BIOENGINEERING MAJOR (B.S.)

https://ceps.unh.edu/chemical-engineering/bioengineering-bs

Description

Bioengineering, as defined by the NIH, is “the application of life sciences, mathematics, and engineering principles to define and solve problems in biology, medicine, health care, and other fields.”

The bioengineering program 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 the fields of biotechnology and pharmaceuticals, as well as medicine and biofuels. By graduation, students will have experience measuring and interpreting data from living systems and addressing the interactions between living and non-living materials.

Students are required to obtain a minimum 2.0 grade-point average in CHE 501 Introduction to Chemical Engineering I/CHE 502 Introduction to Chemical Engineering II 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.

For more information on the bioengineering program, please contact Xiaowei Teng (XW.Teng@unh.edu), professor and chair.

Requirements

Major Requirements

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>BENG 763</td>
<td>Bioengineering Design I</td>
<td>2</td>
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<tr>
<td>BENG 764</td>
<td>Bioengineering Design II</td>
<td>4</td>
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<tr>
<td>BENG 766</td>
<td>Biomaterials</td>
<td>4</td>
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<tr>
<td>BMBC 659</td>
<td>General Biochemistry &amp; General Biochemistry Lab</td>
<td>5</td>
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<tr>
<td>BMS 503</td>
<td>General Microbiology</td>
<td>3</td>
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<tr>
<td>BMS 504</td>
<td>General Microbiology Laboratory</td>
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<tr>
<td>BMS 508</td>
<td>Human Anatomy and Physiology I</td>
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<td>BIOL 411</td>
<td>Introductory Biology: Molecular and Cellular</td>
<td>4</td>
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<tr>
<td>CHE 400</td>
<td>Chemical Engineering Lectures</td>
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<tr>
<td>CHE 501</td>
<td>Introduction to Chemical Engineering I</td>
<td>3</td>
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<tr>
<td>CHE 502</td>
<td>Introduction to Chemical Engineering II</td>
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<tr>
<td>CHE 601</td>
<td>Fluid Mechanics and Unit Operations</td>
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<tr>
<td>CHE 604</td>
<td>Chemical Engineering Thermodynamics</td>
<td>3</td>
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<tr>
<td>CHE 614</td>
<td>Separation Processes</td>
<td>3</td>
</tr>
<tr>
<td>CHE 761</td>
<td>Biochemical Engineering</td>
<td>4</td>
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<tr>
<td>CHE 762</td>
<td>Biomedical Engineering</td>
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<tr>
<td>CHEM 405</td>
<td>Chemical Principles for Engineers</td>
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<tr>
<td>CHEM 545</td>
<td>Organic Chemistry &amp; Organic Chemistry Laboratory</td>
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<tr>
<td>GEN 604</td>
<td>Principles of Genetics</td>
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<tr>
<td>MATH 425</td>
<td>Calculus I</td>
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<td>MATH 426</td>
<td>Calculus II</td>
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<td>MATH 527</td>
<td>Differential Equations with Linear Algebra</td>
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<td>MATH 644</td>
<td>Statistics for Engineers and Scientists</td>
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<td>PHYS 407</td>
<td>General Physics I</td>
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Electives

Select five courses from the following:

- BENG 725 Cell Phenotyping and Tissue Engineering Laboratory
- BENG 755 Computational Molecular Bioengineering
- BMBC 763 Cell Culture
- BMS 507 Human Anatomy and Physiology I
- BMS 702 Endocrinology
- BMS 704 Pathologic Basis of Disease
- BMS 706 Virology & BMS 708 Virology Laboratory
- CEE 502 Project Engineering
- CEE 705 Introduction to Sustainable Engineering
- CEE 724 Environmental Engineering Microbiology
- CHE 602 Heat Transfer and Unit Operations
- CHE 603 Applied Mathematics for Chemical Engineers
- CHE 651 Biotech Experience/Biomanufacturing
- CHE 703 Mass Transfer and Stagewise Operations
- CHE 707 Chemical Engineering Kinetics
- CHE 709 Fundamentals of Air Pollution and Its Control
- CHE 712 Introduction to Nuclear Engineering
- CHE 714 Chemical Sensors
- CHE 722 Introduction to Microfluidics
- CHE 752 Process Dynamics and Control
- ECE 537 Introduction to Electrical Engineering
- ECE 541 Electric Circuits
- ECE 543 Introduction to Digital Systems
- ECE 633 Signals and Systems
- ECE 633H Honors/Signals and Systems I
- ECE 717 Introduction to Digital Image Processing
- ECE 784 Biomedical Instrumentation
- GEN 711 Genomics and Bioinformatics
- GEN 711W Genomics and Bioinformatics
- GEN 712 Programming for Bioinformatics
- GEN 717 Molecular Microbiology
- GEN 717F Molecular Genetics
- GEN 774 Techniques in Plant Genetic Engineering and Biotechnology
- 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

- CHE 400 Chemical Engineering Lectures 1
- MATH 425 Calculus I
- CHEM 405 Chemical Principles for Engineers
- ENGL 401 First-Year Writing
- Discovery Program Elective

Credits 17

Spring

- MATH 426 Calculus II
- PHYS 407 General Physics I
- BIOL 411 Introductory Biology: Molecular and Cellular
- Discovery Program Elective

Credits 16
## Second Year

### Fall
- CHE 501 Introduction to Chemical Engineering I 3
- MATH 527 Differential Equations with Linear Algebra 4
- CHEM 545 Organic Chemistry 3
- CHEM 546 Organic Chemistry Laboratory 2
- GEN 604 Principles of Genetics 4

### Spring
- CHE 502 Introduction to Chemical Engineering II 5
- MATH 644 Statistics for Engineers and Scientists 4
- Discovery Program Elective 4
- BMS 503 General Microbiology 3
- BMS 504 General Microbiology Laboratory 2

### Credits
16

## Third Year

### Fall
- CHE 601 Fluid Mechanics and Unit Operations 3
- BENG 766 Biomaterials 4
- BMCB 658 General Biochemistry 3
- BMCB 659 General Biochemistry Lab 2
- Bioengineering Program Elective 4

### Spring
- CHE 604 Chemical Engineering Thermodynamics 3
- CHE 761 Biochemical Engineering 4
- BMS 508 Human Anatomy and Physiology II 4
- Bioengineering Program Elective 4

### Credits
16

## Fourth Year

### Fall
- BENG 763 Bioengineering Design I 2
- BENG 762 Biomedical Engineering 4
- Discovery Program Elective 4
- Bioengineering Program Electives (2) 8

### Spring
- BENG 764 Bioengineering Design II 4
- CHE 614 Separation Processes 3
- Discovery Program Elective 4
- Bioengineering Program Elective 4

### Credits
18

### Total Credits
129

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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.

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5. CHE 502 Introduction to Chemical Engineering II satisfies the Discovery Inquiry category.

The Discovery ETS category requirement is met upon receiving a passing grade in CHE 400 Chemical Engineering Lectures; CHE 761 Biochemical Engineering; CHE 762 Biomedical Engineering; BENG 763 Bioengineering Design I; BENG 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: 15 to 16 credits engineering; 4 credits science, math, or engineering

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**Student Learning Outcomes**

- The ability to apply knowledge of mathematics, physical and life science and engineering.
- The ability to design and safely conduct experiments on living cells and nonliving materials.
- The ability to analyze and interpret data The ability to identify, formulate and solve bioengineering problems.
- The ability to design a process or device that meets desired specifications with consideration of environmental, safety, economic and ethical criteria.
- An appreciation of contemporary issues relevant to bioengineering.
- Completed the Discovery program and obtained a broad education useful to understand the impact of engineering solutions in a global and societal context.
- The ability to use computers effectively for engineering practice.