BACHELOR OF SCIENCE IN CHEMICAL ENGINEERING

Chemical engineering is concerned with the design, development, and management of facilities that convert raw materials into useful products. The engineer must assume responsibility for the economical use of the raw materials, preservation of the environment, and profitability of the operation. The chemical engineering program has been designed to provide both the engineering competence and the professional skills necessary to succeed in this endeavor. In order to achieve this objective, the curriculum incorporates coursework in both of these areas throughout the four-year duration of the program.

Coursework

The chemical engineering curriculum emphasizes basic knowledge and applications of transport processes, thermodynamics and kinetics of processes, automatic control, and design, as well as fundamental sciences, mathematics, and engineering sciences. Design experience is spread across the curriculum, beginning with the Introduction to the Profession courses. Equipment design is emphasized in courses such as Fluid Mechanics, Heat and Mass-Transfer Operations, Thermodynamics, and Chemical Reaction Engineering. Control-system design is practiced in the Process Control course. Process modeling, simulations, and optimization are discussed and practiced in Transport Phenomena, Process Modeling and System Theory, Numerical and Data Analysis, Statistical Tools for Engineering, and Process Control courses. The capstone design courses (Chemical Process Design I & II) integrate these design concepts and practice process design and optimization. In addition to engineering competence, the program also examines the economic, environmental, and societal implications of chemical engineering.

Professional Training

Professional training is stressed in the design of the chemical engineering curriculum. Because engineering is largely a team effort, the department develops the individual's ability to work effectively as a team member. Group projects are assigned starting with the Introduction to the Profession course. Laboratory course and capstone design course projects are conducted by teams of students. The laboratory work is designed to reinforce the concepts developed in the lectures and to show the application of chemical engineering principles to the solution of real-world problems.

Because individual attention is so important to the student's growth, laboratory sections are small and a high-level of personal contact between student and instructor is maintained. Students are encouraged to become involved with state-of-the-art research projects at the undergraduate level. The industry/university co-op program is available to students who would like to use one or more extra semesters any time after their second year to work on an internship in industry.

Specialized Programs

In addition to the core curriculum, special programs exist to accommodate students who want to develop more extensive background in related areas. With their exposure to a wide range of industrial applications and problems, students are better equipped to make a decision to explore an area of interest in depth. Professional specializations are available in:

- Bioengineering
- Energy/Environment/Economics (E3)
- Environmental Engineering
- Polymer Science and Engineering
- Process Design and Operation

Students may also choose a minor program. All students must include in their minor program, or as a technical elective, CHE 426 or at least one three credit hour engineering science course. Students who plan to go to graduate school are advised to take CHE 535 as a technical elective.

Required Courses

Code	Title	Credit Hours
Chemical Engineering Requirements		**(47)**
CHE 100	Introduction to the Profession I	2
CHE 101	Introduction to the Profession II	2
CHE 202	Material Energy Balances	3
CHE 239	Mathematical and Computational Methods	3
CHE 301	Fluid Mechanics	3
CHE 302	Heat and Mass Transfer Operations	3
CHE 311	Foundations of Biological Science for Engineering	3
CHE 317	Chemical and Biological Engineering Laboratory I	2

CHE 351	Thermodynamics I	3
CHE 406	Transport Phenomena	3
CHE 418	Chemical and Biological Engineering Laboratory II	2
CHE 423	Chemical Reaction Engineering	3
CHE 433	Process Modeling and System Theory	3
CHE 435	Process Control	3
CHE 451	Thermodynamics II	3
CHE 494	Process Design I	3
CHE 496	Process Design II	3
Mathematics Requirements		**(18)**
MATH 151	Calculus I	5
MATH 152	Calculus II	5
MATH 251	Multivariate and Vector Calculus	4
MATH 252	Introduction to Differential Equations	4
Physics Requirements		**(8)**
PHYS 123	General Physics I: Mechanics	4
PHYS 221	General Physics II: Electricity and Magnetism	4
Chemistry Requirements		**(18)**
CHEM 125	Principles of Chemistry II with Laboratory [1]	4
CHEM 237	Organic Chemistry I	4
CHEM 239	Organic Chemistry II	3
CHEM 343	Physical Chemistry I	3
CHEM 344	Physical Chemistry II	4
or BIOL 403	Biochemistry	
Computer Science Requirement		**(2)**
CS 104	Introduction to Computer Programming for Engineers	2
or CS 105	Introduction to Computer Programming	
Electrical and Computer Engineering Requirement		**(3-4)**
ECE 211	Circuit Analysis I	3-4
or ECE 218	Digital Systems	
Technical Electives		**(9)**
Select nine credit hours [2]		9
Humanities and Social Science Requirements		**(21)**
See Illinois Tech Core Curriculum, sections B and C		21
Interprofessional Projects (IPRO)		**(6)**
See Illinois Tech Core Curriculum, section E		6
Total Credit Hours		**132-133**

1 Initial placement in CHEM 125 requires consent of the chemistry department.
2 One technical elective must be CHE 426 or an engineering science elective (CHE 400+ level).

Bachelor of Science in Chemical Engineering Curriculum

			Year 1
Semester 1	**Credit Hours**	**Semester 2**	**Credit Hours**
CHE 100	2	CHE 101	2
MATH 151	5	MATH 152	5
CHEM 125[1]	4	PHYS 123	4
CS 104 or 105	2	Social Sciences Elective	3
Humanities 200-level Course	3	Humanities or Social Sciences Elective	3
	16		**17**

			Year 2
Semester 1	**Credit Hours**	**Semester 2**	**Credit Hours**
CHE 202	3	CHE 239	3
MATH 252	4	CHE 301	3
CHEM 237	4	MATH 251	4
PHYS 221	4	CHEM 239	3
Humanities Elective (300+)	3	CHEM 343	3
	18		**16**

			Year 3
Semester 1	**Credit Hours**	**Semester 2**	**Credit Hours**
CHE 302	3	CHE 317	2
CHE 311	3	CHE 433	3
CHE 351	3	CHE 451	3
ECE 211 or 218	3-4	CHEM 344 or BIOL 403	4
Humanities Elective (300+)	3	IPRO Elective I	3
		Technical Elective[2]	3
	15-16		**18**

			Year 4
Semester 1	**Credit Hours**	**Semester 2**	**Credit Hours**
CHE 418	2	CHE 406	3
CHE 423	3	CHE 496	3
CHE 435	3	IPRO Elective II	3
CHE 494	3	Technical Elective[2]	3
Technical Elective[2]	3	Social Sciences Elective (300+)	3
Social Sciences Elective (300+)	3		
	17		**15**

Total Credit Hours: 132-133

1 Initial placement in CHEM 125 requires the consent of the chemistry department.
2 One technical elective must be CHE 426 or an engineering science elective (CHE 400+ level).

This program is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology.

Professional Specializations

Students choosing one of the professional specializations should take a total of three courses in the specialization area.

Appropriate substitutions may be made with the approval of the program adviser.

Bioengineering

Program advisers: S. Parulekar and V. Pérez-Luna

Bioengineering has two career specializations:

Biomedical Engineering

Code	Title	Credit Hours
BIOL 107	General Biology Lectures	3
BIOL 115	Human Biology	3
Select one elective from the following:		3
BIOL 214	Genetics	3
or BIOL 414	Genetics for Engineering Scientists	
BIOL 401	Introductory Biochemistry	3
BIOL 430	Human Physiology	3
BIOL 445	Cell Biology	3
CHE 491	Undergraduate Research	1-6
CHE 577	Bioprocess Engineering	3

Biotechnology

Code	Title	Credit Hours
Select three electives from the following:		9
BIOL 107	General Biology Lectures	3
BIOL 214	Genetics	3
or BIOL 414	Genetics for Engineering Scientists	
BIOL 401	Introductory Biochemistry	3
BIOL 445	Cell Biology	3
CHE 577	Bioprocess Engineering	3

Energy/Environment/Economics (E3)

Program adviser: H. Arastoopour

Code	Title	Credit Hours
CHE 543	Energy, Environment, and Economics	3
Energy Sources, Conversion, Utilization, and Distribution		**(3)**
Select at least one course from the following:		3
CHE 465	Electrochemical Energy Conversion	3
CHE 467	Fuel Cell System Design	3
CHE 489	Fluidization	3
CHE 491	Undergraduate Research	1-6
CHE 541	Renewable Energy Technologies	3
CHE 542	Fluidization and Gas-Solids Flow Systems	3
CHE 565	Fundamentals of Electrochemistry	3
CHE 567	Fuel Cell Fundamentals	3
CHE 582	Interfacial and Colloidal Phenomena with Applications	3
ECE 319	Fundamentals of Power Engineering	4
ECE 411	Power Electronics	4
ECE 419	Power Systems Analysis with Laboratory	4
ECE 420	Analytical Methods for Power System Economics and Cybersecurity	3
ECE 438	Control Systems	3

MMAE 425	Direct Energy Conversion	3
MMAE 426	Nuclear, Fossil-Fuel, and Sustainable Energy Systems	3
MMAE 524	Fundamentals of Combustion	3
MMAE 525	Fundamentals of Heat Transfer	3
Energy and Environment, System Analysis, and Special Problems		**(3)**
Select at least one course from the following:		3
CHE 426	Statistical Tools for Engineers	3
ECE 491	Undergraduate Research	1-3
ECON 423	Economics of Capital Investments	3
ENVE 404	Water and Wastewater Engineering	3
ENVE 463	Introduction to Air Pollution Control	3
ENVE 485	Industrial Ecology	3
IPRO 497	Interprofessional Project (IPRO)	3
MMAE 491	Undergraduate Research	1-6
MMAE 494	Undergraduate Design Project	1-3
MMAE 497	Undergraduate Special Topics	1-6
PS 338	Energy Policy	3

Environmental Engineering

Program adviser: B. Stephens

Code	Title	Credit Hours
Environmental Engineering		**(3)**
Select at least one course from the following:		3
CHE 426	Statistical Tools for Engineers	3
ENVE 404	Water and Wastewater Engineering	3
ENVE 463	Introduction to Air Pollution Control	3
ENVE 485	Industrial Ecology	3
Civil Engineering		**(3)**
Select at least one course from the following:		3
CAE 421	Risk Assessment Engineering	3
CAE 482	Hydraulic Design of Open Channel Systems	3
IPRO 497	Interprofessional Project (IPRO)	3

Polymer Science and Engineering

Program advisers: J. Schieber and F. Teymour

The program embraces polymer chemistry, characterization, structure and properties, as well as the manufacture of polymeric raw materials and their processing into finished products.

Code	Title	Credit Hours
Select one course from the following:		3
CHE 470	Introduction to Polymer Science	3
CHEM 470	Introduction to Polymers	3
MMAE 470	Introduction to Polymer Science	3
Select at least one course from the following:		3
CHE 538	Polymerization Reaction Engineering	3
CHE 555	Polymer Processing	3
CHE 575	Polymer Rheology	3
CHEM 535	Polymer Synthesis	3
CHEM 537	Polymer Chemistry Laboratory	3
CHEM 542	Polymer Characterization and Analysis	3
MMAE 579	Advanced Materials Processing	3
Students may take up to one of the following courses:		3

CHE 426	Statistical Tools for Engineers	3
CHE 489	Fluidization	3
CHE 491	Undergraduate Research	1-6
CHE 582	Interfacial and Colloidal Phenomena with Applications	3
MMAE 451	Finite Element Methods in Engineering	3
MMAE 485	Manufacturing Processes	3

Process Design and Operation

Program adviser: D. Chmielewski

For students interested in design, operation, monitoring, optimization, and control of chemical processes.

Code	Title	Credit Hours
Select at least one course from the following:		3
CHE 426	Statistical Tools for Engineers	3
CHE 508	Process Design Optimization	3
CHE 530	Advanced Process Control	3
CHE 560	Statistical Quality and Process Control	3
Select at least one course from the following: [1]		3
CHE 465	Electrochemical Energy Conversion	3
CHE 489	Fluidization	3
CHE 491	Undergraduate Research	1-6
ENVE 463	Introduction to Air Pollution Control	3
ENVE 476	Engineering Control of Industrial Hazards	3
ENVE 485	Industrial Ecology	3
ENVE 578	Physical and Chemical Processes for Industrial Gas Cleaning	3
ENVE 580	Hazardous Waste Engineering	3

[1] Only one course selection may be an ENVE course.