

BIOENGINEERING, BS

Overview

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 attain:

- recognition as skilled engineers in biotechnology, life sciences, medical technology, and health care industries;
- advanced degrees through graduate studies in bioengineering-related fields, or professional degrees in the health sciences, law, and business; and
- recognition for fostering an inclusive and collaborative environment while demonstrating leadership and effective teamwork within diverse professional and community organizations.

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.

Degree Requirements

for the degree of Bachelor of Science in Bioengineering

Graduation Requirements

Minimum hours required for graduation: 128 hours.

Minimum Overall GPA: 2.0

University Requirements

Minimum of 40 hours of upper-division coursework, generally at the 300- or 400-level. These hours can be drawn from all elements of the degree.

Students should consult their academic advisor for additional guidance in fulfilling this requirement.

The university and residency requirements can be found in the Student Code (<https://studentcode.illinois.edu/article3/part8/3-801/>) (§ 3-801) and in the Academic Catalog (<http://catalog.illinois.edu/general-information/degree-general-education-requirements/>).

General Education Requirements

Follows the campus General Education (Gen Ed) requirements (<https://courses.illinois.edu/gened/DEFAULT/DEFAULT/>). Some Gen Ed

requirements may be met by courses required and/or electives in the program.

Code	Title	Hours
	Composition I	4-6
	Advanced Composition	3
	fulfilled by BIOE 400	
	Humanities & the Arts (6 hours)	6
	Natural Sciences & Technology (6 hours)	6
	fulfilled by CHEM 102, CHEM 104, MCB 150, PHYS 211, PHYS 212	
	Social & Behavioral Sciences (6 hours)	6
	Cultural Studies: Non-Western Cultures (1 course)	3
	Cultural Studies: US Minority Cultures (1 course)	3
	Cultural Studies: Western/Comparative Cultures (1 course)	3
	Quantitative Reasoning (2 courses, at least one course must be Quantitative Reasoning I)	6-10
	fulfilled by MATH 220 or MATH 221; and MATH 231, MATH 241, MATH 285, PHYS 211, PHYS 212; and CS 101 or CS 124	
	Language Requirement (Completion of the third semester or equivalent of a language other than English is required)	0-15

Major Requirements

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	CS 466	Introduction to Bioinformatics	3
BIOE 210	Linear Algebra for Biomedical Data Science	3	CS 498	Special Topics (Intro to Deep Learning)	3
BIOE 302	Modeling Human Physiology	3	ECE 210	Analog Signal Processing	4
BIOE 303	Quantitative Physiology Lab	2	ECE 310	Digital Signal Processing	3
BIOE 310	Computational Tools for Biological Data	3	ECE 311	Digital Signal Processing Lab	1
BIOE 360	Transport & Flow in Bioengrg	3	ECE 329	Fields and Waves I	3
BIOE 400	Bioengineering Senior Design	4	ECE 365	Data Science and Engineering	3
BIOE 414	Biomedical Instrumentation	3	ECE 380	Biomedical Imaging	3
BIOE 415	Biomedical Instrumentation Lab	2	ECE 416	Biosensors	3
BIOE 420	Intro Bio Control Systems	3	ECE 417	Multimedia Signal Processing	4
BIOE 476	Tissue Engineering	3	ECE 418	Image & Video Processing	4
CHEM 232	Elementary Organic Chemistry I	4	ECE 437	Sensors and Instrumentation	3
CS 101	Intro Computing: Engrg & Sci	3	ECE 365	Data Science and Engineering	3
or CS 124	Introduction to Computer Science I		ECE 460	Optical Imaging	4
MCB 150	Molecular & Cellular Basis of Life	4	ECE 467	Biophotonics	3
Total Hours		51	ECE 472	Biomedical Ultrasound Imaging	3
			ECE 473	Fund of Engrg Acoustics	3
Technical Electives			ECE 480	Magnetic Resonance Imaging	3
Code	Title	Hours	ECE 481	Nanotechnology	4
Students are required to complete 15 hours of credit from the course options listed below.		15	ECE 490	Introduction to Optimization	3
ABE 446	Biological Nanoengineering	3	ECE 498	Special Topics in ECE (Deep Learning in Hardware)	3
BIOE 306	Biofabrication Lab	3	IE 310	Deterministic Models in Optimization	3
BIOE 424	Preclinical Molecular Imaging	3	IE 330	Industrial Quality Control	3
BIOE 430	Intro Synthetic Biology	3	IE 370	Stochastic Processes and Applications	3
BIOE 432	Systems Biology: Uncovering Design Principles of Biological Networks	3	ME 330	Engineering Materials	4
BIOE 434	Immunoengineering	3	ME 481	Whole-Body Musculoskel Biomech	3
BIOE 450	Introduction to Quantitative Pharmacology	3	ME 482	Musculoskel Tissue Mechanics	3
BIOE 460	Gene Editing Lab	3	ME 483	Mechanobiology	4
BIOE 461	Cellular Biomechanics	4	ME 487	MEMS-NEMS Theory & Fabrication	4
BIOE 479	Cancer Nanotechnology	3	MSE 403	Synthesis of Materials	3
BIOE 483	Biomedical Computed Imaging Systems	3	MSE 404	Laboratory Studies in Materials Science and Engineering	1.5
BIOE 484	Statistical Analysis of Biomedical Images	3	MSE 450	Polymer Science & Engineering	3
BIOE 485	Computational Mathematics for Machine Learning and Imaging	4	MSE 457	Polymer Chemistry	3 or 4
BIOE 486	Applied Deep Learning for Biomedical Imaging	3	MSE 470	Design and Use of Biomaterials	3
BIOE 487	Stem Cell Bioengineering	3	MSE 473	Biomolecular Materials Science	3
BIOE 498	Special Topics (Technologies for Cancer Diagnosis and Therapy)	3	MSE 474	Biomaterials and Nanomedicine	3
BIOE 498	Special Topics (Regulatory Safety Issues in Bioengineering)	3	MSE 480	Surfaces and Colloids	3
BIOE 498	Special Topics (Surgical Techniques)	3	NPRE 461	Probabilistic Risk Assessment	3 or 4
CHBE 471	Biochemical Engineering	3	SE 402	Comp-Aided Product Realization	3
CHBE 472	Techniques in Biomolecular Eng	3	SE 423	Mechatronics	3
CS 128	Introduction to Computer Science II	3	TAM 211	Statics	3
CS 225	Data Structures	4	TAM 212	Introductory Dynamics	3
CS 411	Database Systems	3	TAM 251	Introductory Solid Mechanics	3
CS 412	Introduction to Data Mining	3	TAM 445	Continuum Mechanics	4
CS 440	Artificial Intelligence	3	TMGT 461	Tech, Eng, & Mgt Final Project	4
CS 446	Machine Learning	3 or 4			
CS 465	User Interface Design	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

Sample Sequence

for the degree of Bachelor of Science in Bioengineering

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

Requirements	Hours
BIOE 100 - Bioengineering Seminar	1
CHEM 102 - General Chemistry I	3
CHEM 103 - General Chemistry Lab I	1
MATH 221 - Calculus I or MATH 220 - Calculus	4
ENG 100 - Grainger Engineering Orientation Seminar	1
General Education course (choose a Humanities or Social/Behavioral Science course with Cultural Studies designation)	3
Composition I or MCB 150	4
Semester Hours	17

Second Semester

Requirements	Hours
BIOE 120 - Introduction to Bioengineering	1
CHEM 104 - General Chemistry II	3
CHEM 105 - General Chemistry Lab II	1
MATH 231 - Calculus II	3

PHYS 211 - University Physics: Mechanics	4
MCB 150 - Molecular & Cellular Basis of Life (or Composition I course)	4
Semester Hours	16

Second Year

First Semester

Requirements	Hours
BIOE 201 - Conservation Principles Bioeng	3
BIOE 206 - Cellular Bioengineering	3
MATH 241 - Calculus III	4
PHYS 212 - University Physics: Elec & Mag	4
CS 101 - Intro Computing: Engrg & Sci or CS 124 - Introduction to Computer Science I	3
Semester Hours	17

Second Semester

Requirements	Hours
BIOE 202 - Cell & Tissue Engineering Lab	2
BIOE 205 - Signals & Systems in Bioengrg	3
BIOE 210 - Linear Algebra for Biomedical Data Science	3
MATH 285 - Intro Differential Equations	3
CHEM 232 - Elementary Organic Chemistry I	4
Semester Hours	15

Third Year

First Semester

Requirements	Hours
BIOE 302 - Modeling Human Physiology	3
BIOE 303 - Quantitative Physiology Lab	2
BIOE 476 - Tissue Engineering	3
Technical Elective course	3
General Education course (choose a Humanities or Social/Behavioral Science course with Cultural Studies designation)	3
Semester Hours	14

Second Semester

Requirements	Hours
BIOE 310 - Computational Tools for Biological Data	3
BIOE 360 - Transport & Flow in Bioengrg	3

BIOE 414 - Biomedical Instrumentation	3
BIOE 415 - Biomedical Instrumentation Lab	2
Technical Elective course	3
Language Other Than English (3rd level)	4
Semester Hours	18

Fourth Year

First Semester

Requirements	Hours
BIOE 400 - Bioengineering Senior Design (or Free Elective course)	4
Technical Elective course	3
Technical Elective course	3
General Education course (choose a Humanities or Social/Behavioral Science course with Cultural Studies designation)	3
Free Elective course	2
Semester Hours	15

Second Semester

Requirements	Hours
BIOE 400 - Bioengineering Senior Design (or Free Elective course)	4
BIOE 420 - Intro Bio Control Systems	3
Technical Elective course	3
Free Elective course	3
General Education course (choose a Humanities or Social/Behavioral Science course with Cultural Studies designation)	3
Semester Hours	16

Total Hours

Total hours for all requirements: 128

Learning Outcomes

for the degree of Bachelor of Science 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.

Contact Information

for the degree of Bachelor of Science in Bioengineering

Bioengineering

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

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

The Grainger College of Engineering (<https://grainger.illinois.edu/>)

The Grainger College of Engineering Admissions (<https://grainger.illinois.edu/admissions/>)