

BIOENGINEERING, BS

for the degree of Bachelor of Science 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 in Bioengineering

Graduation Requirements

Minimum Overall GPA: 2.0

Minimum hours required for graduation: 128 hours

General education: Students must complete the Campus General Education (<https://courses.illinois.edu/gened/DEFAULT/DEFAULT/>) 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 Bioengr	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 Bioengr	3
BIOE 414	Biomedical Instrumentation	3
BIOE 415	Biomedical Instrumentation Lab	2
BIOE 420	Intro Bio Control Systems	3
BIOE 435	Senior Design I	2
BIOE 436	Senior Design II	2
BIOE 476	Tissue Engineering	3
CHEM 232	Elementary Organic Chemistry I	4
CS 101	Intro Computing: Engrg & Sci (CS 124 may be taken instead of CS 101.)	3
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 498	Special Topics (Regulatory Safety Issues in Bioengineering)	3
BIOE 498	Special Topics (Surgical Techniques)	3

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

Required courses:

ECE 210	Analog Signal Processing	4
ECE 329	Fields and Waves I	3

Select the remaining 8 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 310	Digital Signal Processing	3
ECE 311	Digital Signal Processing Lab	1
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/)		13
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)		3 CHEM 232	4
		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
Free elective course	2	BIOE 415	2
Track elective course	3	Track elective course	3
General Education course (choose a Humanities or Social/Behavioral Science course with Cultural Studies designation)	3		
	16		14
Fourth Year			
First Semester	Hours	Second Semester	Hours
BIOE 435	2	BIOE 436	2
Track elective course	3	BIOE 420	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	Language Other Than English (3rd level) course	4
General Education course (choose a Humanities or Social/Behavioral Science course that is also Advanced Composition)	3	Free elective course	4
Free elective course	3		
	17		16

Total Hours 128

for the degree of Bachelor of Science Major in Bioengineering

Student learning outcomes are based on learning outcomes in line with the ABET accreditation process.

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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Bioengineering Website

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