Biomedical Engineering, MS

Graduate study in biomedical engineering prepares students to use contemporary methods at an advanced level during a professional career in engineering design, development, and research.

Each student's course of study is based on individual background, career objectives, and sound academic practice. An individual program for each student may be developed from courses offered by the Roy J. Carver Department of Biomedical Engineering and other departments, especially mechanical engineering, electrical engineering, physiology, mathematics, and biological sciences. Students who want a more general program may combine emphases, while those who want some specialization in a particular field can achieve their goals through the combination of departmental courses and appropriate electives from other departments in the College of Engineering and the university.

Learning Outcomes

By completing the graduate curriculum in biomedical engineering, students will be able to:

- demonstrate broad knowledge of the field of biomedical engineering and deep knowledge in their specific area of study;
- communicate complex technical ideas concisely and effectively to both general and specialized audiences through verbal, visual, and written formats;
- formulate research questions, pose testable hypotheses, employ methods that enhance the reproducibility of research, and apply critical thinking skills to produce solutions to complex engineering problems that intersect with biology and human health; and
- operate with professionalism and under standards of ethical conduct.

Requirements

The Master of Science in biomedical engineering requires a minimum of 30 s.h. of graduate credit and may be completed with or without a thesis. Students must maintain a UI cumulative grade-point average of at least 2.75 in all work for the degree. The MS may be a terminal degree or a step toward the PhD.

A tentative plan of study for each student is determined through consultation with an advisor. An MS committee of at least three faculty members, including at least two tenure-track biomedical engineering faculty, is required.

Requirements	Hours
Engineering Ethics and Graduate Seminar	3
Formal Coursework	21
Engineering Research or Elective Courses	6

Engineering Ethics and Graduate Seminar

All students are required to complete ENGR:7270 Engineering Ethics (1 s.h.) in their first semester.

Attendance and participation in seminars are mandatory and important parts of graduate education. All biomedical engineering graduate students are required to register for and attend the weekly graduate seminar BME:5010 Seminar in Biomedical Engineering (1 s.h.) for two semesters.

In the case of a conflict, (for example, an internship out of town) a student may request to be excused from attending the graduate seminar. Please note course conflicts do not qualify for a waiver. In the instance where a student feels they may have a qualifying conflict, the student must obtain approval from the Director of Graduate Studies and explain the rationale for the request. Students would then be expected to make up the credits with additional electives or research in order to reach the minimum 30 s.h. required for the degree.

Formal Coursework

The formal coursework requirement includes at least 6 s.h. in core courses. Additional graded engineering coursework brings the formal coursework total to 21 s.h. At least 18 s.h. of formal coursework must be taken on an A–F graded basis, including all core courses.

Core Courses

Students are expected to complete the core courses during their first year of study.

Students may apply ME:5113 Mathematical Methods in Engineering to both the math requirement and the graded engineering courses requirement.

Core courses may be substituted by other equivalent courses at the discretion of the student's examining committee. Equivalent coursework taken as part of a student's undergraduate or graduate studies prior to starting the MS program at the University of Iowa may satisfy one or more of the core courses requirements. Students who wish to request a substitution must submit a course substitution or waiver form. Forms may be obtained from the graduate program coordinator.

Course #	Title	Hours
One of these human physiology courses:		
BME:3260	Quantitative Physiology	3
HHP:3550	Human Physiology With Laboratory	5
One of these math courses:		
ME:5113/CBE:5140/ CEE:5513	Mathematical Methods in Engineering (strongly recommended)	3
MATH:3720	Introduction to Abstract Algebra	4
MATH:3770	Foundations of Analysis	4
MATH:3800/ CS:3700	Introduction to Numerical Methods	3
MATH:4050	Introduction to Discrete Mathematics	3
MATH:4250	Introduction to Financial Mathematics	3
MATH:4840	Mathematics of Machine Learning	3

Graded Engineering Courses

The remaining formal coursework is selected from courses numbered 5000 or above in biomedical engineering (prefix

BME), chemical and biochemical engineering (prefix CBE), civil and environmental engineering (prefix CEE), electrical and computer engineering (prefix ECE), industrial and systems engineering (ISE), or mechanical engineering (prefix ME), with some exclusions.

Students may also select from the following courses numbered below 5000.

Course #	Title	Hours
BME:4310/ BMB:4310	Computational Biochemistry	3
CEE:4511/ME:4111	Scientific Computing and Machine Learning	3
CEE:4533/IGPI:4115	Finite Element I	3
ECE:3330/IGPI:3330	Introduction to Software Design	3
ISE:3400	Human Factors	3
ISE:3450	Ergonomics	3
ISE:4172	Big Data Analytics	3
ME:4080	Experimental Engineering	4
ME:4110/CEE:4515	Computer-Aided Engineering	3
ME:4111/CEE:4511	Scientific Computing and Machine Learning	3
ME:4112/CEE:4512	Engineering Design Optimization	3
ME:4117	Finite Element Analysis	3
ME:4140	Modern Robotics and Automation	3
ME:4150	Artificial Intelligence in Engineering	3
ME:4200	Modern Engineering Materials for Mechanical Design	3

The following courses may not be counted.

Course #	Title	Hours
Not from these:		
BME:5010	Seminar in Biomedical Engineering	1
BME:5999	Research: Biomedical Engineering MS Thesis	arr.
BME:7999	Research: Biomedical Engineering PhD Dissertation	arr.
CBE:5100	Graduate Professional Development Seminar	1
CBE:5998	Individual Investigations: Chemical and Biochemical Engineering	arr.
CEE:5099	Civil and Environmental Engineering Graduate Seminar	0
CEE:5998	Individual Investigations: Civil and Environmental Engineering	arr.
CEE:5999	Research: Civil and Environmental Engineering MS Thesis	arr.
CEE:7999	Research: Civil and Environmental Engineering PhD Dissertation	arr.
ECE:5000	Graduate Seminar: Electrical and Computer Engineering	0
ECE:5998	Individual Investigations: Electrical and Computer Engineering	arr.
ECE:5999	Research: Electrical and Computer Engineering MS Thesis	arr.
ECE:7999	Research: Electrical and Computer Engineering PhD Thesis	arr.
ISE:5000	Graduate Seminar: Industrial Engineering	1
ISE:5998	Individual Investigations: Industrial Engineering	arr.
ISE:5999	Research: Industrial Engineering MS Thesis	arr.
ISE:7998	Special Topics in Industrial Engineering	arr.
ISE:7999	Research: Industrial Engineering PhD Dissertation	arr.
ME:6191	Graduate Seminar: Mechanical Engineering	1
ME:6198	Individual Investigations: Mechanical Engineering	arr.
ME:6199	Research: Mechanical Engineering MS Thesis	arr.
ME:7299	Research: Mechanical Engineering PhD Dissertation	arr.

Engineering Research or Elective Courses

Students in the program with thesis complete 6 s.h. of BME:5999 Research: Biomedical Engineering MS Thesis.

Students in the program without thesis complete 6 s.h. of elective courses selected from the preceding "Graded Engineering Courses" section; these courses must be taken on an A–F graded basis.

Additional Requirements

All thesis students must successfully complete the final examination administered by their committee, which consists of a written thesis and an oral presentation and defense to the examining committee.

There is no oral or written exam required for completing the master's degree without thesis.

Graduate Education

Graduate education prepares students with advanced knowledge and skills in specialized fields. At the University of Iowa, the Graduate College advocates for student-centered graduate education and supports equitable application of rules and policies across graduate programs.

Academics

University of Iowa graduate credentials are regulated by policies and requirements found in the Graduate College Manual of Rules and Regulations. This includes minimum grade-point average (GPA) requirements for academic standing and degree conferral. The Graduate College sets the

minimum requirement. Individual graduate programs may establish higher GPA requirements.

Admissions

Graduate student applicants must meet admission requirements for both the Graduate College and the program to which they have applied. University of Iowa graduate admission requirements are published by the Graduate College and on the Graduate Admissions website.

Financial Support

Graduate students might be eligible for financial support. Several contingencies apply, including degree program and award type, satisfactory progress toward degree, satisfactory completion of all duties related to an appointment, and availability of funding. Graduate students should inquire directly with their program for more information about funding availability. The Graduate Student Employment Standards govern the employment relationship between the University of Iowa and all graduate teaching and research assistants in all matters except wages, which are covered by an existing collective bargaining agreement or the conditions of an applicable federal grant.

Admission

Applicants must meet the admission requirements of the Graduate College; see the Manual of Rules and Regulations on the Graduate College website.

Applicants who have earned a baccalaureate or postbaccalaureate degree in engineering or in the mathematical or physical sciences with a grade-point average (GPA) of at least 3.00 are eligible to be considered for admission to the Master of Science program.

Reference letters, research interests, previous graduate GPA, and other factors may be considered in admission decisions.

Career Advancement

Biomedical engineers with MS degrees can pursue career opportunities in the health care industry in the fields of biomedical devices, diagnostic equipment, and software. Graduates have started careers in research, design, development, sales, and entrepreneurship, and they advance to administrative and leadership positions in their organizations. Graduates also have careers with health care providers, such as in hospitals, or use their biomedical engineering expertise to advance careers in medicine and law. Faculty mentors assigned to graduate students aid in their professional development. Students are exposed to opportunities through seminar speakers who have relevant expertise and are invited to campus.

The Graduate College offers numerous career advancement opportunities and professional development programs for graduate students. Ongoing program offerings, news, and announcements can be found under Grad Success Center on the Graduate College website.

Academic Plans

Sample Plan of Study

Sample plans represent one way to complete a program of study. Actual course selection and sequence will vary and should be discussed with an academic advisor. For additional sample plans, see MyUI.

Biomedical Engineering, MS

This sample plan is currently being reviewed and will be added at a later date.