

MAJOR IN CHEMICAL AND BIOLOGICAL ENGINEERING

Chemical and biological engineering is a powerful blend of basic sciences and the skills to quantitatively describe, predict, and control all changes of matter. This provides the foundation to create cutting-edge materials and products, to design new devices to improve health or the environment, and to design processes for the safe production of chemicals and biochemicals, the production of alternative energy sources, and prevention of hazardous waste.

The Chemical and Biological Engineering curriculum is based on the sciences of physics, chemistry, biology, and mathematics. It includes engineering science and design methods, as well as humanities and social sciences. Students can pursue interdisciplinary studies programs or minors. Popular options include minors in chemistry, mathematics, environmental engineering, and biomedical engineering. The curriculum is well-aligned to meet pre-health profession requirements. The Chemical and Biological Engineering program provides an environment that promotes a sense of professionalism, the development of project management skills, and an appreciation for the value of life-long learning. Graduates of our program are well prepared to enter a variety of professions, or to pursue further education. The broad, strong scientific basis of chemical and biological engineering has kept our graduates consistently near or at the top in salary and demand among B.S. graduates.

The Chemical and Biological Engineering major is accredited by the Engineering Accreditation Commission of ABET (<https://www.abet.org/>).

Concentrations

While our undergraduate program gives students the option to keep their studies broad, they may also specialize in one of the following concentrations:

- Advanced Materials Concentration (<https://catalog.colostate.edu/general-catalog/colleges/engineering/biomedical-chemical-engineering/chemical-biological-engineering-major-advanced-materials-concentration/>)
- Biomanufacturing Concentration (<https://catalog.colostate.edu/general-catalog/colleges/engineering/biomedical-chemical-engineering/chemical-biological-engineering-major-biomanufacturing-concentration/>)
- Molecular Medicine Concentration (<https://catalog.colostate.edu/general-catalog/colleges/engineering/biomedical-chemical-engineering/chemical-biological-engineering-major-molecular-medicine-concentration/>)

- Sustainable Engineering Concentration (<https://catalog.colostate.edu/general-catalog/colleges/engineering/biomedical-chemical-engineering/chemical-biological-engineering-major-sustainable-engineering-concentration/>)

Learning Objectives

The Chemical and Biological Engineering program at CSU will empower graduates with the educational foundation to:

1. Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. 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. Communicate effectively with a range of audiences.
4. 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. Function effectively on a team whose members together provide leadership, create a collaborative environment, establish goals, plan tasks, and meet objectives.
6. Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. Acquire and apply new knowledge as needed, using appropriate learning strategies.

Potential Occupations

Chemical and Biological Engineering graduates find employment in the biotechnology, biomedical, microelectronics, environmental, consulting, alternative energy, petroleum, chemical, food, pharmaceutical and other private sector industries and with government agencies. Participation in undergraduate research, internships, volunteer activities, or cooperative education opportunities is highly recommended to enhance practical training and development. Graduates who go on for advanced studies can attain more responsible positions with the possibility of rising to top professional levels. In addition to pursuing M.S. and Ph.D. degrees in chemical and biological engineering and related fields, some of our graduates have obtained M.D., D.V.M., law, and M.B.A. degrees.

Requirements Effective Fall 2026

Students may enroll in either the standalone major or (at most) one of the concentrations under the Major in Chemical and Biological Engineering.

Freshman

		AUCC	Credits
CHEM 120 ¹	Foundations of Modern Chemistry (GT-SC2)	3A	4
CHEM 121 ¹	Foundations of Modern Chemistry Laboratory (GT-SC1)	3A	1
CO 150	College Composition (GT-CO2)	1A	3
ENGR 111	Fundamentals of Engineering		3
ENGR 114	Engineering for Grand Challenges		3
LIFE 102	Attributes of Living Systems (GT-SC1)	3A	4
MATH 160	Calculus for Physical Scientists I (GT-MA1)	1B	4

MATH 161	Calculus for Physical Scientists II (GT-MA1)	1B	4
1C (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#aucc)		1C	3
Total Credits			29
Sophomore			
CBE 201	Material and Energy Balances		3
CBE 205/BIOM 205	Biological and Cellular Engineering		3
CBE 210	Thermodynamic Process Analysis		3
CBE 223	CBE Design and Experimentation I		2
CBE 393	Professional Development Seminar		1
CHEM 241	Foundations of Organic Chemistry		4
CHEM 242	Foundations of Organic Chemistry Laboratory		1
MATH 261	Calculus for Physical Scientists III		4
MATH 340	Intro to Ordinary Differential Equations		4
PH 141	Physics for Scientists and Engineers I (GT-SC1)	3A	5
Arts and Humanities (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities)		3B	3
Total Credits			33
Junior			
CBE 320	Chemical and Biological Reactor Design		3
CBE 330	Process Simulation		3
CBE 331	Momentum Transfer and Mechanical Separations		3
CBE 332	Heat and Mass Transfer Fundamentals		3
CBE 334	CBE Design and Experimentation II		1
CBE 335	CBE Design and Experimentation III		1
CBE 340	Statistics for CBE Applications		3
Select one course from the following:			4
BC 351	Principles of Biochemistry		
CHEM 321	Foundations of Chemical Biology		
Bioscience Elective (see list below)			3
Chemistry Electives (see list below)			6
Historical Perspectives (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#historical-perspectives)		3D	3
Total Credits			33
Senior			
CBE 430	Process Control and Instrumentation		3
CBE 442	Separation Processes		4
CBE 443	Chemical and Biological Engineering Lab II		2
CBE 451	Chemical and Biological Engineering Design I	4A,4B,4C	3
CBE 452	Chemical and Biological Engineering Design II	4A,4B,4C	3
Advanced Writing (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#advanced-writing)		2	3
Arts and Humanities (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities)		3B	3
Social and Behavioral Sciences (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#social-behavioral-sciences)		3C	3
Electives ²			9
Total Credits			33
Program Total Credits:			128

¹ Students who complete General Chemistry (CHEM 111, CHEM 112, and CHEM 113, CHEM 114) do not have to take CHEM 120 and CHEM 121.

² Select enough elective credits to bring the program total to a minimum of 128 credits, of which at least 42 credits must be upper-division (300-level or higher).

Electives

The CBE program requires 18 credit hours of electives. These include 3 credits of Bioscience, 6 credits of Chemistry, and 9 credits of free electives. New courses are added all the time, if you find a course you believe is valuable to your education ask your advisor if it is an appropriate elective course.

Bioscience Electives

Select a minimum of 3 credits from the following.

Code	Title	AUCC	Credits
BC 401	Comprehensive Biochemistry I		3
BC 403	Comprehensive Biochemistry II		3
BC 404	Comprehensive Biochemistry Laboratory		2
BC 406A	Investigative Biochemistry: Protein Biochemistry		2
BC 406B	Investigative Biochemistry: Molecular Genetics		2
BC 406C	Investigative Biochemistry: Cellular Biochemistry		2
BC 411	Physical Biochemistry		4
BC 441	3D Molecular Models for Biochemistry		1
BC 463	Molecular Genetics		3
BC 464	Molecular Genetics Recitation		1
BC 465	Molecular Regulation of Cell Function		3
BC 517	Metabolism		2
BC 521/CHEM 521	Principles of Chemical Biology		3
BMS 300	Principles of Human Physiology		4
BMS 301	Human Gross Anatomy		5
BMS 302	Laboratory in Principles of Physiology		2
BMS 305	Domestic Animal Gross Anatomy		4
BMS 325	Cellular Neurobiology		3
BMS 330	Microscopic Anatomy		4
BMS 345	Functional Neuroanatomy		4
BMS 360	Fundamentals of Physiology		4
BMS 409	Human and Animal Reproductive Biology		3
BMS 420	Cardiopulmonary Physiology		3
BMS 430	Endocrinology		3
BMS 450	Pharmacology		3
BMS 460	Essentials of Pathophysiology		3
BMS 500	Mammalian Physiology I		4
BMS 501	Mammalian Physiology II		4
BMS 503/NB 503	Developmental Neurobiology		3
BMS 505/NB 505	Neuronal Circuits, Systems and Behavior		3
BMS 545	Neuroanatomy		5
BMS 575	Human Anatomy Dissection		4
BSPM 302	Applied and General Entomology		2
BSPM 361	Elements of Plant Pathology		3

BZ 240	Synthetic Biology-Principles and Applications	3
BZ 310	Cell Biology	4
BZ 311	Developmental Biology	4
BZ 348/MATH 348	Theory of Population and Evolutionary Ecology	4
BZ 350	Molecular and General Genetics	4
BZ 360	Bioinformatics and Genomics	4
LIFE 201B	Introductory Genetics: Molecular/ Immunological/Developmental (GT-SC2)	3A 3
LIFE 202B	Introductory Genetics Recitation: Molecular	1
LIFE 203	Introductory Genetics Laboratory	2
LIFE 210	Introductory Eukaryotic Cell Biology	3
LIFE 211	Introductory Cell Biology Honors Recitation	1
LIFE 212	Introductory Cell Biology Laboratory	2
LIFE 320	Ecology	3
MIP 300	General Microbiology	3
MIP 302	General Microbiology Laboratory	2
MIP 315	Pathology of Human and Animal Disease	3
MIP 334	Food Microbiology	3
MIP 335	Food Microbiology Laboratory	2
MIP 342	Immunology	4
MIP 343	Immunology Laboratory	2
MIP 351	Medical Bacteriology	3
MIP 352	Medical Bacteriology Laboratory	3
MIP 410	Foundations of Modern Biotechnology	2
MIP 420	Medical and Molecular Virology	4
MIP 432/ESS 432	Microbial Ecology	3
MIP 433/ESS 433	Microbial Ecology Laboratory	1
MIP 443	Microbial Physiology	3
MIP 450	Microbial Genetics	3
MIP 555	Principles and Mechanisms of Disease	3

Chemistry Electives

Select a minimum of 6 credits from the following; 3 credits must be at the 300 level or higher.

Code	Title	Credits
CBE 310	Molecular Concepts and Applications	3
CHEM 231	Foundations of Analytical Chemistry	3
CHEM 232	Foundations of Analytical Chemistry Lab	2
CHEM 263	Foundations of Inorganic Chemistry	4
CHEM 264	Foundations of Inorganic Chemistry Laboratory	1

Upper division courses from subject code BC (400-479) and (500-579)

Upper division courses from subject code CHEM (310-340 and 350-379), (400-479), and (500-579)

Major Completion Map

Students may enroll in either the standalone major or (at most) one of the concentrations under the Major in Chemical and Biological Engineering.

Distinctive Requirements for Degree Program:

TO PREPARE FOR FIRST SEMESTER: The curriculum for this major assumes students enter college prepared to take calculus.

Freshman

Semester 1		Critical	Recommended	AUCC	Credits
CHEM 120	Foundations of Modern Chemistry (GT-SC2)	X		3A	4
CHEM 121	Foundations of Modern Chemistry Laboratory (GT-SC1)	X		3A	1
CO 150	College Composition (GT-CO2)		X	1A	3
ENGR 111	Fundamentals of Engineering	X			3
MATH 160	Calculus for Physical Scientists I (GT-MA1)	X		1B	4
Total Credits					15

Semester 2		Critical	Recommended	AUCC	Credits
ENGR 114	Engineering for Grand Challenges	X			3
LIFE 102	Attributes of Living Systems (GT-SC1)	X		3A	4
MATH 161	Calculus for Physical Scientists II (GT-MA1)	X		1B	4
1C	(https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#aucc)		X	1C	3
Total Credits					14

Sophomore

Semester 3		Critical	Recommended	AUCC	Credits
CBE 201	Material and Energy Balances	X			3
CBE 205/ BIOM 205	Biological and Cellular Engineering	X			3
MATH 261	Calculus for Physical Scientists III	X			4
PH 141	Physics for Scientists and Engineers I (GT-SC1)	X		3A	5
Arts and Humanities	(https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities)		X	3B	3
Total Credits					18

Semester 4		Critical	Recommended	AUCC	Credits
CBE 210	Thermodynamic Process Analysis	X			3
CBE 223	CBE Design and Experimentation I	X			2
CBE 393	Professional Development Seminar		X		1
CHEM 241	Foundations of Organic Chemistry	X			4
CHEM 242	Foundations of Organic Chemistry Laboratory	X			1
MATH 340	Intro to Ordinary Differential Equations	X			4
Total Credits					15

Junior

Semester 5		Critical	Recommended	AUCC	Credits
CBE 320	Chemical and Biological Reactor Design	X			3
CBE 330	Process Simulation	X			3
CBE 331	Momentum Transfer and Mechanical Separations	X			3
CBE 334	CBE Design and Experimentation II	X			1
Bioscience Elective			X		3
Chemistry Elective			X		3
Total Credits					16

Semester 6		Critical	Recommended	AUCC	Credits
CBE 332	Heat and Mass Transfer Fundamentals	X			3
CBE 335	CBE Design and Experimentation III	X			1
CBE 340	Statistics for CBE Applications	X			3
Select one course from the following:					4
BC 351	Principles of Biochemistry		X		
CHEM 321	Foundations of Chemical Biology		X		
Chemistry Elective			X		3

Historical Perspectives (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#historical-perspectives)	X	3D	3
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Total Credits			17
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Senior

Semester 7		Critical	Recommended	AUCC	Credits
CBE 442	Separation Processes	X			4
CBE 443	Chemical and Biological Engineering Lab II	X			2
CBE 451	Chemical and Biological Engineering Design I	X		4A,4B,4C	3
Advanced Writing (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#advanced-writing)			X	2	3
Arts and Humanities (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities)			X	3B	3
Elective			X		3

Total Credits			18
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Semester 8		Critical	Recommended	AUCC	Credits
CBE 430	Process Control and Instrumentation	X			3
CBE 452	Chemical and Biological Engineering Design II	X		4A,4B,4C	3
Social and Behavioral Sciences (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#social-behavioral-sciences)		X		3C	3
Electives		X			6
The benchmark courses for the 8th semester are the remaining courses in the entire program of study.		X			

Total Credits			15
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Program Total Credits:			128
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