

BACHELOR OF SCIENCE: BIOMEDICAL ENGINEERING

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:

- use mathematics and biostatistical methods to solve problems;
- analyze fluid flow properties of thermal-fluid systems;
- design and implement biomedical engineering components;
- analyze biomedical systems and solve systems problems;
- investigate characteristics of biomaterials;
- use measurements to solve biomedical 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 biomedical 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 degree 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 Biomedical Engineering is a program in an engineering discipline that combines biological and chemical sciences with multiple fields of engineering, including mechanical and electrical.

An approved Machine Shop Safety course 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 students 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.

| Code | Title | Credits |
|------------------------|--|---------|
| Math Coursework | | |
| MATH 120 | Precalculus (typically not required due to admission requirements) | |

| | | |
|---------------------------|---|-----------|
| MATH 266 | Accelerated Calculus I | 4 |
| MATH 268 | Accelerated Calculus II | 3 |
| MATH 250 | Calculus III | 4 |
| MATH 345 | Ordinary Differential Equations | 3 |
| BIOLOGY 304 | Biostatistics 1 | 3 |
| Science Coursework | | |
| BIOLOGY 108 & 108L | General Biology I and General Biology I Laboratory | 4 |
| BIOLOGY 202 | Cell Biology | 3 |
| BIOLOGY 316 | Principles of Physiology | 3 |
| CHEM 211 & 211L | General Chemistry I and Experimental General Chemistry I | 5 |
| CHEM 212R & CHEM 212LR | General Chemistry II and Experimental General Chemistry II | 5 |
| PHYSICS 240 | Physics For Scientists and Engineers I | 5 |
| PHYSICS 250 | Physics For Scientists and Engineers II | 5 |
| Total Credits | | 47 |

| Code | Title | Credits |
|--------------------------------|--|-----------|
| Engineering Coursework | | |
| CIV-ENGR 275 | Engineering Statics (Satisfies GECRT-SC) | 3 |
| E&C-ENGR 216 | Engineering Computation | 4 |
| E&C-ENGR 276 & E&C-ENGR 277 | Circuit Theory I and Circuit Theory I Lab | 4 |
| E&C-ENGR 380 & E&C-ENGR 381 | Signals and Systems and Signals and Systems Lab | 4 |
| MEC-ENGR 285 | Engineering Dynamics | 3 |
| MEC-ENGR 299 | Engineering Thermodynamics | 3 |
| MEC-ENGR 406 | Introduction to Biomaterials | 3 |
| MEC-ENGR 411 | Introduction to Biomechanics | 3 |
| MEC-ENGR 492 | Mechanical Design Synthesis I (Satisfies GECUE) | 3 |
| Total Credits | | 30 |

| Code | Title | Credits |
|--|--|-----------|
| Biomedical Engineering Coursework | | |
| BMD-ENGR 115 | Introduction to Biomedical Engineering | 1 |
| BMD-ENGR 215 | 3D Modeling and Printing | 1 |
| BMD-ENGR 315 | Biomedical Instrumentation | 3 |
| BMD-ENGR 325 | Biomedical Systems Physiology | 3 |
| BMD-ENGR 335 | Biomedical Transport Phenomena | 3 |
| BMD-ENGR 415 | Bioelectromagnetics and Bioelectricity | 3 |
| BMD-ENGR 495WI | Biomedical Capstone Design | 3 |
| Total Credits | | 17 |

| Code | Title | Credits |
|--|---|---------|
| Biomedical Electives ^{1,2} | | |
| BIOLOGY 206 | Genetics | |
| BIOLOGY 218 | Introductory Anatomy ³ | |
| BIOLOGY 306 | From Bench to Bedside: Translational Research | |
| BIOLOGY 404 | Biostatistics 2 | |
| BIOLOGY 441 | Biochemistry ³ | |
| BIOLOGY 452 | Bioinformatics ³ | |
| CHEM 321 | Organic Chemistry I ³ | |
| CHEM 341 | Analytical Chemistry I: Quantitative Analysis | |

| | |
|--------------|--|
| CIV-ENGR 276 | Strength Of Materials |
| CIV-ENGR 351 | Fluid Mechanics |
| CIV-ENGR 447 | Legal Topics for Engineers |
| E&C-ENGR 330 | Electronic Circuits ³ |
| E&C-ENGR 334 | Semiconductors and Devices ³ |
| E&C-ENGR 401 | Topics In Electrical And Computer Engineering (Nano-electromagnetics & Plasmonics) |
| E&C-ENGR 416 | Neural and Adaptive Systems ³ |
| E&C-ENGR 479 | Introduction to Computer Vision |
| E&C-ENGR 480 | Digital Signal Processing |
| E&C-ENGR 484 | Digital Image Processing |
| E&C-ENGR 486 | Pattern Recognition |
| MEC-ENGR 306 | Numerical Analysis |
| MEC-ENGR 351 | Fluid Mechanics |
| MEC-ENGR 385 | System Dynamics |
| MEC-ENGR 407 | Advanced Dynamics and Modeling ³ |
| MEC-ENGR 412 | Biodynamics |
| MEC-ENGR 413 | Experimental Biomechanics of Human Motion |
| MEC-ENGR 416 | Biomedical Device Design |
| MEC-ENGR 457 | Mechatronic System Design ³ |

Total Credits **9**

- ¹ NOTE: at least 1 course must be an engineering elective & only 1 elective course can be below the 300 level
- ² Students may petition to include any upper level course in Biology, Chemistry, Electrical Engineering, or Mechanical Engineering.
- ³ If selected as an elective, course pre or co-requisites may add hours to program completion.

Minimum GPA: 2.0

Total Credit Hours: 127

Major Map

First Year

| Fall Semester | Credits | Spring Semester | Credits |
|---------------|---------|---------------------------------|-----------|
| MATH 266 | | 4 MATH 268 | 3 |
| CHEM 211 | | 4 PHYSICS 240 | 5 |
| CHEM 211L | | 1 CHEM 212R | 4 |
| GEFSE 101 | | 3 CHEM 212LR | 1 |
| ENGLISH 110 | | 3 COMM-ST 110, 140, 212, or 277 | 3 |
| BMD-ENGR 115 | | 1 | |
| | | 16 | 16 |

Second Year

| Fall Semester | Credits | Spring Semester | Credits |
|-----------------------------------|---------|---|-----------|
| MATH 250 | | 4 MATH 345 | 3 |
| PHYSICS 250 | | 5 BMD-ENGR 215 | 1 |
| CIV-ENGR 275 (Satisfies GECRT-SC) | | 3 BIOLOGY 202 | 3 |
| BIOLOGY 108 | | 3 E&C-ENGR 216 | 4 |
| BIOLOGY 108L | | 1 MEC-ENGR 285 | 3 |
| | | GECRT-AH 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 112, 113, or 114 | 3 |
| | | 16 | 17 |

Third Year

| Fall Semester | Credits | Spring Semester | Credits |
|----------------------|----------------|---|----------------|
| BIOLOGY 304 | | 3 BMD-ENGR 315 | 3 |
| BIOLOGY 316 | | 3 BMD-ENGR 325 | 3 |
| E&C-ENGR 380 | | 3 E&C-ENGR 276 | 3 |
| E&C-ENGR 381 | | 1 E&C-ENGR 277 | 1 |
| MEC-ENGR 411 | | 3 MEC-ENGR 299 | 3 |
| ENGLISH 225 | | 3 GECRT-SS 101, 102, 104, 105, 106, 107, 108, or 111 | 3 |
| | | 16 | 16 |

Fourth Year

| Fall Semester | Credits | Spring Semester | Credits |
|--------------------------------|----------------|---|----------------|
| BMD-ENGR 335 | | 3 BMD-ENGR 495WI | 3 |
| BMD-ENGR 415 | | 3 3XX/4XX Biomedical Elective | 3 |
| MEC-ENGR 406 | | 3 3XX/4XX Biomedical Elective | 3 |
| MEC-ENGR 492 (Satisfies GECUE) | | 3 HISTORY 101, 102, POL-SCI 210, or CJC 364 | 3 |
| Biomedical Elective | | 3 GECDV 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, or 211 | 3 |
| | | 15 | 15 |

Total Credits: 127