

# BACHELOR OF SCIENCE: ELECTRICAL COMPUTER ENGINEERING

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## ABET Program Educational Objectives

Within a few years of graduation, graduates of the Electrical & Computer Engineering program are expected to:

- Utilize their unique blend of electrical and computer engineering proficiencies to create innovative solutions to current and emerging challenges in areas such as nanotechnology, artificial intelligence, embedded systems, robotics, RF engineering, microelectronics, communications, and the smart grid.
- Successfully apply technical knowledge to innovate and bring forth transformational change for metropolitan, regional, and global well-being.
- Exhibit strong leadership skills in solving electrical and computer engineering problems in society.
- Communicate effectively to build successful teams, convey technical information to multiple audiences, and bring technologies to success in the marketplace.
- Continually contribute to the profession through graduate education, professional licensure, or other professional development pursuits.

## ABET Student Outcomes

- An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
- An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
- An ability to communicate effectively with a range of audiences.
- An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
- An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
- An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
- An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

## University Requirements

### General Education

UMKC Essentials is the university-wide curriculum that all undergraduate students will complete. The 30-credit hour program includes a First Year Experience course; three critical thinking courses in the areas of Arts & Humanities, Natural & Physical Sciences, and Social & Behavioral Sciences; a Culture and Diversity course; a Civic & Urban Engagement course; two courses in Written Composition and one course in Oral Communication; and a Math Pathway course. Transfer students entering UMKC will elect from the UMKC Essentials General Education Program or the Missouri Core 42 General Education Curriculum. Academic advisors will meet with incoming transfer students to determine which option best serves the student's educational needs. More information about General Education may be found here: <https://catalog.umkc.edu/undergraduate-academic-regulations-information/general-education-requirements/> (<http://catalog.umkc.edu/undergraduate-academic-regulations-information/general-education-requirements/>)

### Constitution Course

Every undergraduate student must take a course covering the United States Constitution and the Missouri State Constitution before graduation. Course options are included in the program requirements section below.

### Exit Examinations

Information on exit examinations is available in the Undergraduate Academic Regulations and Information (<http://catalog.umkc.edu/undergraduate-academic-regulations-information/graduation/exitexams/>) section of the catalog.

### Missouri Higher Education Civics Achievement Examination

In accordance with Missouri Senate Bill 807 (section 170.013.1), 'any student entering a public institution of higher education for the first time after July 2019 who is pursuing an associate's or bachelor's degree from such institution shall successfully pass an examination on the provisions and principles of American civics with a score of seventy percent or greater as a condition of graduation from such institution'. To satisfy this requirement at UMKC, students access the exam through the Canvas site. This requirement will be listed in the degree audit system as 'Take State Mandated Missouri Higher Education Civics Achievement Examination', and listed on the transcript as 'Missouri Civics Examination'.

## Student Learning Outcomes

Students graduating from this program will:

- Identify core challenges, formulate and devise methodology for solving complex engineering problems by applying principles of engineering, science, and mathematics.
- Apply the engineering design process to produce solutions for a given set of engineering requirements in the context of the program's discipline.
- Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
- Effectively communicate technical information both in written and oral presentation formats and function effectively on teams in a variety of professional contexts.
- Identify professional responsibilities and make informed judgments in engineering practice based on legal and ethical principles.
- Acquire new knowledge, choose appropriate learning strategies, and apply this knowledge in engineering applications and beyond.

## Program Description

The Bachelor of Science in Electrical and Computer Engineering (ECE) is accredited by the Engineering Accreditation Commission of ABET <http://www.abet.org/>.

The ECE degree program is designed to provide the key elements of both an electrical engineering and a computer engineering curriculum. Graduates of this program are prepared for larger breadth in job opportunities than are typically available in a traditional electrical engineering program. A BS/MS Program for completing both a BS in ECE and a MS in EE in five years is available. For additional information, please contact the SS&C Student Services Center at (816)235-2399 or [sce@umkc.edu](mailto:sce@umkc.edu).

## Program Educational Objectives

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2. Successfully apply technical knowledge to innovate and bring forth transformational change for metropolitan, regional, and global well-being.
3. Exhibit strong leadership skills in solving electrical and computer engineering problems in society.
4. Communicate effectively to build successful teams, convey technical information to multiple audiences, and bring technologies to success in the marketplace.
5. Continually contribute to the profession through graduate education, professional licensure, or other professional development pursuits.

## Career Implications

Job opportunities abound for electrical and computer engineering majors. In terms of starting salaries and the number of job offers, ECE graduates compare favorably with other engineering graduates. In addition, the ECE curriculum at UMKC equips the graduate with the analytical decision-making skills necessary to pursue diverse technical, managerial and entrepreneurial career opportunities.

## Admission Requirements

High school students planning to apply to this degree program are strongly encouraged to take a college preparatory program that emphasizes mathematics, science and communication skills.

First-time college student applicants to the undergraduate program in electrical and computer engineering will be automatically admitted if they obtain:

1. An ACT mathematics score of at least 25 and
2. An ACT composite score of at least 24 and
3. A 3.0 Core High School GPA

First-time college student applicants who do not meet the above criteria but do meet UMKC general admission requirements will have their applications reviewed for admission. Applicants who are not admitted to this program but do meet UMKC general admission requirements may be admitted to University College.

Students without the prerequisite preparation must take the needed coursework before enrolling in courses required for the bachelor's degree. Students seeking re-admission must have been in good academic standing when last enrolled. Otherwise, re-admission requires a formal review by the undergraduate program committee.

Transfer applicants must have at least 24 credits of transferable college credit, an overall 2.0 GPA on a 4.0 scale in all coursework, which includes repeated coursework, attempted at previous institutions. Transfer applicants without a 2.0 or higher college GPA must submit a petition for admission.

## Program Requirements

### UMKC Essentials

Code	Title	Credits
First Semester Experience Course (GEFSE)		3
Written Communication:		
ENGLISH 110	Introduction to Academic Prose	3
ENGLISH 225	English II: Intermediate Academic Prose	3
Oral Communication (choose one of the following):		3
COMM-ST 110	Fundamentals of Effective Speaking and Listening	
COMM-ST 140	Introduction to Communication	
COMM-ST 212	Argumentation And Debate	
COMM-ST 277	Interpersonal Communication	
Math Pathway (Satisfied in program requirements below)		
Critical Thinking in Arts & Humanities (GECRT-AH)		3
Critical Thinking in Natural & Physical Sciences (GECRT-SC; Satisfied in program requirements below)		
Critical Thinking in Social & Behavioral Sciences (GECRT-SS)		3
Culture & Diversity Course (GECDV)		3
Civic & Urban Engagement Course (GECUE; Satisfied in program requirements below)		
Total Credits		21

### Constitution Course Requirement

Section 170.011.1 of the Missouri Revised Statutes, 2015, states that all candidates for a degree issued by a college or university in the state of Missouri must have "satisfactorily passed an examination on the provisions and principles of the Constitution of the United States and of the state of Missouri, and in American history and American institutions."

Courses at UMKC that satisfy this state requirement are:

Code	Title	Credits
Choose one of the following:		3
CJC 364	The Supreme Court And The Criminal Process	
HISTORY 101	U.S. History to 1877	
HISTORY 102	U.S. History Since 1877	
HONORS 230	Honors American Government	
POL-SCI 210	American Government	
Total Credits		3

There are a few other ways this requirement can be satisfied for students transferring to UMKC:

- Take an equivalent course from the list above at a regionally accredited institution.
- Earn credit for one of the above courses through AP, IB, or CLEP.
- Take a course that directly satisfies the Missouri Constitution Requirement at another Missouri institution.
- Have a previous bachelors degree (or higher) from a regionally accredited institution.
- Have an Associate of Arts degree from a regionally accredited institution.
- Complete the 42 Hour Core at a Missouri institution and have it listed on the official transcript.

### Major Requirements

Code	Title	Credits
<b>Math Requirements</b>		
MATH 110 (PreCalculus Algebra; Typically not required due to ACT Admission Requirement)		
MATH 120 (Pre-Calculus; Typically not required due to ACT Admission Requirement)		
MATH 210	Calculus I	4
MATH 220	Calculus II	4
COMP-SCI 394R	Applied Probability	3
E&C-ENGR 241	Applied Engineering Analysis I	3

E&C-ENGR 341R	Applied Engineering Analysis II	3
<b>Life and Physical Sciences Requirements</b>		
BIOLOGY 102 & 102L or CHEM 211/211L	Biology and Living and Biology and Living Laboratory General Chemistry I	4
PHYSICS 240	Physics For Scientists and Engineers I	5
PHYSICS 250	Physics For Scientists and Engineers II	5
<b>Higher Order Thinking Requirements</b>		
E&C-ENGR 216	Engineering Computation	4
<b>Electrical and Computer Engineering Requirements</b>		
COMP-SCI 304WI	Ethics and Professionalism (satisfied GECUE requirement)	3
E&C-ENGR 226	Logic Design	3
E&C-ENGR 227	Logic Design Laboratory	1
E&C-ENGR 228	Introduction to Computer Design	3
E&C-ENGR 229	Introduction to Computer Design Laboratory	1
E&C-ENGR 276	Circuit Theory I	3
E&C-ENGR 277	Circuit Theory I Lab	1
E&C-ENGR 302	Electromagnetic Waves and Fields (satisfies GECRT-SC course requirement)	3
E&C-ENGR 303	Electromagnetic Waves and Fields Lab	1
E&C-ENGR 330	Electronic Circuits	3
E&C-ENGR 331	Electronic Circuits Laboratory	1
E&C-ENGR 334	Semiconductors and Devices	3
E&C-ENGR 358 or E&C-ENGR 474	Introduction to Control Systems Introduction to Communication Systems	3
E&C-ENGR 376	Circuit Theory II	3
E&C-ENGR 377	Circuit Theory II Lab	1
E&C-ENGR 380	Signals and Systems	3
E&C-ENGR 381	Signals and Systems Lab	1
E&C-ENGR 402	Senior Design I	3
E&C-ENGR 403	Senior Design II	2
E&C-ENGR 416 or E&C-ENGR 486	Neural and Adaptive Systems Pattern Recognition	3
E&C-ENGR 426	Microcomputer Architecture and Interfacing	3
E&C-ENGR 427	Microcomputer Laboratory	1
E&C-ENGR 428R	Embedded Systems	3
E&C-ENGR 429	Embedded Systems Laboratory	1
E&C-ENGR 466	Power Systems I	3
MEC-ENGR 130	Engineering Graphics	3
<b>Senior Electives</b>		
Take 2 elective courses at the 400 level in ECE (not already completed above or from the list below).		6
E&C-ENGR 412	Principles of RF/Microwave Engineering	
E&C-ENGR 436	Power Electronics I	
E&C-ENGR 439	Principles of Nanoscale Devices & Circuits	
E&C-ENGR 440	Principles of Nanomanufacturing	
E&C-ENGR 442	Introduction to VLSI Design	
E&C-ENGR 443	Introduction to VLSI Design Laboratory	
E&C-ENGR 455	Instrumentation and Control	
E&C-ENGR 457	Fundamentals of Solar Photovoltaic Cells	
E&C-ENGR 458	Automatic Control System Design	
E&C-ENGR 459	Introduction to Photovoltaic Systems	
E&C-ENGR 463	Advanced Sustainable Energy Systems Engineering	
E&C-ENGR 464	Smart Grid and SCADA Systems	

E&C-ENGR 467	Power Systems II	
E&C-ENGR 468	Electric Power Distribution Systems	
E&C-ENGR 473	Introduction to Power System Protection	
E&C-ENGR 475	Data Compression	
E&C-ENGR 477	Introduction to Wireless Networking	
E&C-ENGR 480	Digital Signal Processing	
E&C-ENGR 484	Digital Image Processing	
Take one elective course at the 400 level in ECE, COMP-SCI, INFO-TEC, or PHYSICS (not already completed above).		3
COMP-SCI 423	Client/Server Programming and Applications	
COMP-SCI 457	Software Architecture: Requirements & Design	
COMP-SCI 458	Software Testing and Verification	
INFO-TEC 426	Practical Network Security	
INFO-TEC 429	Introduction to Cybersecurity	
PHYSICS 410	Thermal Physics	
PHYSICS 420	Optics	
PHYSICS 450	Introduction To Solid State Physics	
PHYSICS 460	Electricity And Magnetism I	
PHYSICS 461	Electricity And Magnetism II	
PHYSICS 472	Introduction To Quantum Mechanics	

Total Credits

103

**Minimum GPA: 2.0****Minimum grade of C in all courses offered in the School Science Engineering.****Total Credit Hours: 127**

## Tools for Planning and Fulfilling Academic Requirements

UMKC's Major Maps are detailed, semester by semester plans that lead a student to complete all degree requirements within four years. Plans include benchmarks and critical courses by term that assist a student's evaluation of progress and major "fit". In order to ensure that the appropriate courses are taken, students are encouraged to consult with the undergraduate advisor for this major. Please see the tab above to view the major map for this program.

UMKC's Transfer Guides (<https://www.umkc.edu/admissions/transfer-guides.html>) provide detailed guidance on recommended transfer coursework, plans of study, transfer timelines, and transfer contact information. To ensure a seamless transfer experience, students are encouraged to work with both their community college advisor and a UMKC advisor when planning their coursework.

UMKC's PlanMyDegree 'Audit' (<https://www.umkc.edu/registrar/academic-programs/plan-my-degree.html>) degree audit system provides an individual evaluation of all degree requirements (General Education, Degree Specific, Major Specific, etc.) for students' officially recorded (Office of Registration and Records) and "what if" exploratory plans of study. This evaluation is used to certify all graduation requirements.

UMKC's PlanMyDegree 'Plans' (<https://www.umkc.edu/registrar/academic-programs/plan-my-degree.html>) degree planning tool enables students to develop a personalized semester by semester plan of study towards completion of degree requirements for student's officially recorded (Office of Registration and Records) and "what if" exploratory plans of study. Update and edit your full plan to degree completion each term and confirm accuracy each semester with your Academic Advisor(s).

## Major Map

### Four Year Graduation Plan - Courses & Critical Benchmarks for First Time College Students:

UMKC's Major Maps are detailed, undergraduate four-year course outlines that inform students on the classes they should take and when to take them. Outlines are updated yearly. Graduate students should visit their program's individual school for program outlines.

The following is a sample course of study. Your path to graduation may vary based on factors such as college credit you earned while in high school, transfer work from other institutions of higher learning, and placement in Mathematics. You are responsible for checking prerequisites to any courses. It is the Student's responsibility to ensure that all program requirements are met. This guide is not a substitute for academic advisement.

<b>First Year</b>			
<b>Fall Semester</b>	<b>Credits</b>	<b>Spring Semester</b>	<b>Credits</b>
MATH 210 <sup>CC</sup>		4 MATH 220 <sup>CC</sup>	4
MEC-ENGR 130		3 PHYSICS 240 <sup>CC</sup>	5
BIOLOGY 102 & 102L (or CHEM 211 & 211L)		4 ENGLISH 225	3
GEFSE 101		3 GECRT-SS 101	3
ENGLISH 110		3	
		17	15
<b>Second Year</b>			
<b>Fall Semester</b>	<b>Credits</b>	<b>Spring Semester</b>	<b>Credits</b>
E&C-ENGR 216		4 E&C-ENGR 228 & E&C-ENGR 229	4
E&C-ENGR 226 & E&C-ENGR 227 <sup>CC</sup>		4 E&C-ENGR 276 & E&C-ENGR 277 <sup>CC</sup>	4
E&C-ENGR 241 <sup>CC</sup>		3 E&C-ENGR 341R <sup>CC</sup>	3
PHYSICS 250 <sup>CC</sup>		5 COMP-SCI 394R	3
		COMM-ST 110, 140, or 277	3
		16	17
<b>Third Year</b>			
<b>Fall Semester</b>	<b>Credits</b>	<b>Spring Semester</b>	<b>Credits</b>
E&C-ENGR 334		3 E&C-ENGR 302 & E&C-ENGR 303	4
E&C-ENGR 376 & E&C-ENGR 377		4 E&C-ENGR 330 & E&C-ENGR 331	4
E&C-ENGR 380 & E&C-ENGR 381		4 E&C-ENGR 428R & E&C-ENGR 429	4
E&C-ENGR 426 & E&C-ENGR 427		4 E&C-ENGR 466	3
		15	15
<b>Fourth Year</b>			
<b>Fall Semester</b>	<b>Credits</b>	<b>Spring Semester</b>	<b>Credits</b>
E&C-ENGR 358 or 474		3 COMP-SCI 304WI	3
E&C-ENGR 402		3 E&C-ENGR 403	2
E&C-ENGR 416		3 E&C-ENGR 4XX Major Elective	3
E&C-ENGR 4XX Major Elective		3 E&C-ENGR 4XX Major Elective	3
GECRT-AH 101		3 HISTORY 101, 102, or POL-SCI 210	3
		GECDV 201	3
		15	17
Total Credits: 127			

CC Critical Courses provide feedback regarding major fit and help indicate likelihood of successful completion of chosen academic program and degree.

## Recommendations to Maintain Progress toward 4-Year Degree Completion

- Completion of the First Semester Experience (FSE) course in first term.
- Early completion of Written Communication, Oral Communication, and Math Pathway requirements.
- Maintain the minimum GPA required for academic Good Standing for your degree program.

- Completion of at least 15 credit hours toward degree each regular semester. (*Students may use the summer to ensure completion of 30 hours per academic year or to lighten Fall and Spring course loads.*)
- Enrollment in Critical Courses as listed on the Major Map is recommended in order to maintain timely progress and completion of prerequisite coursework.
- Regular consultation with Academic Advisor(s) for program(s) of study is strongly recommended and may be required for some degree programs..

Roo Advising (<http://catalog.umkc.edu/roo-advising/>)

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