

CHEMICAL, BIOMOLECULAR, AND CORROSION ENGINEERING

The Department of Chemical, Biomolecular, and Corrosion Engineering offers graduate programs that provide students the opportunity to deepen their fundamental knowledge of chemical engineering and gain professional skills and hands-on experience useful for careers in industry, government, or academia. Faculty research is centered around engineering the molecules, materials, devices, and systems for solving chemical engineering problems and beyond in energy, health, and sustainability industries.

Visit the Department of Chemical, Biomolecular, and Corrosion Engineering website (<https://uakron.edu/engineering/cbe/>) to learn more about its faculty and facilities.

- Chemical Engineering, MS (<https://bulletin.uakron.edu/graduate/colleges-programs/engineering/chemical-engineering/chemical-engineering-ms/>)

Chemical Engineering (CHEE)

CHEE:521 Fundamentals of Multiphase Transport Phenomena (3 Credits)

Prerequisite: CHEE 321 or equivalent and permission. Major topics to be covered include intraphase and interphase transport phenomena, transport phenomena in multiphase fluids, transport in porous media, transport in gas/liquid pipe flows, computational fluid dynamics of multiphase systems, and case studies. (Formerly 4200:521)

CHEE:535 Process Analysis & Control (3 Credits)

Prerequisites: CHEE 330 and CHEE 353. This course is intended for a student holding a BS in a discipline other than engineering. Response of simple and chemical processes and design of appropriate control systems. (Formerly 4200:535)

CHEE:541 Process Design I (3 Credits)

Prerequisites: CHEE 330, CHEE 351, and CHEE 353. Application of chemical engineering fundamentals to the design of a multi-unit process. Emphasis on use of process simulators. Advanced equipment design, oral, written communication skills, teamwork. (Formerly 4200:541)

CHEE:561 Solids Processing (3 Credits)

Prerequisites: CHEE 321 and CHEE 353 or permission. Comprehensive problems in sedimentation, fluidization, drying and other operations involving mechanics of particulate solids in liquid and gas continua. (Formerly 4200:561)

CHEE:563 Pollution Control (3 Credits)

Prerequisite: CHEE 353 or permission. Air and water pollution sources and problems. Engineering aspects and methodology. (Formerly 4200:563)

CHEE:566 Digitized Data & Simulation (3 Credits)

Prerequisite: Permission. Data acquisition and analysis by digital devices, digital control applications and design. (Formerly 4200:566)

CHEE:570 Electrochemical Engineering (3 Credits)

Chemical engineering principles as applied to the study of electrode processes and to the design of electrochemical reactors. Topics include electrochemical thermodynamics, cell polarizations, Faraday's Laws, electrode kinetics, transport processes in electrochemical systems, current distributions, reactor design, experimental methods, commercial processes, and batteries and fuel cells. (Formerly 4200:570)

CHEE:572 Separation Processes in Biochemical Engineering (3 Credits)

Prerequisite: CHEE 353. Introduction to the separation and purification techniques pertinent to bioprocesses, with emphasis on the engineering considerations for large-scale operations. (Formerly 4200:572)

CHEE:600 Transport Phenomena (3 Credits)

Systematic presentation of conservation of momentum, energy and mass at microscopic and macroscopic levels in conjunction with illustrative examples and analogies. (Formerly 4200:600)

CHEE:605 Chemical Reaction Engineering (3 Credits)

Prerequisite: CHEE 330 or permission. Kinetics of homogeneous and heterogeneous systems. Reactor design for ideal and non-ideal flow systems. (Formerly 4200:605)

CHEE:610 Classical Thermodynamics (3 Credits)

Prerequisite: CHEE 225. Discussion of laws of thermodynamics and their application. Predication and correlation of thermodynamic data. Phase and reaction equilibria. (Formerly 4200:610)

CHEE:621 Surface Science in Chemical Engineering (3 Credits)

Prerequisite: Permission of instructor. This course emphasizes the basics of surface science (surface energy, wetting, adhesion); surface characterization techniques (contact angle, ellipsometry, XPS); and surface engineering methods (SAMs, soft-lithography). (Formerly 4200:621)

CHEE:622 Biochemical Engineering (3 Credits)

Application of chemical engineering principles to biological processes which produce desirable compounds or destroy unwanted or hazardous substances. (Formerly 4200:622)

CHEE:625 Physical Properties of Structural Biopolymers (3 Credits)

Prerequisite: Permission of instructor. Examination of the physical properties of biological tissues from a material science perspective leading to a rational design of biomaterials. (Formerly 4200:625)

CHEE:630 Chemical Process Dynamics (3 Credits)

Prerequisite: CHEE 600. Development and solutions of mathematical models for chemical processes including models based on transport phenomena principles, population balance methods and systems analysis. (Formerly 4200:630)

CHEE:631 Chemical Engineering Analysis (3 Credits)

Mathematical analysis of problems in transport processes, chemical kinetics and control systems. Solution techniques for these problems and their practical significances are stressed. Heuristic proofs will be given for necessary theory developments. (Formerly 4200:631)

CHEE:632 Nonlinear Dynamics & Chaos (3 Credits)

Prerequisite: MATH 335. Description and analysis of the complex behavior exhibited by nonlinear equations. Emphasis is on the numerical methods to quantify chaos. (Formerly 4200:632)

CHEE:633 Colloids-Principles & Practice (3 Credits)

Prerequisite: Permission of instructor. Colloid science and applications in chemical and biomaterials engineering: disperse systems, interparticle forces, surface tension, interfacial thermodynamics, colloid applications, biomaterials applications and characterization techniques. (Formerly 4200:633)

CHEE:634 Applied Surfactant Science (3 Credits)

Prerequisite: CHEE 610. The basics of surfactant science, the chemical engineering application of surfactants including use in polymerization media, separations, emulsion, microemulsion, and a rheology modifier. (Formerly 4200:634)

CHEE:635 Advanced Polymer Engineering (3 Credits)

Prerequisite: CHEE 600 or permission. Reactors for polymerization, polymer characterization, polymer processing, polymer rheology. (Formerly 4200:635)

CHEE:640 Advanced Plant Design (3 Credits)

Prerequisite: Permission. Topical treatment of process and equipment design, scale-up, optimization, process syntheses, process economics. Case problems. (Formerly 4200:640)

CHEE:674 Renewable Resources for Environmentally Benign Chemical Production (3 Credits)

Prerequisite: Permission of instructor. Focus is on chemical and biochemical processing technologies for the preparation of fuels, polymeric materials, and specialty chemicals from renewable resources. (Formerly 4200:674)

CHEE:680 Heterogeneous Catalysis (3 Credits)

Prerequisite: CHEE 330. Kinetics and mechanisms of heterogeneous and homogeneous catalytic reactions; characterization and design of heterogeneous catalysts. (Formerly 4200:680)

CHEE:696 Topics in Chemical Engineering (1-3 Credits)

(May be repeated for a total of six credits.) Prerequisite: Permission. Topics selected from new and developing areas of chemical engineering, such as electrochemical engineering, coal and synthetic fuels processing, bioengineering, simultaneous heat and mass transfer phenomena and new separation techniques. (Formerly 4200:696)

CHEE:697 Chemical Engineering Report (3 Credits)

Prerequisite: Permission of advisor. A relevant problem in chemical engineering is studied. Required course for students electing non-thesis option. Final report must be approved by advisor and advisory committee. (Formerly 4200:697)

CHEE:699 Master's Thesis (1-6 Credits)

(May be repeated to a maximum of six credits.) For properly qualified candidate for master's degree. Supervised original research in specific area of chemical engineering selected on basis of availability of staff and facilities. (Formerly 4200:699)

CHEE:701 Advanced Transport Phenomena (3 Credits)

Prerequisite: CHEE 600. Advanced theory of transport phenomena such as applied tensor analysis, constitutive equations, multicomponent reactive transport and multiphase transport. Illustrative practical examples presented. (Formerly 4200:701)

CHEE:702 Multiphase Transport Phenomena (3 Credits)

Prerequisite: CHEE 600. General transport theorem, kinematics, Cauchy's lemmas and the jump boundary conditions are developed followed by the theory of volume averaging. The single phase equations are then volume averaged to obtain the multiphase equations of change. The technique for using these equations and their practical significance is also covered. (Formerly 4200:702)

CHEE:706 Advanced Reaction Engineering (3 Credits)

Prerequisite: CHEE 605. Kinetics of heterogeneous systems, steady and unsteady state mathematical modeling of chemical reactors, fluidization and additional topics drawn from current literature. (Formerly 4200:706)

CHEE:711 Advanced Chemical Engineering Thermodynamics (3 Credits)

Prerequisite: CHEE 610. Advanced topics in thermodynamics, including phase and reaction equilibria at high pressures, phase equilibrium for multiphase systems, reaction equilibria in multiphase systems, thermodynamics of surfaces, thermodynamics of systems under stress, non-equilibrium thermodynamics and current topics from literature. (Formerly 4200:711)

CHEE:715 Momentum Transport (3 Credits)

Prerequisite: CHEE 600. Discussion of potential flow, boundary layer formation and turbulent flow phenomena for Newtonian fluids. (Formerly 4200:715)

CHEE:716 Non-Newtonian Fluid Mechanics (3 Credits)

Prerequisite: CHEE 600. Tensor and curvilinear coordinates. Newtonian viscometrics. Development of non-Newtonian constitutive equations. Special and general flows of various constitutive models. (Formerly 4200:716)

CHEE:720 Energy Transport (3 Credits)

Prerequisite: CHEE 600. Conduction, natural and forced convection, and radiation heat transfer starting with equations of continuity, motion and energy. (Formerly 4200:720)

CHEE:721 Topics in Energy Transport (3 Credits)

Prerequisite: CHEE 720. Advanced analytical and graphical methods for solving complex heat transfer problems found in chemical engineering. (Formerly 4200:721)

CHEE:725 Mass Transfer (3 Credits)

Prerequisite: CHEE 600. Theory of mass transfer with applications to absorption, adsorption, distillation and heterogeneous catalysis. (Formerly 4200:725)

CHEE:731 Process Control (3 Credits)

Prerequisite: CHEE 630. Introduction to modern control theory of chemical processes including cascade control, multivariate control and data sampled control. (Formerly 4200:731)

CHEE:736 Polymer Engineering Topics (3 Credits)

Prerequisite: Permission. Selected topics of current interest in polymer engineering, such as modeling of reactors or processes, multiphase materials, multiphase flow, artificial fiber engineering, etc. (Formerly 4200:736)

CHEE:738 Chemical Processing of Advanced Materials (3 Credits)

Prerequisite: CHEE 605. Advanced materials such as ceramics, optical materials, sensors, catalysts; application of reaction engineering to sol-gel processing, ceramic processing, modified chemical vapor deposition. (Formerly 4200:738)

CHEE:742 Advanced Catalyst Design (3 Credits)

Prerequisite: CHEE 605. Development of catalysis theory and its application to the design of practical catalysts. (Formerly 4200:742)

CHEE:750 Advanced Pollution Control (3 Credits)

Prerequisite: CHEE 463 or permission. Analysis of current environmental research in analytical instrumentation, air and water, pollution control, hazardous waste treatment, and nuclear waste disposal. (Formerly 4200:750)

CHEE:780 Advanced Biocatalysis & Biotransformations (3 Credits)

Prerequisite: CHEM 401 or CHEM 501 or permission of instructor. Focuses include: (a) high performance enzymes via chemical modification, recombinant technology, evolution, extremophiles; (b) applications of enzymes in biosynthesis, bioprocessing, biosensing, and bioremediation. (Formerly 4200:780)

CHEE:791 Chemical Engineering Seminar (1 Credit)

(May be repeated for a maximum of six credits.) Prerequisite: Permission of instructor. Advanced level coverage of specialized chemical engineering topics. Intended for students seeking a Ph.D. in engineering. (Formerly 4200:791)

CHEE:794 Advanced Seminar Research Techniques for Engineering (3 Credits)

(May be repeated for a total of six credits.) Prerequisite: permission of department chair. Advanced projects, readings and other studies in various areas of chemical engineering. Intended for student seeking Ph.D. in engineering. (Formerly 4200:794)

CHEE:898 Preliminary Research (1-15 Credits)

(May be repeated for a total of 15 credits.) Prerequisite: approval of dissertation director. Preliminary investigations prior to the submission of a dissertation proposal to the Interdisciplinary Doctoral Committee. (Formerly 4200:898)

CHEE:899 Doctoral Dissertation (1-15 Credits)

(May be taken more than once.) Prerequisite: acceptance of research proposal by the Interdisciplinary Doctoral Committee and approval of the dissertation director. Original research by the doctoral student. (Formerly 4200:899)