Chemical Engineering, BSChE

The chemical engineering program offers students a broad education built on fundamentals in science, mathematics, and engineering, which are then applied to contemporary problems using modern tools, such as computational software and computer-aided design. Chemical engineers have traditionally been employed in chemical, petrochemical, agricultural chemical, pulp and paper, plastics, cosmetics, and textiles industries and in consulting and design firms. Today, chemical engineers also play an integral role in bioprocesses and biomedicine, Big Data and artificial intelligence, sustainability and energy, and study of advanced materials, including nanotechnology. For example, chemical engineers are creating new materials needed for space exploration, alternative energy sources, and faster, self-powered computer chips. In biotechnology and biomedicine, chemical engineers are working to understand human diseases, developing new therapies and drug delivery systems, and producing new medicines through cell culture techniques. Chemical engineers employ nanotechnology to revolutionize sensors, security systems, and medical diagnostics and treatments. In addition to creating important products, chemical engineers are also involved in protecting our environment by exploring ways to reduce acid rain and smog; to recycle and reduce wastes; to develop new sources of environmentally clean energy; and to design inherently safe, efficient, and "green" processes. The role of a chemical engineer is to develop new products and to design processes while reducing costs, increasing production, and improving the quality and safety of new products.

The degree also serves as a springboard to advanced study in chemical engineering or postgraduate pathways including law school, business school, or medical/health professions school.

Visit the department website (https://che.northeastern.edu/academics/undergraduate-studies/che-accreditation/) for program educational objectives.

Program Requirements

- Concentrations and course offerings may vary by campus and/or by program modality. Please consult with your advisor or admissions coach for the course availability each term at your campus or within your program modality.
- Certain options within the program may be *required* at certain campuses or for certain program modalities. Please consult with your advisor or admissions coach for requirements at your campus or for your program modality.

Complete all courses listed below unless otherwise indicated. Also complete any corequisite labs, recitations, clinicals, or tools courses where specified and complete any additional courses needed beyond specific college and major requirements to satisfy graduation credit requirements.

Universitywide Requirements

All undergraduate students are required to complete the Universitywide Requirements (https://catalog.northeastern.edu/undergraduate/university-academics/university-wide-requirements/).

NUpath Requirements

All undergraduate students are required to complete the NUpath Requirements (https://catalog.northeastern.edu/undergraduate/university-academics/nupath/).

NUpath requirements Interpreting Culture (IC), Understanding Societies and Institutions (SI), Engaging Differences and Diversity (DD), and Integrating Knowledge and Skills Through Experience (EX) are not explicitly satisfied by required engineering coursework. Successful completion of a cooperative education experience fulfills the EX requirement. Students are responsible for satisfying unfulfilled NUpath requirements with general elective coursework.

Engineering Requirements

Code	Title	Hours
CHME 2308	Conservation Principles in Chemical Engineering	4
CHME 2310	Transport Processes 1	4
CHME 2320	Chemical Engineering Thermodynamics	4
CHME 3305 and CHME 3306	Chemical Engineering Laboratory and Recitation for CHME 3305	4
CHME 3312	Transport Processes 2	4
CHME 3322	Chemical Thermodynamics	4
CHME 4510	Chemical Engineering Kinetics	4
CHME 4512	Chemical Engineering Process Control	4
CHME 4701	Separations and Process Analysis	4
Chemical Engineering Capstone		

CHME 4703 and CHME 4705	Chemical Process Design Capstone and Recitation for CHME 4703	4
Supplemental Credit		
2 semester hours from the following course count toward the engineering requirement:		2
GE 1501	Cornerstone of Engineering 1 [1]	
3 semester hours from the following course count toward the engineering requirement:		3
GE 1502	Cornerstone of Engineering 2 [1]	

Concentration or Electives Option

A concentration is not required. Students may complete the electives option in lieu of a concentration.

- Biomolecular and Biomedical Systems (p. 3)
- Complex and Computational Systems (p. 4)
- Energy and Sustainability (p. 4)
- Materials and Nanotechnology (p. 5)
- Electives (p. 5)

Supporting Courses: Mathematics/Science

Complete all mathematics/science courses with a minimum of 30 semester hours.

Code	Title	Hours
Required Mathematics/Science		
CHEM 1151 and CHEM 1153	General Chemistry for Engineers and Recitation for CHEM 1151	4
MATH 1341	Calculus 1 for Science and Engineering	4
MATH 1342	Calculus 2 for Science and Engineering	4
MATH 2321	Calculus 3 for Science and Engineering	4
MATH 2341	Differential Equations and Linear Algebra for Engineering	4
PHYS 1151 and PHYS 1152 and PHYS 1153	Physics for Engineering 1 and Lab for PHYS 1151 and Interactive Learning Seminar for PHYS 1151	5
Complete one of the following:		4-5
BIOL 1111	General Biology 1	
PHYS 1155 and PHYS 1156 and PHYS 1157	Physics for Engineering 2 and Lab for PHYS 1155 and Interactive Learning Seminar for PHYS 1155	
Supplemental Credit		
1 semester hour from the following course counts toward the mathematics/science requirement:		1
GE 1501	Cornerstone of Engineering 1 [1]	

Supporting Courses: Advanced Science

Code	Title	Hours
Complete one of the following pairs:		5-6
CHEM 2311 and CHEM 2312	Organic Chemistry 1 and Lab for CHEM 2311	
CHEM 2315 and CHEM 2316	Organic Chemistry 1 for Chemistry Majors and Lab for CHEM 2315	
Complete one of the following pairs:		5-6
CHEM 2313 and CHEM 2314	Organic Chemistry 2 and Lab for CHEM 2313	
CHEM 2317 and CHEM 2318	Organic Chemistry 2 for Chemistry Majors and Lab for CHEM 2317	

Professional Development

Code	Title	Hours
Professional Development		
GE 1000	First-Year Seminar	1
ENCP 2000	Introduction to Engineering Co-op Education	1
ENCP 3000	Professional Issues in Engineering	1
Additional Required Courses		
1 semester hour from the following course counts toward the professional development requirement:		1
GE 1501	Cornerstone of Engineering 1 [1]	
1 semester hour from the following course counts toward the professional development requirement:		1
GE 1502	Cornerstone of Engineering 2 [1]	

Writing Requirements

Code	Title	Hours
A grade of C or higher is required:		
ENGW 1111	First-Year Writing	4
ENGW 3302	Advanced Writing in the Technical Professions	4
or ENGW 3315	Interdisciplinary Advanced Writing in the Disciplines	

Required General Electives

Code	Title	Hours
Complete 24 semester hours of academic, nonremedial, nonrepetitive courses.		24

Major GPA Requirement

A 2.000 minimum GPA is required in CHME coursework.

Program Requirement

134 total semester hours required

[1] Students can substitute Engineering Design (GE 1110) and Engineering Problem Solving and Computation (GE 1111) for Cornerstone of Engineering 1 (GE 1501) and Cornerstone of Engineering 2 (GE 1502) .

Concentration in Biomolecular and Biomedical Systems

Code	Title	Hours
Advanced Engineering Electives		
Complete two of the following courses, at least one of which must be a CHME course:		8
BIOE 5115	Dynamical Systems in Biological Engineering	
BIOE 5250	Regulatory and Quality Aspects of Medical Device Design	
BIOE 5410	Molecular Bioengineering	
BIOE 5411	Applied Molecular Bioengineering	
BIOE 5420	Cellular Engineering	
BIOE 5430	Principles and Applications of Tissue Engineering	
CHME 5160	Drug Delivery: Engineering Analysis	
CHME 5185	Design of Experiments and Ethical Research (DOEER)	
CHME 5630	Biochemical Engineering	
CHME 5631	Biomaterials Principles and Applications	
CHME 5632	Advanced Topics in Biomaterials	
Advanced Science Elective		
Complete one of the following:		4-6
BIOL 3411	Current Topics in Cell and Molecular Biology	
BIOL 4707	Cell and Molecular Biology	
BIOL 5593	Cell and Molecular Biology of Aging	
BIOL 5595	Cell and Molecular Neuroscience	
NNMD 5270	Foundations in Nanomedicine: Therapeutics	

NNMD 5271	Foundations in Nanomedicine: Diagnostics
NNMD 5370	Nanomedicine Research Techniques
NNMD 5470	Nano/Biomedical Commercialization: Concept to Market
NNMD 5570	Preclinical and Clinical Study Design

Students may petition for additional science and/or engineering courses to be counted towards the electives if the course content falls within the concentration focus. Students may also petition for independent research to be counted towards the non-CHME engineering elective.

Concentration in Complex and Computational Systems

Code	Title	Hours
Advanced Engineering Electives		
Complete two of the following courses, at least one of which must be a CHME course:		8
BIOE 5115	Dynamical Systems in Biological Engineering	
CHME 5137	Computational Modeling in Chemical Engineering	
CHME 5649	Numerical Strategies and Data Analytics for Chemical Sciences	
CS 2500	Fundamentals of Computer Science 1	
CS 2510	Fundamentals of Computer Science 2	
CS 2810	Mathematics of Data Models	
CS 4100	Artificial Intelligence	
GE 2500	Design Analysis and Innovation	
EECE 5639	Computer Vision	
EECE 5645	Parallel Processing for Data Analytics	
Advanced Science Elective		
Complete one of the following:		4-6
CHEM 3403	Quantum Chemistry and Spectroscopy	
CHEM 5641	Computational Chemistry	
EEMB 5130	Population Dynamics	
PHYS 4606	Mathematical and Computational Methods for Physics	
PHYS 5352	Quantum Computation and Information	
Students may petition for additional science and/or engineering courses to be counted towards the electives if the course content falls within the concentration focus. Students may also petition for independent research to be counted towards the non-CHME engineering elective.		

Concentration in Energy and Sustainability

Code	Title	Hours
Advanced Engineering Electives		
Complete two of the following courses, at least one of which must be a CHME course:		8
CHME 5137	Computational Modeling in Chemical Engineering	
CHME 5621	Electrochemical Engineering	
CIVE 5275	Life Cycle Assessment of Materials, Products, and Infrastructure	
CIVE 5365	Climate Technologies for Decarbonization, Mitigation, and Adaptation	
CIVE 5527	Sustainable Rehabilitation of Structures	
Advanced Science Elective		
Complete one of the following:		4-6
CHEM 5651	Materials Chemistry of Renewable Energy	
EEMB 3455	Ecosystems Ecology	
EEMB 3460	Conservation Biology	
EEMB 5546	Sustainability of the Land-Sea Interface	
ENVR 3150	Food Security and Sustainability	
ENVR 3850	Sustainable Agriculture	
ENVR 5350	Sustainable Energy and Climate Solutions	
ENVR 5800	Climate Adaptation and Nature-Based Solutions	

Students may petition for additional science and/or engineering courses to be counted towards the electives if the course content falls within the concentration focus. Students may also petition for independent research to be counted towards the non-CHME engineering elective.

Concentration in Materials and Nanotechnology

Code	Title	Hours
Advanced Engineering Electives		
Complete two of the following courses, at least one of which must be a CHME course:		8
CHME 5105	Materials Characterization Techniques	
CHME 5179	Complex Fluids and Everyday Materials	
CHME 5632	Advanced Topics in Biomaterials	
CHME 5683	Introduction to Polymer Science	
MATL 5380	Particulate Materials Processing	
ME 4630	Ceramic Science and Engineering	
ME 5600	Materials Processing and Process Selection	
ME 5620	Fundamentals of Advanced Materials	
ME 5630	Nano- and Microscale Manufacturing	
ME 5661	Composite Materials	
Advanced Science Elective		
Complete one of the following:		4-6
CHEM 5610	Polymer Chemistry	
CHEM 5627	Mechanistic and Physical Organic Chemistry	
PHYS 5113	Particle Physics	
PHYS 5260	Introduction to Nanoscience and Nanotechnology	

Students may petition for additional science and/or engineering courses to be counted towards the electives if the course content falls within the concentration focus. Students may also petition for independent research to be counted towards the non-CHME engineering elective.

Electives Option

Code	Title	Hours
Advanced Engineering Electives		
Complete any two advanced elective courses in engineering, at least one of which must be a CHME course (level 2000+), while the other can also be CHME or any engineering elective (level 4000+). Students may petition for independent research to be counted towards the non-CHME course.		8
Advanced Science Elective		
Complete one of the following:		4-6
BIOL 2301	Genetics and Molecular Biology	
BIOL 2327	Human Parasitology	
BIOL 3421 and BIOL 3422	Microbiology and Lab for BIOL 3421	
BIOL 3603	Mammalian Systems Physiology	
BIOL 3611 and BIOL 3612	Biochemistry and Lab for BIOL 3611	
CHEM 2321 and CHEM 2322 and CHEM 2323	Analytical Chemistry and Lab for CHEM 2321 and Recitation for CHEM 2321	
CHEM 3403 and CHEM 3404	Quantum Chemistry and Spectroscopy and Lab for CHEM 3403	
CHEM 3431 and CHEM 3432	Physical Chemistry and Lab for CHEM 3431	
CHEM 3501 and CHEM 3502 and CHEM 3503	Inorganic Chemistry and Lab for CHEM 3501 and Recitation for CHEM 3501	
CHEM 4628 and CHEM 4629	Introduction to Spectroscopy of Organic Compounds and Identification of Organic Compounds	
EEMB 2302 and EEMB 2303	Ecology and Lab for EEMB 2302	

EEMB 3460	Conservation Biology
PHYS 1211	Computational Problem Solving in Physics
PHYS 2303	Modern Physics
PHYS 2371 and PHYS 2372	Electronics and Lab for PHYS 2371
PHYS 3601	Classical Dynamics
PHYS 3602	Electricity and Magnetism 1

Plan of Study

Sample Plans of Study

FOUR YEARS, TWO CO-OPS IN SUMMER 2/FALL

Year 1

Fall	Hours	Spring	Hours	Summer 1	Hours	Summer 2	Hours
CHEM 1151 and CHEM 1153 (ND)	4	GE 1502 (ER)	4	CHME 2308	4	CHME 2320	4
ENGW 1111 (WF)	4	MATH 1342 (FQ)	4	MATH 2321 (FQ)	4	General elective	4
GE 1000	1	PHYS 1151 and PHYS 1152 and PHYS 1153 (ND)	5				
GE 1501	4	General elective	4				
MATH 1341 (FQ)	4						
	17		**17**		**8**		**8**

Year 2

Fall	Hours	Spring	Hours	Summer 1	Hours	Summer 2	Hours
CHEM 2311 or 2315	4	BIOL 1111 or PHYS 1155 ***and*** PHYS 1156 ***and*** PHYS 1157 (ND)	4	Advanced science elective	4	Co-op	0
CHEM 2312 or 2316	1	CHEM 2313 or 2317	4	General elective	4		
CHME 2310	4	CHEM 2314 or 2318	1				
MATH 2341	4	CHME 3312	4				
General elective	4	CHME 3322	4				
		ENCP 2000	1				
	17		**18**		**8**		**0**

Year 3

Fall	Hours	Spring	Hours	Summer 1	Hours	Summer 2	Hours
Co-op	0	ENGW 3302 or 3315 (WD)	4	General elective	4	Co-op	0
		CHME 3305 and CHME 3306	4	General elective	4		
		CHME 4510	4				
		CHME 4701	4				
		ENCP 3000	1				
	0		**17**		**8**		**0**

Year 4

Fall	Hours	Spring	Hours
Co-op	0	CHME 4512	4
		CHME 4703 and CHME 4705 (EI, CE, WI)	4
		Advanced CHME elective	4
		Advanced engineering elective	4
	0		**16**

Total Hours: 134

FOUR YEARS, TWO CO-OPS IN SPRING/SUMMER 1

Year 1

Fall	Hours	Spring	Hours	Summer 1	Hours	Summer 2	Hours
CHEM 1151 and CHEM 1153 (ND)	4	GE 1502 (ER)	4	CHME 2308	4	CHME 2320	4
ENGW 1111 (WF)	4	MATH 1342 (FQ)	4	MATH 2321 (FQ)	4	General elective	4
GE 1000	1	PHYS 1151 and PHYS 1152 and PHYS 1153 (ND)	5				
GE 1501	4	General elective	4				
MATH 1341 (FQ)	4						
	17		**17**		**8**		**8**

Year 2

Fall	Hours	Spring	Hours	Summer 1	Hours	Summer 2	Hours
BIOL 1111 or PHYS 1155 ***and*** PHYS 1156 ***and*** PHYS 1157 (ND)	4	Co-op	0	Co-op	0	CHEM 2313 or 2317	4
CHEM 2311 or 2315	4					CHEM 2314 or 2318	1
CHEM 2312 or 2316	1					General elective	4
CHME 2310	4						
MATH 2341	4						
ENCP 2000	1						
	18		**0**		**0**		**9**

Year 3

Fall	Hours	Spring	Hours	Summer 1	Hours	Summer 2	Hours
CHME 3312	4	Co-op	0	Co-op	0	General elective	4
CHME 3322	4					General elective	4
CHME 3305 and CHME 3306	4						
ENGW 3302 or 3315 (WD)	4						
	16		**0**		**0**		**8**

Year 4

Fall	Hours	Spring	Hours
CHME 4510	4	CHME 4512	4
CHME 4701	4	CHME 4703 and CHME 4705 (EI, CE, WI)	4
ENCP 3000	1	Advanced engineering elective	4
Advanced CHME elective	4	Advanced science elective	4
General elective	4		
	17		**16**

Total Hours: 134

FIVE YEARS, THREE CO-OPS IN SUMMER 2/FALL

Year 1

Fall	Hours	Spring	Hours	Summer 1	Hours	Summer 2	Hours
CHEM 1151 and CHEM 1153 (ND)	4	GE 1502 (ER)	4	Vacation		Vacation	
ENGW 1111 (WF)	4	MATH 1342 (FQ)	4				
GE 1000	1	PHYS 1151 and PHYS 1152 and PHYS 1153 (ND)	5				
GE 1501	4	General elective	4				
MATH 1341 (FQ)	4						
	17		**17**		**0**		**0**

Year 2

Fall	Hours	Spring	Hours	Summer 1	Hours	Summer 2	Hours
BIOL 1111 or PHYS 1155 ***and*** PHYS 1156 ***and*** PHYS 1157 (ND)	4	CHEM 2313 or 2317	4	Vacation		Co-op	0
CHEM 2311 or 2315	4	CHEM 2314 or 2318	1				
CHEM 2312 or 2316	1	CHME 2310	4				
CHME 2308	4	CHME 2320	4				
MATH 2321 (FQ)	4	ENCP 2000	1				
		MATH 2341	4				
	17		**18**		**0**		**0**

Year 3

Fall	Hours	Spring	Hours	Summer 1	Hours	Summer 2	Hours
Co-op	0	CHME 3312	4	General elective	4	Co-op	0
		CHME 3322	4	General elective	4		
		CHME 3305 and CHME 3306	4				
		ENGW 3302 or 3315 (WD)	4				
	0		**16**		**8**		**0**

Year 4

Fall	Hours	Spring	Hours	Summer 1	Hours	Summer 2	Hours
Co-op	0	CHME 4510	4	General elective	4	Co-op	0
		CHME 4701	4	General elective	4		
		ENCP 3000	1				
		Advanced engineering elective	4				
		General elective	4				
	0		**17**		**8**		**0**

Year 5

Fall	Hours	Spring	Hours
Co-op	0	CHME 4512	4
		CHME 4703 and CHME 4705 (EI, CE, WI)	4
		Advanced CHME elective	4
		Advance science elective	4
	0		**16**

Total Hours: 134

FIVE YEARS, THREE CO-OPS IN SPRING/SUMMER 1

Year 1

Fall	Hours	Spring	Hours	Summer 1	Hours	Summer 2	Hours
CHEM 1151 and CHEM 1153 (ND)	4	GE 1502 (ER)	4	Vacation		Vacation	
ENGW 1111 (WF)	4	MATH 1342 (FQ)	4				
GE 1000	1	PHYS 1151 and PHYS 1152 and PHYS 1153 (ND)	5				
GE 1501	4	General elective	4				
MATH 1341 (FQ)	4						
	17		**17**		**0**		**0**

Year 2

Fall	Hours	Spring	Hours	Summer 1	Hours	Summer 2	Hours
BIOL 1111 or PHYS 1155 ***and*** PHYS 1156 ***and*** PHYS 1157	4	Co-op	0	Co-op	0	CHEM 2313 or 2317	4
CHEM 2311 or 2315	4					CHEM 2314 or 2318	1
CHEM 2312 or 2316	1					CHME 2320	4
CHME 2308	4						
ENCP 2000	1						
MATH 2321 (FQ)	4						
	18		**0**		**0**		**9**

Year 3

Fall	Hours	Spring	Hours	Summer 1	Hours	Summer 2	Hours
CHME 2310	4	Co-op	0	Co-op	0	General elective	4
CHME 3322	4					General elective	4
MATH 2341	4						
General elective	4						
	16		**0**		**0**		**8**

Year 4

Fall	Hours	Spring	Hours	Summer 1	Hours	Summer 2	Hours
CHME 3305 and CHME 3306	4	Co-op	0	Co-op	0	Vacation	
CHME 3312	4						
ENGW 3302 or 3315 (WD)	4						
General elective	4						
	16		**0**		**0**		**0**

Year 5

Fall	Hours	Spring	Hours
CHME 4510	4	CHME 4512	4
CHME 4701	4	CHME 4703 and CHME 4705 (EI, CE, WI)	4
ENCP 3000	1	Advanced engineering elective	4
Advanced CHME elective	4	General elective	4
Advanced science elective	4		
	17		**16**

Total Hours: 134