**CME Major Requirements**

- **CME 101 Introduction to Chemical and Molecular Engineering**
- **CME 199 Introduction to Undergraduate Research**
- **CME 201-H Sustainable Energy - Evaluating the Options**
- **CME 300 Writing in Chemical and Molecular Engineering**
- **CME 304 Chemical Engineering Thermodynamics I**
- **CME 310 Chemical Engineering Laboratory I: Unit Operation and Fundamentals**
- **CME 312 Material and Energy Balance**
- **CME 314 Chemical Engineering Thermodynamics II**
- **CME 315 Numerical Methods for Chemical Engineering Analysis**
- **CME 318 Chemical Engineering Fluid Mechanics**
- **CME 320 Chemical Engineering Lab II: Chemical and Molecular Engineering**
- **CME 322 Chemical Engineering Heat and Mass Transfer**
- **CME 323 Reaction Engineering and Chemical Kinetics**
- **CME 327 Molecular Modeling for Chemical Engineers**
- **CME 330 Principles of Engineering for Chemical Engineers**
- **CME 333 Business Economics for Engineers**
- **CME 369 Polymer Engineering**
- **CME 370 Cell Biology for Chemical Engineers**
- **CME 371 Biomedical Polymers**

**CME Major Courses**

- **Chemical and Molecular Engineering**
- **Corequisite:** Permission of instructor
- **Prerequisite:** U3 standing
- **Prerequisite:** U3 standing; CME 312 and 314

**Course Descriptions**

- **CME 312 Material and Energy Balance**
  Introduces analysis of chemical processes using the laws of conservation and energy as they apply to non-reacting and reacting systems. Integration of the concepts of equilibrium in physicochemical systems, and utilization of basic principles of thermodynamics. Numerical methods used in the design an optimization of chemical engineering processes. Solution of complex chemical engineering problems.
  **Prerequisites:** CME major; ESG 111; CHE 132 and 134; AMS 261 or MAT 203; CME 304, B- or better in CME 304
  **3 credits**

- **CME 314 Chemical Engineering Thermodynamics II**
  Equilibrium and the Phase Rule; VLE model and K-value correlations; chemical potential and phase equilibrium for ideal and non-ideal solutions; heat effects and property changes on mixing; application of equilibria to chemical reactions; Gibbs-Duhem and chemical potential for reacting systems; liquid/liquid, liquid/solid, solid/vapor, and liquid/vapor equilibria; adsorption and osmotic equilibria, steady state flow and irreversible processes. Steam power plants, internal combustion and jet engines, refrigeration cycle and vapor compression, liquefaction processes.
  **Prerequisite:** CME major; CME 304, B- or better in CME 304
  **3 credits**

- **CME 315 Numerical Methods for Chemical Engineering Analysis**
  Critical analysis of experimental data development of engineering models by integrating a variety of computer-based programs: (1) Executing numerical calculus and solving numerical equations using a mathematical program (Mathcad); (2) Process simulation for typical chemical engineering processes (unit operation, distillation, etc.) using a simulation program (Labview).
  **Prerequisite:** CME major
  **3 credits**

- **CME 318 Chemical Engineering Fluid Mechanics**
  Introduces fluid mechanics, Dynamics of fluids in motion; laminar and turbulent flow, Bernoulli’s equation, friction in conduits; flow through fixed and fluidized beds. Study of pump and compressor performance and fluid handling devices. Includes introduction to microfluids.
  **Prerequisites:** AMS 261 or MAT 303 or MAT 305
  **3 credits**

- **CME 320 Chemical Engineering Lab II: Chemical and Molecular Engineering**
  Introduction and operation of a continuous unit, handling of air-sensitive/water-sensitive materials, sonication and ultrasonic cells. Study of pump and compressor performance and fluid handling devices. Includes introduction to microfluids.
  **Prerequisites:** AMS 261 or MAT 203 or 205; PHY 131 (or 125 or 141)
  **3 credits**

- **CME 322 Chemical Engineering Heat and Mass Transfer**
  Heat transfer by conduction, principles of heat flow in fluids with and without phase change, heat transfer by radiation, heat-exchange equipment. Principles and theory of diffusion, mass transfer between phases, distillation, leaching and extraction, fixed-bed membrane separation, crystallization.
  **Prerequisite:** CME major; CME 318, CME 304, B- or better in CME 304
  **3 credits**

- **CME 323 Reaction Engineering and Chemical Kinetics**
  **Prerequisites:** CME major; U3 standing; CME 312 and 314
  **3 credits**

- **CME 327 Molecular Modeling for Chemical Engineers**
  Molecular modeling techniques and simulation of complex chemical processes. Use of Monte Carlo methods and Molecular Dynamics methods. Emphasis on the simulation and modeling of biopolymers systems.
  **Prerequisites:** CME major; PHY 132; ESG 111; AMS 261 or MAT 203; AMS 361 or MAT 303; CME 304, B- or better in CME 304
  **3 credits**

- **CME 330 Principles of Engineering for Chemical Engineers**
  This course focuses on the basic principles required for functioning in an engineering environment. Includes equilibrium and dynamics of rigid bodies, analysis of simple structures, conservation of energy, vectorial kinematics, collisions, general circuit analysis, fundamentals of AC power, CAD programs, introduction to market analysis, and discussion on ethics in engineering management.
  **Prerequisite:** CME major; U3 or U4 standing
  **3 credits**

- **CME 333 Business Economics for Engineers**
  The course focuses on critical business concepts as they relate to engineering practices. Survey of general business environment and business functions, with an emphasis on ethics and law, economics, finance, and marketing. Project management of cost, risk and alternatives. Quality management: Six Sigma concept.
  **3 credits**

- **CME 339 Polymer Engineering**
  An introductory survey of the physics, chemistry and engineering processes of polymers. Topics covered include classification of polymers, structures of polymers, morphology of polymers, thermodynamics of polymers, phase separation and phase transition of polymers, crystallization of polymers. Case studies of commercial polymer production and processing.
  **Prerequisite:** B- or higher in CME 304 or ESG 302 or equivalent course; AMS 261 or MAT 203 or MAT 205
  **3 credits**

- **CME 370 Cell Biology for Chemical Engineers**
  The course is intended to describe and introduce cellular and biochemical concepts and principles for chemical engineers. The course will provide details on the cellular processes, structures and regulations of the cellular homeostasis as response to internal and external changes and stimuli.
  **Prerequisite:** CME major
  **3 credits**

- **CME 371 Biomedical Polymers**
  This course focuses on the clinical performance of polymers and discusses the chemical, physical, mechanical and biological questions raised by the unique use of these materials within the human body. The chemistry and properties of key biomedical polymers will be studied and their biomedical applications will be discussed. The biomaterial’s response to the various components of its biological environment will be addressed, followed by the response of the host to the presence of the implanted polymer. Special attention will be given to the interaction of the system with two fundamental phenomena: the Foreign Body
CME 375 Fundamentals of Professional Chemical and Molecular Engineering
Preparatory class that provides an overview of professional licensure testing procedures for the Fundamentals of Engineering exam. This class reviews subject areas on the general section of the test as well as the profession-specific section covering chemical engineering. Course is designed to be completed in time for registration for the April F.E. Exam date.

Prerequisite: CME major
1 credit

CME 401 Separation Technologies
Fundamentals of separations. Introduction to standard classical and advanced separation methods and their relative merits and limitations. Distillation, crystallization, filtration, centrifugation, absorption and stripping methods. Includes fundamentals of chromatography.

Prerequisites: CME major; U3 or U4 standing; CME 323
3 credits

CME 410 Chemical Engineering Laboratory III: Instrumentation, Material Design and Characterization
Students research a topic and together with the course instructor and undergraduate program director, select an advisor and thesis committee. The student, with the advisor, drafts a course of preliminary experiments and the student presents a written thesis proposal, with an oral defense, to his/her committee.

Prerequisite: CME 320
2 credits

CME 420 Chemical Engineering Laboratory IV: Senior Thesis
Directed laboratory research. At the end of the junior year, in consultation with an advisor, the CME student will write a 1-2 page abstract describing proposed research. This abstract must be approved by the Undergraduate Program Committee (UPC). Through work accomplished in CME 420, the student will expand the research proposal into a senior thesis written in the format of a paper in a scientific journal. The student will defend his/her thesis in front of the UPC prior to the end of the senior year. After the defense, three copies of the finished thesis must be presented to the student’s advisor at least 21 days before the date of graduation. The advisor then submits the thesis for final approval to the other UPC members.

Prerequisite: CME 410
2 credits

CME 440 Process Engineering and Design I
Classical methods of chemical process engineering, advanced mathematical techniques and computer software for efficient and accurate process design and development. Mini-project design.

Prerequisites: CME major, U3 or U4 standing, CME 320, CME 327
3 credits

CME 441 Process Engineering and Design II
Major design project: a review of engineering design principles; engineering economics, economic evaluation, capital cost estimation; process optimization; profitability analysis for efficient and accurate process design.

Prerequisites: CME 401 and 440
3 credits