CHEMICAL & BIOLOGICAL ENGINEERING

Bachelor of Science in Chemical Engineering (B.S.Ch.E.)
Department of Chemical & Biological Engineering
Catalog Year: 2018-2019

Minimum credit hours required for graduation: 123

FRESHMAN YEAR

FALL SEMESTER

CBE 101	Introduction to Chemical Engineering and Biological Engineering[1]	1
CHEM 121 (or 131)	General Chemistry I[1] (or Principles of Chemistry)	3
CHEM 123L	General Chemistry I Laboratory[1]	1
ENGL 110 (or 112 or 113)	Accelerated Composition[1] (or Composition II or Enhanced Composition)	3
MATH 162	Calculus I[1]	4
	Core Humanities Elective[2]	3
	Total Semester Hours:	15

SPRING SEMESTER

CHEM 122 (or 132)	General Chemistry II[1] (or Principles of Chemistry)	3
CHEM 124L	General Chemistry II Laboratory[1]	1
ENGL 120	Composition III	3
MATH 163	Calculus II[1]	4
PHYC 160	General Physics[1]	3
	Core Social and Behavioral Science Elective[2]	3
	Total Semester Hours:	17

SOPHOMORE YEAR

FALL SEMESTER

CBE 251	Chemical Process Calculations[3]	3
CHEM 301	Organic Chemistry	3
CHEM 303L	Organic Chemistry Laboratory	1
MATH 264	Calculus III	4
PHYC 161	General Physics	3
	Total Semester Hours:	14

SPRING SEMESTER

CBE 253	Chemical & Biological Engineering Computing[3]	3
CBE 302	Chemical Engineering Thermodynamics[3]	3
ECON 105	Introductory Macroeconomics	3
MATH 316	Applied Ordinary Differential Equations	3
	Advanced CHEM course for Concentration[7]	3
	Total Semester Hours:	15

JUNIOR YEAR [4]

FALL SEMESTER

CBE 311	Introduction to Transport Phenomena[3]	3
CBE 317	Numerical Methods for Chemical and Biological Engineering[3]	2
CBE 318L	Chemical Engineering Laboratory I[3]	1
CBE 361	Biomolecular Engineering[3]	3
ENGL 219	Technical and Professional Writing	3
	Advanced CHEM course for Concentration[7]	3
	Total Semester Hours:	15

SPRING SEMESTER

CBE 312	Unit Operations[3]	3
CBE 321	Mass Transfer[3]	3
CBE 319L	Chemical Engineering Laboratory II[3]	1
CBE 371	Introduction to Materials Engineering[3]	3
ENG 301	Fundamentals of Engineering: Dynamics	1
ENG 302	Fundamentals of Engineering: Electronic Circuits	1
	Advanced CHEM course for Concentration[7]	3
	Total Semester Hours:	15

SENIOR YEAR [5]

FALL SEMESTER

CBE 418L	Chemical Engineering Laboratory III[3]	1
CBE 454	Process Dynamic and Control[3]	3
CBE 461	Chemical Reactor Engineering[3]	3
CBE 486	Introduction to Statistics and Design of Experiments[3]	2
CBE 493L	Chemical Engineering Design[3]	3
	Technical Elective[6]	3
	Total Semester Hours:	15

SPRING SEMESTER

CBE 419L	Chemical Engineering Laboratory IV[3]	1
CBE 451	Senior Seminar[3]	1
CBE 494L	Advanced Chemical Engineering Design[3]	3
	Technical Elective - Engineering[6]	3
	Core Fine Arts Elective[2]	3
	Core Humanities Elective[2]	3
	Core Second Language Elective[2]	3
	Total Semester Hours:	17

(1) Admission to the BSCHE degree program requires completion of all math, science, and engineering courses listed in the freshman year with a grade of "C" or better and a minimum 2.5 GPA average in those courses, completion of ENGL 110 or the equivalent with a "C" or better, and a minimum UNM cumulative GPA of a 2.20.
(2) A list of acceptable core humanities, social/behavioral science, fine arts and second language electives can be found here: http://unmcore.unm.edu/. These courses may be taken whenever convenient. A grade of "C" or better is required.
(3) CBE Core Courses must be taken in the order and semester in which they are listed on this sheet in order to avoid a delay in graduation. A grade of "C-" or better is required.
(4) Students must file an application for the B.S.Ch.E. degree prior to the completion of 95 credit hours of applicable courses.
(5) Students are encouraged to take the Fundamentals of Engineering (FE) Examination during their senior year. This is the first formal step toward professional registration.
(6) Technical electives are chosen with the consultation of the student's faculty advisor to ensure that they support the student individual academic, career, and/or research goals. A list of approved technical electives can be found on the CBE website: http://cbe.unm.edu/students/cbe-student-forms.html
(7) Advanced Chemistry & Science Electives required are based on the student's choice of concentration. Please see the back of this sheet for a list of the required Advanced Chemistry & Science Electives for each concentration.

Concentrations

BIOENGINEERING

Since biological and medical systems involve complex chemical and physical processes, chemical engineering is a natural professional background for bioengineering applications. Bioengineering is an interdisciplinary field that combines the tools and methods of engineering to address challenges in the health sciences and in basic research. Bioengineers strive to understand biological systems, from molecules to whole organisms, from a quantitative and analytical perspective. Because of this in-depth study, bioengineers are uniquely qualified to work at the interface between living and non-living systems, enhancing our ability to measure, image, repair, or replace physiological substances or processes. Training in bioengineering prepares students for graduate school or industry, and is an excellent preparation for professional programs (medicine, dentistry, nursing, pharmacy). Career opportunities for bioengineers at the undergraduate level include the biosensor, pharmaceutical and medical device industries as well as positions in hospitals, federal labs, and environmental agencies.

Advanced Chemistry and Science Electives (10 hrs)				Technical Electives (6 hrs)	
BIOL 201L	Molecular and Cell Biology[7]	4		Technical Elective [6]	3
CHEM 302	Organic Chemistry[7]	3		Technical Elective - Engineering [6]	3
CHEM 312	Physical Chemistry[7]	3			

CHEMICAL PROCESS ENGINEERING

The Chemical Process Engineering concentration is designed to provide maximum flexibility for students to pursue career opportunities in a wide range of industries as a process engineer. Historically, many chemical process engineers have found employment in the petroleum or chemical industries, and many still do. However, chemical engineers with a strong process engineering foundation are in increasing demand in many other technology areas, including pharmaceuticals, semiconductors and electronic materials, and environmental or “green” engineering. This concentration builds on the traditional process engineering emphasis, allowing the technical electives to be chosen by the student in consultation with his adviser to fit the interests or professional goals of the student.

Advanced Chemistry and Science Electives (9 hrs)				Technical Electives (6 hrs)	
CHEM 302	Organic Chemistry[7]	3		Technical Elective [6]	3
CHEM 311	Physical Chemistry[7]	3		Technical Elective - Engineering [6]	3
CHEM 312	Physical Chemistry[7]	3			

ENVIRONMENTAL ENGINEERING

The chemical engineer with a concentration in Environmental Engineering is prepared to enter a field of growing importance. This field deals with treatment of waste to reduce its volume, to recover recyclable resources and to prepare appropriately for long-term disposal. Interesting applications exist in atmospheric discharge control and clean-up, bio-treatable water decontamination, soil remediation, and nuclear byproduct handling. Increasingly, chemical engineers are required to develop new processes to minimize byproduct and waste generation, and achieve higher energy efficiencies.

Advanced Chemistry and Science Electives (10 hrs)				Technical Electives (6 hrs)	
BIOL 201L	Molecular and Cell Biology[7]	4		Technical Elective [6]	3
CHEM 302	Organic Chemistry[7]	3		Technical Elective - Engineering [6]	3
CHEM 312	Physical Chemistry[7]	3			

MATERIALS PROCESSING

The Materials Processing concentration is designed to add additional emphasis in inorganic materials, polymeric, or biological materials, depending on the students interest. Students who are interested in working in the realm of high technology materials, biomedical materials, or nanotechnology should choose this concentration. These rapidly developing fields are expected to provide many job opportunities in the next decade. New materials are currently being developed whose properties depend strongly on their microstructure, nanostructure and processing history. Materials included in this category are advanced ceramics, polymers, composites, photonics, superconductors, semiconductors, and recording media. This concentration provides flexibility for students interested in inorganic or organic materials technology.

Advanced Chemistry and Science Electives (9 hrs)				Technical Electives (6 hrs)	
CHEM 311	Physical Chemistry[7]	3		Technical Elective [6]	3
CHEM 312	Physical Chemistry[7]	3		Technical Elective - Engineering [6]	3
CHEM 431, 471 or 471	Advanced Inorganic Chemistry, Adv T: Polymer Science, or Adv T: Chemistry and Physics at the Nanoscale[7]	3			

SEMICONDUCTOR MANUFACTURING

There is an increasing demand for chemical engineers in high technology oriented semiconductor manufacturing companies like Intel, Motorola, IBM, etc. This concentration is designed to prepare the student in the fundamental unit operations used in semiconductor manufacturing (oxidation, diffusion, lithography, plasma etch, CVD, ion implant and metalization) and statistical methods used extensively in the industry to optimize the performance of these unit operations. The continuing revolution occurring in computer technology virtually insures there is a strong future demand for engineers with the background needed for semiconductor manufacturing. The goal of this concentration is to introduce students to the specific chemical engineering tools used in micro-chip fabrication.

Advanced Chemistry and Science Electives (9 hrs)				Technical Electives (7 hrs)	
CHEM 311	Physical Chemistry[7]	3		Technical Elective [6]	3
CHEM 312	Physical Chemistry[7]	3	ECE 371	Materials and Devices	3
CHEM 431	Advanced inorganic Chemistry[7]	3			