CHEMICAL ENGINEERING

http://www.cbe.iastate.edu/

Administered by the Department of Chemical and Biological Engineering

For undergraduate curriculum in Chemical Engineering leading to the degree Bachelor of Science. The Chemical Engineering Program is accredited by the Engineering Accreditation Commission of ABET, https://www.abet.org (https://www.abet.org/), under the commission's General Criteria and Program Criteria for Chemical, Biochemical, Biomolecular and Similarly Named Engineering Programs.

Chemical engineering is a profession, which provides a link between scientific knowledge and manufactured products. The chemical engineer relies on science, experience, creativity, and ingenuity to produce these materials economically. Almost everything of a material nature used by society today has at some point felt the influence of the chemical engineer. From raw materials such as minerals, coal, petroleum, and agricultural products; chemical engineers create versatile intermediate and commodity chemicals, high performance fuels, new materials for construction, pharmaceuticals, high performance foodstuffs, synthetic textiles, plastics, solid state electronic components, and dozens of other engineered materials. The chemical engineer's influence has been important in the development of catalysts, fuel cells, automatic controls, biochemical processes, artificial kidneys, tissue engineering, nuclear energy, medical instruments and devices, as well as in the development of air and water pollution control systems. Many new and equally exciting challenges await the practicing chemical engineer of the future.

The profession of chemical engineering embraces a wide variety of activities including research, process development, product development, design, manufacturing supervision, technical sales, consulting, and teaching. The engineer can be behind a desk, in a laboratory, in a manufacturing plant, or engaged in nationwide and worldwide travel. Successful chemical engineers find chemistry, mathematics, and physics to be interesting and exciting. Many chemical engineers also have interest in the biological sciences. The curriculum in chemical engineering includes continued study of chemistry, biochemistry, mathematics, and physics as well as intensive study in the engineering sciences such as chemical reaction engineering, thermodynamics, mass transfer, fluid mechanics, heat transfer, system analysis and process synthesis, and design.

Student Learning Outcomes

Upon graduation, students should be able to:

1. Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. Communicate effectively with a range of audiences.
4. Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. Acquire and apply new knowledge as needed, using appropriate learning strategies.

The curriculum assures that graduates have a thorough grounding in chemistry, along with a working knowledge of advanced chemistry such as organic, inorganic, physical, analytical, materials chemistry, or biochemistry. In addition, a working knowledge, including safety and environmental aspects, of material and energy balances applied to chemical processes; thermodynamics of physical and chemical equilibria; heat, mass, and momentum transfer; chemical reaction engineering; continuous and stage-wise separation operations; process dynamics and control; process design; and appropriate modern experimental and computing techniques is assured.

Program Educational Objectives

The objectives of the Chemical Engineering Program at Iowa State University are to produce graduates who:

- Will excel in careers as professional chemical engineers in the businesses and industries related to chemical engineering; and
- Will successfully pursue research and advanced studies in chemical engineering, or in related fields such as chemistry or biology, or in related professional fields such as medicine, law, and business.

Cooperative Education

A cooperative education program is available to students in chemical engineering.

Curriculum in Chemical Engineering

Degree requirements leading to the degree Bachelor of Science.

Total credits required: 128.0.

INTERNATIONAL PERSPECTIVES [1]: 3 CR.
U.S. DIVERSITY [1]: 3 CR.
COMMUNICATION PROFICIENCY/LIBRARY REQUIREMENT:

ENGL 1500	Critical Thinking and Communication (Must have a C or better in this course)	3

ENGL 2500	Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course)	3
LIB 1600	Introduction to College Level Research	1
One of the following (C or better in this course)		3
ENGL 3090	Proposal and Report Writing	
ENGL 3120	Communicating Science and Public Engagement	
ENGL 3140	Technical Communication	
JLMC 3470	Science Communication	

The CBE Department requires a grade of a C or better for any transfer credit course that is applied to the degree program but will not be calculated into the ISU cumulative GPA, Basic Program GPA or Core GPA.

Social Sciences and Humanities: 15 cr. [2]

Complete a total of 15 cr. with at least 6 cr. but not more than 9 cr. from the same department.

Basic Program: 24 cr. [3]

A minimum GPA of 2.00 required for this set of courses (please note that transfer course grades will not be calculated into the Basic Program GPA). See Basic Program for Engineering Curricula in College of Engineering section.

CHEM 1770	General Chemistry I	4
or CHEM 1670	General Chemistry for Engineering Students	
or CHEM 2010	Advanced General Chemistry	
ENGL 1500	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGR 1010	Engineering Orientation	
CHE 1600	Chemical Engineering Problems with Computer Applications Laboratory [3]	3
LIB 1600	Introduction to College Level Research	1
MATH 1650	Calculus I	4
MATH 1660	Calculus II	4
PHYS 2310	Introduction to Classical Physics I	4
PHYS 2310L	Introduction to Classical Physics I Laboratory	1
Total Credits		**24**

Math and Physical Science: 30 cr.

MATH 2650	Calculus III	4
MATH 2670	Elementary Differential Equations and Laplace Transforms	4
CHEM 1770L	Laboratory in General Chemistry I [4]	1
or CHEM 1670L	Laboratory in General Chemistry for Engineering	
or CHEM 2010L	Laboratory in Advanced General Chemistry	
CHEM 1780	General Chemistry II [4]	3
CHEM 1780L	Laboratory in College Chemistry II [4]	1
CHEM 3250	Chemical Thermodynamics	3
CHEM 3310	Organic Chemistry I	3
CHEM 3320	Organic Chemistry II	3
PHYS 2320	Introduction to Classical Physics II	4
PHYS 2320L	Introduction to Classical Physics II Laboratory	1
BBMB 3030	General Biochemistry	3
Total Credits		**30**

Chemical Engineering Core: 38 cr.

A minimum GPA of 2.00 required for this set of courses (please note that transfer course grades will not be calculated into the Core Program GPA).

CHE 2020	Chemical Engineering Seminar	
CHE 2050	Chemical Engineering Progress Assessment	
CHE 2100	Material and Energy Balances	3
CHE 3100	Computational Methods in Chemical Engineering	3
CHE 3250	Chemical Engineering Laboratory I	2
CHE 3560	Transport Phenomena I	3
CHE 3570	Transport Phenomena II	3
CHE 3580	Separations	3
CHE 3810	Chemical Engineering Thermodynamics	3
CHE 3820	Chemical Reaction Engineering	3
CHE 4200	Chemical Process Safety	3
CHE 4210	Process Control	3
CHE 4260	Chemical Engineering Laboratory II	2
CHE 4290	Chemical Engineering Product Design	3
CHE 4300	Process and Plant Design	4
Total Credits		**38**

Other Remaining Courses: 21 cr. [2]

ENGL 2500	Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course)	3
One of the following Communication Electives:		3
ENGL 3090	Proposal and Report Writing (Must have a C or better in this course)	
ENGL 3120	Communicating Science and Public Engagement (Must have a C or better in this course)	
ENGL 3140	Technical Communication (Must have a C or better in this course)	
JLMC 3470	Science Communication (Must have a C or better in this course)	
Statistics Electives [2]		3
Chemical Engineering Electives [2]		6
Engineering Electives [2]		3

Professional Electives [2]	3
Total Credits	**21**

SEMINARS/CO-OPS/INTERNSHIPS:

Co-op/Internship is optional

1. These university requirements will add to the minimum credits of the program unless the university-approved courses are also approved by the department to meet other course requirements within the degree program. U.S. diversity and international perspectives courses may not be taken Pass/Not Pass.
2. Choose from department approved list (http://www.cbe.iastate.edu/current-students/guides-and-handbooks/).
3. See Basic Program for Engineering Curricula for accepted substitutions for curriculum designated courses in the Basic Program.
4. Students who substitute CHEM 2010/2010L credit for CHEM 1770/CHEM 1770L/CHEM 1780L credit cannot also receive credit for CHEM 1780. Credit for CHEM 1780 must be earned through an Advanced Chemistry Elective[2].

Note: Transfer students with transfer credits in chemical engineering core courses must earn at least 15 semester credits in ISU courses in this category at the 3000-level or above to qualify for the B.S. degree in chemical engineering.

Pass-Not Pass Policy

A maximum of nine Pass-Not Pass semester credits may be used to meet graduation requirements. Courses offered on a Satisfactory-Fail basis may not be taken on a Pass-Not Pass basis. Pass-Not Pass credits can be applied toward requirements for a B.S. degree in chemical engineering only if the course is specified in the curriculum as a social science and humanities elective or is a course not used in the degree program. Pass-Not Pass credits are not acceptable for technical elective courses or for courses used to satisfy the US diversity or international perspectives requirements.

See also: A 4-year plan of study grid showing course template by semester.

Chemical Engineering, B.S.

Freshman

Fall	Credits	Spring	Credits
CHE 1600	3	CHEM 1780	3
ENGR 1010	R	CHEM 1780L	1
CHEM 1770	4	MATH 1660	4
CHEM 1770L	1	PHYS 2310	4
MATH 1650	4	PHYS 2310L	1
ENGL 1500	3	SSH Elective*	3
LIB 1600	1		
	16		**16**

Sophomore

Fall	Credits	Spring	Credits
CHE 2020	R	CHE 3560	3
CHE 2050	R	CHEM 3250	3
CHE 2100	3	CHEM 3320	3
CHEM 3310	3	MATH 2670	4
MATH 2650	4	ENGL 2500	3
PHYS 2320	4		
PHYS 2320L	1		
	15		**16**

Junior

Fall	Credits	Spring	Credits
CHE 3100	3	CHE 3250	2
CHE 3570	3	CHE 3580	3
CHE 3810	3	CHE 3820	3
BBMB 3030	3	Engineering Elective*	3
Statistics Elective*	3	Communication Elective*	3
		SSH Elective*	3
	15		**17**

Senior

Fall	Credits	Spring	Credits
CHE 4200	3	CHE 4260	2
CHE 4210	3	CHE 4300	4
CHE 4290	3	CHE Elective*	3
CHE Elective*	3	Professional Elective*	3
SSH Elective*	3	SSH Elective*	3
		SSH Elective*	3
	15		**18**

* Choose from department approved list (http://www.cbe.iastate.edu/current-students/guides-and-handbooks/).

The Chemical and Biological Engineering Department offers well-qualified juniors and seniors in chemical engineering who are interested in graduate study the opportunity to apply for concurrent enrollment in the Graduate College to simultaneously pursue both the Bachelor of Science in Chemical Engineering and the Master of Engineering in Chemical Engineering.

For more information about concurrent undergraduate and graduate programs in Chemical Engineering visit: https://www.cbe.iastate.edu/prospective-students/bachelorsmasters-concurrent-degree-programs (https://www.cbe.iastate.edu/prospective-students/bachelorsmasters-concurrent-degree-programs/)/.

Graduate Study

The department offers work for the degrees Master of Science, Master of Engineering, and Doctor of Philosophy with major in chemical engineering, and minor work to students taking major work in other departments. Prerequisite to major graduate work is a bachelor's degree in chemical engineering, chemistry, or another related field. Students with undergraduate background other than chemical engineering should contact the department for further details. A thesis is required for the Master of Science degree. The Master of Science degree also requires a minimum of 30 graduate credits (minimum of 15 for coursework, 12 within CHE and 3 outside). The Master of Engineering requirements are the same for total credits but include a special project or coursework rather than research thesis. The Doctor of Philosophy degree requires a minimum of 72 graduate credits (minimum of 26 for coursework, at least 16 inside CHE). Candidates for the Doctor of Philosophy degree can refer to the department's home page and/or the department's Graduate Student Handbook for degree options and credit requirements.