

# BACHELOR OF ENGINEERING IN CHEMICAL ENGINEERING

## Introduction

The Chemical Engineering Program at Youngstown State University—supplemented with courses in chemistry, physics, mathematics, and general engineering—provides a broad preparation for design, operation, and management in the chemical, biomedical, biological, nuclear, pharmaceutical, and energy-conversion industries, as well as graduate study leading to research positions in industry and government and to academic careers.

## Program Contact Information

Dr. Holly J. Martin - Associate Professor and Program Coordinator  
(330) 941-3022  
hjmartin02@ysu.edu

Dr. Byung-Wook Park - Assistant Professor  
(330) 941-3088  
bwpark@ysu.edu

Dr. Shirley Xie - Lecturer  
(330) 941-3019  
zxie01@ysu.edu

## Program Educational Objectives

Graduates of the chemical engineering program at YSU:

- Pursue careers as practicing chemical engineers in chemical and energy-related industries as well as in areas of materials, environmental, and biomedical engineering and biotechnology.
- Demonstrate strong, functional command of chemical engineering fundamentals and hold safety as paramount in the operation and design of chemical processes.
- Are aware of the scope of the chemical engineering profession and its global opportunities and requirements.
- Exhibit professional responsibility and a sensitivity to a broad range of societal concerns including ethical, environmental, political, regulatory, and global issues in making decisions.

## Mission

The mission of the Chemical Engineering program is to:

1. Offer a wide variety of electives to students according to the global trend in chemical engineering
2. Provide real world experiences to students through laboratory study and capstone experiences
3. Conduct research with faculty in the areas commonly associated with traditional chemical engineering disciplines and their impact on the local and global environment
4. Participate in interdisciplinary programs.

## Admission into the Program

To be admitted into the program, students are required to have an overall GPA of 2.3 and a grade of "C" or higher in CHEM 1515/L, MATH 1571, and ENGL 1550. Students can only repeat these courses one time.

## Graduation Policy

In addition to the overall recalculated "C" average required by the University, an unrecalculated "C" average in the major is required. Also, an unrecalculated "C" average in all engineering courses is required.

## Student Outcomes

The curriculum is structured to achieve the following outcomes as prescribed by ABET:

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

## Accreditation

The Chemical Engineering BE program has been accredited by 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.

## Co-Operative Education and Internships

The Chemical Engineering Program encourages all of its students to participate in co-ops and internships prior to graduation. Students should register with the STEM Office of Professional Practice in order to participate.

## Facilities

The chemical engineering laboratories are well-equipped for undergraduate instruction and student and faculty research. The equipment includes fluid flow apparatus, concentric tube and plate and frame heat exchangers, thermal conductivity apparatus, boiling heat transfer apparatus, tray dryer, double effect evaporator, computer-controlled distillation tower, gas absorption and liquid-liquid extraction columns, chemical reactors, electrostatic particle separator, centrifuges, filter presses, and other miscellaneous equipment.

For more information, contact Holly J. Martin, Program Coordinator.

COURSE	TITLE	S.H.
FIRST YEAR REQUIREMENT -STUDENT SUCCESS		
YSU 1500	Success Seminar	1-2
or YSU 1500S	Youngstown State University Success Seminar	
or HONR 1500	Intro to Honors	
<b>General Education Requirements</b>		
ENGL 1550	Writing 1	3-4
or ENGL 1549	Writing 1 with Support	
ENGL 1551	Writing 2	3
Mathematics requirement (met with MATH in major)		
Select one Arts and Humanities:		
PHIL 1561	Technology and Human Values	
PHIL 2625	Introduction to Professional Ethics	
PHIL 2628	Business Ethics	
Arts and Humanities (Select 1 course)		
Natural Science (met with CHEM and PHYS required for major)		
Social Sciences (6 s.h. Select 2 courses)		

General Education Electives (9 s.h.)		CHEM 3720	Organic Chemistry 2	3	
CMST 1545	Communication Foundations	3	CHEM 3720L	Organic Chemistry 2 Laboratory	1
General Education Electives (6 s.h. Select 2 courses)		6	CHEM 3720R	Organic Chemistry Recitation 2	1
<b>General Engineering Courses</b>					
ENGR 1500	Engineering Orientation	1	CHEM 3739	Physical Chemistry 1	3
ENGR 1550	Engineering Concepts	2	<b>Physics Courses</b>		
ENGR 1560	Engineering Computing	2	PHYS 2610	General Physics 1	4
<b>Chemical Engineering Courses</b>			PHYS 2611	General Physics 2	4
CHEN 2650	Computer Methods in Chemical Engineering	2	<b>Regulatory Safety (choose one of the following)</b>		2-3
CHEN 2683	Chemical Engineering Principles 1	3	CHEN 4860	Chemical Engineering Process Safety Management	
CHEN 2684	Chemical Engineering Principles 2	3	ENST 5810	Environmental Safety	
CHEN 3771	Chemical Engineering Thermodynamics 1	3	ENST 5860	Environmental Regulations	
CHEN 5800A	Special Topics Thermo Dynamics Lab	1	<b>Total Semester Hours</b>		<b>128-131</b>
CHEN 3785L	Transport Phenomena Laboratory	1	<b>Year 1</b>		
CHEN 3786	Transport Phenomena 1	4	<b>Fall</b>		
CHEN 3787	Transport Phenomena 2/Unit Operations 1	3	YSU 1500	Success Seminar	1-2
CHEN 3787L	Unit Operations Laboratory 1	1	or YSU 1500S	or Youngstown State University Success Seminar	
CHEN 4815	Unit Operations 2	3	or HONR 1500	or Intro to Honors	
CHEN 4815R	Unit Operations 2 Applications	1	ENGL 1550	Writing 1	3-4
CHEN 4815L	Unit Operations Laboratory 2	1	or ENGL 1549	or Writing 1 with Support	
CHEN 4880	Chemical Reactor Design 1	3	ENGR 1500	Engineering Orientation	1
CHEN 4880R	Reactor Design Applications	1	ENGR 1550	Engineering Concepts	2
CHEN 4882	Process Dynamics	3	CHEM 1515	General Chemistry 1	3
CHEN 4887	Process and Plant Design 1	3	CHEM 1515L	General Chemistry 1 Laboratory	1
CHEN 4888	Process and Plant Design 2	3	MATH 1571	Calculus 1	4
Chemical Engineering Electives (select two courses from the following)		6	GER AH-1	Arts and Humanities Elective	3
STEM 4890	STEM Internship		<b>Semester Hours</b>		<b>18-20</b>
CHEN 2688	Energy Assessment		<b>Spring</b>		
CHEN 3700	Measurements and Instrumentation		ENGL 1551	Writing 2	3
CHEN 4801	Chemical Engineering Projects		GER GE-1	CMST 1545 Communication Foundations	3
CHEN 4840	Biochemical Engineering Fundamentals		ENGR 1560	Engineering Computing	2
CHEN 5800	Special Topics		CHEM 1516	General Chemistry 2	3
CHEN 5800I	Special Topics Green Engineering		CHEM 1516L	General Chemistry 2 Laboratory	1
CHEN 5805	Principles of Biomedical Engineering		MATH 1572	Calculus 2	4
CHEN 5811	Advanced Transport Phenomena		<b>Semester Hours</b>		<b>16</b>
CHEN 5820	Industrial Pollution Control		<b>Year 2</b>		
CHEN 5821	Fundamentals of Polymer Science		<b>Fall</b>		
CHEN 5845	Corrosion Engineering		CHEM 3719	Organic Chemistry 1	3
CHEN 5850	Industrial Processes		CHEM 3719L	Organic Chemistry 1 Laboratory	1
CHEN 5883	Mathematical Methods in Chemical Engineering		CHEM 3719R	Organic Chemistry Recitation 1	1
CHEN 6981	Advanced Chemical Reaction Engineering		MATH 2673	Calculus 3	4
<b>Mathematics/Statistics Courses</b>			PHYS 2610	General Physics 1	4
MATH 1571	Calculus 1	4	CHEN 2683	Chemical Engineering Principles 1	3
MATH 1572	Calculus 2	4	CHEN 2650	Computer Methods in Chemical Engineering	2
MATH 2673	Calculus 3	4	<b>Semester Hours</b>		<b>18</b>
Accelerated Honors Calculus 1 and 2 can be substituted for Calculus 1, 2, and 3					
MATH 3705	Differential Equations	3	<b>Spring</b>		
STAT 3743	Probability and Statistics	4	CHEM 3720	Organic Chemistry 2	3
<b>Chemistry Courses</b>					
CHEM 1515	General Chemistry 1	3	CHEM 3720L	Organic Chemistry 2 Laboratory	1
CHEM 1515L	General Chemistry 1 Laboratory	1	CHEM 3720R	Organic Chemistry Recitation 2	1
CHEM 1516	General Chemistry 2	3	MATH 3705	Differential Equations	3
CHEM 1516L	General Chemistry 2 Laboratory	1	PHYS 2611	General Physics 2	4
CHEM 3719	Organic Chemistry 1	3	CHEN 2684	Chemical Engineering Principles 2	3
CHEM 3719L	Organic Chemistry 1 Laboratory	1	<b>Semester Hours</b>		<b>15</b>
CHEM 3719R	Organic Chemistry Recitation 1	1	<b>Year 3</b>		
<b>Fall</b>					
CHEM 3739	Physical Chemistry 1	3	<b>Fall</b>		
<b>Year 3</b>					
<b>Fall</b>					
CHEM 3739	Physical Chemistry 1	3	<b>Year 3</b>		

STAT 3743	Probability and Statistics	4
CHEN 3771	Chemical Engineering Thermodynamics 1	3
CHEN 5800A	Special Topics Thermo Dynamics Lab	1
CHEN 3786	Transport Phenomena 1	4
<b>Semester Hours</b>		<b>15</b>

**Spring**

GER SS-1 Social Science Elective		3
GER GE-2 General Education Elective		3
Regulatory Safety Course <sup>3</sup>		2-3
CHEN 3787	Transport Phenomena 2/Unit Operations 1	3
CHEN 4880	Chemical Reactor Design 1	3
CHEN 4880R	Reactor Design Applications	1
CHEN 3785L	Transport Phenomena Laboratory	1
<b>Semester Hours</b>		<b>16-17</b>

**Year 4**
**Fall**

GER AH-2 Arts and Humanities Elective: Ethics <sup>1</sup>		3
CHEN 3787L	Unit Operations Laboratory 1	1
CHEN 4815	Unit Operations 2	3
CHEN 4815R	Unit Operations 2 Applications	1
CHEN 4887	Process and Plant Design 1	3
CHEN Elective-1 Chemical Engineering Elective <sup>2</sup>		3
<b>Semester Hours</b>		<b>14</b>

**Spring**

GER SS-2 Social Science Elective		3
GER GE-3 General Education Elective		3
CHEN 4815L	Unit Operations Laboratory 2	1
CHEN 4882	Process Dynamics	3
CHEN 4888	Process and Plant Design 2	3
CHEN Elective-2 Chemical Engineering Elective <sup>2</sup>		3
<b>Semester Hours</b>		<b>16</b>

**Total Semester Hours 128-131**

Note: Transfer students from any two- or four-year academic program at other institutions or at this University who wish to pursue studies in chemical engineering should consult with the program coordinator for individual counseling to develop a program of study that fully uses their educational background and requires a minimum of time to satisfy the requirements for the degree of Bachelor of Engineering in chemical engineering.

COURSE	TITLE	S.H.
<b>1. Ethics Elective</b>		<b>3</b>
Select one of the following:		
PHIL 1561	Technology and Human Values	
PHIL 2625	Introduction to Professional Ethics	
PHIL 2626	Engineering Ethics	
PHIL 2628	Business Ethics	
Select one course from the following:		
<b>2. Chemical Engineering Elective</b>		<b>6</b>
Select 2 courses from the following:		
STEM 4890	STEM Internship	
CHEN 2688	Energy Assessment	
CHEN 3700	Measurements and Instrumentation	
CHEN 4801	Chemical Engineering Projects	
CHEN 4840	Biochemical Engineering Fundamentals	
CHEN 5800	Special Topics	
CHEN 5800I	Special Topics Green Engineering	
CHEN 5805	Principles of Biomedical Engineering	

CHEN 5811	Advanced Transport Phenomena
CHEN 5820	Industrial Pollution Control
CHEN 5821	Fundamentals of Polymer Science
CHEN 5845	Corrosion Engineering
CHEN 5850	Industrial Processes
CHEN 5883	Mathematical Methods in Chemical Engineering
CHEN 6981	Advanced Chemical Reaction Engineering
Other courses may be used at the discretion of the program coordinator	

**3. Regulatory Safety Course**

Choose one of the following:	
CHEN 4860	Chemical Engineering Process Safety Management
ENST 5810	Environmental Safety
ENST 5860	Environmental Regulations

## Student Outcomes

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