



# Computer Engineering

## MISSOURI UNIVERSITY OF SCIENCE AND TECHNOLOGY

Formerly University of Missouri-Rolla

The Computer Engineering Program is designed to prepare an engineer to work with all aspects of computers, emphasizing hardware and software. In the software world, high-level languages and complex programs are often the solution to a problem. In the hardware world, designs also include many aspects of the physical world, like temperature or noise, and often must include compromises between many opposing factors. The ability of computer engineers to work in both worlds is what distinguishes them from computer scientists or electrical engineers who may specialize in computers. Computer scientists typically have little training with hardware. Electrical engineers typically have little training with software. Our students are trained to work with both, since many computer systems cannot be built well without a clear understanding of hardware and software.

Computer engineers can be found just about anywhere there are computers. Computer engineers might build the integrated circuits (ICs) that go into your home video game or your cell phone. They might develop the microprocessor that goes into your home computer, deciding what instructions it executes and how it interfaces with memory. Computer engineers also build computer systems that use these ICs. For example, computer engineers might put together the ICs to build the motherboard for your home computer or the video card that goes into that computer. Computer engineers also help computers work together, such as developing computer networks or working with parallel processing. Computer engineers help build embedded computer systems. These are devices with a computer inside them that work directly with their environment. They could be as complicated as a satellite or as everyday as your car, your phone, or even your microwave oven. Computer engineers build software. They might be found at companies like Microsoft, working strictly with software, or helping complex software systems interface better with hardware. They might also try to make the computer “smarter” by working with computational intelligence. Since computers are everywhere and such an important part of our lives, the options for computer engineers are wide open.

Our ABET-accredited Computer Engineering Program emphasizes both hands-on experiences and training in fundamental concepts and theory. Students participate in many laboratories that include both hardware and software. Many lecture courses include one or more projects that require the student to build something “real” and make it work. All students take a one-year design course for this reason in the final year in the program. While these projects are challenging, they are also fun and prepare a student to perform immediately on the job when they get out of school. Coursework also concentrates strongly on theory and fundamentals, which is essential for our students to fully understand the systems they will work on, to quickly learn new concepts as their job function changes, and to equip them to adapt to the rapidly changing world of computers in the future.

The Computer Engineering Program includes several courses in both Electrical Engineering and Computer Science. The Program follows the Electrical Engineering Program into the sophomore year, with courses in circuits and electronics, and then branches into Computer Science courses, including data structures and operating systems. Students first complete the Freshman Engineering Program, obtaining basic science skills and an overview of the various degree programs at Missouri S&T, before entering the main program. This allows students time to consider different career options before they commit to a given degree program.

Students work closely with their advisors to carefully plan each semester’s class schedule in order to have the correct prerequisites for courses in the following semesters. Working with their advisor, they should also select electives in the program to provide the background in areas they wish to emphasize for their career path. Emphasis areas in the Computer Engineering Program include computers and architecture, integrated circuits and logic design, embedded computer systems, computational intelligence, networking and software engineering, and security and reliability. Educational opportunities include dual major programs (such as Electrical Engineering or Computer Science), minor programs and honors activities (such as the departmental Honors Scholar Program). Students may also supplement their coursework with participation in design teams and competitions, research experiences, internships, professional societies, etc. Students seeking additional coursework and research experience should consider the alternative of working towards an M.S. or Ph.D. degree in graduate school.

### Faculty

#### Professors:

Daryl Beetner, D.Sc., (Chair), Washington University in St. Louis  
Mariesa Crow, Ph.D., University of Illinois (UIUC)  
James Drewniak, Ph.D. (Associate Chair), University of Illinois (UIUC)  
Richard E. DuBroff, Ph.D., University of Illinois (UIUC)  
Kelvin T. Erickson, Ph.D., 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:

Egemen Cetinkaya, Ph.D, University of Kansas  
Kristen Donnell, Ph.D., Missouri University of Science and Technology  
Jonathan Kimball, Ph.D., University of Illinois (UIUC)  
Pouya 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  
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

### 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. It provides progressive experiences in integrating theory and practice.

The career opportunities center can provide you with a current list of companies seeking Computer Engineering interns. Among the companies that have co-op programs in Computer Engineering at Missouri S&T are: Adtran, Inc.; AmerenUE; Central Intelligence Agency; Cerner Corp.; Garmin International; General Motors; Hallmark Cards; Lexmark International, Inc.; Microsoft; Sandia National Labs; SBC Communications; Symbol Technologies; Unigraphics Solutions; Hewlett-Packard; and the Naval Research Laboratory.

### Scholarships

In conjunction with Electrical Engineering, approximately \$50,000 department scholarships are awarded per year.

### Admissions Contact

Missouri S&T Office of Admissions • 1-800-522-0938 • [admissions@mst.edu](mailto:admissions@mst.edu)

# Curriculum

## Bachelor of Science Computer Engineering<sup>1</sup> FRESHMAN YEAR

First Semester	Credit
FE 1100-Study & Careers in Eng <sup>2</sup>	1
Math 1214-Calculus I for Engineers <sup>3</sup>	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

Second Semester	Credit
Mc Eng 1720-Eng Design with Comp Appl	3
Math 1215-Calculus II for Engineers <sup>3</sup>	4
Physics 1135-Engineering Physics I <sup>3,4</sup>	4
Econ 1100 or 1200	3
Elective-Hum or Soc (any level) <sup>5</sup>	<u>3</u>
	17

## SOPHOMORE YEAR

First Semester	Credit
El Eng 2100-Circuits I <sup>3,6,7</sup>	3
El Eng 2101-Circuits Analysis I Lab <sup>3,6</sup>	1
Cmp Sc 1570-Introduction to Programming <sup>3</sup>	3
Cmp Sc 1580-Introduction to Programming Lab <sup>3</sup>	1
Math 2222-Calculus w/ Analytic Geometry III <sup>3</sup>	4
Physics 2135-Engineering Physics II <sup>3,4</sup>	<u>4</u>
	16

Second Semester	Credit
Cp Eng 2210-Introduction to Computer Engineering <sup>3,6,8</sup>	3
Cp Eng 2211-Computer Engineering Lab <sup>3,6</sup>	1
El Eng 2120-Circuits II <sup>3,7,9</sup>	3
Cmp Sc 1510-Data Structures <sup>3</sup>	3
Cmp Sc 1200-Discrete Mathematics <sup>3</sup>	3
Math 3304-Elementary Differential Equations <sup>3</sup>	<u>3</u>
	16

## JUNIOR YEAR

First Semester	Credit
Cp Eng 3150-Digital Systems Design <sup>3,6,8</sup>	3
Cp Eng 3151-Digital Engineering Lab II <sup>3,6,8</sup>	1
Cp Eng 3110-Computer Architecture <sup>3,8</sup>	3
El Eng 2200-Introduction to Electronic Devices <sup>3,6,7</sup>	3
El Eng 2201-Electronic Devices Lab <sup>3,6,7</sup>	1
Mathematics Elective <sup>10</sup>	3
Sp&M 1185-Principles of Speech	<u>3</u>
	17

Second Semester	Credit
Cp Eng Elective A <sup>3,14</sup>	3
El Eng 3410-Discrete Linear Systems <sup>3,6,9</sup>	3
Cmp Sc 3800-Introduction to Operating Systems <sup>3</sup>	3
Stat 3117-Prob & Stat for Eng and Scientists <sup>12</sup>	3
English 3560-Technical Writing <sup>13</sup>	<u>3</u>
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## SENIOR YEAR

First Semester	Credit
Cp Eng 5410 or Cmp Sc 5600 <sup>3</sup>	3
Cp Eng Elective C <sup>3,15,16</sup>	3
Cp Eng 4096-El Eng Senior Project I <sup>3,17</sup>	1
Elective-Hum or Soc (any level) <sup>5</sup>	3
Cp Eng Elective B <sup>19</sup>	3
Engineering Science Elective <sup>11</sup>	<u>3</u>
	16

Second Semester	Credit
Cp Eng Elective D <sup>3,15,16</sup>	3
Cp Eng Elective E <sup>3,15,16</sup>	3
Cp Eng 4097-El Eng Senior Project II <sup>3,17</sup>	3
Elective-Hum or Soc (upper level) <sup>5</sup>	3
Free Elective <sup>18</sup>	<u>3</u>
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**NOTE:** Students must satisfy the common engineering freshman year requirements and be admitted into the department.

- The minimum number of hours required for a degree in Computer Engineering is 128.
- Students that transfer after their freshman year are not required to enroll in Freshman Engineering Seminars.
- A minimum grade of "C" must be attained in Math 1214, 1215, 2222, and 3304, Physics 1135 and 2135 (or their equivalents), Cmp Sc 1570, 1580, 1200, 1510, and 3800, Cp Eng 2210, 2211, 3110, 3150, 3151, 5410, 4096, and 4097, and El Eng 2100, 2101, 2120, 2200, 2201, 3410, and 3411, and the Cp Eng electives A, B, C, D and E. 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 3410 and 3411.
- Students must take Math 3103, 3108, 3109, 5302, 5603, 5105, 5106, 5107, 5108, 5209, 5211, 5215, 5222, 5325, 4530, 5737, 5351, 5154, 4096, 5483, 5585 or Stat 5644, 5346, 5353.
- Students must take Mc Eng 2340, Mc Eng 2519, Mc Eng 2527, Physics 2311, Physics 2401, Chem 2210, Biology 2213, or Biology 2223. The following pairs of course are substitutions for any single course: Civ Eng 2200 and Mc Eng 2350, Physics 2305 and Physics 4311, Physics 2305 and Cer Eng 4240, or Physics 2305 and Nuc Eng 3205.
- Students may replace Stat 3117 with Stat 3115 or stat 5643.
- Students may replace English 3560 with English 1160.
- Cp Eng Elective A must be a 4xxx or 5xxx-level Cp Eng, El Eng or Cmp Sc course with a least a 3-hour lecture component. This normally includes all Cp Eng and El Eng 4xxx or 5xxx-level courses except Cp Eng 4000, 4099, 4096 and 4097 or Cmp Sc 5000, 4010, 5600 and 4099.
- Cp Eng Electives C, D and E must be 3xxx, 4xxx or 5xxx-level courses from an approved list of science, mathematics and engineering courses. In particular, this list includes all 3xxx, 4xxx or 5xxx-level Cp Eng, El Eng and Cmp Sc courses except required courses in Cp Eng, El Eng, and Cmp Sc and except Cp Eng 4096 and 4097, El Eng 2800, 1002, 1003, 4096, and 4097, and Cmp Sc 2002 and 4600/5600. Cp Eng Electives C, D and E must include at least six hours of engineering or computer science courses.
- Cp Eng Electives C, D and E cannot include more than three hours of Cp Eng or El Eng 4000 or 4099.
- Students pursuing dual degrees in Cp Eng and El Eng may take either Cp Eng 4096 or El Eng 4096 and Cp Eng 4097 or El Eng 4097. Students may not receive credit for both Cp Eng 4096 and El Eng 4096 or Cp Eng 4097 and El Eng 4097 in the same degree program.
- Students are required to take at least three credit hours. El Eng 28xx, El Eng 4096, El Eng 4097, Cp Eng 4096 and Cp Eng 4097 may not be used for free electives. No more than one credit hour of Cp Eng 3002 or El Eng 3002 may be applied to the BS degree for free electives.
- Cp Eng Elective B must be a 4xxx or 5xxx-level Cp Eng course with at least a 3-hour lecture component, excluding Cp Eng 4096 or Cp Eng 4097.

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