



Electrical Engineering

MISSOURI UNIVERSITY OF SCIENCE AND TECHNOLOGY

Formerly University of Missouri-Rolla

Electrical engineers are involved in channeling natural resources into uses for society such as heating, lighting, home appliances, consumer products, computing, sensing, control, and communication. They contribute to systems and devices for power, instrumentation, measurement, communication, management, manufacturing, transportation, etc. They are primarily concerned with the processes of generation, transmission, transformation, control, and utilization of energy or information.

Students who are interested in electrical engineering begin in the Freshman Engineering Program, thus obtaining fundamental skills and an overview of the various degree programs at Missouri S&T, before entering the main program. They commit to a given degree program after exposure to the different career options. Once in the program, students gain knowledge in the main areas of electrical engineering, learn to use hardware and software tools in numerous laboratories, and apply engineering concepts in both freshman and capstone design experiences. Educational options include dual major programs (such as electrical and computer engineering degrees), emphasis areas (formal degree emphasis options in seven areas), minor programs, and honors activities (such as the departmental Honors Scholar program). They may supplement their education with participation in design competitions, professional societies, work internships, research experiences, etc.

Students are exposed to the breadth of electrical engineering and they can pursue electives in several areas or to emphasize a specialty. The areas are circuits and electronics, power and energy, communications and signal processing, controls and systems, electromagnetics, optics and devices, and computer engineering.

In **circuits and electronics**, courses provide study of basic electrical devices – energy sources, resistors, inductors, capacitors, diodes, and transistors – and their interconnection in operational networks. Circuits design and analysis techniques are covered with both analog and digital applications.

In **power and energy**, courses emphasize motors, generators, transformers, distribution systems, high-voltage devices, and power electronics.

In **communications and signal processing**, courses include concepts required for the characterization and manipulation of information-bearing signals, modulation systems, wireless networks, image processing, and detection hardware.

In **controls and systems**, courses emphasize the design and application of circuits and systems to automatically monitor and regulate devices, machines, and processes. Advanced technologies using digital control, intelligent processing, neural networks, and programmable logic controllers are included.

In **electromagnetics**, courses provide study in the interaction, propagation, and transmission of high-frequency waves and signals through space and in conductors. Topics include grounding and shielding, antennas, microwaves, and systems.

In **optics and devices**, courses provide study of solid-state materials, electronic devices, and optoelectronics. Applications are microfabrication, sensing, computing, instrumentation, lasers and fiber optics, nanotechnologies, and smart technologies.

In **computer engineering**, courses are offered in integrated circuits and logic design, architecture and embedded systems, computational intelligence, networking, and software security and reliability.

Our ABET-accredited Electrical Engineering Program and the closely-related Computer Engineering Program are run in the same department. The Electrical and Computer Engineering Department strives to contribute to the state, nation, and world through the education of outstanding professionals and leaders in engineering. *Our educational focus is on a broad, rigorous education in all areas of electrical and computer engineering with significant hands-on experiences.* The program aims to provide students with an understanding of engineering problem solving at all levels and an appreciation for engineering as a profession. The program is designed to emphasize technical competency and an engineering perspective, as well as incorporate professional skills and knowledge.

Admissions Contact

Missouri S&T Office of Admissions • 1-800-522-0938 • admissions@mst.edu

Faculty

Professors:

Daryl Beetner, D.Sc., Washington University in St. Louis
Mariesa Crow, Ph.D., University of Illinois (UIUC)
James Drewniak, Ph.D., (Assoc. Chair), University of Illinois (UIUC)
Richard E. DuBroff, Ph.D., University of Illinois (UIUC)
Kelvin T. Erickson, Ph.D. (Chair), Iowa State University
Randy Moss, Ph.D., University of Illinois (UIUC)
David Pommerenke, Dr. – Ing., Technical University at Berlin
Jagannathan Sarangapani, Ph.D., University of Texas at Arlington
Steve E. Watkins, Ph.D. (Associate Chair), University of Texas at Austin
Cheng-Hsiao Wu, Ph.D., University of Rochester
Donald Wunsch II, Ph.D., University of Washington
Chengshan Xiao, Ph.D., University of Sydney, Australia
Reza Zoughi, Ph.D., University of Kansas

Associate Professors:

Levant Acar, Ph.D., Ohio State University
Minsu Choi, Ph.D., Oklahoma State University
Jun Fan, Ph.D., University of Missouri-Rolla
Mehdi Ferdowsi, Ph.D., Illinois Institute of Technology
Steven Grant, Ph.D., Rutgers, The State University of New Jersey
Chang-Soo Kim, Ph.D., Kyungpook National University
Kurt Kosbar, Ph.D. (Associate Chair), University of Southern California
Sahra Sedighsarvestani, Ph.D., Purdue University
R. Joe Stanley, Ph.D. (Associate Chair), University of Missouri-Columbia
Rosa Zheng, Ph.D., Carleton University at Ottawa, Canada

Assistant Professors:

Kristen Donnell, Ph.D., Missouri University of Science and Technology
Jonathan Kimball, Ph.D., University of Illinois (UIUC)
Pourya Shamsi, Ph.D., University of Texas at Dallas
Yiyu Shi, Ph.D., University of California, Los Angeles
Maciej Zawodniok, Ph.D., University of Missouri-Rolla

Associate Teaching Professor:

Bijaya Shrestha, Ph.D., University of Missouri-Rolla

Assistant Teaching Professor:

Rohit Dua, Ph.D., University of Missouri-Rolla
Theresa Odun-Ayo, Ph.D., Missouri University of Science and Technology
John E. Seiffert IV, Ph.D., Missouri University of Science and Technology
Theresa M. Swift, Ph.D., University of Missouri-Rolla

Scholarships in Electrical and Computer Engineering

Approximately \$50,000 in department scholarships are awarded per year.

Cooperative Education Program

Cooperative Education (Co-op) is a structured educational strategy integrating classroom studies with learning through productive work experiences in a field related to a student's academic or career goals.

The career opportunities center can provide you with a current list of companies seeking electrical engineering interns. Among the companies that have co-op programs in Electrical Engineering at Missouri S&T are: AB Chance; Adtran, Inc.; Ameren UE; American Airlines; Anheuser-Busch, Argonne National Lab; Benson Electric; Black & Veatch; Boeing; Burns & McDonnell; Bussmann; Calgon-Vestal; Caterpillar, Inc.; CIA; Copeland Corp.; Deere & Company; Emerson Electric; Energy Operations; Fisher Controls; Garmin International; General Electric; General Motors; Hampton-Tilley Assoc.; Harmon Electronics; Hunter Engineering; Hussman Corp.; Johnson Controls; Lexmark International, Inc.; Magnetek Advanced Design; Magnum Technologies; Monsanto; Northern Telecom; Olin Corp.; Paxon Company; Primex Technologies; Raytheon Company; Rockwell Collins Defense; Sandia National Labs; Sega; Union Pacific RR; and Westar Corp.

Curriculum

Bachelor of Science, Electrical Engineering¹

	<i>Credit</i>
FRESHMAN YEAR First Semester	
FE 10-Study & Careers in Eng ²	1
Math 14-Calculus I for Engineers ³	4
Chem 1-General Chemistry	4
Chem 2-General Chemistry Lab	1
Hist 112, 175, 176, or Pol Sc 90	3
English 20-Exposition & Argumentation	3
	16
FRESHMAN YEAR Second Semester	
IDE 20-Eng Design with Comp Applications	3
Math 15-Calculus II for Engineers ³	4
Physics 23-Engineering Physics I ^{3,4}	4
Econ 121 or 122	3
Elective-Hum or Soc (any level) ⁵	3
	17
SOPHOMORE YEAR First Semester	
El Eng 151-Circuits I ^{3,6,7}	3
El Eng 152-Circuits Analysis I Lab ^{3,6}	1
Cp Eng 111-Introduction to Computer Engineering ^{3,6,8}	3
Cp Eng 112-Computer Engineering Lab ^{3,6}	1
Math 22-Calculus w/ Analytic Geometry III ³	4
Physics 24-Engineering Physics II ^{3,4}	4
	16
SOPHOMORE YEAR Second Semester	
El Eng 121-Introduction to Electronic Devices ^{3,6,7,10}	3
El Eng 122-Electronic Devices Lab ^{3,6,7}	1
El Eng 153-Circuits II ^{3,7,9}	3
Math 204-Elementary Differential Equations ³	3
Engineering Science Elective ¹¹	3
Cmp Sc 53-Introduction to Programming	3
Cmp Sc 54-Introduction to Programming Lab	1
	17
JUNIOR YEAR First Semester	
El Eng 217-Continuous Linear Systems I ^{3,6,9}	3
El Eng 218-Continuous Linear Systems I Lab ^{3,6,9}	1
El Eng 253-Electronics I ^{3,6,9,10}	3
El Eng 255-Electronics I Lab ^{3,6,9,10}	1
Math 208-Linear Algebra	3
Sp&M 85-Principles of Speech	3
	14
JUNIOR YEAR Second Semester	
El Eng 271-Electromagnetics ^{3,9}	4
El Eng 215-Discrete Linear Systems I ^{3,6,9}	3
El Eng 216-Discrete Linear Systems I Lab ^{3,6,9}	1
El Eng Elective A ^{10,14,19}	3
Stat 217-Prob & Stat for Eng and Scientists ¹²	3
English 160-Technical Writing ¹³	3
	17
SENIOR YEAR First Semester	
El Eng Power Elective ^{3,6,9,15}	3
El Eng Power Elective Lab ^{3,6,9,15}	1
El Eng Elective B ^{10,14}	3
El Eng Elective D ^{10,16,19}	3
El Eng 391-El Eng Senior Project I ³	1
Elective-Hum or Soc (any level) ⁵	3
Free Elective ¹⁸	2
	16
SENIOR YEAR Second Semester	
El Eng Elective C ^{10,14}	3
El Eng Elective E ¹⁷	3
El Eng 392-El Eng Senior Project II	3
Elective-Hum or Soc (upper level) ⁵	3
Free Elective ¹⁸	3
	15

Students must satisfy the common engineering freshman requirements and be admitted into the department. See Freshman Engineering Program.

- 1) The minimum number of hours required for a degree in Electrical Engineering is 128.
- 2) Students that transfer after their freshman year are not required to enroll in Freshman Engineering Seminar.
- 3) A minimum grade of "C" must be attained in Math 14, 15, 22, and 204, Physics 23 and 24 (or their equivalents), El Eng 151, 152, 153, 121, 122, 215, 216, 217, 218, 253, 255, and 271, the El Eng power elective (205 and 208 or 207 and 209), El Eng 391, and Cp Eng 111 and 112. Also, students may not enroll in other courses that use these courses as prerequisites until the minimum grade of "C" is attained.
- 4) Students may take Physics 21 and 22 or Physics 21 and 27 in place of Physics 23. Students may take Physics 25 and 26 or Physics 25 and 28 in place of Physics 24.
- 5) All electives must be approved by the student's advisor. Students must comply with the engineering general education requirements with respect to selection and depth of study. These requirements are specified in the current catalog.
- 6) Students who drop a lecture prior to the last week to drop a class must also drop the corequisite lab.
- 7) Students must earn a passing grade on the El Eng Advancement Exam I (associated with El Eng 151) before they enroll in El Eng 153 or 121 and 122.
- 8) Students must earn a passing grade on the Cp Eng Advancement Exam (associated with Cp Eng 111) before they enroll in any course with Cp Eng 111 and 112 as prerequisites.
- 9) Students must earn a passing grade on the El Eng Advancement Exam II (associated with El Eng 153) before they enroll in El Eng 205 and 208, 207 and 209, 215 and 216, 217 and 218, 253 and 255, or 271 and 255 or other courses with El Eng 153 as a prerequisite.
- 10) Students must earn a passing grade on the El Eng Advancement Exam III (associated with El Eng 121) before they enroll in El Eng 253 and 255 or other courses with El Eng 121 as a prerequisite.
- 11) Students must take IDE 140, Mc Eng 219, Mc Eng 227, Physics 207, Physics 208, Chem 221, Biology 211, or Biology 231. The following pairs of courses are substitutions for any single course: CE 50 and IDE 150, Physics 107 and Physics 311, Physics 107 and Cr Eng 284, Physics 107 and Nu Eng 205, or Eng Mt 134 and Eng Mt 253.
- 12) Students may replace Stat 217 with Stat 215 or Stat 343.
- 13) Students may replace English 160 with English 60.
- 14) El Eng Electives A, B, and C must be chosen from the El Eng 205, 207, 225, 231 or 235, 243, 254, or Cp Eng 213.
- 15) The El Eng Power Elective may be satisfied with El Eng 205 and 208 or El Eng 207 and 209.
- 16) El Eng Elective D must be a 300-level El Eng or Cp Eng course with at least a 3-hour lecture component. This normally includes all El Eng and Cp Eng 3xx courses except El Eng and Cp Eng 300, 38x, 390, 391, and 392.
- 17) El Eng Elective E may be any 200 or 300-level El Eng or Cp Eng course except El Eng 202 28x, 391, and 292 and Cp Eng 202, 300, 390, 391, and 392.
- 18) Students are required to take five hours of free elective in consultation with their academic advisors. Credits that do not count toward this requirement are deficiency courses (such as algebra and trigonometry) and extra credits from courses meeting other requirements. Any courses outside of engineering and science must be at least three credit hours. El Eng 28x, and El Eng or Cp Eng 391 and 392 may not be used for free electives.
- 19) Students that pursue an optional degree emphasis have restricted options for El Eng Electives A, D, and E.

All Electrical Engineering students are encouraged to take the Fundamentals of Engineering Examination prior to graduation. It is the first step toward becoming a registered professional engineer.

Students may pursue a formal emphasis specialty in circuits and electronics, power and energy, communications and signal processing, controls and systems, electromagnetics, optics and devices, or computer engineering. An emphasis is not required.