Electrical Engineering

Electrical Engineering Major

The Electrical Engineering program at NDSU is accredited by the Engineering Accreditation Commission of ABET (http://www.abet.org) .

EE 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:** This area is firmly based in engineering and the life sciences. The integration of medicine and engineering serves to provide appropriate products, tools, 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:** These 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.
- **Computer Engineering:** This area involves hardware and software for small and large computers and for all the products that have dedicated computers within the product, such as microwave ovens and automobiles.
- **Control Engineering:** This is the design and implementation of algorithms for controlling physical systems. Examples include active suspension for cars, auto pilots for aircraft, and robot motion control.
- **Electromagnetics:** This area includes electromagnetic compatibility, fiber optics, antennas, microwave devices, radar, sonar, satellite systems, power and communication transmission lines, grounding, shielding, and propagation.
- **Electronics and Microelectronics:** Examples are integrated circuits, VLSI, transistors, lasers, consumer electronics, defense electronics, power electronics, and electronic materials.
- **Optical Engineering:** The Optical Engineering area was developed jointly with the Department of Physics (https://www.ndsu.edu/physics) . The Optical Engineering area 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:** This area includes the generation, transmission, distribution, and utilization of electric energy subject to safety, environmental, and economic concerns.

Major Requirements

Major: Electrical Engineering

Degree Type: B.S.E.E.
Required Degree Credits to Graduate: 126

General Education Requirements

First Year Experience (F):		
UNIV 189	Skills For Academic Success (Students transferring in 24 or more credits do not need to take UNIV 189.)	1
Communication (C):		
ENGL 110	College Composition I	3
ENGL 120	College Composition II	3
One Course in Upper Level Writing. Select one of the following:		3
ENGL 320	Business and Professional Writing	
ENGL 321	Writing in the Technical Professions	
ENGL 324	Writing in the Sciences	
ENGL 459	Researching and Writing Grants and Proposal	
COMM 110	Fundamentals of Public Speaking	3
Quantitative Reasoning (R):		
MATH 165	Calculus I	4
Science & Technology (S):		

CHEM 121	General Chemistry I	3
PHYS 251	University Physics I	4
PHYS 252	University Physics II	4
Select one of the following co-req labs		1
CHEM 121L	General Chemistry I Laboratory	
PHYS 251L	University Physics I Laboratory	
PHYS 252L	University Physics II Laboratory	
Humanities & Fine Arts (A): Select from current general education list		6
Social & Behavioral Sciences (B): Select from current general education list		6
Wellness (W): Select from current general education list		2
Cultural Diversity (D): Select from current general education list		
Global Perspectives (G): Select from current general education list		
Total Credits		**43**

Major Requirements

General Education Requirements		40
Electrical Engineering Core Requirements		
ECE 111	Introduction to Electrical and Computer Engineering	3
ECE 173	Introduction to Computing *	3
ECE 275	Digital Design *	4
ECE 311	Circuit Analysis II	4
ECE 320	Electronics I	3
ECE 321	Electronics II	2
ECE 331	Energy Conversion	4
ECE 341	Random Processes	3
ECE 343	Signals & Systems	4
ECE 351	Applied Electromagnetics	4
ECE 376	Embedded Systems	4
ECE 401	Design I (capstone)	1
ECE 403	Design II (capstone)	2
ECE 405	Design III (capstone)	3
MATH Courses Required		
MATH 129	Basic Linear Algebra *	2
MATH 166	Calculus II *	4
MATH 265	Calculus III (w/ vectors) *	4
MATH 266	Introduction to Differential Equations *	3
Other Courses Required		
EE 206	Circuit Analysis I *	4
ENGR 402	Engineering Ethics and Social Responsibility	1
ECE Electives	**Select 9 credits of ECE 400 level electives (excluding 494 and 496)**	9
Includes the cross listed courses of ECE/IME 427; ECE/IME 429; ECE/PHYS 411; & ECE/PHYS 411L		
Tech Electives: Select 12 credits from the following:		12
ABEN 456	Biobased Energy	
BIOL 150 & 150L	General Biology I and General Biology I Laboratory	
BIOL 220 & 220L	Human Anatomy and Physiology I and Human Anatomy and Physiology I Laboratory	
BIOL 221 & 221L	Human Anatomy and Physiology II and Human Anatomy and Physiology II Laboratory	
BIOL 315 & 315L	Genetics and Genetics Laboratory	
CE 309 & CE 310	Fluid Mechanics and Fluid Mechanics Laboratory	

CE/ME 486	Nanotechnology and Nanomaterials
CHEM 122 & 122L	General Chemistry II and General Chemistry II Laboratory
CHEM 341 & 341L	Organic Chemistry I and Organic Chemistry I Laboratory
CHEM 342 & 342L	Organic Chemistry II and Organic Chemistry II Laboratory
CHEM 364	Physical Chemistry I
CHEM 365 & CHEM 471	Physical Chemistry II and Physical Chemistry Laboratory
CHEM 425 & CHEM 429	Inorganic Chemistry I and Inorganic Chemistry Laboratory
CSCI 161	Computer Science II
CSCI 222	Discrete Mathematics
CSCI 336	Theoretical Computer Science II
CSCI 366	Database Systems
CSCI 372	Comparative Programming Languages
CSCI 426	Introduction to Artificial Intelligence
CSCI 458	Microcomputer Graphics
CSCI 459	Foundations of Computer Networks
CSCI 467	Algorithm Analysis
CSCI 474	Operating Systems Concepts
CSCI 477	Object-Oriented Systems
ECE 374	Computer Organization
ECE XX04	(Any ECE 400 level didactic course)
ECE 494	Individual Study (max. of 6 cr.)
ECE 496	Field Experience (max. of 3 cr.)
ENGR 310	Entrepreneurship for Engineers and Scientists
IME 440	Engineering Economy
IME 456	Program and Project Management
IME 461	Quality Assurance and Control
MATH 270	Introduction to Abstract Mathematics
MATH 420	Abstract Algebra I
MATH 421	Abstract Algebra II
MATH 429	Linear Algebra
MATH 450	Real Analysis I
MATH 451	Real Analysis II
MATH 452	Complex Analysis
MATH 480	Applied Differential Equations
MATH 481	Fourier Analysis
MATH 483	Partial Differential Equations
MATH 488	Numerical Analysis I
MATH 489	Numerical Analysis II
ME 221	Engineering Mechanics I
ME 222	Engineering Mechanics II
ME 223	Mechanics of Materials
ME 350	Thermodynamics and Heat Transfer
ME 470	Renewable Energy Technology
MICR 445	Animal Cell Culture Techniques
PHYS 350	Modern Physics
PHYS 360	Modern Physics II
PHYS 413	Lasers for Scientists and Engineers
PHYS 415	Elements of Photonics

PHYS 485	Quantum Mechanics I
STAT 450	Stochastic Processes
STAT 468	Probability and Mathematical Statistics II
ZOO 460	Animal Physiology
Total Credits	**126**

* No grade less than a C accepted in these courses and before enrolling in ECE 300 level courses, excluding ECE 311.

Degree Requirements and Notes

- A student must complete at least 60 semester credits of professional level course work in his/her program while in residence and enrolled in the college. Students transferring into the college from programs with professional accreditation are exempt from this residency requirement but are subject to the residency requirement of NDSU.
- In order to graduate, an ECE student must have at least a 2.0 GPA in all required EE and ECE courses taken at NDSU. Elective ECE courses are not included in this GPA requirement.
- Transfer Students – Transfer courses with grades less than 'C' in Biology, Chemistry, Computer Science, Mathematics, Physics, and any type of engineering class will not be accepted as a major requirement.
- All Students – Students are required to attain a grade of 'C' or better in ECE 173 Introduction to Computing, ECE 275 Digital Design, EE 206 Circuit Analysis I, and all required MATH courses.

Note: *For students interested in pursuing one of the areas of specialization, lists of recommendations for specific electives are available from the ECE Department* (https://www.ndsu.edu/ece) .