

BIOENGINEERING, BS

for the degree of Bachelor of Science Major in Bioengineering

Bioengineers use engineering principles to solve problems in the life sciences, human health and medicine, and related industries. At the undergraduate level, the goal of bioengineering education is to instill a fundamental understanding of biology while developing core skills to design technologies relevant to human health and disease.

The Bioengineering department at the University of Illinois Urbana-Champaign provides a rigorous engineering education that prepares graduates to:

- secure and excel in jobs as engineers in industries of biotechnology, health care equipment and technology, life science tools, and pharmaceuticals,
- pursue graduate studies in bioengineering-related fields, and
- pursue professional degrees in the health sciences, law, and business.

During the first and second years of the curriculum, fundamental courses in biology, chemistry, computing, mathematics, and physics introduce students to the multidisciplinary principles underlying bioengineering as a field. Throughout the curriculum, core coursework becomes progressively more integrative across the disciplines and in years three and four, students specialize in a chosen bioengineering subdiscipline. The program is distinguished by laboratory courses that provide diverse experiences and hands-on skills as well as a capstone design course in which students practice the rigorous application of engineering fundamentals to biological problems identified by faculty, clinicians, and industrial partners.

Current Program Educational Objectives

for the degree of Bachelor of Science Major in Bioengineering

Graduation Requirements

Minimum Overall GPA: 2.0

Minimum hours required for graduation: Minimum hours for graduation is 128, to include a minimum of 40 hours of upper-division coursework generally at the 300- and 400- level. These hours can be drawn from all elements of the degree

General education: Students must complete the Campus General Education requirements including the campus general education language requirement.

Orientation and Professional Development

Code	Title	Hours
ENG 100	Grainger Engineering Orientation Seminar (External transfer students take ENG 300.)	1
BIOE 100	Bioengineering Seminar	1
BIOE 120	Introduction to Bioengineering	1
Total Hours		3

Foundational Mathematics and Science

Code	Title	Hours
CHEM 102	General Chemistry I	3
CHEM 103	General Chemistry Lab I	1
CHEM 104	General Chemistry II	3
CHEM 105	General Chemistry Lab II	1
MATH 221	Calculus I (MATH 220 may be substituted. MATH 220 is appropriate for students with no background in calculus. 4 of 5 credit hours count towards degree.)	4
MATH 231	Calculus II	3
MATH 241	Calculus III	4
MATH 285	Intro Differential Equations	3
PHYS 211	University Physics: Mechanics	4
PHYS 212	University Physics: Elec & Mag	4
Total Hours		30

Bioengineering Technical Core

Code	Title	Hours
BIOE 201	Conservation Principles Bioeng	3
BIOE 202	Cell & Tissue Engineering Lab	2
BIOE 205	Signals & Systems in Bioengrg	3
BIOE 206	Cellular Bioengineering	3
BIOE 210	Linear Algebra for Biomedical Data Science	3
BIOE 302	Modeling Human Physiology	3
BIOE 303	Quantitative Physiology Lab	2
BIOE 310	Computational Tools for Biological Data	3
BIOE 360	Transport & Flow in Bioengrg	3
BIOE 400	Bioengineering Senior Design	4
BIOE 414	Biomedical Instrumentation	3
BIOE 415	Biomedical Instrumentation Lab	2
BIOE 420	Intro Bio Control Systems	3
BIOE 476	Tissue Engineering	3
CHEM 232	Elementary Organic Chemistry I	4
CS 101	Intro Computing: Engrg & Sci	3
or CS 124	Introduction to Computer Science I	
MCB 150	Molec & Cellular Basis of Life	4
Total Hours		51

Track Electives

Code **Title** **Hours**
Students are required to complete 15 hours of credit from one track area listed below. 15

Biomechanics Track

Required courses:

TAM 211	Statics	3
TAM 212	Introductory Dynamics	3
TAM 251	Introductory Solid Mechanics	3

Select the remaining 6 hours from the below list:

BIOE 461	Cellular Biomechanics	4
BIOE 498	Special Topics (Experimental Design in Automation)	3
BIOE 498	Special Topics (Finite Element Methods in Biomedicine)	3

BIOE 498	Special Topics (Quantitative Pharmacology)	3	BIOE 479	Cancer Nanotechnology	3
BIOE 498	Special Topics (Regulatory Safety Issues in Bioengineering)	3	BIOE 498	Special Topics (Experimental Design in Automation)	3
BIOE 498	Special Topics (Surgical Techniques)	3	BIOE 498	Special Topics (Immunoengineering)	3
ME 330	Engineering Materials	4	BIOE 498	Special Topics (Preclinical Molecular Imaging)	3
ME 481	Whole-Body Musculoskel Biomech	3	BIOE 498	Special Topics (Quantitative Pharmacology)	3
ME 482	Musculoskel Tissue Mechanics	3	BIOE 498	Special Topics (Regulatory Safety Issues in Bioengineering)	3
ME 483	Mechanobiology	4	BIOE 498	Special Topics (Surgical Technologies)	3
NPRE 461	Probabilistic Risk Assessment	3	BIOE 498	Special Topics (Systems Biology)	3
SE 402	Comp-Aided Product Realization	3	BIOE 498	Special Topics (Technologies for Cancer Diagnosis and Therapy)	3
SE 423	Mechatronics	3	CHBE 472	Techniques in Biomolecular Eng	3
TAM 445	Continuum Mechanics	4	ECE 481	Nanotechnology	4
TMGT 461	Tech, Eng, & Mgt Final Project	4	MSE 403	Synthesis of Materials	3
Recommended free elective:			MSE 404	Laboratory Studies in Materials Science and Engineering	1.5
SE 101	Engineering Graphics & Design	3	MSE 450	Polymer Science & Engineering	3
Cell and Tissue Engineering Track			MSE 457	Polymer Chemistry	3 or 4
Select 15 hours from the list below:			MSE 470	Design and Use of Biomaterials	3
BIOE 306	Biofabrication Lab	3	MSE 473	Biomolecular Materials Science	3
BIOE 416	Biosensors	3	MSE 474	Biomaterials and Nanomedicine	3
BIOE 430	Intro Synthetic Biology	3	MSE 480	Surfaces and Colloids	3
BIOE 460	Gene Editing Lab	3	TMGT 461	Tech, Eng, & Mgt Final Project	4
BIOE 461	Cellular Biomechanics	4	Computational and Systems Biology Track		
BIOE 487	Stem Cell Bioengineering	3	Required courses:		
BIOE 498	Special Topics (Experimental Design in Automation)	3	CS 128	Introduction to Computer Science II	3
BIOE 498	Special Topics (Finite Element Methods in Biomedicine)	3	CS 225	Data Structures	4
BIOE 498	Special Topics (Immunoengineering)	3	Select the remaining 8 hours from the list below:		
BIOE 498	Special Topics (Preclinical Molecular Imaging)	3	ABE 440		
BIOE 498	Special Topics (Quantitative Pharmacology)	3	BIOE 483	Biomedical Computed Imaging Systems	3
BIOE 498	Special Topics (Regulatory Safety Issues in Bioengineering)	3	BIOE 484	Statistical Analysis of Biomedical Images	3
BIOE 498	Special Topics (Systems Biology)	3	BIOE 485	Computational Mathematics for Machine Learning and Imaging	4
CHBE 471	Biochemical Engineering	3	BIOE 486	Applied Deep Learning for Biomedical Imaging	3
CHBE 472	Techniques in Biomolecular Eng	3	BIOE 430	Intro Synthetic Biology	3
IE 330	Industrial Quality Control	3	BIOE 498	Special Topics (Experimental Design in Automation)	3
MSE 404	Laboratory Studies in Materials Science and Engineering	1.5	BIOE 498	Special Topics (Finite Element Methods in Biomedicine)	3
MSE 470	Design and Use of Biomaterials	3	BIOE 498	Special Topics (Regulatory Safety Issues in Bioengineering)	3
MSE 474	Biomaterials and Nanomedicine	3	BIOE 498	Special Topics (Systems Biology)	3
ME 483	Mechanobiology	4	CS 411	Database Systems	3
TMGT 461	Tech, Eng, & Mgt Final Project	4	CS 412	Introduction to Data Mining	3
Recommended free elective			CS 440	Artificial Intelligence	3
MCB 450	Introductory Biochemistry	3	CS 446	Machine Learning	3 or 4
Therapeutics Engineering Track			CS 465	User Interface Design	4
Select 15 hours from the list below:			CS 466	Introduction to Bioinformatics	3
ABE 446	Biological Nanoengineering	3	CS 498	Special Topics (Intro to Deep Learning)	3
BIOE 306	Biofabrication Lab	3	ECE 490	Introduction to Optimization	3
BIOE 430	Intro Synthetic Biology	3			
BIOE 460	Gene Editing Lab	3			

ECE 498	Special Topics in ECE (Deep Learning in Hardware)	3
IE 310	Deterministic Models in Optimization	3
IE 370	Stochastic Processes and Applications	3
NPRE 461	Probabilistic Risk Assessment	3 or 4
SE 423	Mechatronics	3
TMGT 461	Tech, Eng, & Mgt Final Project	4

Imaging and Sensing Track

Select 15 hours from the list below:

BIOE 498	Special Topics (Experimental Design in Automation)	3
BIOE 484	Statistical Analysis of Biomedical Images	3
BIOE 486	Applied Deep Learning for Biomedical Imaging	3
BIOE 498	Special Topics (Immunoengineering)	3
BIOE 498	Special Topics (Preclinical Molecular Imaging)	3
BIOE 498	Special Topics (Quantitative Pharmacology)	3
BIOE 498	Special Topics (Regulatory Safety Issues in Bioengineering)	3
BIOE 498	Special Topics (Surgical Techniques)	3
BIOE 498	Special Topics (Systems Biology)	3
BIOE 498	Special Topics (Technologies for Cancer Diagnosis and Therapy)	3
ECE 210	Analog Signal Processing	4
ECE 310	Digital Signal Processing	3
ECE 311	Digital Signal Processing Lab	1
ECE 329	Fields and Waves I	3
ECE 365	Data Science and Engineering	3
ECE 380	Biomedical Imaging	3
ECE 416	Biosensors	3
ECE 417	Multimedia Signal Processing	4
ECE 418	Image & Video Processing	4
ECE 437	Sensors and Instrumentation	3
ECE 365	Data Science and Engineering	3
ECE 460	Optical Imaging	4
ECE 467	Biophotonics	3
ECE 472	Biomedical Ultrasound Imaging	3
ECE 473	Fund of Engrg Acoustics	3
ECE 480	Magnetic Resonance Imaging	3
ME 487	MEMS-NEMS Theory & Fabrication	4
NPRE 461	Probabilistic Risk Assessment	3
SE 423	Mechatronics	3
TMGT 461	Tech, Eng, & Mgt Final Project	4
Recommended Free Elective		
CHEM 442	Physical Chemistry I	4

Free Electives

Code	Title	Hours
	Additional coursework, subject to the Grainger College of Engineering restrictions to Free Electives, so that there are at least 128 credit hours earned toward the degree. (https://go.grainger.illinois.edu/FreeElectives/)	9
Total Hours of Curriculum to Graduate		128

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Sample Sequence

This sample sequence is intended to be used only as a guide for degree completion. All students should work individually with their academic advisors to decide the actual course selection and sequence that works best for them based on their academic preparation and goals. Enrichment programming such as study abroad, minors, internships, and so on may impact the structure of this four-year plan. Course availability is not guaranteed during the semester indicated in the sample sequence. The curriculum sequence can also be viewed via dynamic and static curricular maps (<https://grainger.illinois.edu/academics/undergraduate/majors-and-minors/bioengineering-map/>), which include prerequisite sequencing.

Students must fulfill their Language Other Than English requirement by successfully completing a third level of a language other than English. See the corresponding section on the Degree and General Education Requirements (<http://catalog.illinois.edu/general-information/degree-general-education-requirements/>).

Free Electives: Additional course work, subject to the Grainger College of Engineering restrictions to Free Electives (<https://go.grainger.illinois.edu/FreeElectives/>), so that there are at least 128 credit hours earned toward the degree.

First Year

First Semester	Hours	Second Semester	Hours
BIOE 100		1 BIOE 120	1
CHEM 102		3 CHEM 104	3
CHEM 103		1 CHEM 105	1
MATH 221 (MATH 220 may be substituted)		4 MATH 231	3
ENG 100		1 PHYS 211	4
General Education course (choose a Humanities or Social/Behavioral Science course with Cultural Studies designation)		3 MCB 150 (or Composition I course)	4
Composition I course or MCB 150		4	
		17	16

Second Year

First Semester	Hours	Second Semester	Hours
BIOE 201		3 BIOE 202	2
BIOE 206		3 BIOE 205	3
MATH 241		4 BIOE 210	3

PHYS 212	4	MATH 285	3
CS 101 (CS 124 may be substituted)	4	CHEM 232	3
		17	15

Third Year

First Semester	Hours	Second Semester	Hours
BIOE 302		3 BIOE 310	3
BIOE 303		2 BIOE 360	3
BIOE 476		3 BIOE 414	3
Track elective course		3 BIOE 415	2
General Education course (choose a Humanities or Social/Behavioral Science course with Cultural Studies designation)		3 Track elective course	3
		Language Other Than English (3rd level) course	4
		14	18

Fourth Year

First Semester	Hours	Second Semester	Hours
BIOE 400 (or Free Elective)		4 Free Elective or BIOE 400	4
BIOE 420		3 Track elective course	3
Track elective course		3 Track elective course	3
General Education course (choose a Humanities or Social/Behavioral Science course with Cultural Studies designation)		3 Free elective course	3
Free elective course		2 General Education course (choose a Humanities or Social/Behavioral Science course that is also Advanced Composition)	3
		15	16

Total Hours 128*for the degree of Bachelor of Science Major in Bioengineering*

This program is accredited by the Engineering Accreditation Commission of ABET (<https://www.abet.org>), under the General Criteria and the Bioengineering, Biomedical, and similarly named Engineering Programs Criteria.

Bioengineering graduates will have:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. 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.
3. An ability to communicate effectively with a range of audiences.
4. 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.
5. 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.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

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B.S. in Bioengineering (<https://bioengineering.illinois.edu/academics/undergraduate/bioengineering/>)

Bioengineering Faculty (<https://bioengineering.illinois.edu/people/faculty/>)

The Grainger College of Engineering Admissions (<http://catalog.illinois.edu/undergraduate/engineering/bioengineering-bs/grainger.illinois.edu>)

The Grainger College of Engineering