

Engineering

Accreditation

The bachelor's programs in chemical engineering, electrical engineering, engineering mechanics, environmental engineering, materials engineering, mineral engineering and petroleum engineering are accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET).

Professional Examinations

All engineering majors are required to take the Fundamentals in Engineering (FE) [previously known as the Engineer in Training or EIT] examination as a requirement for graduation. This examination is the entry-level requirement for those individuals who intend to attain a professional engineer status. The FE examination is given in the fall and spring each year at New Mexico Tech. The FE examination is a national examination; therefore, the results are transferable to any state or territory of the United States.

Contents

Chemical Engineering	132
Civil Engineering	135
Electrical Engineering	137
Engineering Management	142
Environmental Engineering	144
Materials and Metallurgical Engineering	148
Materials Engineering Courses	150
Metallurgical Engineering Courses	154
Mechanical Engineering	155
Aerospace Engineering Courses	158
Engineering Science Courses	159
Mechanical Engineering Courses	159
Mechanical Engineering Design Courses	160
Mineral Engineering	164
Petroleum Engineering	169

Minors

Aerospace Engineering	156
Civil Engineering	135
Electrical Engineering	137
Environmental Engineering.....	144
Materials Engineering	148
Mineral Engineering	164
Petroleum Engineering	169
Polymer Science	133

Chemical Engineering

(www.nmt.edu/~cheme)

Professor Weinkauff (Chair of the Department)
Associate Professor Bretz
Assistant Professor Tartis
Adjunct Faculty Bickel, Cal, Dunston, Lee, McCoy
Laboratory Associate Marshall

Degree Offered: B.S. in Chemical Engineering

Chemical Engineering is considered one of the base engineering disciplines with applications in nearly every facet of life. The development and production of food, pharmaceuticals, fuels, semiconductors, detergents, fertilizers, plastics, and paper have all been driven by the ingenuity of chemical engineers. Current frontiers being explored by Chemical Engineers include biofuels, renewable energy, new batteries, nanotechnology, fuel cells, microsensors, explosives, and other critical technologies important to the 21st century. Chemical engineering graduates find challenging careers in a broad spectrum of fields including petroleum, chemical, plastics, paper, semiconductor, pharmaceutical, and biotechnology. At the same time, the breadth of a chemical engineering background helps graduates flourish in careers such as medicine, patent law, and technical marketing.

Throughout the Chemical Engineering curriculum, we focus on the development of complete engineers who can foster innovation through know-how and champion ideas through effective communication. We deliver a thorough education with insightful teaching, an innovative curriculum, research opportunities, summer job experiences, and channels for permanent, successful careers. Each year, our program is reviewed by an outside advisory board of professionals, who help ensure that our graduates are well prepared for lifelong successful careers in the exciting array of fields open to chemical engineers.

An important part of the chemical engineering experience at New Mexico Tech is the abundance of opportunities to participate in cutting edge research projects of our faculty and staff. Virtually all of our graduates engage in significant research projects and/or internships while working toward B.S. degrees in Chemical Engineering. Examples of areas of research open to Tech chemical engineering undergraduates include energetic materials, fuel cells, nano-composite materials, membrane separations, computer simulation, bioenergy, and thin film plasma processing. Numerous opportunities exist for summer research internships, including employment at the nearby Sandia and Los Alamos national labs as well as the research divisions on campus.

To learn more, the Student Handbook section of the Chemical Engineering website (www.nmt.edu/~cheme) is an excellent resource with quick links and great insights to taking advantage of the outstanding educational opportunities at New Mexico Tech.

Program Educational Objectives

The following objectives have been established by the program faculty in conjunction with our students and advisors from industry. They describe the characteristics and expected accomplishments of our future alumni.

1. Our graduates will be complete engineers who can: solve problems, experiment, innovate, be resourceful, and champion ideas through effective communication.
2. Our graduates will possess an understanding of the broad reach of a modern Chemical Engineering education and the array of knowledge required to implement solutions which will benefit our society.
3. Our graduates will be engaged in successful careers covering the spectrum of fields which require a command of the principles of Chemical Engineering.
4. Our graduates will benefit from a lifelong love of learning, opening doors to graduate study and enabling graduates to adapt to changes and opportunities in the profession.

Undergraduate Program

Bachelor of Science in Chemical Engineering

Minimum credit hours required—136

In addition to the General Degree Requirements (page 54), the following courses are required:

- ChE 326 (3), 345L (1), 349 (3), 351 (3), 352 (3), 443 & 443L (3), 445L (1), 461 (3), 462 (3), 485 (1)
- CHEM 311 & 311L (4), 331 & 331L (4), 333 & 333L (4)
- ES 110 (2), 111 (3), 201 (3), 216 (3), 302 (3), 316 (3), 347(3), 350 (3), 405L (1)
- EE 211 (3) or ES 332 (3)
- MATH 231 (4), 335 (3)
- MATE 202 & 202L or 235 & 235L (4)
- Chemistry/Biology Elective (3) Any upper-division chemistry or biology course approved by the advisor
- Engineering/Technical Electives (6) Upper-division engineering or other approved courses. These electives should generally be Chemical Engineering or other engineering program courses at the 300-, 400- or 500-level. Advanced courses in chemistry, biology, mathematics, and computer science are encouraged. Chemical Engineering technical elective courses include ChE 463, 464, 470, 472, 473, 474, 475, and 489. Consult the semester schedule and your advisor for the availability of other technical electives of interest.

Chemical engineering majors must maintain a minimum GPA of 2.0 in required courses in order to graduate.

All engineering majors are required to take the Fundamentals in Engineering (FE) exam as a requirement for graduation.

Sample Curriculum for the Bachelor of Science in Chemical Engineering

To help plan your course of study, be sure to use the degree flowchart found in the Student Handbook at www.nmt.edu/~cheme

Semester 1

- 2 ES 110 (intro to engineering)
 - 3 ENGL 111 (college English)
 - 4 MATH 131 (calculus I)
 - 4 CHEM 121 & 121L (general)
 - 3 Social Science
-
- 16 Total credit hours

Semester 2

- 3 ES 111 (computer programming)
 - 4 MATH 132 (calculus II)
 - 4 CHEM 122 & 122L (general)
 - 5 PHYS 121 & 121L (general)
-
- 16 Total credit hours

Semester 3

- 3 ChE 326 (intro to chemical engineering)
 - 4 MATH 231 (calculus III)
 - 3 ES 201 (statics)
 - 4 CHEM 311 & 311L (analytical)
 - 3 ENGL 112 (college English II)
-
- 17 Total credit hours

Semester 4

- 3 ES 216 (fluid mechanics)
 - 3 ES 347 (engineering thermodynamics)
 - 3 MATH 335 (ordinary differential equations)
 - 5 PHYS 122 & 122L (general)
 - 3 Humanities
-
- 17 Total credit hours

Semester 5

- 3 ChE 349 (ChE thermodynamics)
 - 3 EE 211 (circuits) or ES 332 (electrical engineering)
 - 3 ES 350 (heat and mass transfer)
 - 1 ES 405L (instrumentation)
 - 4 CHEM 331 & 331L (physical)
 - 3 Social Science
-
- 17 Total credit hours

Semester 6

- 1 ChE 345L (junior design)
 - 3 ChE 351 (kinetics)
 - 3 ChE 352 (separation processes)
 - 3 ES 316 (engineering economics)
 - 3 ENGL 341 (technical writing)
 - 4 MATE 202 & 202L or 235 & 235L (materials engineering)
-
- 17 Total credit hours

Semester 7

- 1 ChE 445L (unit operations lab)
 - 3 ChE 461 (plant design I)
 - 1 ChE 485 (senior seminar)
 - 3 ES 302 (strength of materials)
 - 4 CHEM 333 & 333L (organic)
 - 3 Engineering/Technical Elective
 - 3 Humanities/Social Science
-
- 18 Total credit hours

Semester 8

- 2 ChE 443 (process control)
 - 1 ChE 443L (process control lab)
 - 3 ChE 462 (plant design II)
 - 3 Chemistry/Biology Elective
 - 3 Engineering/Technical Elective
 - 3 Humanities
 - 3 Social Science
-
- 18 Total credit hours

Minor in Polymer Science

Minimum credit hours required—19

The following courses are required:

- CHEM 334 (3), 446 (3)
- MATE 202 & 202L (4) or 235 & 235L (4)
- MATE 351 (3), 474 (3)
- ChE 473 (3)

Chemical Engineering Courses:

ChE 326, Principles of Chemical Engineering, 3 cr, 3 cl hrs

Prerequisite: ES 111; MATH 132

Offered spring and fall semesters

Introduction to stoichiometric computations. Calculations of energy and material balance. Elementary process analysis and reactor design. Single and multi-phase systems. (Same as METE 326)

ChE 345L, Chemical Engineering Design Lab, 1 cr, 3 lab hrs

Prerequisites: ES 216, 347, and 350

Offered spring semester

Team-oriented project design. Introduction to design fundamentals and creative problem-solving techniques. Written and oral presentations summarizing team progress.

ChE 349, Chemical Engineering Thermodynamics, 3 cr, 3 cl hrs

Prerequisites: MATH 231; ES 347 is recommended

Offered fall semester

The theory and engineering applications of the properties of mixtures, phase and chemical reaction equilibria. (Same as MATE 350)

ChE 351, Chemical Process Kinetics, 3 cr, 3 cl hrs*Prerequisites: ChE 326, 349**Offered spring semester*

Fundamentals of chemical reaction kinetics and chemical reactor design. Development of rate equations for both homogeneous and heterogeneous reactions, catalysis, diffusion-controlled reactions, and transport processes. (Previously offered as ChE 451)

ChE 352, Separation Processes, 3 cr, 3 cl hrs*Prerequisites: ChE 349; ES 350**Offered spring semester*

The process approach to solving problems that involve equilibrium in binary and multicomponent mixtures. Phase equilibrium, absorption, distillation (binary and multicomponent), liquid-liquid extraction, leaching. Design of staged operations for separating gas-liquid, liquid-liquid, solid-liquid, and gas-solid mixtures. (Previously offered as ChE 442)

ChE 443, Process Dynamics and Control, 2 cr, 2 cl hrs*Prerequisites: MATH 335 and (ES 350 or ES 314)*

Process dynamics and control theory applied to chemical, mechanical, and other engineering processes. Design of control systems.

ChE 443L, Chemical Process Dynamics & Control Lab, 1 cr, 3 lab hrs*Corequisite: ChE 443*

Computer modeling of system dynamics. Design, implementation, and tuning of process control systems for chemical processes.

ChE 445L, Unit Operations Lab, 1 cr, 3 lab hrs*Prerequisite: ChE 352**Offered fall semester*

Laboratory exercises to illustrate heat exchange, fluid flow, and mass transport phenomena in common unit operations found in the chemical process industries.

ChE 461, Chemical Plant Design, Economics, and Management I, 3 cr, 1 cl hr, 6 lab hrs*Prerequisites: ES 316 or consent of instructor**Offered fall semester*

A two-semester sequence of courses in which a design project is used to illustrate principles and processes of chemical plant design, economics, and management. Lecture topics include intellectual property, capital and operating cost estimation, energy conservation, design optimization and scaling of chemical processes. Use of commercially available process simulation software emphasized.

ChE 462, Chemical Plant Design, Economics, and Management II, 3 cr, 1 cl hr, 6 lab hrs*Prerequisite: ChE 461**Offered spring semester*

Continuation of ChE 461.

Elective Courses**ChE 463, Design and Analysis of Experiments, 3 cr, 3 cl hrs***Prerequisite: Senior standing*

Methods of statistics and modeling important to many problems in materials science and engineering. Examples are chosen from a number of actual experiences. Safety considerations and experiment design including analysis of risk, how risks may be integrated, and how formal procedures should be established. The use of information sources, such as materials safety data sheets (MSDS). (Same as MATE 430)

ChE 464, Natural Gas Engineering, 3 cr, 3 cl hrs*Prerequisite: PETR 245 or ChE 349**Offered fall semester*

Composition and properties of natural gas. Gas separator design. Recovery of liquefiable products from gas. Conditioning, transmission, and compression, measurement of gas, gas pipeline design, and gas storage. (Same as PETR 464)

ChE 470, Fuel Cell Technology, 3 cr, 3 cl hrs*Prerequisite: Consent of instructor*

The principles of fuel cell technology, including classification of fuel cells and operating mechanisms. Analysis of the underlying thermodynamics and physical factors which govern fuel cell performance and efficiency. Cell components and integrative cell design.

ChE 472, Advanced Transport Phenomena, 3 cr, 3 cl hrs*Prerequisites: ES 216 and 350 or consent of instructor**Highly recommended for students considering graduate school*

Advanced principles of momentum, heat and mass transfer.

Topics will include laminar Newtonian and non-Newtonian flow, elementary turbulent flow, heat conduction in composites, boundary layer theory, radiation, and binary diffusion with adsorption reaction.

ChE 473, Polymer Materials Engineering, 3 cr, 3 cl hrs*Prerequisite: MATE 202 or consent of instructor**Offered every fall semester*

Introduction to classes and performance properties of polymeric materials. Methods of polymer synthesis and processing. Special emphasis on structure, viscoelasticity, and mechanical properties.

ChE 474, Polymer Processing and Characterization, 3 cr, 2 cl hrs, 3 lab hrs*Prerequisite: MATE 202 or consent of instructor*

A practical and "hands-on" course covering the essentials of polymer processing and polymer materials characterization. A survey of polymer processing techniques with emphasis on the fundamentals of extrusion. Lab topics include: extruder operation, compounding, scanning calorimetry, rheometry, and mechanical testing. Field trips to manufacturing facilities. (Same as MATE 474)

ChE 475, Explosives Surety, 3 cr, 3 cl hrs*Prerequisite: Upper-class standing or consent of instructor**Offered spring semester*

An introduction to explosives and other energetic materials. The basic chemical compositions, properties and environmental effects of commercial, military, and improvised (terrorist) explosives and some pyrotechnics will be compared. The basic physics of shock waves and detonation. Explosive effects, blast detection, tagging and environmental issues. Case studies or recent bombings will be used to describe a variety of terrorist approaches. Safety in handling of explosive materials and classifications for transportation and storage.

ChE 485, Senior Seminar, 1 cr, 3 lab hrs*Prerequisite: Senior standing or consent of instructor**Offered fall semester*

Student and outside speaker presentations of topics of current interest. Peer and video review of each student's work. Career planning.

ChE 491, Independent Study, hrs and crs to be arranged*Prerequisite: Consent of instructor*

Individual study of chemical engineering problems of special interest.

Faculty Research Interests

Bretz—Transport Phenomena, Phase Behavior, Natural Gas Processing

Marshall – Instrumentation and Data Acquisition

Tartis - Biomedical Engineering, Targeted Drug Delivery

Weinkauff—Polymer Engineering, Membrane Separations, Plasma

Polymer Thin Films, Microsensors, Plasma Surface

Modification