

Chemical Engineering (BS): Biomolecular Concentration

To see more about what you will learn in this program, visit the Learning Outcomes website (<https://apps.oirp.ncsu.edu/pgas/>)!

The Biomolecular Concentration emphasizes hands-on laboratory molecular biology skills that are highly relevant to pharmaceutical, medical, engineering, and agricultural fields. Students completing this concentration also fulfill the requirements for a Minor in Biotechnology.

Plan Requirements

First Year

Fall Semester		Hours
CH 101 or CH 103	Chemistry - A Molecular Science ¹ or General Chemistry I for Students in Chemical Sciences	3
CH 102 or CH 104	General Chemistry Laboratory ¹ or General Chemistry Laboratory I for Students in Chemical Sciences	1
E 101	Introduction to Engineering & Problem Solving ²	1
E 115	Introduction to Computing Environments	1
MA 141	Calculus I ¹	4
ENG 101	Academic Writing and Research ²	4
Hours		14

Spring Semester

CH 201 or CH 203	Chemistry - A Quantitative Science ² or General Chemistry II for Students in Chemical Sciences	3
CH 202 or CH 204	Quantitative Chemistry Laboratory ² or General Chemistry Laboratory II for Students in Chemical Sciences	1
MA 241	Calculus II ¹	4
PY 205 & PY 206	Physics for Engineers and Scientists I and Physics for Engineers and Scientists I Laboratory ¹	4
Select one of the following Economics Courses:		3
ARE 201	Introduction to Agricultural & Resource Economics	
ARE 201A	Introduction to Agricultural & Resource Economics	
EC 201	Principles of Microeconomics	
EC 205	Fundamentals of Economics	
E 102	Engineering in the 21st Century	2
Hours		17

Second Year

Fall Semester		Hours
CH 221 or CH 225	Organic Chemistry I ² or Organic Chemistry I for Students in Chemical Sciences	3

CH 222 or CH 226	Organic Chemistry I Lab ² or Organic Chemistry Laboratory I for Students in Chemical Sciences	1
CHE 205	Chemical Process Principles ²	4
MA 242	Calculus III ²	4
PY 208 & PY 209	Physics for Engineers and Scientists II and Physics for Engineers and Scientists II Laboratory	4
Hours		16

Spring Semester

CH 223 or CH 227	Organic Chemistry II or Organic Chemistry II for Students in Chemical Sciences	3
CH 224 or CH 228	Organic Chemistry II Lab or Organic Chemistry Laboratory II for Students in Chemical Sciences	1
CHE 225	Introduction to Chemical Engineering Analysis ²	3
MA 341	Applied Differential Equations I ²	3
BIO 183	Introductory Biology: Cellular and Molecular Biology	4
Hours		14

Third Year

Fall Semester		Hours
BCH 451	Principles of Biochemistry	4
CHE 311	Transport Processes I ²	3
CHE 315	Chemical Process Thermodynamics ²	3
BIT 410	Manipulation of Recombinant DNA	4
CHE 395	Professional Development Seminar	1
Hours		15

Spring Semester

BIT Laboratory Modules (p. 2)		4
CHE 312	Transport Processes II	3
CHE 316	Thermodynamics of Chemical and Phase Equilibria	3
CHE 330	Chemical Engineering Lab I	4
Hours		14

Fourth Year

Fall Semester		Hours
CHE 446	Design and Analysis of Chemical Reactors	3
CHE 450	Chemical Engineering Design I	3
Biotech Minor Group E Elective (p. 2)		3
CHE 497	Chemical Engineering Projects I	3
Hours		12

Spring Semester

CHE 435	Process Systems Analysis and Control	3
CHE 448	Bioreactor Design	2
CHE 451	Chemical Engineering Design II	3
CHE 452	Biomolecular Engineering	2
Technical Elective (p. 2)		2
Hours		12
Total Hours		114

¹ A grade of C or higher is required.

² A grade of C- or higher is required.

Code	Title	Hours	Counts towards
GEP Courses			
	GEP Humanities (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-humanities/)	6	
	GEP Social Sciences (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-social-sciences/)	3	
	GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)	2	
	GEP US Diversity, Equity, and Inclusion (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-usdei/)	3	
	GEP Global Knowledge (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-global-knowledge/) (verify requirement)		
	Foreign Language Proficiency (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/foreign-language-proficiency/) (verify requirement)		
Total Hours		14	

BIT Lab Modules

Code	Title	Hours	Counts towards
BEC 463/563/ CHE 463/563	Fermentation of Recombinant Microorganisms	2	
BIT 462/562		2	
BIT 464/564	Protein Purification	2	
BIT 465/565	Real-time PCR Techniques	2	
BIT 466/566/ PO 466/566	Animal Cell Culture Techniques	2	
BIT 467/567	PCR and DNA Fingerprinting	2	
BIT 468/568		2	
BIT 471/571	RNA Interference and Model Organisms	2	
BIT 473/573	Protein Interactions	2	
BIT 474/574	Plant Genetic Engineering	2	

BIT 476	Applied Bioinformatics	2	
BIT 477/577	Metagenomics	2	
BIT 478/578		2	
BIT 479/579	High-Throughput Discovery	2	
BIT 480/580	Yeast Metabolic Engineering	2	
BIT/PB 481	Plant Tissue Culture and Transformation	2	
BIT 492	External Learning Experience	1-6	
BIT 493	Special Problems in Biotechnology	1-6	
BIT 495	Special Topics in Biotechnology	1-3	
BIT/BIO/CH 572	Proteomics	3	

Biotech Minor Group E Electives

Code	Title	Hours	Counts towards
IDS 201	Environmental Ethics	3	
IDS 303	Humans and the Environment	3	
NR 303	Humans and the Environment	3	
PHI 325	Bio-Medical Ethics	3	
STS 302	Contemporary Science, Technology and Human Values	3	
STS 304	Ethical Dimensions of Progress	3	
STS 325	Bio-Medical Ethics	3	

Technical Electives

Code	Title	Hours	Counts towards
BBS 426/526/ BEC 426/526	Upstream Biomanufacturing Laboratory	2	
BEC 330	Principles and Applications of Bioseparations	2	
BEC 462/562	Fundamentals of Bio-Nanotechnology	3	
BEC 463/563	Fermentation of Recombinant Microorganisms	2	
BEC 480/580	cGMP Fermentation Operations	2	

BEC 485/585	cGMP Downstream Operations	2
BEC/CHE 488	Animal Cell Culture Engineering	2
BIT 463/563	Fermentation of Recombinant Microorganisms	2
BIT 464/564	Protein Purification	2
BME 466/566	Polymeric Biomaterials Engineering	3
CE 373	Fundamentals of Environmental Engineering	3
CHE 462/562	Fundamentals of Bio-Nanotechnology	3
CHE 463/563	Fermentation of Recombinant Microorganisms	2
ECE 331	Principles of Electrical Engineering	3
FS 426/526	Upstream Biomanufacturing Laboratory	2
MSE 201	Structure and Properties of Engineering Materials	3
NE 419	Introduction to Nuclear Energy	3
PSE 425	Bioenergy & Biomaterials Engineering	3
TE 466/566	Polymeric Biomaterials Engineering	3

Semester Sequence

This is a sample.

First Year

Fall Semester	Hours
CH 101 & CH 102	Chemistry - A Molecular Science and General Chemistry Laboratory ¹ 4
E 101	Introduction to Engineering & Problem Solving ¹ 1
E 115	Introduction to Computing Environments 1
ENG 101	Academic Writing and Research ¹ 4
MA 141	Calculus I ¹ 4

GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)	1
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Hours 15

Spring Semester

CH 201 & CH 202	Chemistry - A Quantitative Science and Quantitative Chemistry Laboratory ² 4
MA 241	Calculus II ¹ 4
PY 205 & PY 206	Physics for Engineers and Scientists I and Physics for Engineers and Scientists I Laboratory ¹ 4

GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)	1
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E 102	Engineering in the 21st Century 2
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Hours 15

Second Year

Fall Semester

CH 221 & CH 222	Organic Chemistry I and Organic Chemistry I Lab 4
CHE 205	Chemical Process Principles ² 4
MA 242	Calculus III ² 4
PY 208 & PY 209	Physics for Engineers and Scientists II and Physics for Engineers and Scientists II Laboratory 4

Hours 16

Spring Semester

CH 223 & CH 224	Organic Chemistry II and Organic Chemistry II Lab 4
CHE 225	Introduction to Chemical Engineering Analysis ² 3
MA 341	Applied Differential Equations I ² 3
BIO 183	Introductory Biology: Cellular and Molecular Biology 4

GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)	3
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Hours 17

Third Year

Fall Semester

BCH 451	Principles of Biochemistry 4
CHE 311	Transport Processes I ² 3
CHE 315	Chemical Process Thermodynamics ² 3
CHE 395	Professional Development Seminar 1
CHE 497	Chemical Engineering Projects I 3
BIT 410	Manipulation of Recombinant DNA 4

Hours 18

Spring Semester

BIT Lab Modules (p. 2)	4
CHE 312	Transport Processes II 3
CHE 316	Thermodynamics of Chemical and Phase Equilibria 3
CHE 330	Chemical Engineering Lab I 4

GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)	3
Hours	17
Fourth Year	
Fall Semester	
CHE 446 Design and Analysis of Chemical Reactors	3
CHE 450 Chemical Engineering Design I	3
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)	3
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)	3
Biotech Minor Group E Elective (p. 2)	3
Hours	15
Spring Semester	
CHE 435 Process Systems Analysis and Control	3
CHE 451 Chemical Engineering Design II	3
CHE 452 Biomolecular Engineering	2
CHE 448 Bioreactor Design	2
Technical Elective (p. 2)	2
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)	3
Hours	15
Total Hours	128

¹ A grade of C- or higher is required.

² A grade of C or higher is required.

Career Opportunities

Careers in chemical engineering are sometimes exciting, always demanding, and ultimately provide a sense of accomplishment and achievement. Graduates find employment in sub-disciplines such as production, technical service, sales, management and administration; research and development; and consulting and teaching. Students desiring careers in teaching, research, or consulting are encouraged to continue their education and pursue a graduate degree (consult the Graduate Catalog). The undergraduate curriculum also provides strong preparation for graduate study in a wide range of professional specialties, and chemical engineering graduates often pursue careers in the medical sciences, business management, and law.