BIOENGINEERING MAJOR (B.S.)

https://ceps.unh.edu/chemical-bioengineering/program/bs/bioengineering-major

Description

The Bioengineering program is tailored to students who want to use engineering principles to analyze problems and design solutions in the fields of healthcare, medicine and biology, biotechnology and pharmaceuticals, as well as biofuels.

The bioengineering program is truly interdisciplinary and will train graduates in biology and physiology as well as engineering. The program will provide graduates with capabilities in advanced mathematics (including differential equations and statistics), science, and engineering. Graduates will be conversant with solving problems at the interface of biology and engineering that may arise in a variety of fields. By graduation, students will have experience measuring and interpreting data from living systems and addressing the interactions between living and non-living materials.

For more information on the bioengineering program, please contact Nivedita Gupta (nivedita.gupta@unh.edu), Professor and Chair.

The Bioengineering program (B Sci in Bioengineering) is accredited by the Engineering Accreditation Commission of ABET, https://www.abet.org, under the General Criteria and the Program Criteria for Bioengineering and Biomedical and Similarly Named Engineering Programs.

Requirements

Degree Requirements

Minimum Credit Requirement: 128 credits

Minimum Residency Requirement: 32 credits must be taken at UNH

Minimum GPA: 2.0 required for conferral*

Core Curriculum Required: Discovery & Writing Program Requirements

Foreign Language Requirement: No

All Major, Option and Elective Requirements as indicated.
**Major GPA requirements as indicated.*

Major Requirements

Students are required to obtain a minimum 2.0 grade-point average in CHBE 501 Material Balances and CHBE 502 Energy Balances and in overall standing at the end of the sophomore year in order to continue in the major. Study abroad (Exchange) students are required to have a cumulative GPA of 3.0 or better in math, physics, chemistry, and other required courses at the end of the semester prior to their exchange semester.

Code	Title	Credits
CHBE 400	Chemical and Bioengineering Lectures	1
CHBE 501	Material Balances	3
CHBE 502	Energy Balances	3
CHBE 601	Fluid Mechanics and Unit Operations	3
CHBE 604	Chemical Engineering Thermodynamics	3
CHBE 614	Separation Processes	3
CHBE 761	Biochemical Engineering	4
CHBE 762	Biomedical Engineering	4
CHBE 763	Bioengineering Design I	2
CHBE 764	Bioengineering Design II	4
CHBE 766	Biomaterials	4
BIOL 411	Introductory Biology: Molecular and Cellular	4
BMCB 658 & BMCB 659	General Biochemistry and General Biochemistry Lab	5
BMS 503	General Microbiology	3
BMS 504	General Microbiology Laboratory	2
BMS 508	Human Anatomy and Physiology II	4
CHEM 405	Chemical Principles for Engineers	4
CHEM 545 & CHEM 546	Organic Chemistry and Organic Chemistry Laboratory	5
GEN 604	Principles of Genetics	4
MATH 425	Calculus I	4
MATH 426	Calculus II	4
MATH 527	Differential Equations with Linear Algebra	4
MATH 644	Statistics for Engineers and Scientists	4
PHYS 407	General Physics I	4
Electives		
Select five courses from the following: [1]		
BMCB 753	Cell Culture	
BMS 507	Human Anatomy and Physiology I	
BMS 702	Endocrinology	
BMS 704	Pathologic Basis of Disease	
BMS 706 & BMS 708	Virology and Virology Laboratory	
CEE 502	Project Engineering [1]	
CEE 705	Introduction to Sustainable Engineering [1]	
CEE 724	Environmental Engineering Microbiology [1]	
CHBE 602	Heat Transfer and Unit Operations [1]	
CHBE 603	Applied Mathematics for Chemical Engineers [1]	
CHBE 651	Biotech Experience/Biomanufacturing [1]	
CHBE 703	Mass Transfer and Stagewise Operations [1]	
CHBE 707	Chemical Engineering Kinetics [1]	
CHBE 709	Fundamentals of Air Pollution and Its Control [1]	
CHBE 712	Introduction to Nuclear Engineering [1]	
CHBE 714	Chemical Sensors [1]	
CHBE 722	Introduction to Microfluidics [1]	
CHBE 725	Cell Phenotyping and Tissue Engineering Laboratory [1]	
CHBE 752	Process Dynamics and Control [1]	
CHBE 755	Computational Molecular Bioengineering [1]	
ECE 537	Introduction to Electrical Engineering [1]	
ECE 541	Electric Circuits [1]	
ECE 543	Introduction to Digital Systems [1]	
ECE 633	Signals and Systems I [1]	
ECE 633H	Honors/Signals and Systems I [1]	
ECE 717	Introduction to Digital Image Processing [1]	
ECE 784	Biomedical Instrumentation [1]	
GEN 711	Genomics and Bioinformatics	
or GEN 711W	Genomics and Bioinformatics	
GEN 712	Programming for Bioinformatics	
GEN 717	Molecular Microbiology	
GEN 771	Molecular Genetics	
GEN 774	Techniques in Plant Genetic Engineering and Biotechnology [1]	
TECH 780	Intellectual Property Law for Engineers & Scientists	
Total Credits		**85**

[1] At least four of the elective courses must be engineering.

Degree Plan

First Year		
Fall		**Credits**
CHBE 400	Chemical and Bioengineering Lectures	1
CHEM 405	Chemical Principles for Engineers [2]	4
ENGL 401	First-Year Writing [3]	4
MATH 425	Calculus I [1]	4
Discovery Program Elective		4
	Credits	**17**
Spring		
BIOL 411	Introductory Biology: Molecular and Cellular [4]	4
MATH 426	Calculus II	4
PHYS 407	General Physics I	4
Discovery Program Elective		4
	Credits	**16**
Second Year		
Fall		
CHBE 501	Material Balances	3
CHEM 545	Organic Chemistry	3
CHEM 546	Organic Chemistry Laboratory	2
GEN 604	Principles of Genetics	4
MATH 527	Differential Equations with Linear Algebra	4
	Credits	**16**
Spring		
BMS 503	General Microbiology	3
BMS 504	General Microbiology Laboratory	2
CHBE 502	Energy Balances [5]	3
MATH 644	Statistics for Engineers and Scientists	4
Discovery Program Elective		4
	Credits	**16**
Third Year		
Fall		
BMCB 658	General Biochemistry	3
BMCB 659	General Biochemistry Lab	2
CHBE 601	Fluid Mechanics and Unit Operations	3
CHBE 766	Biomaterials	4
Bioengineering Program Elective		4
	Credits	**16**
Spring		
BMS 508	Human Anatomy and Physiology II	4
CHBE 604	Chemical Engineering Thermodynamics	3
CHBE 761	Biochemical Engineering	4
Bioengineering Program Elective		4
	Credits	**15**
Fourth Year		
Fall		
CHBE 762	Biomedical Engineering	4
CHBE 763	Bioengineering Design I	2
Bioengineering Program Electives (2)		8
Discovery Program Elective		4
	Credits	**18**
Spring		
CHBE 614	Separation Processes	3
CHBE 764	Bioengineering Design II	4
Bioengineering Program Elective		4
Discovery Program Elective		4
	Credits	**15**
	Total Credits	**129**

1. MATH 425 Calculus I satisfies the Discovery Foundation Quantitative Reasoning category.
2. CHEM 405 Chemical Principles for Engineers satisfies the Discovery Physical Science (with lab) category.
3. ENGL 401 First-Year Writing satisfies the Discovery Foundation Writing Skills category.
4. BIOL 411 Introductory Biology: Molecular and Cellular satisfies the Discovery Biological Science (with lab) category.
5. CHBE 502 Energy Balances satisfies the Discovery Inquiry category.

The Discovery ETS category requirement is met upon receiving a passing grade in CHBE 400 Chemical and Bioengineering Lectures; CHBE 761 Biochemical Engineering; CHBE 762 Biomedical Engineering; CHBE 763 Bioengineering Design I; CHBE 764 Bioengineering Design II. Students who do not complete these courses must take a Discovery ETS course to fulfill the requirement.

34 credits engineering, 16 credits math, 14 credits chemistry, 16 credits life science

Five electives: 12 to 16 credits engineering; 3 to 4 credits science, math, or engineering

Student Learning Outcomes

By the time of graduation, students will have:

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