CHEMICAL ENGINEERING

As has been done since we awarded the nation's first degree in chemical engineering in 1889, the undergraduate program in chemical engineering undertakes to prepare individuals for careers in the chemical process industries. These include all industries in which chemical and energy changes are an important part of the manufacturing process, such as the petroleum, rubber, plastics, synthetic fiber, pulp and paper, fermentation, soap and detergents, glass, ceramic, photographic and organic and inorganic chemical industries. In view of the dynamic nature of this technology, the course of study stresses fundamental principles rather than technical details. It prepares the student either for advanced study at the graduate level or for immediate entrance into industry. Opportunities in the process industries are found in a variety of activities, including design, development, management, production, research, technical marketing, technical service, or engineering.

Mission

The mission of the Department of Chemical Engineering at Rose-Hulman Institute of Technology is to provide an excellent chemical engineering education through a combination of theory and practice that prepares students for productive professional careers including postgraduate studies.

Requirements

Curriculum

The curriculum covers a breadth of fundamental principles so that the chemical engineering graduates have a working knowledge of advanced chemistry, material and energy balances applied to chemical processes; thermodynamics; heat, mass, and momentum transfer; chemical reaction engineering; separation operations, process design and control. The program provides students with appropriate modern experimental and computing techniques in unit operation laboratory and requires them to work in teams and submit written and oral reports on their laboratory projects. A capstone experience in senior year gives students an opportunity to integrate their knowledge. Also included is the study of health, safety, environmental and ethical issues in the chemical engineering profession.

Graduate work leading to the degrees of Master of Science in chemical engineering or Master of Chemical Engineering provides a more thorough understanding of the discipline and enhances a student's ability to handle complex problems. A thesis is required for the Master of Science degree, but not for the Master of Chemical Engineering degree. Most recent graduate students have chosen research topics in biotechnology, polymers, or automatic control, but other specialties also are possible.

The chemical engineering program is accredited by the Engineering Accreditation Commission of ABET, https://www.abet.org, under the commission's General Criteria and Program Criteria for Chemical, Biochemical, Biomolecular, and Similarly Named Engineering Programs.

Chemical Engineering

Depending on the students' schedules, elective courses may be taken in terms other than the ones designated.

Electives

Chemical Engineering students must complete 28 credits of electives in humanities and social sciences in addition to HUM H190 First-Year Writing Seminar and ENGL H290 Technical & Professional Communication. They are also required to take 24 credits of electives (8 credits of CHE electives, and 16 credits of free electives) in addition to the humanities and social sciences mentioned above. The courses listed below qualify as a CHE elective. In very specific circumstances, independent projects or other courses may qualify as a CHE elective if approved by the department.

Code	Title	Hours
CHE 310	Numerical Methods for Chemical Engineers	4
CHE 405	Introduction to MEMS: Fabrication & Applications	4
MDS 539	Advanced topics in MEMs	4
CHE 430	Petrochemical Processes	4
CHE 441	Polymer Engineering	4
CHE 460	Particle Technology	4
CHE 462	Membrane Separations	4
CHE 465	Energy and the Environment	4
CHE 470	Safety, Health, and Loss Prevention	4
CHE 502	Transport Phenomena	4
CHE 504	Advanced Reaction Engineering	4
CHE 513	Advanced Chemical Engineering Thermodynamics	4
CHE 515	Nanomaterials Science & Engineering	4
CHE 525	Process Analytics	4
CHE 530	Petrochemical Processes	4
CHE 540	Advanced Process Control	4
CHE 545	Introduction to Biochemical Engineering	4
CHE 546	Bioseparations	4
CHE 562	Advanced Wastewater Treatment	4
CHE 563	Advanced Water Treatment	4

Students are encouraged to use their electives to focus their studies in a particular subject area.

The chemical engineering profession is rapidly changing and knowledge of specialty areas has become essential in the real world. Technical elective courses are intended to provide an opportunity to introduce students to a specialty area in science and engineering and help them to expand their knowledge and expertise in new areas of chemical engineering. Although it is recommended that a minimum of eight credit hours be focused in one subject area, students are encouraged to focus most or all of the 24 credit hours of electives in a particular subject area. In many cases students can use their electives to take a package of courses toward an area minor such as biochemical engineering, chemistry, environmental engineering, modern languages, materials science and engineering, sustainability, toward a certificate in semiconductor materials and devices, or toward an area of concentration (see below).

Undergraduate students have the opportunity to work on a research project under the guidance of one of the departmental faculty members. Students who are interested in learning about research should talk to members of the faculty to define a project of mutual interest and then enroll in CHE 499 Directed Research, Directed Research. Credit hours of CHE 499 Directed Research can count toward an approved elective.

Areas of Concentration

Although it is not a requirement, students may pursue a concentration in one or more of the following areas. Students who complete the requirements of a concentration may receive, upon request, a letter from the Department Head that attests to the fact that the requirements

have been completed. With proper planning, a student should be able to complete the requirements for an area of concentration without overload.

Advanced Chemical Engineering Analysis

Students need to take CHE 502 Transport Phenomena and 3 additional courses from the list below. Other courses may be substituted only with prior approval by the Department Head. No more than two courses with a MA prefix may be applied towards the concentration.

Code	Title	Hours
CHE 310	Numerical Methods for Chemical Engineers	4
or MA 332	Introduction to Computational Science	
CHE 499	Directed Research	4
CHE 504	Advanced Reaction Engineering	4
CHE 513	Advanced Chemical Engineering Thermodynamics	4
MA 336	Boundary Value Problems	4
MA 371	Linear Algebra I	4
or MA 373	Applied Linear Algebra for Engineers	
MA 438	Advanced Engineering Mathematics	4
or MA 538	Advanced Engineering Mathematics	

Energy Production and Utilization

Students need to take 4 courses from the list below. Other courses may be substituted only with approval of the Department Head.

Code	Title	Hours
CHE 465	Energy and the Environment	4
CHE 430/530	Petrochemical Processes [1]	4
ECE 204	AC Circuits [2]	4
ECE 371	Conventional & Renewable Energy Systems [3]	4
ME 407	Power Plants	4
ME 408	Renewable Energy	4
ME 411	Propulsion Systems	4
ME 450	Combustion	4
PH 265	Fundamentals of Nuclear Physics & Radiation	4

1. At least one of these courses is required in order to earn the concentration.
2. PH 113 Physics III is a prerequisite.
3. PH 113 Physics III and ECE 204 AC Circuits are prerequisites.

Industrial and Process Engineering

Students need to take CHE 470 Safety, Health, and Loss Prevention, either CHE 540 Advanced Process Control or CHE 525 Process Analytics, 2 courses from the Statistics and Modeling list below, and 1 course from the Engineering Management Electives list below. Other courses may be substituted only with approval of the Department Head.

Statistics and Modeling

Code	Title	Hours
EMGT E445	Quality Methods	4
EMGT E446	Statistical Methods in Six Sigma	4
MA 487	Design of Experiments	4
MA 444	Deterministic Models in Operations Research	4

Engineering Management Electives

Code	Title	Hours
EMGT E524	Production/Operations Management	4
EMGT E527	Project Management	4
EMGT 562	Risk Analysis and Management	4
EMGT E581	Multi-Objective Optimization	4
EMGT E586	Supply Chain Management	4
EMGT E589	Manufacturing Systems	4

Plan of Study

Below is a sample plan of study that illustrates one way to achieve the program requirements. Any given student's plan of study may differ based on a variety of factors (e.g., advanced credit, placement exams, adding a minor). Enrolled students will work with their academic advisor; utilize the degree audit/planner to create a specific plan of study.

Course	Title	Hours
Freshman		
Fall		
CHEM 111	General Chemistry I	3
CHEM 111L	General Chemistry I Lab	1
RHIT 100	Foundations for Rose-Hulman Success	1
MA 111	Calculus I	5
HUM H190	First-Year Writing Seminar	4
CHE 101	Introduction to Chemical Engineering	2
	Hours	**16**
Winter		
CHEM 113	General Chemistry II	3
CHEM 113L	General Chemistry II Laboratory	1
MA 112	Calculus II	5
PH 111	Physics I	4
HSSA Elective		4
	Hours	**17**
Spring		
CHE 110	Excel for Chemical Engineers	2
CHEM 115	General Chemistry III	3
CHEM 115L	General Chemistry III Laboratory	1
MA 113	Calculus III	5
PH 112	Physics II	4
	Hours	**15**
Sophomore		
Fall		
CHE 201	Conservation Principles and Balances	4
CHEM 251	Organic Chemistry I	3
CHEM 251L	Organic Chemistry I Laboratory	1
MA 221	Matrix Algebra & Differential Equations I	4
HSSA Elective		4
	Hours	**16**
Winter		
CHE 202	Basic Chemical Process Calculations	4
CHEM 252	Organic Chemistry II	3
CHEM 252L	Organic Chemistry II Laboratory	1
MA 222	Matrix Algebra & Differential Equations II	4
HSSA Elective		4
	Hours	**16**
Spring		
CHE 301	Fluid Mechanics	4
CHE 303	Chemical Engineering Thermodynamics	4
MA 223	Engineering Statistics	4

HSSA Elective		4
	Hours	**16**
Junior		
Fall		
CHE 304	Multi-Component Thermodynamics	4
CHE 320	Fundamentals of Heat & Mass Transfer	4
CHE 315	Materials Science and Engineering	4
CHEM 225	Analytical Chemistry	3
CHEM 225L	Analytical Chemistry Laboratory	1
	Hours	**16**
Winter		
CHE 210	Programming for Chemical Engineers	2
CHE 321	Applications of Heat & Mass Transfer	4
CHEM 360	Introduction to Physical Chemistry for Engineers	4
CHE 340	Process Control	4
ENGL H290	Technical & Professional Communication	4
	Hours	**18**
Spring		
CHE 404	Reaction Engineering	4
CHE 409	Professional Practice	1
CHE 411	Chemical Engineering Laboratory I	3
Free Elective		2
Free Elective		4
	Hours	**14**
Senior		
Fall		
CHE 412	Chemical Engineering Laboratory II	4
CHE 416	Design I: Proc Econ & Equp Dsn	4
Free Elective		4
Elective (CHE)		4
	Hours	**16**
Winter		
CHE 413	Chemical Engineering Laboratory III	4
CHE 417	Design II: Proc Synth & Analys	4
Free Elective		4
HSSA Elective		4
	Hours	**16**
Spring		
CHE 418	Chemical Engineering Design III: Capstone Design Project	2
HSSA Elective		4
HSSA Elective		4
Free Elective		4
Elective (CHE)		4
	Hours	**18**
	Total Hours	**194**

Program Objectives
Program Educational Objectives

- Program Educational Objectives are broad statements that describe what graduates are expected to attain within a few years of graduation.
- Our graduates will attain a promotion and/or responsibilities beyond their entry-level position, or progress toward the completion of an advanced degree.
- Our graduates will continue to develop professionally.
- Our graduates will collaborate professionally within or outside of their organizations at a regional, national and/or international level.

Learning Outcomes
Student Outcomes

Student Outcomes are statements that describe what students are expected to have by the time of graduation.

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. An ability to 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. An ability to communicate effectively with a range of audiences
4. An ability to 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. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies