

BACHELOR OF SCIENCE: MECHANICAL ENGINEERING

ABET Program Educational Objectives

Within a few years of graduation, graduates of the Mechanical Engineering program are expected to:

1. Approach complex problems with curiosity and rigorous application of mechanical engineering principles in their chosen careers.
2. Successfully apply technical knowledge to create innovational and transformational change for metropolitan, regional, and global well-being.
3. Effectively and accurately communicate with technical and non-technical audiences.
4. Further advance in their careers 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:

- Students will be able to use mathematical methods to make design decisions.
- Students will be able to analyze conduction and convection properties of thermal-fluid systems.
- Students will be able to analyze kinematics and dynamics of mechanical components.
- Students will be able to develop algorithms for solving engineering problems.

- Students will be able to analyze strength characteristics of engineering materials.
- Students will be able to use measurements to solve engineering problems.

Admissions

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 mechanical 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 by a faculty committee 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

The Bachelor of Science in Mechanical Engineering prepares students with a breadth and depth in technical knowledge so that they can work immediately in most areas of the profession. **Engineering programs must demonstrate that their students attain the outcomes listed above.**

The Mechanical Engineering curriculum requires a minimum of 127 hours of coursework and satisfies the UMKC General Education requirements.

Approved Machine Shop Safety training must be completed prior to using tools in university sponsored activities and facilities.

A grade of C- or higher must be earned in all major required coursework.

All UMKC student must take HEIghten after completing 90 credit hours and before applying for graduation (<http://www.umkc.edu/exitexams/>).

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
Math and Science Requirements (satisfies Math Pathway)		
MATH 120 (Precalculus; Typically not required due to ACT Admission Requirement)		
CHEM 211 & 211L	General Chemistry I and Experimental General Chemistry I	5
MATH 266	Accelerated Calculus I ¹	4
MATH 268	Accelerated Calculus II	3
MATH 250	Calculus III	4
MATH 300	Linear Algebra I	3
MATH 345	Ordinary Differential Equations	3
PHYSICS 240	Physics For Scientists and Engineers I	5
PHYSICS 250	Physics For Scientists and Engineers II	5
Engineering Fundamental Course Requirements		
CIV-ENGR 275	Engineering Statics (satisfies GECRT-SC course requirement)	3
CIV-ENGR 276	Strength Of Materials	3
E&C-ENGR 276	Circuit Theory I	3
E&C-ENGR 277	Circuit Theory I Lab	1
MEC-ENGR 130	Engineering Graphics	3
MEC-ENGR 219	Computer Programming for Engineers	3
MEC-ENGR 285	Engineering Dynamics	3
MEC-ENGR 306	Numerical Analysis	3
MEC-ENGR 352	Mechanical Instrumentation Lab	3
Energy Systems Course Requirements		
MEC-ENGR 299	Engineering Thermodynamics	3
MEC-ENGR 351	Fluid Mechanics	3
MEC-ENGR 360	Applied Thermodynamics	3
MEC-ENGR 399	Heat Transfer	3
MEC-ENGR 399L	Heat Transfer and Fluids Lab	1
Mechanical Systems Course Requirements		
MEC-ENGR 324	Mechanical Engineering Materials Lab	3
MEC-ENGR 356	Mechanical Component Design	3
MEC-ENGR 380	Manufacturing Methods	3
MEC-ENGR 385	System Dynamics	3

MEC-ENGR 415	Control Systems Theory	3
MEC-ENGR 492	Mechanical Design Synthesis I (satisfies GECUE course requirement)	3
MEC-ENGR 496WI	Mechanical Design Synthesis	3

Engineering Design Electives

Choose at least one of the following: Advanced Dynamics and Modeling, Biomedical Device Design, Heating Ventilation and Air Conditioning, Composite Materials, or Principles of Aircraft Design (additional design electives can count toward 400 level mechanical engineering electives).

MEC-ENGR 407	Advanced Dynamics and Modeling	
MEC-ENGR 416	Biomedical Device Design	
MEC-ENGR 440	Heating Ventilation and Air Conditioning	
MEC-ENGR 444	Composite Materials	
MEC-ENGR 446	Principles of Aircraft Design	

Mechanical Engineering Electives

Take a total of 9 hours of 400 level mechanical engineering electives including any Design course not taken above.

MEC-ENGR 401	Topics in Mechanical Engineering	
MEC-ENGR 406	Introduction to Biomaterials	
MEC-ENGR 407	Advanced Dynamics and Modeling	
MEC-ENGR 411	Introduction to Biomechanics	
MEC-ENGR 412	Biodynamics	
MEC-ENGR 413	Experimental Biomechanics of Human Motion	
MEC-ENGR 416	Biomedical Device Design	
MEC-ENGR 418	Advanced Fluid Mechanics	
MEC-ENGR 424	Non-Metallic Engineering Materials	
MEC-ENGR 425	Failure Analysis	
MEC-ENGR 426	Introduction to Manufacturing Management	
MEC-ENGR 429	Additive Manufacturing	
MEC-ENGR 440	Heating Ventilation and Air Conditioning	
MEC-ENGR 444	Composite Materials	
MEC-ENGR 446	Principles of Aircraft Design	
MEC-ENGR 448	Flight and Road Vehicle Test Engineering	
MEC-ENGR 451	Power Plant Design	
MEC-ENGR 454	Power Generation Systems	
MEC-ENGR 457	Mechatronic System Design	
MEC-ENGR 459	Robotics and Unmanned Systems	
MEC-ENGR 462	Applied Computational Fluid Dynamics	
MEC-ENGR 464	Turbomachines	
MEC-ENGR 467	Fuel Cells and Renewable Energy Systems	
MEC-ENGR 484	Vibration Analysis	
MEC-ENGR 486	Applied Finite Element Analysis	
MEC-ENGR 493	Intermediate Dynamics	
MEC-ENGR 494	Robotic System Identification	

Total Credits**103**

¹ Students not meeting the MATH 266 prerequisite requirements will have 3-8 additional hours (MATH 110 and MATH 125, or MATH 120) with a minimum grade of 'B'.

Minimum GPA: 2.0**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/transfer/transfer-credit/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 the Registrar) 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 the Registrar) 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.

First Year

Fall Semester	Credits	Spring Semester	Credits
MATH 266 ^{CC}		4 MATH 268 ^{CC}	3
CHEM 211 & 211L ^{CC}		5 PHYSICS 240 ^{CC}	5
GEFSE 101		3 MEC-ENGR 130	3
ENGLISH 110		3 ENGLISH 225	3
		GECRT-SS 101, 102, 104, 105, 106, 107, 108, or 111	3
		15	17

Second Year

Fall Semester	Credits	Spring Semester	Credits
MATH 250		4 MATH 345	3
PHYSICS 250 ^{CC}		5 CIV-ENGR 276 ^{CC}	3
CIV-ENGR 275 (Satisfies GE-SC) ^{CC}		3 E&C-ENGR 276 & E&C-ENGR 277	4
MEC-ENGR 219		3 MEC-ENGR 285 ^{CC}	3
		MEC-ENGR 299 ^{CC}	3
		15	16

Third Year

Fall Semester	Credits	Spring Semester	Credits
MEC-ENGR 324		3 MEC-ENGR 306	3
MEC-ENGR 351		3 MEC-ENGR 352	3
MEC-ENGR 360		3 MEC-ENGR 380	3
COMM-ST 110, 140, or 277		3 MEC-ENGR 385	3

MATH 300		3 MEC-ENGR 399 & 399L		4
		15		
Fourth Year				
Fall Semester	Credits	Spring Semester	Credits	
MEC-ENGR 356		3 MEC-ENGR 496WI		3
MEC-ENGR 492 (Satisfies GECUE)		3 MEC-ENGR 4XX Technical Elective		3
MEC-ENGR 4XX Design Elective		3 MEC-ENGR 4XX Technical Elective		3
MEC-ENGR 4XX Technical Elective		3 GECDV 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, or 211		3
GECRT-AH 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 112, 113, or 114		3 HISTORY 101, 102, or POL-SCI 210		3
MEC-ENGR 415		3		
		18	15	

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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Licensure Disclosure

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State licensure as a Professional Engineer (PE) is not required to work in the field of engineering. However, some employment opportunities may require a PE license.

States in Which the Curriculum Meets the Educational Requirements for Licensure

All US states and territories.

States in Which the Curriculum Does Not Meet the Educational Requirements for Licensure

N/A.