

# B.S. IN CHEMICAL ENGINEERING

## Overview

Chemical engineering is a discipline that focuses on discovery, design and manufacturing of wide range of products spanning multiple industrial sectors-chemicals, foods, sustainable energy, consumer goods, pharma, nanotechnology, health and life sciences. The curriculum covers fundamental engineering subjects of thermodynamics, fluid mechanics, heat and mass transfer, and the sciences-chemistry, biology, mathematics, and physics. Relevant components of other engineering disciplines like materials science, computer science, and biomedical, mechanical, electrical, and civil engineering also are integrated into the curriculum. The discipline sits at a unique interface between molecular sciences and engineering. Chemical engineers find employment in industry, government, consulting and education.

The BS in Chemical Engineering is a unique and modern undergraduate program that builds upon the strong fundamental multidisciplinary nature of chemical engineering through combining core chemical engineering fundamentals in thermodynamics, process analysis, fluid mechanics and heat and mass transfer with concentrations in evolving industrial sectors such as sustainable energy, aerosols, nanotechnology, advanced materials, environmental engineering and pre-med.

## Curriculum Requirements

Code	Title	Credit Hours
<b>MAJOR REQUIREMENTS</b>		
<b>Engineering Courses</b>		
Select two courses from the following:		6
EGN 110	Innovation and Entrepreneurship in Engineering	
EGN 114	Global Challenges Addressed by Engineering and Technology	
EGN 123	Computing and Digital Solutions for the future	
CET 200	Engineering Analysis of Chemical, Environmental, and Materials Systems	3
CET 330	Fluid Mechanics	3
CET 350	Chemical Reaction Engineering Kinetics	3
CET 351	Mass Transfer Operations	3
CET 403	Senior Design Project I - Engineering Design <sup>1</sup>	3
CET 404	Senior Design Project II – Integrated Engineering Documents <sup>1</sup>	3
CET 450	Process Dynamics and Control	3
CET 455	Unit Operations Laboratory	1
ECE 118	Introduction to Programming	3
CAE 210	Mechanics of Solids I	3
MAE 301	Engineering Materials Science	3
MAE 303	Thermodynamics	3
MAE 310	Heat Transfer	3
ISE 351	Safety and Ethics in Engineering	3
ISE 380	Engineering Economic Analysis	3
<b>Technical Electives</b>		<b>6</b>
<b>Optional Concentration (or Additional Electives)</b>		<b>9</b>
Pre-Med Concentration (all 16 credits are required)		
CHM 205	Chemical Dynamics Laboratory	
CHM 206	Organic Reactions and Synthesis Laboratory	
BMB 401	Biochemistry for the Biomedical Sciences	
CHM 222	Organic Reactions and Synthesis	
BIL 160	Evolution and Biodiversity	
BIL 161	Evolution and Biodiversity Laboratory	
Aerosol Science and Nanoparticle Technology Concentration (choose from the courses below)(9 credits required)		
CET 560	Aerosol Science and Technology	
ECE 543	BioNanotechnology	
BME 522	Scanning Electron Microscopy for Engineers	
ATM 534	Introduction to Atmospheric Chemistry	

<b>Sustainable Energy Concentration (choose from the courses below)(9 credits required)</b>		
CET 580	Affordable and Sustainable Batteris	
EGN 232		
CAE 381	Building Mechanical Systems I: Hvac Fundamentals	
CAE 481	Building Mechanical Systems II: HVAC Systems	
MAE 510	Fundamentals of Solar Energy Utilization	
MAE 528	Fuel Cells	
MAE 540	Energy Conversion	
<b>Advanced Materials Concentration (choose from the courses below)(9 credits required)</b>		
CET 570	Soft Matter Colloids	
CET 571	Chemical Product Design	
BME 335	Biomaterials	
BME 535	Advanced Biomaterials	
MAE 516	Introduction to Composite Materials	
MAE 531	Scientific and Engineering Foundations of Additive Manufacturing	
MAE 532	Additive Manufacturing of Engineering Materials	
ECE 506	Microfabrication	
<b>Environmental Engineering Concentration (choose from the courses below)(9 credits required)</b>		
CET 340	Introduction to Environmental Engineering	
CET 345	Environmental Laboratory and Analysis	
CET 430	Water-Resources Engineering I	
CET 440	Water Quality Control Systems	
CET 530	Water Resources Engineering II	
CET 533	Water-Quality Control in Natural Systems	
CET 540	Environmental Chemistry	
CET 541	Environmental Engineering Microbiology	
CET 543	Air Pollution Control Engineering	
<b>Math and Science Courses</b>		
ISE 311	Applied Probability and Statistics	3
MTH 151	Calculus I for Engineers	5
MTH 162	Calculus II	4
Select one from the following two		3
EGN 319	Engineering Mathematics II	
MTH 311	Introduction to Ordinary Differential Equations	
BIL 150 & BIL 151	General Biology and General Biology Laboratory	5
CHM 121	Principles of Chemistry	4
CHM 113	Chemistry Laboratory I	1
CHM 221	Introduction to Structure and Dynamics	4
PHY 221	University Physics I	3
PHY 222	University Physics II	3
PHY 224	University Physics II Lab	1
<b>GENERAL EDUCATION REQUIREMENTS</b>		
<b>Written Communication Skills:</b>		
WRS 105	First-Year Writing I	3
WRS 107	First-Year Writing II: STEM	3
<b>Quantitative Skills (3 credits) (fulfilled thru MTH 151)</b>		
<b>Areas of Knowledge:</b>		
Arts and Humanities Cognate		9
People and Society Cognate		9
STEM Cognate (9 credits) (fulfilled through the major)		
<b>Total Credit Hours</b>		<b>124</b>

<sup>1</sup> These courses fulfill the Advanced Writing and Communication Skills requirement for the BSCE degree.

## Plan of Study

<b>Freshman Year</b>		
<b>Fall</b>		<b>Credit Hours</b>
EGN 114	Global Challenges Addressed by Engineering and Technology	3
MTH 151	Calculus I for Engineers	5
PHY 221	University Physics I	3
WRS 105	First-Year Writing I	3
		<b>Credit Hours</b>
		<b>14</b>
<b>Spring</b>		
EGN 123	Computing and Digital Solutions for the future	3
MTH 162	Calculus II	4
PHY 222	University Physics II	3
PHY 224	University Physics II Lab	1
WRS 107	First-Year Writing II: STEM	3
PS Cognate		3
		<b>Credit Hours</b>
		<b>17</b>
<b>Sophomore Year</b>		
<b>Fall</b>		
CET 200	Engineering Analysis of Chemical, Environmental, and Materials Systems	3
EGN 319 or MTH 311	Engineering Mathematics II or Introduction to Ordinary Differential Equations	3
ECE 118	Introduction to Programming	3
CAE 210	Mechanics of Solids I	3
CHM 121	Principles of Chemistry	4
CHM 113	Chemistry Laboratory I	1
		<b>Credit Hours</b>
		<b>17</b>
<b>Spring</b>		
CET 330	Fluid Mechanics	3
BIL 150	General Biology	4
BIL 151	General Biology Laboratory	1
CHM 221	Introduction to Structure and Dynamics	4
MAE 303	Thermodynamics	3
		<b>Credit Hours</b>
		<b>15</b>
<b>Junior Year</b>		
<b>Fall</b>		
CET 450	Process Dynamics and Control	3
MAE 301	Engineering Materials Science	3
MAE 310	Heat Transfer	3
ISE 311	Applied Probability and Statistics	3
AH Cognate		3
		<b>Credit Hours</b>
		<b>15</b>
<b>Spring</b>		
CET 350	Chemical Reaction Engineering Kinetics	3
TECHNICAL ELECTIVE 1		3
CONCENTRATION ELECTIVE 1		3
AH Cognate		3
PS Cognate		3
		<b>Credit Hours</b>
		<b>15</b>

<b>Senior Year</b>		
<b>Fall</b>		
CET 351	Mass Transfer Operations	3
CET 403	Senior Design Project I - Engineering Design	3
CET 455	Unit Operations Laboratory	1
ISE 380	Engineering Economic Analysis	3
ISE 351	Safety and Ethics in Engineering	3
CONCENTRATION ELECTIVE 2		3
<b>Credit Hours</b>		<b>16</b>
<b>Spring</b>		
CET 404	Senior Design Project II – Integrated Engineering Documents	3
TECHNICAL ELECTIVE 2		3
CONCENTRATION ELECTIVE 3		3
AH Cognate		3
PS Cognate		3
<b>Credit Hours</b>		<b>15</b>
<b>Total Credit Hours</b>		<b>124</b>

PS Cognate: 9 Credit Hours

AH Cognate 9 Credit Hours

STEM Cognate: 9 Credit Hours-fulfilled through major

Students will need to take 9 credit hours of prescribed electives to obtain specific concentration of choice, except the pre-Med Concentration that requires all 6 courses (16 credits). If students choose not to take a concentration area, they will get a general chemical engineering degree. Students will also take 6 credit hours of technical electives, where a Technical Elective is any engineering course 200-level or higher. CET 395, Undergraduate Research, can also be used as a Technical Elective. Pre-Med students should discuss with their pre-Med advisor if additional courses are needed for the medical school they intend to apply, such as Foundations of Behavior for Pre-health Professions Cognate.

## Mission

The mission of the chemical engineering program is to prepare future leaders in chemical engineering who are motivated to create a positive impact on chemical engineering education and research in academia and/or on wide ranging industrial sectors covering chemicals, environment, nanotechnology, materials, energy, human health, medicine, consumer products.

Upon graduation, the graduates of the Department of Chemical Engineering will be:

- Working as professionals in industry, research, entrepreneurship with high ethical standards.
- Building careers across disciplinary boundaries while promoting a culture of inclusion.
- Engaging in their self-development through professional development activities or the pursuit of post-graduate education.

## Student Learning Outcomes

1. Students will be able to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. Students will be able 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. Students will be able to communicate effectively with a range of audiences.
4. Students will be able 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. Students will be able 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. Students will be able to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. Students will be able to acquire and apply new knowledge as needed, using appropriate learning strategies.