Biomedical Engineering, BSE

Requirements

The Bachelor of Science in Engineering (BSE) with a major in biomedical engineering requires a minimum of 128 s.h. of credit, plus up to two 1 s.h. departmental seminars. At the time of graduation, students must have a cumulative grade-point average of at least 2.00 in all college work used to complete degree requirements and in all UI coursework in order to be awarded the BSE.

All BSE students are required to take the same collegiate curriculum. For information about these collegiate requirements, see the Bachelor of Science in Engineering, BSE in the catalog. 6 s.h. of a student's major courses fulfill the collegiate curriculum's basic science and college-level math requirement. Students completing the major in biomedical engineering fulfill the collegiate statistics requirement through BIOS:4120 Introduction to Biostatistics or STAT:3510 Biostatistics.

The major in biomedical engineering may include the following departmental seminars depending on when a student declares the major.

Course #	Title	Hours
BME:1010	First-Year Forum	1
BME:2010	Professional Seminar: Biomedical Engineering	1

The program has been designed carefully to enable students to satisfy the entrance requirements of the Graduate College.

The BSE with a major in biomedical engineering requires the following coursework.

Requirements	Hours
Collegiate Curriculum	49
Basic Science and College-Level Math, from Major Requirements or Focus Area coursework	6
Major Requirements	40
Focus Area	33-34

Major Requirements

Major requirements include a set of common courses (38 s.h.) and two capstone design courses (8 s.h.).

Common Courses

Students in the bioimaging or computational bioengineering focus areas may choose between ENGR:2130 Thermodynamics or ENGR:3110 Introduction to Artificial Intelligence and Machine Learning in Engineering.

Course #	Title	Hours
All of these:		
BME:2200	Systems, Instrumentation, and Data Acquisition (with lab)	4
BME:2210	Bioimaging and Bioinformatics (with lab)	4
BME:2260	Quantitative Physiology	3
or HHP:2400	Fundamentals of Human Physiology	
BME:2400	Cell Biology for Engineers (with lab)	3
BME:2500	Biomaterials and Biomechanics (with lab)	4
BIOL:1411	Foundations of Biology	4
CHEM:1120	Principles of Chemistry II	4
ENGR:2110	Statics	2
ENGR:2120	Electrical Circuits	3
ENGR:2130	Thermodynamics	3
PHYS:1612	Introductory Physics II (with lab)	4

Capstone Design Courses

Course #	Title	Hours
Both of these:		
BME:4910	Biomedical Engineering Senior Design I	4
BME:4920	Biomedical Engineering Senior Design II	4

Focus Area

Students must select focus area courses according to guidelines established by the Roy J. Carver Department of Biomedical Engineering. Biomedical engineering students choose one of four preapproved focus areas: bioimaging [p. 1], biomechanics and biomaterials [p. 2], cellular engineering [p. 3], or computational bioengineering [p. 3]. For details about focus areas and their requirements, visit Curriculum Focus Areas on the department's website.

Each focus area has a group of four required courses (12–13 s.h.) and a list of suggested electives (21 s.h.).

Pre-Medicine Focus Area Electives

Students who choose to pursue pre-medicine can select any focus area and complete five of the following courses (16 s.h.) as their additional electives.

Course #	Title	Hours
Five of these:		
BIOL:1412	Diversity of Form and Function	4
BIOL:2512	Fundamental Genetics	4
BMB:3110	Biochemistry	3
CHEM:2210	Organic Chemistry I	3
CHEM:2220	Organic Chemistry II	3
CHEM:2410	Organic Chemistry Laboratory	3

Bioimaging

Required Bioimaging Courses

Course #	Title	Hours
All of these:		
BME:5210/ ECE:5470/IGPI:5206	Medical Imaging Physics	3
ECE:3330/IGPI:3330	Introduction to Software Design	3
ECE:5480/IGPI:5480	Digital Image Processing	3
ENGR:2730	Computers in Engineering	3

Bioimaging Electives

Course #	Title	Hours
Two of these:		
BME:5200/ IGPI:5212	Biomedical Signal Processing	3
BME:5240	Deep Learning in Medical Imaging (DLMI)	3
ECE:5330/IGPI:5331	Graph Algorithms and Combinatorial Optimization	3
ECE:5450/IGPI:5450	Machine Learning	3
ECE:5490	Multi-Dimensional Image Analysis Tools and Techniques	3
ENGR:3110	Introduction to Artificial Intelligence and Machine Learning in Engineering (if not taken to fulfill major requirements)	3

Additional Electives–Bioimaging

The following courses are suggested additional electives for the bioimaging focus area. Students are encouraged to consult their academic advisor when selecting electives.

Course #	Title	Hours
At least 15 s.h. from these:		
BME:5251/ IGPI:5251	Advanced Biosystems	3
BME:5441	Numerical and Statistical Methods for Bioengineering	3
ECE:5460/IGPI:5460	Digital Signal Processing	3
CS:2210	Discrete Structures	3
CS:2230	Computer Science II: Data Structures	4
ENGR:2130	Thermodynamics (if not taken to fulfill major requirements)	3
HHP:2100	Human Anatomy	3
HHP:4250	Human Pathophysiology	3
HHP:4260	Respiratory Pathophysiology	3
MATH:3550	Engineering Vector Calculus	3
MATH:3800/ CS:3700	Introduction to Numerical Methods	3
Additional courses from the "Bioimaging Electives" list		3
Courses from the "Pre-Medicine Focus Area Electives" list		3-4

Biomechanics and Biomaterials

Required Biomechanics and Biomaterials Courses

Course #	Title	Hours
All of these:		
ENGR:2510	Fluid Mechanics (with lab)	4
ENGR:2710	Dynamics	3
ENGR:2720	Materials Science	3
ENGR:2750	Mechanics of Deformable Bodies	3

Biomechanics and Biomaterials Electives

Course #	Title	Hours
Two of these:		
BME:2710	Engineering Drawing, Design, and Solid Modeling	3
BME:5101	Biomaterials and Implant Design	3
BME:5510	Cardiovascular Engineering	3
BME:5525	Cardiopulmonary Design and Modeling	3
BME:5610	Musculoskeletal Biomechanics	3

Additional Electives–Biomechanics and Biomaterials

The following courses are suggested additional electives for the biomechanics and biomaterials focus area. Students are encouraged to consult their academic advisor when selecting electives.

Course #	Title	Hours
At least 15 s.h. from these:		
BME:3710	Medical Device Design: The Fundamentals	3
BME:4710	Medical Device Design Studio	3
BME:5421	Cell Material Interactions	3
BME:5430	Biotransport	3
BME:5431	Biofabrication for Tissue Engineering	3
BME:5441	Numerical and Statistical Methods for Bioengineering	3
BME:5460	Biomedical Micro Devices and Systems	3
BME:5540	Quantitative Studies of Respiratory and Cardiovascular Systems	3
BME:5620	Introduction to Applied Biomedical Finite Element Modeling	3
BME:5630	Kinetics of Musculoskeletal Systems	3
BME:5715	Advanced Medical Device Design Studio	3
HHP:2100	Human Anatomy	3
HHP:4130	Skeletal Muscle Physiology	3
HHP:4460	Cardiovascular Physiology	3
ISE:2360 or ME:2300	Design for Manufacturing Manufacturing Processes	3
MATH:3550	Engineering Vector Calculus	3
ME:4110/CEE:4515	Computer-Aided Engineering	3
OEH:4310	Occupational Ergonomics: Principles	3
Additional courses from the "Biomechanics and Biomaterials Electives" list		3
Courses from the "Pre-Medicine Focus Area Electives" list		3-4
May include one of these:		
CEE:4533/IGPI:4115	Finite Element I	3
ME:4117	Finite Element Analysis	3

Cellular Engineering

Required Cellular Engineering Courses

Course #	Title	Hours
All of these:		
BME:5421	Cell Material Interactions	3
BME:5430	Biotransport	3
BME:5435	Systems Biology for Biomedical Engineering	3
ENGR:2750	Mechanics of Deformable Bodies	3

Cellular Engineering Electives

Course #	Title	Hours
Two of these:		
BME:4310/ BMB:4310	Computational Biochemistry	3
BME:5441	Numerical and Statistical Methods for Bioengineering	3
BME:5445	Stem Cells in Regenerative Engineering	3
BME:5451	Research Methods in Cellular Engineering	3
ECE:5480/IGPI:5480	Digital Image Processing	3

Additional Electives–Cellular Engineering

The following courses are suggested additional electives for the cellular engineering focus area. Students are encouraged to consult their academic advisor when selecting electives.

Course #	Title	Hours
At least 15 s.h. from these:		
BME:5431	Biofabrication for Tissue Engineering	3
BME:5460	Biomedical Micro Devices and Systems	3
BME:5525	Cardiopulmonary Design and Modeling	3
BIOL:1412	Diversity of Form and Function	4
BIOL:2512	Fundamental Genetics	4
BMB:3120	Biochemistry and Molecular Biology I	3
BMB:3130	Biochemistry and Molecular Biology II	3
ENGR:2510	Fluid Mechanics	4
ENGR:2710	Dynamics	3
ENGR:2720	Materials Science	3
ENGR:2730	Computers in Engineering	3
MATH:3550	Engineering Vector Calculus	3
MATH:4750	Introduction to Mathematical Biology	3
ME:5179/CEE:5179	Continuum Mechanics	arr.
Additional courses from the "Cellular Engineering Electives" list		3
Courses from the "Pre-Medicine Focus Area Electives" list		3-4

Computational Bioengineering

Required Computational Bioengineering Courses

Course #	Title	Hours
All of these:		
BME:4310/ BMB:4310	Computational Biochemistry	3
BME:5335	Computational Bioinformatics	3
ECE:3330/IGPI:3330	Introduction to Software Design	3
ENGR:2730	Computers in Engineering	3

Computational Bioengineering Electives

Course #	Title	Hours
Two of these:		
BME:5240	Deep Learning in Medical Imaging (DLMI)	3
ECE:5330/IGPI:5331	Graph Algorithms and Combinatorial Optimization	3
ECE:5820/CS:5820	Software Engineering Languages and Tools	3
ENGR:2130	Thermodynamics (if not taken to fulfill major requirements)	3
ENGR:3110	Introduction to Artificial Intelligence and Machine Learning in Engineering (if not taken to fulfill major requirements)	3

Additional Electives–Computational Bioengineering

The following courses are suggested additional electives for the computational bioengineering focus area. Students are encouraged to consult their academic advisor when selecting electives.

Course #	Title	Hours
At least 15 s.h. from these:		
BME:5435	Systems Biology for Biomedical Engineering	3
BME:5441	Numerical and Statistical Methods for Bioengineering	3
ANTH:2320/ GHS:2320	Origins of Human Infectious Disease	3
BIOL:2512	Fundamental Genetics	4
BIOL:3212/ IGPI:3212	Bioinformatics for Beginners	3
BIOL:3314/ IGPI:3314	Genomics	3
CHEM:5431	Statistical Thermodynamics I	3
CS:2210	Discrete Structures	3
CS:2230	Computer Science II: Data Structures	4
CS:3330	Algorithms	3
CS:5350	Design and Analysis of Algorithms	3
ECE:5450/IGPI:5450	Machine Learning	3
ECE:5800/CS:5800	Fundamentals of Software Engineering	3

ECE:5995	Contemporary Topics in Electrical and Computer Engineering (when topic is applied machine learning)	3
MATH:3550	Engineering Vector Calculus	3
MATH:4750	Introduction to Mathematical Biology	3
Additional courses from the "Computational Bioengineering Electives" list		3
Courses from the "Pre-Medicine Focus Area Electives" list		3-4