 ¹	4
ECE 275 ¹	4	PHYS 252	4
GEN ED Social/Behavioral Sciences and Global Perspective	3	Tech Elective ²	3
GEN ED Humanities/Fine Arts Cultural Diversity	3	GEN ED Science Lab (CHEM 121L, PHYS 251L or PHYS 252L)	3
18		18	
Third Year			
Fall	Credits	Spring	Credits
MATH 266 ¹		3 ECE 401	1
ECE 311		4 ECE 343	4
ECE 320		3 ECE 331	4
ECE 321		2 ECE 351	4
ECE 376		4 ECE Elective	3
16		16	
Fourth Year			
Fall	Credits	Spring	Credits
ECE 403		2 ECE 405	3
ECE 341		3 ECE 341	3
GEN ED Upper Level English		3 ECE Elective	3
ENGR 327		3 Tech Elective ²	3
Tech Elective ²		3 Tech Elective ²	3
ECE Elective		3	
17		15	

Total Credits: 134

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Freshman			
Fall	Credits	Spring	Credits
MATH 165 ¹		4 ECE 111 ¹	3
CHEM 121		3 ENGL 120	3
GEN ED Wellness		2 MATH 129 ¹	3
ECE 173 ¹		4 MATH 166 ¹	4
ENGL 110		3 PHYS 251	4
		16	17
Sophomore			
Fall	Credits	Spring	Credits
EE 206 ¹		4 COMM 110	3

MATH 265 ¹		4 ECE 311	4
PHYS 252		4 MATH 266 ¹	3
ECE 275 ¹		4 Tech Elective ²	3
GEN ED Science Lab (CHEM 121L, PHYS 251L or PHYS 252L)		1 GEN ED Humanities/Fine Arts and Cultural Diversity	3
		17	16
Junior			
Fall	Credits	Spring	Credits
ECE 320		3 ECE 401	1
ECE 321		2 ECE 341	3
ECE 376		4 ECE 331	4
ECE 351		4 Tech Elective ²	3
GEN ED ENGL/Upper Level Writing ³		3 ECE 343	4
		16	15
Senior			
Fall	Credits	Spring	Credits
ECE 403		2 ECE 405	3
ENGR 327 (FULFILLS HUMANITIES & FINE ARTS (A))		3 ECE Elective	3
ECE Elective		3 ECE Elective	3
Tech Elective ²		3 Tech Elective ²	3
GEN ED Social/Behavioral Sciences and Global Perspective		3 GEN ED Social & Behavioral Sciences	3
		14	15
Total Credits: 126			

1

This course requires the student to earn a "C" or better, in order to take upper level ECE courses.

2

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3

Choose from ENGL 320, 321, 324 or 459