

CHEMICAL ENGINEERING MAJOR: BIOENGINEERING OPTION (B.S.)

<https://ceps.unh.edu/chemical-engineering-bioengineering/program/bs/chemical-engineering-major-bioengineering-option>

Description

Under this option, the required courses deal with the application of basic biological sciences and chemical engineering principles to the design and operation of large-scale bioprocesses for the production of high-value medicinal, food and beverage, pharmaceutical, biomedical, genetic engineering, and health care products. The elective courses permit the student to study topics of special interest in more depth or gain a broader perspective in bioengineering or some closely related subjects such as biochemistry or biotechnology experience in manufacturing or research. Three courses are required, and an additional course of at least three credits should be selected from the electives list. Students interested in the bioengineering option should declare their intention to the department faculty during the sophomore year.

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

Requirements

Degree Requirements

Minimum Credit Requirement: 132 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

Code	Title	Credits
Required Courses		
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 602	Heat Transfer and Unit Operations	3
CHBE 603	Applied Mathematics for Chemical Engineers	4
CHBE 604	Chemical Engineering Thermodynamics	3
CHBE 612	Chemical Engineering Laboratory I	3
CHBE 614	Separation Processes	3
CHBE 651	Biotech Experience/Biomanufacturing	4
CHBE 703	Mass Transfer and Stagewise Operations	3
CHBE 707	Chemical Engineering Kinetics	3

CHBE 708	Chemical Engineering Design	4
CHBE 713	Chemical Engineering Laboratory II	3
CHBE 752	Process Dynamics and Control	4
CHBE 761	Biochemical Engineering	4
CHBE 766	Biomaterials	4
CHEM 405	Chemical Principles for Engineers	4
CHEM 683	Physical Chemistry I	3
CHEM 684	Physical Chemistry II	3
CHEM 685	Physical Chemistry Laboratory	2
CHEM 686	Physical Chemistry Laboratory	2
CHEM 651	Organic Chemistry I	3
CHEM 652A	Organic Chemistry II	3
CHEM 653	Organic Chemistry Laboratory	2
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
PHYS 408	General Physics II	4
Elective Courses		
Select one of the following:		3-4
CHBE 695	Chemical Engineering Project	
CHBE 696	Independent Study	
CHBE 714	Chemical Sensors	
CHBE 725	Cell Phenotyping and Tissue Engineering Laboratory	
CHBE 755	Computational Molecular Bioengineering	
CHBE 762	Biomedical Engineering	
BMCB 750	Physical Biochemistry	
BMCB 751	Principles of Biochemistry I	
BMCB 752	Principles of Biochemistry II	
Total Credits		104-105

Degree Plan

Sample Degree Plan

This sample degree plan serves as a general guide; students collaborate with their academic advisor to develop a personalized degree plan to meet their academic goals and program requirements.

First Year

Fall		Credits
CHBE 400	Chemical and Bioengineering Lectures	1
CHEM 405	Chemical Principles for Engineers ³	4
ENGL 401	First-Year Writing ¹	4
MATH 425	Calculus I ²	4
Discovery Program Electives ⁶		4
Credits		17

Spring

MATH 426	Calculus II	4
PHYS 407	General Physics I ³	4
Discovery Program Electives (2) ⁶		8
Credits		16

Second Year

Fall		
CHBE 501	Material Balances	3
CHEM 683	Physical Chemistry I	3
CHEM 685	Physical Chemistry Laboratory	2
MATH 527	Differential Equations with Linear Algebra	4

PHYS 408	General Physics II	4
Credits		16
Spring		
CHBE 502	Energy Balances ⁴	3
CHEM 684	Physical Chemistry II	3
CHEM 686	Physical Chemistry Laboratory	2
MATH 740 or MATH 644	Design of Experiments I ⁶ or Statistics for Engineers and Scientists	4
Discovery Program Elective ⁶		4
Credits		16
Third Year		
Fall		
CHBE 601	Fluid Mechanics and Unit Operations	3
CHBE 603	Applied Mathematics for Chemical Engineers	4
CHEM 651	Organic Chemistry I	3
CHEM 653	Organic Chemistry Laboratory	2
CHBE 766	Biomaterials	4
Credits		16
Spring		
CHBE 602	Heat Transfer and Unit Operations	3
CHBE 604	Chemical Engineering Thermodynamics	3
CHBE 612	Chemical Engineering Laboratory I	3
CHEM 652A	Organic Chemistry II	3
CHBE 761	Biochemical Engineering	4
Credits		16
Fourth Year		
Fall		
CHBE 703	Mass Transfer and Stagewise Operations	3
CHBE 707	Chemical Engineering Kinetics	3
CHBE 713	Chemical Engineering Laboratory II	3
CHBE 752	Process Dynamics and Control	4
Discovery Elective ⁶		4
Credits		17
Spring		
CHBE 614	Separation Processes	3
CHBE 708	Chemical Engineering Design ⁵	4
CHBE 651	Biotech Experience/Biomanufacturing	4
Bioengineering Option Elective		3-4
Discovery Elective ⁶		4
Credits		18-19
Total Credits		132-133

⁶ Chemical Engineering students do not have to take a course in the Discovery ETS category since they satisfy this requirement through a combination of courses in the curriculum.

Student Learning Outcomes

Program 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.

¹ ENGL 401 First-Year Writing satisfies the Discovery Foundation Writing Skills category.

² MATH 425 Calculus I satisfies the Discovery Foundation Quantitative Reasoning category.

³ PHYS 407 General Physics I or CHEM 405 Chemical Principles for Engineers satisfies the Discovery Physical Science (with lab) category.

⁴ CHBE 502 Energy Balances satisfies the Discovery Inquiry requirement.

⁵ CHBE#708 Chemical Engineering Design satisfies the Discovery Capstone Experience/Course.