



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

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 **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., (Chair), Washington University in St. Louis
Mariesa Crow, Ph.D., University of Illinois (UIUC)
James Drewniak, Ph.D., University of Illinois (UIUC)
Richard E. DuBroff, Ph.D., University of Illinois (UIUC)
Kelvin T. Erickson, Ph.D., Iowa State University
Chang-Soo Kim, Ph.D., Kyungpook National 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
Jonathan Kimball, Ph.D., University of Illinois (UIUC)
Kurt Kosbar, Ph.D. (Associate Chair), University of Southern California
Sahra Sedighsarvestani, Ph.D., (Associate Chair), Purdue University
R. Joe Stanley, Ph.D. (Associate Chair), University of Missouri-Columbia
Rosa Zheng, Ph.D., Carleton University at Ottawa, Canada
Maciej Zawodniok, Ph.D., University of Missouri-Rolla

Assistant Professors:

Kristen Donnell, Ph.D., Missouri University of Science and Technology
Pourya Shamsi, Ph.D., University of Texas at Dallas
Yiyu Shi, Ph.D., University of California, Los Angeles

Associate Teaching Professor:

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

Assistant Teaching Professor:

Rohit Dua, Ph.D., University of Missouri-Rolla
Amardeep Kaur, Ph.D., Missouri University of Science and Technology
Theresa Odun-Ayo, 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

FRESHMAN YEAR *First Semester*

FE 1100-Study & Careers in Eng ²	Credit	1
Math 1214-Calculus I for Engineers ³		4
Chem 1310-General Chemistry		4
Chem 1319-General Chemistry Lab		1
Hist 1200, 1300, 1310, or Pol Sc 1200		3
English 1120-Exposition & Argumentation		<u>3</u>
		16

FRESHMAN YEAR *Second Semester*

ME 1720-Eng Design with Comp Applications	Credit	3
Math 1215-Calculus II for Engineers ³		4
Physics 1135-Engineering Physics I ^{3,4}		4
Econ 1100 or 1200		3
Elective-Hum or Soc (any level) ⁵		<u>3</u>
		17

SOPHOMORE YEAR *First Semester*

El Eng 2100-Circuits I ^{3,6,7}	Credit	3
El Eng 2101-Circuits Analysis I Lab ^{3,6}		1
Cp Eng 2210-Introduction to Computer Engineering ^{3,6,8}		3
Cp Eng 2211-Computer Engineering Lab ^{3,6}		1
Math 2222-Calculus w/ Analytic Geometry III ³		4
Physics 2135-Engineering Physics II ^{3,4}		<u>4</u>
		16

SOPHOMORE YEAR *Second Semester*

El Eng 2120-Circuits II ^{3,7,9}	Credit	3
El Eng 2200-Introduction to Electronic Devices ^{3,6,7,10}		3
El Eng 2201-Electronic Devices Lab ^{3,6,7}		1
Math 3304-Elementary Differential Equations ³		3
Engineering Science Elective ¹¹		3
Cmp Sc 1570-Introduction to Programming		3
Cmp Sc 1580-Introduction to Programming Lab		<u>1</u>
		17

JUNIOR YEAR *First Semester*

El Eng 3100-Electronics I ^{3,6,9,10}	Credit	3
El Eng 3101-Electronics I Lab ^{3,6,9,10}		1
El Eng 3320-Control Systems ^{3,6,9}		3
El Eng 3321-Control Systems Lab ^{3,6,9}		1
Math 3108-Linear Algebra		3
Sp&M 1185-Principles of Speech		<u>3</u>
		14

JUNIOR YEAR *Second Semester*

El Eng 3430-Digital Communications I ^{3,6,9}	Credit	3
El Eng 3431-Digital Communications Lab ^{3,6,9}		1
El Eng 3600-Electromagnetics ^{3,9}		4
El Eng Elective A ^{10,14,19}		3
Stat 3117-Prob & Stat for Eng and Scientists ¹²		3
English 3560-Technical Writing ¹³		<u>3</u>
		17

SENIOR YEAR *First Semester*

El Eng Power Elective ^{3,6,9,15}	Credit	3
El Eng Power Elective Lab ^{3,6,9,15}		1
El Eng Elective B ^{10,14}		3
El Eng Elective D ^{10,14,19}		3
El Eng 4096-El Eng Senior Project I ³		1
Elective-Hum or Soc (any level) ⁵		3
Free Elective ¹⁸		<u>2</u>
		16

SENIOR YEAR *Second Semester*

El Eng Elective C ^{10,14}	Credit	3
El Eng Elective E ¹⁷		3
El Eng 4097-El Eng Senior Project II		3
Elective-Hum or Soc (upper level) ⁵		3
Free Elective ¹⁸		3
Assessment		<u>0</u>
		15

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

- The minimum number of hours required for a degree in Electrical Engineering is 128.
- Students that transfer after their freshman year are not required to enroll in Freshman Engineering Seminar FE 1100.
- A minimum grade of "C" must be attained in Math 1214, 1215, 2222, and 3304, Physics 1135 and 2135 (or their equivalents), El Eng 2100, 2101, 2120, 2200, 2201, 3100, 3101, 3320, 3321, 3430, 3431, and 3600, the El Eng power elective (3500 and 3501 or 3540 and 3541), El Eng 4096, and Cp Eng 2210 and 2211. Also, students may not enroll in other courses that use these courses as prerequisites until the minimum grade of "C" is attained.
- Students may take Physics 1111 and 1119 in place of Physics 1135. Students may take Physics 2111 and 2119 in place of Physics 2135.
- 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.
- Students who drop a lecture prior to the last week to drop a class must also drop the corequisite lab.
- Students must earn a passing grade on the El Eng Advancement Exam I (associated with El Eng 2100) before they enroll in El Eng 2120 or 2200 and 2201.
- Students must earn a passing grade on the Cp Eng Advancement Exam (associated with Cp Eng 2210) before they enroll in any course with Cp Eng 2210 and 2211 as prerequisites.
- Students must earn a passing grade on the El Eng Advancement Exam II (associated with El Eng 2120) before they enroll in El Eng 3100, 3101, 3320, 3321, 3430, 3431, 3500, 3501, 3540, 3541 and 3600, or other courses with El Eng 2120 as a prerequisite.
- Students must earn a passing grade on the El Eng Advancement Exam III (associated with El Eng 2200) before they enroll in El Eng 3100 and 3101 or other courses with El Eng 2200 as a prerequisite.
- Students must take ME 2340, ME 2519, ME 2527, Physics 2305, Physics 2311, Physics 2401, Nu Eng 3103, Chem 2210, Bio Sc 2213, Bio Sc 2223. The following pairs of courses are substitutions: CE 2200 and ME 2350 or Eng Mgt 2110 and Eng Mgt 3310.
- Students may replace Stat 3117 with Stat 3115 or Stat 5643. Student may replace Cmp Sc 1580 with El Eng 3311.
- Students may replace English 3560 with English 1160.
- El Eng Electives A, B, and C must be chosen from the El Eng 3120, 3250, 3340, 3410, 3440, 3500, 3540, or Cp Eng 3150.
- The El Eng Power Elective may be satisfied with El Eng 3500 and 3501 or El Eng 3540 and 3541.
- El Eng Elective D must be a 4XXX-level or above El Eng or Cp Eng course with at least a 3-hour lecture component. El Eng 4000, 5000, 4096, 4097, 4099, 5070, 58XX and Cp Eng 4000, 5000, 4096, 4097, 4099, 5070, 58XX may not be used for Elective D.
- El Eng Elective E may be any 3XXX-level or above El Eng or Cp Eng course except El Eng 3002, 38XX, 4096, 4097, 5070, and Cp Eng 3002, 38XX, 4000, 4096, 4097, 5070.
- 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 28XX, 38XX, 4096, 4097 and Cp Eng 28XX, 38XX, 4096, 4097 may not be used for free electives. No more than one credit hour of El Eng 3002 or Cp Eng 3002 may be applied to the BS degree for free electives.
- 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.

A formal emphasis in circuits and electronics, optics and devices, controls and systems, communications and signal processing, power and energy, electromagnetics, or computer engineering is optional.