Chemical Engineering (BS): Sustainable Engineering, Energy, and the Environment

The Sustainable Engineering, Energy, and Environment Concentration connects chemical engineering concepts with global grand challenges in the generation of clean and affordable energy, as well as sustainable and environmentally responsible engineering practices.

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		
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
	Hours	**12**
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
PY 208 & PY 209	Physics for Engineers and Scientists II and Physics for Engineers and Scientists II Laboratory	4
	Hours	**14**
Third Year		
Fall Semester		
PSE 335	Principles of Green Chemistry	4
CHE 311	Transport Processes I [2]	3
CHE 315	Chemical Process Thermodynamics [2]	3
CHE 497	Chemical Engineering Projects I	3
	Hours	**13**
Spring Semester		
Select one of the following Chemistry Electives:		4
PCC 464 & PCC 461	Chemistry of Polymeric Materials Laboratory and Chemistry of Polymeric Materials	
BCH 451	Principles of Biochemistry	
CH 437	Physical Chemistry for Engineers	
CH 610	Special Topics In Chemistry	
BIO 183	Introductory Biology: Cellular and Molecular Biology	
FS 402	Chemistry of Food and Bioprocessed Materials	
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		
CHE 331	Chemical Engineering Lab II	2
CHE 446	Design and Analysis of Chemical Reactors	3
CHE 450	Chemical Engineering Design I	3
Concentration Elective (p. 2)		3
CHE 395	Professional Development Seminar	1
	Hours	**12**
Spring Semester		
CHE 435	Process Systems Analysis and Control	3

CHE 451	Chemical Engineering Design II	3
Concentration Elective (p. 2)		3
	Hours	**9**
	Total Hours	**105**

[1] A grade of C or higher is required.
[2] A grade of C- or higher is required.

Code	Title	Hours
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 Elective (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
Restricted Elective - Interdisciplinary Perspectives (p. 2)		3
GEP Global Knowledge (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-global-knowledge/) (verify requirement)		
GEP Foundations of American Democracy (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-fad/) (verify requirement)		
World Language Proficiency (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/world-language-proficiency/) (verify requirement)		
Free Electives		
Free Electives (12 Hr S/U Lmt) [1]		3
Total Hours		**20**

[1] Students should consult their academic advisors to determine which courses fill this requirement.

Concentration Electives

Code	Title	Hours
BAE 528	Biomass to Renewable Energy Processes	3
CE 373	Fundamentals of Environmental Engineering	3
CE 476	Air Pollution Control	3
CE 477	Principles of Solid Waste Engineering	3
CE 478	Energy and Climate	3
CE 484	Water Supply and Waste Water Systems	3
CE 578	Energy and Climate	3
FB 576	Environmental Life Cycle Analysis	3
PSE 425	Bioenergy & Biomaterials Engineering	3
PSE 476	Environmental Life Cycle Analysis	3

Interdiscplinary Perspectives Electives

Code	Title	Hours
ES 100	Introduction to Environmental Sciences	3
ES 200	Climate Change and Sustainability	3
ES 300	Energy and Environment	3
IDS 201	Environmental Ethics	3
SMT 232	Recycling to Create a Sustainable Environment	2
PCC 201	Impact of Industry on the Environment and Society	3

Semester Sequence

This is a sample.

First Year		
Fall Semester		**Hours**
CH 101 & CH 102	Chemistry - A Molecular Science and General Chemistry Laboratory [1,2]	4
E 101	Introduction to Engineering & Problem Solving [3]	1
E 115	Introduction to Computing Environments	1
ENG 101	Academic Writing and Research [3]	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
	Hours	**15**
Spring Semester		
CH 201 & CH 202	Chemistry - A Quantitative Science and Quantitative Chemistry Laboratory [2,3]	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
Select one of the following Economics Courses:		3
EC 205	Fundamentals of Economics	
EC 201	Principles of Microeconomics	
ARE 201	Introduction to Agricultural & Resource Economics	
GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)		1
E 102	Engineering in the 21st Century	2
	Hours	**18**
Second Year		
Fall Semester		
CH 221 & CH 222	Organic Chemistry I and Organic Chemistry I Lab [4]	4
CHE 205	Chemical Process Principles [3]	4
MA 242	Calculus III [3]	4
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
	Hours	**15**
Spring Semester		
CH 223 & CH 224	Organic Chemistry II and Organic Chemistry II Lab [3,4]	4
CHE 225	Introduction to Chemical Engineering Analysis [3]	3
MA 341	Applied Differential Equations I [3]	3
PY 208 & PY 209	Physics for Engineers and Scientists II and Physics for Engineers and Scientists II Laboratory	4

GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
	Hours	**17**
Third Year		
Fall Semester		
PSE 335	Principles of Green Chemistry	4
CHE 311	Transport Processes I [3]	3
CHE 315	Chemical Process Thermodynamics [3]	3
CHE 497	Chemical Engineering Projects I	3
Free Elective		3
	Hours	**16**
Spring Semester		
Select one of the following Chemistry Electives:		4
PCC 461 & PCC 464	Chemistry of Polymeric Materials and Chemistry of Polymeric Materials Laboratory	
BCH 451	Principles of Biochemistry	
CH 437	Physical Chemistry for Engineers	
BIO 183	Introductory Biology: Cellular and Molecular Biology	
FS 402	Chemistry of Food and Bioprocessed Materials	
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 331	Chemical Engineering Lab II	2
CHE 446	Design and Analysis of Chemical Reactors	3
CHE 450	Chemical Engineering Design I	3
Concentration Elective (p. 2)		3
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
CHE 395	Professional Development Seminar	1
	Hours	**15**
Spring Semester		
CHE 435	Process Systems Analysis and Control	3
CHE 451	Chemical Engineering Design II	3
Concentration Elective (p. 2)		3
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
	Hours	**12**
	Total Hours	**125**

1 Grade of C (2.0) or higher required.

2 CH 103 General Chemistry I for Students in Chemical Sciences/CH 104 General Chemistry Laboratory I for Students in Chemical Sciences may substitute for CH 101 Chemistry - A Molecular Science/CH 102 General Chemistry Laboratory, and CH 203 General Chemistry II for Students in Chemical Sciences/CH 204 General Chemistry Laboratory II for Students in Chemical Sciences may substitute for CH 201 Chemistry - A Quantitative Science/CH 202 Quantitative Chemistry Laboratory.

3 Minimum grade of (C-) required.

4 CH 225 Organic Chemistry I for Students in Chemical Sciences/CH 226 Organic Chemistry Laboratory I for Students in Chemical Sciences may substitute for CH 221 Organic Chemistry I/CH 222 Organic Chemistry I Lab and CH 227 Organic Chemistry II for Students in Chemical Sciences/CH 228 Organic Chemistry Laboratory II for Students in Chemical Sciences may substitute for CH 223 Organic Chemistry II/CH 224 Organic Chemistry II Lab.

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.

Career Titles

- Agricultural Engineer
- Automotive Engineer
- Biochemist
- Biomedical Engineer
- Chemical Engineer
- Chemist
- Dairy Technologist
- Electronics Engineer
- Engineering Professor
- Environmental Engineer
- Fire Prevention Engineer
- Industrial Air Pollution Analyst
- Industrial Waste Inspector
- Laboratory Tester
- Materials Engineer
- Materials Scientist
- Nanosystems Engineers
- Non-Destructive Testing Specialists
- Nuclear Engineer
- Nuclear Fuels Research Engineer
- Occupational Safety & Health Inspector
- Perfumer
- Petroleum Engineer
- Physicist
- Physics Professor
- Product Safety Engineer
- Quality Control Managers
- Radiation Protection Engineer
- Safety Inspector
- Sales Engineers

- Sales Representative (Chemicals & Drugs)
- Soil Engineer
- Solar Energy Systems Engineers
- Sustainability Specialists
- Toxicologist
- Water/Wastewater Engineers

Learn More About Careers

NCcareers.org (https://nccareers.org/)
Explore North Carolina's central online resource for students, parents, educators, job seekers and career counselors looking for high quality job and career information.

Occupational Outlook Handbook (https://www.bls.gov/ooh/)
Browse the Occupational Outlook Handbook published by the Bureau of Labor Statistics to view state and area employment and wage statistics. You can also identify and compare similar occupations based on your interests.

Career One Stop Videos (https://www.careeronestop.org/)
View videos that provide career details and information on wages, employment trends, skills needed, and more for any occupation. Sponsored by the U.S. Department of Labor.

Focus 2 Career Assessment (https://careers.dasa.ncsu.edu/explore-careers/career-assessments/) (NC State student email address required)
This career, major and education planning system is available to current NC State students to learn about how your values, interests, competencies, and personality fit into the NC State majors and your future career. An NC State email address is required to create an account. Make an appointment with your career counselor (https://careers.dasa.ncsu.edu/about/hours-appointments/) to discuss the results.

Focus 2 Apply Assessment (https://www.focus2career.com/Portal/Register.cfm?SID=1929) (Available to prospective students)
A career assessment tool designed to support prospective students in exploring and choosing the right major and career path based on your unique personality, interests, skills and values. Get started with Focus 2 Apply and see how it can guide your journey at NC State.

American Institute of Chemical Engineers (https://www.aiche.org/)
American Chemical Society (https://www.acs.org/)
American Oil Chemists' Society (http://www.aocs.org/)
National Society of Professional Engineers (https://www.nspe.org/)