

CME

Chemical Engineering

- CME 006 THE ENGINEERING PROFESSION (JUNIOR AND SENIOR). (0)**
Activities of the Student Chapter of the American Institute of Chemical Engineers (for junior and senior year chemical engineering students). Lecture: one hour per week. May be repeated three times. Prereq: Chemical engineering major.
- CME 101 INTRODUCTION TO CHEMICAL ENGINEERING. (1)**
An introduction to the chemical engineering profession including: problem-solving techniques, use of computers, computer problems and lectures by practitioners.
- CME 200 PROCESS PRINCIPLES. (3)**
A course in material and energy balances, units, conversions, tie elements, recycle, bypass, equations of state, heat effects, phase transitions, and the first and second laws of thermodynamics applications in separation processes involving equilibrium reactions and energy exchange. Prereq: "C" or better in MA 113; "C" average in CHE 105 and 107; prereq or concur: MA 114, PHY 231.
- CME 220 COMPUTATIONAL TOOLS IN CHEMICAL ENGINEERING. (3)**
An introduction to computational tools used in chemical engineering, such as Microsoft Excel, MATLAB, and Aspen. Prereq: Grade of "C" or better in CME 200.
- *CME 320 ENGINEERING THERMODYNAMICS. (3)**
Fundamentals of thermodynamics, review of first law, second and third laws, VL, LL and SL equilibria, homogeneous and heterogeneous chemical reaction equilibria. Prereq: MA 213, PHY 231, and "C" or better in CME 200.
- CME 330 FLUID MECHANICS. (3)**
Introduction to the physical properties of fluids, fluid statics. Equations of conservation of mass, momentum and energy for systems and control volumes. Dimensional analysis and similarity. Principles of inviscid and real fluid flows; flow through pipes and around bodies. Application and design of fluid handling systems. Prereq: Engineering standing; CME 220, 320; MA 214.
- CME 395 SPECIAL PROBLEMS IN CHEMICAL ENGINEERING. (1-3)**
Individual work on some selected problems in the field of chemical engineering. May be taken three times for a total of 9 credit hours. Prereq: Engineering standing and approval of the chairman of the department.
- CME 404G POLYMERIC MATERIALS. (3)**
Synthesis, structure, and processing of polymers, useful geometric forms, mechanical and thermal properties, crystallinity, polymer blends, evaluation of polymers for specific applications (aerospace, automotive, biomedical), laboratory activities for each of the above. Prereq: Engineering standing. CHE 230 or CHE 236. MSE 301 or consent of instructor. (Same as MSE 404G.)
- CME 415 SEPARATION PROCESSES. (3)**
Separations based on both equilibrium stage concepts and mass transfer rate control are addressed for a range of chemical process operations, including distillation, gas absorption, extraction, adsorption, and membrane-based processes. Design problems are conceived to require computer-aided modeling and analysis. Prereq: Engineering standing; CME 220, 320.
- CME 420 PROCESS MODELING IN CHEMICAL ENGINEERING. (3)**
Applications of principles of material and energy balances, thermodynamics, heat and mass transfer, physical chemistry and numerical methods to problems in separation and transport processes and reactive systems. Prereq: Engineering standing; CME 330, 415.
- CME 425 HEAT AND MASS TRANSFER. (4)**
Fundamental principles of conduction and convective heat transfer, and diffusional and convective mass transfer. Design applications to heat exchanges and packed bed absorbers. Prereq: Engineering standing; CME 330, 415.
- CME 432 CHEMICAL ENGINEERING LABORATORY I. (2)**
A laboratory course emphasizing experimental work in fluid flow, separations, heat transfer, and mass transfer. A majority of this course will focus on lab report writing, statistics, experimental design and safety in the laboratory. Prereq: Engineering standing; CME 330, CME 415; CHE 230, 231.

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CME 433 CHEMICAL ENGINEERING LABORATORY II. (3)

A continuation of CME 432. A laboratory course emphasizing more detailed experiments in fluid flow, heat transfer, mass transfer, separations, and chemical reaction kinetics with more extensive data collection and analysis as well as a design component based on the experimental results. Prereq: Engineering standing; CME 432; concur: CME 550.

CME 455 CHEMICAL ENGINEERING PRODUCT AND PROCESS DESIGN I. (3)

A lecture and problem-solving course emphasizing process economic evaluation, product design, and process synthesis as they apply to chemical units and systems. Appropriate use of software for simulation and design of chemical systems will also be emphasized. Prereq: Engineering standing; concur: CME 550.

***CME 456 CHEMICAL ENGINEERING PROCESS DESIGN II. (3)**

A lecture and problem-solving course intended to combine the principles of chemical engineering with optimization as they apply to the design of chemical processes. Results of each design case studied will be presented by both oral and written reports. Prereq: Engineering standing; CME 455, 550.

CME 462 PROCESS CONTROL. (3)

Basic theory of automatic control devices and their application in industrial chemical plants is emphasized. Identification of control objectives, appropriate measurements and manipulations, and possible loops between these, requires integration of the control system with the original process design. Interactions between process units are analyzed using well-known analytical tools and design strategies. Prereq: Engineering standing; CME 420, 550.

CME 470 PROFESSIONALISM, ETHICS AND SAFETY. (2)

Detailed lectures and supervised discussions on standards of ethics and safety as they relate to the chemical engineering profession. Emphasis will be on safety in plant design and process operations, laboratory safety, hazardous risk management, regulation and oversight. Prereq: Engineering Standing. Concurrent: CME 455.

CME 505 ANALYSIS OF CHEMICAL ENGINEERING PROBLEMS. (3)

The application of differential and integral equations to traditional and non-traditional chemical engineering problems. Prereq: CME 425, CME 550 concurrent or consent of instructor.

CME 515 AIR POLLUTION CONTROL. (3)

Kinetics and equilibria of photochemical and "dark" atmospheric reactions. Atmospheric statics and dynamics including lapse rates, inversions, and vertical and horizontal air motion. Single and area source diffusion. Stack meteorology. Prereq: CME 320 or ME 220.

CME 523 CONCEPTS, ASSESSMENT TOOLS AND METHODS IN SUSTAINABLE POWER AND ENERGY. (3)

A multidisciplinary course presenting an overview of key topics in sustainability and environmental impact assessment for engineers. Topics will include assessment of current and future energy systems, renewable and conventional energy technologies, supply chain management, sustainability metrics, energy assessment tools, environmental impact assessment and life cycle assessment. Topics will be presented and their attributes described within a framework that aids in evaluation and analysis of energy technology systems and designs in the context of political, social, economic, and environmental goals. Prereq: Engineering Standing and Senior Classification or Consent of Instructor. (Same as EGR/MFS 523.)

CME 542 ELECTRIC POWER GENERATION TECHNOLOGIES. (3)

Overview of technologies used for generating electricity from location, recovery, transportation and storage of fuel to the types of technologies used to convert the fuel to electricity. Included is a discussion of the advantages and disadvantages of each technology and how they must adapt to be viable in the future. Technologies covered include coal, natural gas, nuclear, biomass, wind, solar and advanced technologies. Prereq: Engineering standing or consent of instructor. (Same as EGR 542.)

CME 550 CHEMICAL REACTOR DESIGN. (3)

A lecture and problem course dealing with interpretation of rate data and development of performance equations for single and multiple reactor systems. A design problem will be selected for an industrially important chemical reaction system requiring computer solution. Prereq: Engineering standing; CME 420, 425.

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#CME 552 AUTOMOTIVE PLASTICS. (3)

Overview of materials and processes for the application of plastics in the automotive industry. Engineering properties of plastics, rheology and governing relations for melt process flows. Plastic injection molding including design, control, and simulation of molding operations. Plastic part design and material selection; material testing and quality control. Prereq: Engineering Standing, MSE 201 or enrollment in the Production Engineering Certificate. (Same as MSE 552.)

CME 554 CHEMICAL AND PHYSICAL PROCESSING OF POLYMER SYSTEMS. (3)

Theory and practice as related to the chemical and physical processing of polymer systems. Polymer rheology, heat transfer in polymer flows, polymer engineering properties. Polymer processing operations and materials selection; flow instabilities. Prereq: CME 330, CME 425 or ME 325; or consent of instructor. This course is open only to graduate students or undergraduates with engineering standing. (Same as ME/MFS/MSE 554.)

CME 556 INTRODUCTION TO COMPOSITE MATERIALS. (3)

Modern composite materials and their applications. Basic concepts and definitions. Fundamental properties of fibers and polymer resins. Manufacturing methods. Analysis and design of laminated and chopped fiber reinforced composites. Micro- and macro-mechanical analysis of elastic constants. Failure theory of composite materials. Computational design of composites. Prereq: Engineering Standing, and EM 302 or with instructor permission. (Same as ME/MFS/MSE 556.)

#CME 570 BIONANOTECHNOLOGY: INTERFACES AND DEVICES. (3)

This course introduces the broad impact of small-scale biological and synthetic structures and resulting miniature technologies on the biological, medical, and environmental fields, focusing on interfaces and devices. It will discuss the fundamental science behind the technologies, highlighting the advantages that result at the micro- and nanoscale (e.g. mass and energy transport). In particular, medical (diagnostic and therapeutic devices) and environmental applications will be examined, with several examples of micro- and nanoscale systems exhibiting enhanced properties highlighted. The student will be introduced to the fundamental science, the cutting-edge research activities, and the current commercially available technologies. Prereq: Upper level in CME or consent of instructor.

CME 580 DESIGN OF RATE AND EQUILIBRIUM PROCESSES FOR WATER POLLUTION CONTROL. (3)

The design of chemical and physical processes for the removal and concentration of organic, inorganic, and particulate pollutants from aqueous solution/suspension: adsorption, destabilization, disinfection, membrane processes, thermal processes, flow through beds of solids, etc. Prereq: CHE 440G, CME 425 and prereq or concur: CME 550 or consent of instructor.

***CME 599 TOPICS IN CHEMICAL ENGINEERING. (3)**

A detailed investigation of a topic of current significance in chemical engineering such as: contemporary energy topics, fuels development, membrane science, computer control of chemical processing. A particular topic may be offered twice under the CME 599 number. May be repeated to a maximum of nine credits. Prereq: Engineering standing.

PREREQUISITE FOR GRADUATE WORK

Students desiring to take any of the following courses should have a thorough working knowledge of chemistry, physics, and mathematics. For major work, a candidate must hold a bachelor's degree in chemical engineering or its equivalent.

CME 620 EQUILIBRIUM THERMODYNAMICS. (3)

The criteria for physical and chemical equilibria, including: predictive equations, solution theory, chemical activity, coupled chemical equilibria, and external constraints. Emphasis may be on vapor-liquid equilibrium, chemical reaction equilibrium, or complex ionic equilibria in dilute aqueous solutions and suspensions. Prereq: CHE 440G and CME 320 or consent of instructor.

CME 630 TRANSPORT I. (3)

A unified study of physical rate processes in liquids and vapors, including: mass, energy, and momentum transport, transport in chemically reacting systems, similarities, turbulence modeling, buoyance-induced transport and multicomponent diffusion. Prereq: ME 330, CME 425, CME 505 concurrent or consent of instructor.

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- CME 650 ADVANCED CHEMICAL REACTOR DESIGN. (3)**
Rate expressions for heterogeneous reaction kinetics; energy and mass transport within and external to reacting porous catalysts; design equations for multiphase fixed and moving bed reactors. Prereq: CME 550, CME 630, CME 505, or instructor consent.
- CME 664 MULTIDISCIPLINARY SENSORS LABORATORY. (3)**
A multidisciplinary laboratory course with laboratory experiences in areas related to sensors and sensing architectures, typically including chemistry, chemical and materials engineering, and electrical engineering. Lecture, 1 hour; laboratory, 2 hours. Prereq: One year of college chemistry, calculus and physics. GS 660 or by consent of instructor. (Same as CHE/EE/MSE 664.)
- CME 680 BIOCHEMICAL ENGINEERING. (3)**
Principles and design of processes involving biochemical reactions, including aerobic and anaerobic respirations and fermentations, and involving pure and mixed cultures. Energy considerations, heat and mass transfer, biochemical kinetics, and application to biological waste treatment. Prereq: CME 550, CME 630, CHE 440G or consent of instructor. (Same as BAE 680.)
- CME 748 MASTER'S THESIS RESEARCH. (0)**
Half-time to full-time work on thesis. May be repeated to a maximum of six semesters. Prereq: All course work toward the degree must be completed.
- CME 749 DISSERTATION RESEARCH. (0)**
Half-time to full-time work on dissertation. May be repeated to a maximum of six semesters. Prereq: Registration for two full-time semesters of 769 residence credit following the successful completion of the qualifying exams.
- CME 767 DISSERTATION RESIDENCY CREDIT. (2)**
Residency credit for dissertation research after the qualifying examination. Students may register for this course in the semester of the qualifying examination. A minimum of two semesters are required as well as continuous enrollment (Fall and Spring) until the dissertation is completed and defended.
- CME 768 RESIDENCE CREDIT FOR THE MASTER'S DEGREE. (1-6)**
May be repeated to a maximum of 12 hours.
- CME 769 RESIDENCE CREDIT FOR THE DOCTOR'S DEGREE. (0-12)**
- CME 771 SEMINAR. (0)**
Review of current literature in the field of chemical engineering, general discussion and presentation of papers on departmental research. Lecture, one hour per week. Required for all graduate students in chemical engineering.
- CME 779 MEMBRANE SCIENCES COLLOQUIUM. (1)**
Outstanding membrane scientists present their current research on biological and/or synthetic membranes. Students read a pertinent paper by the speaker prior to his/her talk and write a short paper on the talk; especially important is relevance of the main points of the talk to membrane science in general and the student's own research in particular. May be repeated to a maximum of six credits. (Same as BCH/CHE/PHA/PHR 779.)
- CME 780 SPECIAL PROBLEMS IN CHEMICAL ENGINEERING. (1-3)**
Independent study, design, or research in chemical engineering topics. May be repeated to a maximum of 12 credits. Prereq: Approval of the departmental director of Graduate Studies.
- CME 790 RESEARCH IN CHEMICAL ENGINEERING. (1-9)**
Graduate Research in Chemical Engineering on a topic approved by the Departmental Graduate Studies Committee. May be repeated to a maximum of two semesters. Prereq: Consent of the Director of Graduate Studies.