

Chemical Engineering (BS): Nanoscience Concentration

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

The Nanoscience Concentration develops students' understanding of the scientific and technological principles associated with the design and manufacture of patterns and devices with features and advanced functionality on the nanometer scale.

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
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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
MSE 201	Structure and Properties of Engineering Materials	3
Hours		13

Third Year

Fall 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 315 & CH 316	Quantitative Analysis and Quantitative Analysis Laboratory	
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 311	Transport Processes I ²	3
CHE 315	Chemical Process Thermodynamics ²	3
CHE 395	Professional Development Seminar	1
Hours		11

Spring Semester

CH 437	Physical Chemistry for Engineers	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

CHE 331	Chemical Engineering Lab II	2
CHE 446	Design and Analysis of Chemical Reactors	3
CHE 450	Chemical Engineering Design I	3

Nanosciences Elective (p. 2)	3
Hours	11
Spring Semester	
CHE 435 Process Systems Analysis and Control	3
CHE 451 Chemical Engineering Design II	3
Nanosciences 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	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 Interdisciplinary Perspectives (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-interdisciplinary-perspectives/)	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)		
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.

Nanosciences Electives

Code	Title	Hours	Counts towards
BEC 462	Fundamentals of Bio-Nanotechnology	3	
BEC 562	Fundamentals of Bio-Nanotechnology	3	
CHE 460	Chemical Processing of Electronic Materials	3	
CHE 461	Polymer Sciences and Technology	3	
CHE 462	Fundamentals of Bio-Nanotechnology	3	
CHE 465	Colloidal and Nanoscale Engineering	3	
CHE 467	Polymer Rheology	3	
CHE 562	Fundamentals of Bio-Nanotechnology	3	
E 304	Introduction to Nano Science and Technology	3	
ECE 331	Principles of Electrical Engineering	3	
MSE 355	Electrical, Magnetic and Optical Properties of Materials	3	
MSE 455	Polymer Technology and Engineering	3	
MSE 460	Microelectronic Materials	3	
PY 407	Introduction to Modern Physics	3	

Semester Sequence

This is a sample.

First Year		Hours
Fall Semester		
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:	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	Organic Chemistry I ^{3,4} 3
CH 222	Organic Chemistry I Lab ⁴ 1
CHE 205	Chemical Process Principles ³ 4
MA 242	Calculus III ³ 4
PY 208	Physics for Engineers and Scientists II 3
PY 209	Physics for Engineers and Scientists II Laboratory 1
Hours	16
Spring Semester	
CH 223 & CH 224	Organic Chemistry II and Organic Chemistry II Lab ⁴ 4
CHE 225	Introduction to Chemical Engineering Analysis ³ 3
MA 341	Applied Differential Equations I ³ 3
MSE 201	Structure and Properties of Engineering Materials 3
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)	3
Hours	16
Third Year	
Fall Semester	
Select one of the following Chemistry Electives:	4
CH 315 & CH 316	Quantitative Analysis and Quantitative Analysis Laboratory
PCC 461 & PCC 464	Chemistry of Polymeric Materials and Chemistry of Polymeric Materials Laboratory
BCH 451	Principles of Biochemistry
BIO 183	Introductory Biology: Cellular and Molecular Biology
CH 610	Special Topics In Chemistry

FS 402	Chemistry of Food and Bioprocessed Materials	
CHE 311	Transport Processes I ³	3
CHE 315	Chemical Process Thermodynamics ³	3
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
CHE 395	Professional Development Seminar	1
Hours		17
Spring Semester		
CH 437	Physical Chemistry for Engineers	4
CHE 312	Transport Processes II	3
CHE 316	Thermodynamics of Chemical and Phase Equilibria	3
CHE 330	Chemical Engineering Lab I	4
Free Elective		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
Nanosciences Elective (p. 2)		3
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
Hours		14
Spring Semester		
CHE 435	Process Systems Analysis and Control	3
CHE 451	Chemical Engineering Design II	3
Nanosciences 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.