

CHEMICAL ENGINEERING

Courses

ECHE 520 - Chemical Engineering Fluid Mechanics (3 Credits)

Multi-phase pressure drop, phase contacting, flow through porous media, fluidization, mixing, and turbulence.

Prerequisites: D or better in ECHE 320 or ENCP 360.

ECHE 521 - Computational Fluid Dynamics for Engineering Applications (3 Credits)

Introduction to the use of computational fluid dynamics codes to analyze flow, heat, and mass transfer problems of practical engineering applications.

Prerequisites: D or better in ECHE 320, EMCH 360, ECIV 360, ENCP 360, or AESP 265.

ECHE 530 - Intermediate Chemical Engineering Kinetics (3 Credits)

Intermediate concepts of chemical kinetics, batch and flow reactors, catalysts and reactor design, including non-ideal systems.

Prerequisites: C or better in ECHE 311.

Prerequisite or Corequisite: D or better in ECHE 321.

ECHE 540 - Intermediate Separation Process Design (3 Credits)

Intermediate level design of stagewise chemical separation cascades; analysis of binary and ternary systems; multicomponent separations, plate and column specification procedures; distillation, crystallization, extraction, and leaching.

Prerequisites: C or better in ECHE 300.

Prerequisite or Corequisite: D or better in ECHE 311.

ECHE 550 - Chemical-Process Dynamics and Control (3 Credits)

Fundamental physical and chemical principles in mathematically modeling the dynamic response of chemical processes; feedforward and feedback control systems; design of control schemes for selected chemical processes.

Prerequisites: C or better in ECHE 300 and MATH 242; D or better in ECHE 456.

ECHE 567 - Process Safety, Health and Loss Prevention (3 Credits)

Reliability, availability, and fault-tree analyses, risk indices, hazard evaluation, vapor cloud modeling, toxicology, material safety classification and regulations, individual/corporate ethical responsibilities.

Prerequisite or Corequisite: D or better in ECHE 466.

ECHE 571 - Corrosion Engineering (3 Credits)

Basic principles of corrosion engineering developed from a chemical engineering approach to thermodynamics, kinetics, mass transfer, and potential theory.

Prerequisites: D or better in ECHE 311.

ECHE 572 - Polymer Processing (3 Credits)

Industrial polymers with emphasis on their characterization and on the modeling of the major polymer fabrication processes.

ECHE 573 - Next Energy (3 Credits)

An examination of energy technologies that will enable society to move from an economy based on fossil fuels to one based on sustainable energy.

ECHE 574 - Combustion (3 Credits)

Fundamental process and applications related to the broad field of combustion and energy generation including emissions control technologies.

Prerequisites: D or better in ECHE 430.

ECHE 575 - Engineering of Soft Materials (3 Credits)

Introductory overview of fundamental concepts in science and engineering of soft materials; the relation between microstructure and macroscopic behavior in a variety of soft matter systems; key applications in chemical and biomedical engineering.

Prerequisites: C or better in MATH 122 or MATH 141.

Cross-listed course: BMEN 575

ECHE 589 - Special Advanced Topics in Chemical Engineering (3 Credits)

Course content varies and will be announced in the schedule of classes by title. May be repeated as topic varies.

ECHE 700 - Chemical Process Analysis (3 Credits)

Quantitative analysis of industrial chemical operations. Equilibrium relations, material and energy balances, and reaction kinetics principles are used to analyze a variety of chemical processes and systems.

ECHE 709 - Selected Topics in Industrial Stoichiometry (3 Credits)

Special topics in industrial stoichiometry with emphasis on current research.

ECHE 710 - Advanced Chemical Engineering Thermodynamics (3 Credits)

Mass, energy, and entropy balance analysis of complex systems; evaluation of thermodynamic property changes of pure materials; solution thermodynamics of single-phase multicomponent systems; phase and chemical reaction equilibrium.

Prerequisites: ECHE 311.

ECHE 719 - Selected Topics in Chemical Engineering Thermodynamics (3 Credits)

Special topics in chemical engineering thermodynamics with emphasis on current research.

ECHE 720 - Advanced Fluid Flow Analysis (3 Credits)

Theory and application of fluid flow phenomena; momentum equations, conformal mapping, empirical methods, boundary layers, dimensional analysis.

Prerequisites: ENCP 360 and MATH 242.

ECHE 721 - Advanced Heat Flow Analysis (3 Credits)

Theory and application of heat flow phenomena; classical techniques and finite-difference numerical methods; conduction, convection, radiation, boiling.

Prerequisites: ECHE 321 and ECHE 720.

ECHE 722 - Advanced Mass Transfer (3 Credits)

Diffusive and convective mass transfer. Applications of the Stefan-Maxwell equations, prediction of diffusion coefficients, convective mass transport, correlations for mass transfer coefficients, and combined mass transfer and reaction modeling.

Prerequisite or Corequisite: ECHE 720.

ECHE 725 - Rheology (3 Credits)

Rheological characteristics of viscous, elastic, viscoelastic, and plastic substances; non-Newtonian fluid flow, viscometry, and rheogoniometry; rheological equations of state; engineering applications.

ECHE 728 - Selected Topics in Fluid Mechanics (3 Credits)

Special topics in fluid mechanics with emphasis on current research.

ECHE 729 - Selected Topics in Heat and Mass Transfer (3 Credits)

Special topics in heat and mass transfer with emphasis on current research.

ECHE 730 - Chemical Reactor Design (3 Credits)

Optimum temperature sequencing. Modeling of non-ideal reactors. Theories of catalysis with emphasis on the rate of diffusion. Interpretation of experimental catalytic data and use of these data in reactor design.

ECHE 735 - Heterogeneous Catalysis - Fundamentals (3 Credits)

Fundamentals of heterogeneous catalysis, with emphasis on computational catalysis.

ECHE 736 - Heterogeneous Catalysis – Synthesis, Characterization and Evaluation (3 Credits)

Catalyst synthesis methods; experimental characterization approaches; correlating synthesis/characterization with catalytic performance.

ECHE 737 - Industrial Catalysis (3 Credits)

History of catalysis; industrial applications of catalysis; development of catalytic reactions from lab to pilot to production scale.

ECHE 739 - Selected Topics in Kinetics and Reactor Design (3 Credits)

Special topics in kinetics and reactor design with emphasis on current research.

ECHE 740 - Distillation (3 Credits)

Analytical, shortcut, and computer techniques for plate contacting of multicomponent systems. Review of binary separations, V-L-E models, azeotropic and extractive distillation, effects of non-key components, computational schemes, and convergence criteria.

ECHE 741 - Liquid-Liquid Extraction (3 Credits)

Principles of modeling liquid-liquid extraction cascades. Evaluation of L-L-E, ternary systems, design applications for hydrometallurgical systems, interlinked cascade structures for multiple solute systems, efficiency of process equipment, and synergism.

ECHE 742 - Adsorption Fundamentals and Processes (3 Credits)

Advanced principles of adsorption and adsorption processes including adsorbents, thermodynamics, kinetics, fixed bed adsorption and cyclic adsorption processes.

ECHE 749 - Selected Topics in Separations (3 Credits)

Special topics in separations with emphasis on current research.

ECHE 750 - Process Dynamics and Control (3 Credits)

Advanced topics in chemical process dynamics and control. Multivariate analysis, system identification, sampling, optimal process control.

Prerequisites: ECHE 550.

ECHE 759 - Selected Topics in Process Control (3 Credits)

Special topics in process control with emphasis on current research.

ECHE 769 - Selected Topics in Chemical Engineering Design (3 Credits)

Special topics in chemical engineering design with emphasis on current research.

ECHE 770 - Electrochemical Engineering (3 Credits)

Electrochemical engineering principles developed from thermodynamic, kinetic, mass transfer, and potential theory. Numerical analysis and design of electrochemical systems. Statistical analysis of experimental data and industrial experimental designs.

ECHE 771 - Corrosion Engineering (3 Credits)

Corrosion engineering principles developed from thermodynamic, kinetic, mass transfer, and potential theory. Numerical analysis of corroding systems, statistical analysis of experimental data, and industrial experimental designs.

ECHE 772 - Principles of Polymer Systems (3 Credits)

Theory and applications of polymer systems. Structure, physical properties, rheological, and mechanical behavior of polymers. Polymerization reactions and industrial polymerization processes. Fabrication techniques.

ECHE 789 - Selected Topics in Chemical Engineering (3 Credits)

Approved for special topic offerings.

ECHE 797 - Research (1-12 Credits)

Individual research to be arranged with instructor.

ECHE 798 - Graduate Seminar in Chemical Engineering (1-2 Credits)

Seminar on current topics in chemical engineering. Includes oral presentations by students on research projects.

ECHE 799 - Thesis Preparation (1-12 Credits)

To be arranged by candidates for the master's degree with the thesis advisor.

ECHE 865 - Chemical Process Safety and Loss Prevention (3 Credits)

Chemical process quantitative risk analysis, consequence modeling, risk estimation, and hazards assessment; design principles including inherent safety and mitigation techniques; elements of process safety management.

Prerequisites: ECHE 720.

ECHE 899 - Dissertation Preparation (1-12 Credits)