CHEMICAL ENGINEERING (B.S.)

Chemical engineering applies the sciences of chemistry, biology, physics and mathematics in a synergistic way to develop new or improved technologies, products and processes for the benefit of mankind. The chemical engineering B.S. degree provides a strong technical background, from which graduates may enter into professional careers in fields such as petrochemical processing, energy, pharmaceuticals, medical devices, advanced materials, semiconductor processing, biotechnology, environmental control, natural and synthetic rubbers and plastics, surface coatings, food processing, cosmetics, and consumer products. Many chemical engineering undergraduates continue their studies in graduate programs (M.S. or Ph.D.) in chemical engineering, or in related disciplines such as materials science and biomedical engineering, in preparation for careers in research and development. Chemical engineering also provides excellent undergraduate preparation for professional programs in medicine (M.D.), law (J.D.), and business (M.B.A.).

The undergraduate program in chemical engineering includes studies in chemistry, mathematics, and physics, as well as an understanding of physical, biological and chemical systems and processes. Engineering science courses cover material and energy balances, transport phenomena, thermodynamics, reaction kinetics, separation processes, and dynamics, simulation, and control of systems and processes.

Admission Requirements

Admission is contingent upon satisfaction of the general undergraduate admission requirements of the University (http://bulletins.wayne.edu/undergraduate/general-information/admission/) and the bachelor of science programs in the College of Engineering (http://bulletins.wayne.edu/undergraduate/college-engineering/bs/).

Mission Statement

As an urban research university, our mission is to discover, examine, transmit, and apply knowledge that contributes to the positive development and well-being of individuals, organizations, and society. Wayne State University is a national research institution dedicated to preparing students to excel in an increasingly advanced and interconnected, global society.

Program Educational Objectives

1. The overall objective of the BS CHE program at Wayne State University is to prepare students for a) success in their immediate and long-term careers as practicing chemical engineers; and b) success in continuing education in graduate and professional schools.

2. The program supports the university's urban mission by promoting diversity and encouraging disadvantaged and nontraditional students to enter the engineering profession.

3. We utilize our faculty's strengths in research to enrich undergraduate education through: a) individual undergraduate research experiences; and b) we engage in educational partnerships with our industrial constituents in southeastern Michigan through an active undergraduate coop program.

Student Outcomes

The Student Outcomes are described below, and the contribution of each Program Outcome to the ABET Criterion 3, components 1-7 is explained. ABET Criterion 3 1-7 can be found at: https://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting-engineering-programs-2020-2021/

1. **Chemistry.** Graduates of the BS CHE program will possess a strong grounding in Chemistry, together with a working knowledge of organic chemistry and materials science. Graduates will possess a working knowledge of either physical chemistry or biochemistry, depending on their choice of Curriculum Options. Contributes to the Science portion of Criterion 3 component (1).

2. **Math and Science.** Graduates of the BS CHE program will possess a working knowledge of mathematics, including calculus through differential equations, and they will be able to apply modern mathematical and computational techniques to the solution of engineering problems. Graduates will be well grounded in physics. Contributes to the Math and Science parts of Criterion 3, component (1).

3. **Chemical Engineering Fundamentals.** Graduates of the BS CHE program will possess a working knowledge of material and energy balances applied to chemical processes; thermodynamics of physical and chemical equilibrium; fluid flow and heat transfer; chemical reaction kinetics and reaction engineering; mass transfer and separation processes, and they will be able to apply this knowledge to identify, formulate, and solve engineering problems. Contributes to Criterion 3, components (1) and (7).

4. **Chemical Process Engineering.** Graduates of the BS CHE program will possess a working knowledge of process dynamics and control and product and process design. Contributes to the Engineering part of Criterion 3, component (1). Contributes intensively to Criterion 3, components (2), (4), and (6) through the design project in CHE 4200 (Product and Process Design).

5. **Design Experience.** Graduates of the BS CHE program will develop skills in engineering design via content throughout the curriculum that includes identification, formulation, and solution of open-ended problems, scale-up concepts, consideration of safety and environmental issues, and understanding of economic factors. Contributes to the engineering part of Criterion 3, component (1). Contributes intensively to Criterion 3, components (2), (3), (4), (5), and (7) through the capstone design projects in CHE 4200 (Product and Process Design) and CHE 4800 (Chemical Process Integration) .

6. **Laboratory Experience.** Graduates of the BS CHE program will develop experimental skills via laboratory experiences relevant to chemical engineering principles, covering design of appropriate experiments for measurement of engineering properties and process variables, the analysis and interpretation of data, written and oral presentation of results, and teamwork skills including project management and multidisciplinary team functions. Contributes broadly to Criterion 3, component (1). Contributes intensively to Criterion 3, components (5), (6), and (7)

7. **Advanced Technical Knowledge.** Graduates of the BS CHE program will develop in-depth knowledge of an advanced area of chemical engineering through a variety of technical elective course options. Contributes to Criterion 3, component (1).

8. **Communication Skills.** Graduates of the BS CHE program will be able to communicate effectively in oral presentations, electronic communications, and written technical reports. Contributes to Criterion 3, component (3).

9. **Professionalism.** The BS CHE program will develop awareness in staying current with the changing chemical engineering profession through lifelong learning and continuing professional development. The BS CHE program will foster the development of professional conduct

through awareness of the importance of ethics, safety, environmental issues, and sustainability to the practice of chemical engineering. Contributes to Criterion 3, components (4), and (7).

Candidates for the Bachelor of Science degree must complete 124-125 credits of coursework, including the University General Education (http://bulletins.wayne.edu/undergraduate/general-information/general-education/) requirements. Forty-eight credits of coursework must be in engineering sciences or engineering design. All course work must be completed in accordance with the academic procedures of the University (http://bulletins.wayne.edu/undergraduate/general-information/) and the College of Engineering (http://bulletins.wayne.edu/undergraduate/college-engineering/academic-regulations/) governing undergraduate scholarship and degrees. Non-engineering entries, cited below by subject rather than individual course number, indicate courses to be selected in fulfillment of the University General Education Requirements. Degree requirements shown in the curricula below are in effect as of the publication date of this Bulletin. Students should consult their advisors for verification of current requirements.

First Year

First Semester		**Credits**
BE 1200	Basic Engineering I: Design in Engineering	3
MAT 2010	Calculus I	4
CHM 1125	General Chemistry I for Engineers	3
CHM 1130	General Chemistry I Laboratory	1
ENG 1020	Introductory College Writing	3
(WE) Wayne Experience		1
	Credits	**15**
Second Semester		
BE 1500	Introduction to Programmin and Computatior for Engineers	3
MAT 2020	Calculus II	4
CHM 1240	Organic Chemistry I	4
CHM 1250	Organic Chemistry I Laboratory	1
PHY 2175	University Physics for Engineers I	4
	Credits	**16**

Second Year

First Semester		
BE 1300	Basic Engineering II: Materials Science for Engineering Applications	3
BE 1310	Materials Science for Engineering: Laboratory	1
MAT 2030	Calculus III	4
CHE 2800	Material and Energy Balances	4
CHM 2225	Organic Chemistry II for Engineers	3
	Credits	**15**
Second Semester		
MAT 2150	Differential Equations and Matrix Algebra	4
PHY 2185	University Physics for Engineers II	4
CHE 3300	Thermodyna Chemical Equilibria	4
(SI) Social Inquiry		3
	Credits	**15**

Third Year

First Semester		
CHE 3100	Transport Phenomena I	3
CHE 3400	Kinetics and Reactor Design	4
BE 2100	Basic Engineering III: Probability and Statistics in Engineering	3
ENG 3050	Technical Communicat I: Reports	3
PHI 1120	Professional Ethics	3
	Credits	**16**
Second Semester		
CHE 3220	Measurements Laboratory	2
CHE 3600	Transport Phenomena II	3
CHE 3800	Separation Processes	3
CHE 4260	Chemical Engineering Seminar I	0
CHM 5440	Physical Chemistry II	4
ENG 3060	Technical Communicat II: Presentatior	3
	Credits	**15**

Fourth Year

First Semester		
CHE 3820	Chemical Engineering Laboratory	2
CHE 4200	Product and Process Design	3

CHE 4600	Process Dynamics and Simulation	3
CHE 4860	Chemical Engineering Seminar II	1
Chemical Engineering Technical Elective		2-3
(CIV) Civic Literacy		3
	Credits	**14-15**
Second Semester		
CHE 4800	Chemical Process Integration	3
CHE 6570	Safety in the Chemical Process Industry	3
Chemical Engineering Technical Electives		6
(GL) Global Learning		3
(DEI) Diversity, Equity and Inclusion		3
	Credits	**18**
	Total Credits	**124-125**

[1] Elect either CHM 5440 and 8 Technical Elective Credits, or CHM 5600 and 9 Technical Elective Credits.

Technical Electives for Chemical Engineering

- Chemical Engineering students are required to complete 8 or 9 credits from the list below, or other courses with the approval of the undergraduate program coordinator.
- Combination of BE 1050 and BE 3510 may be counted as technical elective credit; BE 1050 must be completed first in the sequence
- A maximum of 2 credits of BE 3510 can be taken as technical electives
- No more than 1 credit per semester of BE 3510

Code	Title	Credits
CHE 4990	Directed Study	1-3
CHE 5050	Statistics and Design of Experiments	3
CHE 5100	Quantitative Physiology	4
CHE 5110	Fundamental Fuel Cell Systems	4
CHE 5120	Fundamentals of Battery Systems for Electric and Hybrid Vehicles	4
CHE 5350	Polymer Science	3
CHE 5360	Polymer Processing	3
CHE 5995	Special Topics in Chemical Engineering I	1-4
CHE 5996	Chemical Engineering Research	1-3
CHE 6100	Introduction to Sustainable Engineering	3
CHE 6450	Biochemical Engineering	3
CHE 6610	Risk Assessment	3
MSE 5650	Surface Science	3
BME 5370	Introduction to Biomaterials	4
ESG 5510	Environmental Fate and Transport of Pollutants	4
IE 6560	Deterministic Optimization	3
IE 6611	Fundamentals of Six Sigma	3
IE 6310	Lean Operations and Manufacturing	3
IE 6840	Project Management	3
CHM 6240	Organic Spectroscopy	3
PHY 6450	Introduction to Material and Device Characterizations	4
BE 1050	Career Readiness for Engineering Students	1
BE 3510	Co-Op Experience	1