Chemical Engineering, BSE

The major in chemical engineering provides a broad education at the leading edge of technology. It emphasizes fundamental concepts, problem solving, laboratory techniques, and communication skills. The biological sciences join physics, chemistry, and mathematics as foundation disciplines for chemical engineering.

The sophomore, junior, and senior years emphasize chemical engineering courses such as materials and energy balances, computational tools for chemical engineers, fluid flow, chemical engineering thermodynamics, heat and mass transfer, separations, chemical reaction engineering, chemical process safety, biochemical engineering, process dynamics and control, and process design. Experience in instrumentation, analysis, and design is obtained through an integrated laboratory program. Routine use is made of computer-based data analysis, simulation, and design.

Focus Areas

Chemical engineering students may gain a depth of knowledge related to a career path through their selection of science, engineering, and general education courses. Several preapproved focus areas may help students define potential careers; the focus area enables students to gain depth of knowledge in a career path. Students meet with their chemical engineering academic advisor to discuss career options and develop a plan for choosing electives based on their career interests. The department offers preapproved focus areas in biochemical engineering; business; chemical process engineering; computation, data science, and machine learning; energy and environment; entrepreneurship; oil and gas engineering; pharmaceuticals; polymers; pre-medicine; safety and health; and sustainability. Students may prefer to develop an individualized focus area, which is subject to approval by the department's curriculum committee.

Biochemical Engineering

This focus area allows students to choose from a selection of courses that combine concepts of biology, biochemistry, and engineering. Biochemical engineers combine knowledge of these three areas to manufacture products of biological nature, including fermentation products and pharmaceuticals. Students often go on to work in the biotechnology and pharmaceutical industries as production leaders or researchers.

Business

This focus area consists of eight courses from the Tippie College of Business. Students gain foundational business knowledge on topics including finance, economics, accounting, marketing, law, and management. Past students have applied their integrated business and technical knowledge to many different settings including manufacturing plants, consulting, and corporate offices.

Chemical Process Engineering

Process engineering is the design, optimization, and operation of systems that transform raw materials into valuable products. Process engineers are involved with products, including foods and beverages, electronic materials, metals, plastics, fuels, building materials, and pharmaceutics. Since chemical process engineering spans many aspects of engineering, business, applied math, and science, students can choose from a broad selection of engineering, math, and science courses. This focus area provides ample room for customization and opportunities to tailor to individualized interests.

Computation, Data Science, and Machine Learning

This focus area is for students who intend to blend advanced computation and programming with their chemical engineering degree. This area is customizable based on student interest areas and can accommodate introductory training in cyber-physical systems, remote sensing, advanced simulation, supply chain management, in silico chemistry and biology, bioinformatics, software design, next-generation controls, machine learning, and artificial intelligence.

Energy and Environment

Students who are passionate about the environment should consider this focus area. Courses prepare students to solve environmental challenges and to revolutionize energy systems. Topics include air pollution, climate change, clean and renewable energy, environmental regulations, and sustainable systems.

Entrepreneurship

This focus area allows students to focus on the process of succeeding in the world of startups, innovation, business ownership, and new products. The area is well-suited for students who intend to start and operate their own business. It also serves students interested in gaining a better understanding of managing innovation in an existing business environment. The wide range of electives permits students to tailor business courses best suited to their individual interests.

Oil and Gas Engineering

Meant for students interested in pursuing careers in oil and gas engineering, this focus area explores foundational elements of chemistry, geology, petrochemical refining, and environmental science. The course plan offers several recommendations put in place by experienced advisors with petrochemical backgrounds. Often viewed as the birth of chemical engineering, the petroleum industry provides a host of challenging and lucrative opportunities for chemical engineers. This path provides a unique and focused introduction to the field.

Pharmaceuticals

Chemical and biochemical engineering is central to the design, formulation, and manufacturing of pharmaceutical products. Students who are passionate about medical applications can align their chemical engineering skills toward a career in pharmaceuticals by choosing this focus area. The curriculum features biology, drug delivery, and the mechanisms and chemistry of drug interactions. Course options span many departments besides chemical and biochemical engineering, including biomedical engineering, biochemistry and molecular biology, pharmacy, and pharmacology.

Polymers

This focus area enables students to study the development of chemical compounds by polymerization, including combining small molecules into engineered networks to produce valuable plastics and other advanced materials. The program is well

suited for students who intend to use their knowledge to design new materials; it also serves students interested in gaining a better understanding of the links between molecular scale structure and macroscopic scale properties.

Pre-Medicine

Concepts of chemical engineering are naturally applicable to the processes in living organisms. This focus area enables students to apply these concepts to gain a deeper understanding of the atoms and molecules that comprise living organisms, and the pathways through which they operate. This program is for students who intend to use their knowledge to gain acceptance to post-graduate education in the medical field.

Safety and Health

This focus area prepares students to prevent incidents and accidents in chemical and pharmaceutical manufacturing, particularly those resulting from the unintentional release of hazardous materials and energy into the environment; and provide a safe and healthy workplace by preventing injuries and hazards in the workplace environment.

Sustainability

This focus area covers the most important and current topics in environmental science, societal impacts, energy usage, and natural systems. Courses prepare students to understand and discuss these topics as they relate to chemical engineering.

Educational Objectives

The chemical engineering program produces graduates with a strong foundation of scientific and technical knowledge who are equipped with problem-solving, teamwork, and communication skills that will serve them throughout their careers consistent with the following educational objectives. Within a few years following graduation, graduates will:

- attain careers as practicing chemical engineers in fields such as biotechnology, chemicals, computation, energy, environmental engineering, food processing, microelectronics, pharmaceuticals, or polymers/advanced materials;
- pursue advanced studies in disciplines such as business, chemical engineering, dentistry, environmental engineering, law, medicine, or pharmaceuticals; or
- assume professional leadership roles.

The following methods and strategies are used in the chemical engineering undergraduate program to achieve these program educational objectives:

- foster a unique and personalized undergraduate experience by leveraging the advantages of a small college atmosphere within a comprehensive liberal arts and research university;
- provide a diverse, inclusive, and equitable environment for all students;
- enrich the undergraduate experience through cultural diversity, international opportunities, and/or experiential learning;
- provide a solid foundation and understanding of the fundamental principles of mathematics, science, and engineering;
- provide students with experience in learning and applying tools, and analyzing and interpreting data, to solve theoretical and open-ended chemical engineering problems;
- provide students with opportunities to participate in collaborative teams;
- develop students' written and oral communication skills to a wide range of audiences;
- provide students with opportunities to design and conduct chemical engineering experiments and to design systems, components, and chemical processes to meet specific needs and constraints;
- provide a contemporary grounding in ethical and professional responsibility, including global, economic, environmental, safety, and societal impacts of engineering decisions; and
- instill the desire and the understanding of the need for lifelong learning.

Requirements

The Bachelor of Science in Engineering (BSE) with a major in chemical engineering requires a minimum of 128 s.h. of credit, plus up to five 1 s.h. seminars and one 0 s.h. seminar. At the time of graduation, students must have a cumulative grade-point average of at least 2.00 in all college work used to complete degree requirements and in all UI coursework in order to be awarded the BSE.

All BSE students are required to take the same collegiate curriculum. For information about these collegiate requirements, see the Bachelor of Science in Engineering, BSE in the catalog. Students completing the major in chemical engineering fulfill the collegiate statistics requirement by completing CBE:3020 Applied Statistics for Chemical and Natural Resources Engineering, STAT:2020 Probability and Statistics for the Engineering and Physical Sciences, or STAT:3510 Biostatistics. Some focus areas may suggest or require specific courses to fulfill the General Education Component of the collegiate curriculum; see the following section titled "Focus Area."

Students are required to participate in at least one enriching activity, which may include a research experience, a cooperative education or internship experience, study abroad, completion of the Certificate in Technological Entrepreneurship, or other approved experiences.

The major in chemical engineering may include the following departmental seminars depending on when a student declares the major.

Course #	Title	Hours
CBE:1000	CBE Departmental Seminar (typically taken in the first year)	1
CBE:3000	Professional Seminar: Chemical Engineering (taken four times for 1 s.h. each)	4
CBE:4195	Senior Enriching Activities Seminar	0

The major in chemical engineering requires the following coursework. Students who begin in the college fall semester of their first year also complete ENGR:1000 Engineering Success for First-Year Students (1 s.h.). Students who have transferred into the College of Engineering or did not complete ENGR:1000 their first year are required to substitute the seminar with a different course; depending on the student's major, the college may waive this requirement. Students transferring from the College of Liberal Arts and

Sciences or Tippie College of Business typically use 1 s.h. from CSI:1600 Success at Iowa to cover this requirement.

Requirements	Hours
Collegiate Curriculum	49
Major Requirements	64
Focus Area	12
Free Elective	3

Major Requirements

Major requirements include a set of common courses (53 s.h.), an advanced chemistry or biochemistry course (3 s.h.), an advanced science course (3 s.h.), and two capstone design courses (5 s.h.).

Common Courses

Course #	Title	Hours
All of these:		
CBE:2105	Material and Energy Balances	3
CBE:2110	Computational Tools for Chemical Engineers	2
CBE:3105	Chemical Engineering Thermodynamics	3
CBE:3109	Fluid Flow	2
CBE:3113	Heat and Mass Transfer	3
CBE:3117	Separations	3
CBE:3120	Chemical Reaction Engineering	3
CBE:3125	Chemical Process Safety	3
CBE:3150	Thermodynamics/Transport Laboratory	3
CBE:3155	Chemical Reaction Engineering/Separations Laboratory	3
CBE:3205	Introduction to Biochemical Engineering	3
CBE:4105	Process Dynamics and Control in Design	3
CHEM:1120	Principles of Chemistry II	4
CHEM:2210	Organic Chemistry I	3
or CHEM:2230	Organic Chemistry I for Majors	
CHEM:2220	Organic Chemistry II	3
or CHEM:2240	Organic Chemistry II for Majors	
CHEM:2410	Organic Chemistry Laboratory	3
or CHEM:2420	Organic Chemistry Laboratory for Majors	
ENGR:2130	Thermodynamics	3
ENGR:2720	Materials Science	3

Advanced Chemistry or Biochemistry Course

Some focus areas may suggest or require a specific course; see "Focus Area." Students select a course considered advanced for the minor in chemistry (College of Liberal Arts and Sciences) or one of the following courses in the Department of Biochemistry and Molecular Biology (Carver College of Medicine).

Course #	Title	Hours
BMB:3110	Biochemistry	3
BMB:3120	Biochemistry and Molecular Biology I	3
BMB:3130	Biochemistry and Molecular Biology II	3

Acceptable courses from the Department of Chemistry (College of Liberal Arts and Sciences) include but are not limited to the following.

Course #	Title	Hours
CHEM:3110	Equilibria and Electrochemistry	3
CHEM:3120	Spectroscopy and Separations	3
CHEM:4430	Principles of Physical Chemistry	3
CHEM:4431	Chemical Thermodynamics	3
CHEM:4432	Quantum Mechanics and Chemical Kinetics	3

Advanced Science Course

Students select an advanced science-based course either within or outside of the College of Engineering. Appropriate subject areas could include biochemistry and molecular biology (prefix BMB), biology (prefix BIOL), chemistry (prefix CHEM), microbiology and immunology (prefix MICR), and physics (PHYS). Any course numbered 3000 or above in these areas will fulfill this requirement. Some focus areas may suggest or require a specific course; see "Focus Area." Students may consult an advisor or visit the Department of Chemical and Biochemical Engineering website for more information.

Acceptable courses include but are not limited to the following. Consult an academic advisor for approval to take a course not on this list.

Course #	Title	Hours
CBE:4420	Environmental Chemistry	3
CBE:5315	Polymer Chemistry	3
CBE:5425	Atmospheric Chemistry and Physics	3
BIOL:4213	Bioinformatics	4
BME:2400	Cell Biology for Engineers	3
CEE:5440	Foundations of Environmental Chemistry and Microbiology	3
EES:4520	Isotope Geochemistry	3
OEH:4240	Global Environmental Health	3
OEH:6420	Methods in Exposure Science	3
OEH:6710	Human Toxicology and Risk Assessment	3
PHYS:3741	Introduction to Quantum Mechanics I	3
Advanced chemistry and biochemistry courses in the areas previously listed		3

The following courses do not fulfill this requirement.

Course #	Title	Hours
CBE:3405	Green Chemical and Energy Technologies	3
CBE:5210	Bioseparations	3

CBE:5310	Polymer Science and Technology	3
CBE:5410	Electrochemical Engineering	3
BIOL:1411	Foundations of Biology	4
BIOL:1412	Diversity of Form and Function	4
PHYS:1612	Introductory Physics II	4

Capstone Design Courses

Course #	Title	Hours
Both of these:		
CBE:4109	Chemical Engineering Process Design I	2
CBE:4110	Chemical Engineering Process Design II	3

Focus Area

Students must select focus area courses according to guidelines established by the Department of Chemical and Biochemical Engineering. The department offers preapproved focus areas in biochemical engineering [p. 4]; business [p. 4]; chemical process engineering [p. 4]; computation, data science, and machine learning [p. 5]; energy and environment [p. 5]; entrepreneurship [p. 6]; oil and gas engineering [p. 6]; pharmaceuticals [p. 7]; polymers [p. 7]; pre-medicine [p. 7]; safety and health [p. 7]; and sustainability [p. 8].

Students may prefer to develop a custom-tailored focus area, which is subject to approval by the department's curriculum committee. Visit the Department of Chemical and Biochemical Engineering website for detailed descriptions of preapproved focus areas and guidelines for tailored focus areas.

Focus areas in chemical engineering consist of content area courses (12 s.h.) and a free elective course (3 s.h.); carefully selected courses may contribute to earning a minor and/or certificate. Some focus areas also may suggest or require specific courses to fulfill the General Education Component of the collegiate curriculum, the chemical engineering major's advanced chemistry or biochemistry requirement, and/or the major's advanced science requirement.

Biochemical Engineering

Students in the biochemical engineering focus area are encouraged to complete BMB:3110 Biochemistry to satisfy the chemical engineering major's advanced chemistry/biochemistry or advanced science requirement.

Required Biochemical Course

Course #	Title	Hours
This course:		
CBE:5210	Bioseparations	3

Biochemical Electives

Course #	Title	Hours
9 s.h. from these:		
CBE:3998	Individual Investigations: Chemical Engineering	arr.
CBE:5875/ BMB:5875/ CEE:5875/ CHEM:5875/ MICR:5875/ PHAR:5875	Perspectives in Biotechnology	1
BMB:3110	Biochemistry	3
BIOL:1411	Foundations of Biology	4
BIOL:1412	Diversity of Form and Function	4
BMB:3120	Biochemistry and Molecular Biology I	3
BMB:3130	Biochemistry and Molecular Biology II	3
BMB:3140	Experimental Biochemistry	3
BME:2400	Cell Biology for Engineers	3
BME:5430	Biotransport	3
CHEM:4850/ PHAR:4850	Upstream Biotechnology Processes	2
MICR:2157	General Microbiology	3
MICR:2158	General Microbiology Laboratory	2

In addition to the courses previously listed, students may select courses with prefix BIOL, BMB, CHEM, or MICR numbered 3000 or above. Advisor approval is required for courses that center on experiential learning, such as research (e.g., MICR:4161 Undergraduate Research in Microbiology), science communication (e.g., CHEM:4000 Scientists and Writers), service learning, or teaching internships/practica (e.g., BMB:3800 Biochemistry Teaching Practicum).

Business

The business focus area requires the following courses to fulfill the collegiate curriculum General Education Component approved course subjects requirement.

Course #	Title	Hours
All of these:		
ECON:1100	Principles of Microeconomics	4
ECON:1200	Principles of Macroeconomics	4
MKTG:3000	Introduction to Marketing Strategy	3

Required Business Course

Course #	Title	Hours
One of these:		
FIN:3000	Introductory Financial Management	3
ISE:2500	Engineering Economy	3

Business Electives

Course #	Title	Hours
Three of these:		
ACCT:2100	Introduction to Financial Accounting	3
ACCT:2200	Managerial Accounting Analytics and Data Visualization	3
MGMT:2000	Introduction to Law	3
MGMT:2100	Introduction to Management	3

Chemical Process Engineering

Students choose 12 s.h. from a broad selection of engineering, math, and science courses numbered 3000 or above. Students are encouraged to complete MATH:4820 Optimization Techniques and should consult academic advisors for additional course selection.

Computation, Data Science, and Machine Learning

Computation, Data Science, and Machine Learning Electives

Course #	Title	Hours
12 s.h. from these:		
CBE:3020	Applied Statistics for Chemical and Natural Resources Engineering	3
CBE:3998	Individual Investigations: Chemical Engineering	arr.
CBE:5417/IGPI:5417	Physical Meteorology and Atmospheric Radiative Transfer	3
CBE:5425/CEE:5115	Atmospheric Chemistry and Physics	3
ACCT:4200	Advanced Managerial Accounting Analytics	3
BAIS:3500	Data Mining	3
BAIS:3800	Optimization and Simulation Modeling	3
BIOL:4213/ GENE:4213/ IGPI:4213	Bioinformatics	2,4
BME:4310/ BMB:4310	Computational Biochemistry	3
CEE:4512/ME:4112	Engineering Design Optimization	3
CHEM:4480	Introduction to Molecular Modeling	3
CHEM:5431	Statistical Thermodynamics I	3
CS:2110	Programming for Informatics	4
CS:2210	Discrete Structures	3
CS:2230	Computer Science II: Data Structures	4
CS:3330	Algorithms	3
CS:4740/IGPI:4740/ MATH:4740/ STAT:4740	Large Data Analysis	3
CS:5110/IGPI:5110	Introduction to Informatics	3
ECE:2400	Linear Systems I	3
ECE:3330/IGPI:3330	Introduction to Software Design	3
ECE:5330/IGPI:5331	Graph Algorithms and Combinatorial Optimization	3
ECE:5420	Power Electronics	3
ENGR:2730	Computers in Engineering	3
ENGR:3110	Introduction to Artificial Intelligence and Machine Learning in Engineering	3
ISE:3600/CEE:3142/ STAT:3620	Quality Control	3
ISE:4900	Introduction to Six Sigma	3
MATH:3770	Fundamental Properties of Spaces and Functions I	4
MATH:3800/ CS:3700	Introduction to Numerical Methods	3
MATH:5600	Nonlinear Dynamics with Numerical Methods	3
MATH:5700	Introduction to Partial Differential Equations	3
ME:4111/CEE:4511	Scientific Computing and Machine Learning	3
ME:4150	Artificial Intelligence in Engineering	3
ME:5114	Nonlinear Control in Robotic Systems	3
ME:5143	Computational Fluid and Thermal Engineering	3
ME:6115	Cooperative Autonomous Systems	3

Energy and Environment

Required Energy and Environment Course

Course #	Title	Hours
This course:		
CBE:3405	Green Chemical and Energy Technologies	3

Energy and Environment Electives

Course #	Title	Hours
9 s.h. from these:		
CBE:2030	Energy and Society	3
CBE:2040	Environment, Energy, and Climate Change	3
CBE:2050/CEE:2050	Severe and Unusual Weather	3
CBE:4420/CEE:4150	Environmental Chemistry	3
CBE:4459/ CEE:4159/IGPI:4159	Air Pollution Control Technology	3
CBE:4460	Process and Design for Satellites and Environmental Sensors	3
CBE:5410	Electrochemical Engineering	3
CBE:5412	Atmospheric Modeling	3
CBE:5415/IGPI:5415	Satellite Image Processing and Remote Sensing of Atmosphere	3
CBE:5417/IGPI:5417	Physical Meteorology and Atmospheric Radiative Transfer	3
CBE:5425/CEE:5115	Atmospheric Chemistry and Physics	3
CEE:4107/CBE:4410	Sustainable Systems	3
CEE:5380	Fluid Flows in Environmental Systems	3
CEE:5440	Foundations of Environmental Chemistry and Microbiology	3
CHEM:4873	Atmospheric and Environmental Chemistry	3
CHEM:5107	Electrochemistry	2-3
CHEM:5438	Surface Chemistry and Heterogeneous Processes	3
ECE:5630	Sustainable Energy Conversion	3
EES:4490	Elements of Geochemistry	3
EES:4520	Isotope Geochemistry	3
EES:4630	Hydrogeology	4

EES:4790	Applied Environmental Geology	3
ENGR:3110	Introduction to Artificial Intelligence and Machine Learning in Engineering	3
ME:4048	Energy Systems Design	4
OEH:6710	Human Toxicology and Risk Assessment	3

In addition to the courses previously listed, students may select courses with prefix CHEM, EES, GEOG, or OEH numbered 3000 or above. Advisor approval is required for courses that center on experiential learning, such as research (e.g., GEOG:3992 Undergraduate Research), science communication (e.g., CHEM:4000 Scientists and Writers), or practical experiences/field trip courses (e.g., EES:3001 Third-Year Field Trip for Earth and Environmental Sciences).

Entrepreneurship

Required Entrepreneurship Course

Course #	Title	Hours
One of these:		
FIN:3000	Introductory Financial Management	3
ISE:2500	Engineering Economy	3

Entrepreneurship Electives

Course #	Title	Hours
9 s.h. from these:		
ENTR:2000	Entrepreneurship and Innovation	3
ENTR:3100	Entrepreneurial Finance	3
An approved course with prefix ENTR that counts toward the technological entrepreneurship certificate		3

Oil and Gas Engineering

The following courses are prerequisites for many of the oil and gas engineering focus area courses. Due to their introductory nature, they do not count toward the focus area's content requirements, but one of the two may be counted as the free elective.

Course #	Title	Hours
CEE:1030/EES:1030	Introduction to Earth Science	3-4
EES:1050	Introduction to Geology	4

The following courses are recommended to students in the oil and gas engineering focus area to fulfill part of the collegiate curriculum General Education Component approved course subjects requirement.

Course #	Title	Hours
Both of these:		
GEOG:1115/ EES:1115/ ENVS:1115/ HIST:1115	The History of Oil	3
GEOG:3780/ GHS:3780/ HIST:3240/ POLI:3431	U.S. Energy Policy in Global Context	3

Students in this focus area are encouraged to select courses for the chemical engineering major's advanced science requirement from the following list.

Course #	Title	Hours
EES:3110/ ENVS:3110	Chemical Evolution of the Oceans	3
EES:4490	Elements of Geochemistry (recommended for students specializing in petroleum)	3
EES:4630	Hydrogeology (recommended for students specializing in petroleum)	4
EES:4640	Contaminant Hydrogeology	3

Required Oil and Gas Course

Course #	Title	Hours
This course:		
CBE:3405	Green Chemical and Energy Technologies	3

Oil and Gas Electives

Course #	Title	Hours
9 s.h. from these:		
CBE:5199	Contemporary Topics: Chemical and Biochemical Engineering	arr.
CBE:5415/IGPI:5415	Satellite Image Processing and Remote Sensing of Atmosphere	3
CBE:5425/CEE:5115	Atmospheric Chemistry and Physics	3
EES:1290	Energy and the Environment	3
EES:2410	Mineralogy (recommended for students specializing in petroleum)	4
EES:2831	Geologic Field Methods	3
EES:3100/ ENVS:3100	Earth and Planetary Remote Sensing	4
EES:3300	Sedimentary Geology (recommended for students specializing in petroleum)	4
EES:3500	Igneous and Metamorphic Petrology (recommended for students specializing in petroleum)	4
EES:3770	Global Stratigraphy	3
EES:3840	Structural Geology (recommended for students specializing in petroleum)	4
EES:4750	Mineral and Petroleum Exploration Geology	3
EES:4790	Applied Environmental Geology	3
EES:4820	Tectonics and Basin Analysis	3
EES:4832	Geologic Field Analysis	3
ENGR:3110	Introduction to Artificial Intelligence and Machine Learning in Engineering	3

Pharmaceuticals

Required Pharmaceuticals Course

Course #	Title	Hours
At least one of these:		
PCOL:2220	Drug Use and Abuse	3
PCOL:3101	Pharmacology I: A Drug's Fantastic Journey	3

Pharmaceuticals Electives

Students select from the following engineering, pharmaceutics, and science courses listed to reach a total of 12 s.h. when combined with either or both of the required pharmaceuticals courses.

Course #	Title	Hours
CBE:3998	Individual Investigations: Chemical Engineering	arr.
CBE:5210	Bioseparations	3
CBE:5740	Engineering Principles of Drug Delivery	3
BIOL:1411	Foundations of Biology	4
BMB:3110	Biochemistry	3
BMB:3120	Biochemistry and Molecular Biology I	3
BMB:3140	Experimental Biochemistry	3
BME:4310/ BMB:4310	Computational Biochemistry	3
BME:5421	Cell Material Interactions	3
BME:5430	Biotransport	3
CHEM:3110	Equilibria and Electrochemistry	3
CHEM:3120	Spectroscopy and Separations	3
CHEM:3430	Analytical Measurements	3
ENGR:3110	Introduction to Artificial Intelligence and Machine Learning in Engineering	3
HHP:1300	Fundamentals of Human Physiology	3
OEH:6450	Aerosol Technology	3
PCOL:3102	Pharmacology II: Mechanisms of Drug Action	3
PHAR:4146	Drug Disposition and Pharmacokinetics	2
PHAR:4736	Properties of Dosage Forms I	3
PHAR:4737	Properties of Dosage Forms II	3
PHAR:4741	Immunology and Immunotherapies	2
PHAR:4800	Chemical and Biophysical Properties of Drugs	2
A course with prefix CHEM numbered 3000 or above		3

Advisor approval is required to select additional chemistry courses that center on experiential learning, such as research (e.g., CHEM:3994 Undergraduate Research) or science communication (e.g., CHEM:4000 Scientists and Writers).

Polymers

Required Polymers Course

Course #	Title	Hours
This course:		
CBE:5310	Polymer Science and Technology	3

Polymers Electives

Course #	Title	Hours
9 s.h. from these:		
CBE:3998	Individual Investigations: Chemical Engineering	arr.
CBE:5199	Contemporary Topics: Chemical and Biochemical Engineering	arr.
CBE:5390	Photopolymerization Topics	1
CBE:5740	Engineering Principles of Drug Delivery	3
BME:2500	Biomaterials and Biomechanics	4
BME:5421	Cell Material Interactions	3
CHEM:4372	Advanced Organic Chemistry	3
CHEM:5118	Nanomaterials	3
ME:5146	Modeling of Materials Processing	3
ME:5167/CEE:5137	Composite Materials	3
Engineering, math, or science courses numbered 3000 or above		

Pre-Medicine

Students in this focus area are encouraged to complete the major's advanced chemistry or biochemistry and advanced science requirements by completing either the sequence BMB:3120 Biochemistry and Molecular Biology I and BMB:3130 Biochemistry and Molecular Biology II to satisfy both requirements, or BMB:3110 Biochemistry to satisfy one of the two requirements.

The following courses are recommended to students in the pre-medicine focus area to fulfill the collegiate curriculum General Education Component approved course subjects requirement.

Course #	Title	Hours
All of these:		
PSY:1001	Elementary Psychology	3
PSY:2130	Advanced Psychology for Pre-Medical Track	3
SOC:1010	Introduction to Sociology	3-4

Required Pre-Medicine Courses

Course #	Title	Hours
All of these:		
BIOL:1411	Foundations of Biology	4
BIOL:1412	Diversity of Form and Function	4
PHYS:1612	Introductory Physics II	4

Safety and Health

Students in this focus area are encouraged to complete OEH:6710 Human Toxicology and Risk

Assessment to satisfy the chemical engineering major's advanced science requirement.

The following courses are recommended to students in the safety and health focus area as part of the collegiate curriculum General Education Component.

Course #	Title	Hours
Approved Course Subjects		
GHS:3560	Global Garbage and Global Health	3
GHS:3760/ GEOG:3760	Hazards and Society	3
Diversity and Inclusion		
HHP:1045	Diversity and Inclusion in Healthy Living	3

Required Safety and Health Course

Course #	Title	Hours
This course:		
CBE:4125	Advanced Chemical Process Safety	3

Safety and Health Electives

Course #	Title	Hours
9 s.h. from these:		
CBE:4459/ CEE:4159/IGPI:4159	Air Pollution Control Technology	3
CEE:4158/ OEH:4920	Solid and Hazardous Wastes	3
CPH:3200	Death at Work: Case Studies of Workplace Safety and Health	3
ISE:4175	Safety Engineering	3
OEH:5410	Occupational Safety	3
OEH:5620	Occupational Health	3
OEH:6420	Methods in Exposure Science	3
OEH:6440	Control of Occupational Hazards	3
OEH:6450	Aerosol Technology	3
OEH:6720	Advanced Toxicology	4

Sustainability

Students in the sustainability focus area are encouraged to complete CBE:5425 Atmospheric Chemistry and Physics to satisfy the chemical engineering major's advanced science requirement.

Students in this focus area are required to complete the following courses to fulfill the collegiate curriculum's General Education Component.

Course #	Title	Hours
Be Creative		
CNW:2740	The Art and Craft of Writing about the Environment	3
Approved Course Subjects		
ENGL:1510	Introduction to Environmental Literature	3
or JMC:1800	Twenty-first-Century Science: Environmental Communication in the Digital Age	
GEOG:1070	Contemporary Environmental Issues	3
GEOG:2013/ BUS:2013/ SUST:2013/ URP:2013	Introduction to Sustainability	3

Sustainability Electives

It is recommended that students choose courses that contribute to completing the Certificate in Sustainability (University College).

Course #	Title	Hours
12 s.h. from these:		
CBE:4410/CEE:4107	Sustainable Systems	3
A course that counts toward the Certificate in Sustainability		3-4
A science or engineering course numbered 3000 or above		
May include one of these:		
EES:1080/ ENVS:1080	Introduction to Environmental Science	3-4
EES:1085/ ENVS:1085	Fundamentals of Environmental Science	4

Free Elective

Students are required to select an additional course of their choice and should consult with an academic advisor for assistance in selection as needed.

Students in the business focus area interested in completing the minor in business administration (Tippie College of Business) are especially encouraged to complete all four courses listed under "Business Electives."

It is recommended that students in the entrepreneurship focus area choose a course with prefix ENTR that counts toward the Certificate in Technological Entrepreneurship.

It is recommended that students in the sustainability focus area choose a course that contributes to completing the Certificate in Sustainability (University College).

Combined Programs

BSE/MS in Chemical and Biochemical Engineering

The College of Engineering offers a combined Bachelor of Science in Engineering/Master of Science for chemical engineering undergraduate students who intend to earn an MS in chemical and biochemical engineering. BSE/MS students may count 12 s.h. of coursework (typically advanced chemistry sequences and electives) toward both degrees. Once students complete the requirements for the bachelor's degree, they are granted the BSE, and they typically complete the MS one year later.

To be admitted to the degree program, students must have a cumulative grade-point average of at least 3.25 and must apply to the Graduate College for acceptance into the program before starting their final two semesters. Visit Undergraduate to Graduate (U2G) Programs on the Department of Chemical and Biochemical Engineering website to learn more.

BSE/MS in Civil and Environmental Engineering

Bachelor of Science in Engineering students majoring in chemical engineering who are interested in earning a Master of Science in civil and environmental engineering may apply to the combined BSE/MS program offered by the College of Engineering. The combined program enables undergraduate students to begin work on the MS while completing their BSE. Students admitted to the program may count 9 s.h. of coursework toward both the BSE and the MS degree requirements. They also may count an additional 3 s.h. toward the MS degree requirements before they have been awarded the BSE. For more information, see the MS in civil and environmental engineering in the catalog.

Career Advancement

Chemical and biochemical engineers work in a wide range of industries, including petroleum and specialty chemical production, polymer and plastic production, food processing, energy, microelectronics production, pharmaceutical production, biochemical processing, and environmental compliance. Potential jobs include production, process development, plant design and construction, and fundamental research. Many experienced chemical and biochemical engineers move through management ranks to high-level administrative positions. On average, 93–98% of graduates are employed in their field of study or pursuing advanced education within seven months of graduation.

The engineering profession is a foundation for a variety of careers in industry, medicine, law, government, and consulting. Engineering majors continue to result in top-paying salaries post-graduation.

Engineering Career Services develops and promotes experiential education and professional opportunities for students in the College of Engineering. Professional staff coordinate the college's co-op and internship program, engage in employer outreach, and provide opportunities for students to network with employers, including an engineering career fair each semester and other programming related to career development.

Engineering Career Services also offers individual advising and class presentations on résumé and cover letter preparation, job and internship search strategies, interviewing skills, and job offer evaluation.

Academic Plans

Sample Plan of Study

Sample plans represent one way to complete a program of study. Actual course selection and sequence will vary and should be discussed with an academic advisor. For additional sample plans, see MyUI.

Chemical Engineering, BSE

This sample plan is being reviewed and will be added at a later date.