CHEMICAL ENGINEERING (CHE)

CHE 503
Thermodynamics
Laws of thermodynamics applied to chemical and biological engineering problems, properties of real fluids, phase and chemical equilibria, applications to chemical and biological processes and auxiliary equipments. Core course.
Prerequisite(s): CHE 351 with min. grade of C and CHE 451 with min. grade of C
Lecture: 3 Lab: 0 Credits: 3

CHE 506
Entrepreneurship and Intellectual Property Management
Graduate standing or consent of instructor. This course aims to introduce and develop a number of diversified professional skills necessary for success in an engineering research and development environment. Selected topics covered in the areas of technology entrepreneurship, opportunity assessment, creativity and innovation, project management, management of organizational change, entrepreneurial leadership, and intellectual property management.
Lecture: 3 Lab: 0 Credits: 3

CHE 508
Process Design Optimization
Organization of the design problem and application of single and multi-variable search techniques using both analytical and numerical methods. Prerequisite: An undergraduate course in process design.
Lecture: 3 Lab: 0 Credits: 3

CHE 516
Technologies for Treatment of Diabetes
Study of physiological control systems and engineering of external control of biological systems by focusing on an endocrine system disorder – diabetes. The effects of type 1 diabetes on glucose homeostasis and various treatment technologies for regulation of glucose concentration. Development of mathematical models describing the dynamics of glucose and insulin concentration variations, blood glucose concentration measurement and inference techniques, insulin pumps, and artificial pancreas systems.
Lecture: 3 Lab: 0 Credits: 3

CHE 525
Chemical Reaction Engineering
Prerequisite(s): CHE 423 with min. grade of C
Lecture: 3 Lab: 0 Credits: 3

CHE 530
Advanced Process Control
Prerequisite(s): CHE 435 with min. grade of C
Lecture: 3 Lab: 0 Credits: 3

CHE 535
Applications of Mathematics to Chemical Engineering
Mathematical techniques and their application to the analytical and numerical solution of chemical engineering problems. The analytical component includes review of matrices and determinants, as well as solution of ordinary, partial differential and integral equations. The numerical component includes iterative solution of algebraic equations, numerical analysis and solution of ordinary differential equations. Core course.
Lecture: 3 Lab: 0 Credits: 3

CHE 536
Computational Techniques in Engineering
Lecture: 3 Lab: 0 Credits: 3

CHE 538
Polymerization Reaction Engineering
The engineering of reactors for the manufacture of synthetic polymeric materials, commercial processes for manufacture of polymers of many types, polymer chemistry and engineering reactor design.
Prerequisite(s): CHE 423 with min. grade of C
Lecture: 3 Lab: 0 Credits: 3

CHE 541
Renewable Energy Technologies
The course will cover three topics related to renewable Energy Technologies. 1. Review of renewable energy sources; solar, wind, biomass, etc. 2. Energy storage and conversion with emphasis on batteries and fuel cells 3. Hydrogen as an energy carrier and the Hydrogen Economy.
Lecture: 3 Lab: 0 Credits: 3

CHE 542
Fluidization and Gas-Solids Flow Systems
Prerequisite(s): CHE 535 with min. grade of C
Lecture: 3 Lab: 0 Credits: 3
CHE 543  
Energy, Environment, and Economics  
The linkage of energy, environmental and economic issues. The impact of energy supply and end use on human well-being and the ecosystem. A comprehensive approach to the resolution of resource, technical, economic, strategic, environmental, socio- and geopolitical problems of the energy industries. Pathways to a sustainable global energy system.  
Lecture: 3 Lab: 0 Credits: 3

CHE 545  
Metabolic Engineering  
Cellular metabolism, energetics and thermodynamics of cellular metabolism, regulation of metabolic pathways, metabolic flux analysis, metabolic control analysis, analysis of metabolic networks, synthesis and manipulations of metabolic pathways, applications - case studies.  
Lecture: 3 Lab: 0 Credits: 3

CHE 551  
Advanced Transport Phenomena  
Formulation, solution and interpretation of problems in momentum, energy and mass transport phenomena that occur in chemical and biological processes.  
Prerequisite(s): CHE 406  
Lecture: 3 Lab: 0 Credits: 3

CHE 553  
Advanced Thermodynamics  
Advanced thermodynamics for research-oriented graduate students. The course covers the fundamental postulates of thermodynamics and introductory statistical mechanics, with applications to pure fluids, fluid mixtures, elastic solids, surfaces and macromolecules.  
Prerequisite(s): CHE 351 with min. grade of C and CHE 451 with min. grade of C  
Lecture: 3 Lab: 0 Credits: 3

CHE 555  
Polymer Processing  
Analysis of momentum, heat and mass transfer in polymer processing operations. Polymer processes considered include extrusion, calendaring, fiber spinning, injection molding, and mixing.  
Prerequisite(s): CHE 406 with min. grade of C  
Lecture: 3 Lab: 0 Credits: 3

CHE 560  
Statistical Quality and Process Control  
Basic theory, methods and techniques of on-line, feedback, quality-control systems for variable and attribute characteristics. Methods for improving the parameters of the production, diagnosis and adjustment processes so that quality loss is minimized. Same as MMAE 560.  
Lecture: 3 Lab: 0 Credits: 3

CHE 565  
Fundamentals of Electrochemistry  
Thermodynamics and potential, Marcus theory, charge transfer kinetics and mass transport of simple systems. Electrode reactions couple with homogeneous chemical reactions. Double layer structure and adsorbed intermediates in electrode processes. Potential step and potential sweep methods.  
Lecture: 3 Lab: 0 Credits: 3

CHE 566  
Electrochemical Engineering  
Basic concepts of electrochemistry used in electrochemical reactor analysis and design. Thermodynamics, kinetics and transport processes in electrochemical systems, current and potential distribution, corrosion engineering, electrodeposition, batteries and fuel cells, industrial electrolysis, and electrosynthesis.  
Lecture: 3 Lab: 0 Credits: 3

CHE 567  
Fuel Cell Fundamentals  
A detailed study of the thermodynamics, electrochemistry, electrode kinetics and materials aspects of fuel cells with an emphasis on polymer electrolyte fuel cells. The course will include a vigorous laboratory component and will cover the development of detailed data analysis procedures. A part of the course will cover current trends and interests through the critical discussion of recent archival publications.  
Lecture: 2 Lab: 1 Credits: 3

CHE 575  
Polymer Rheology  
Flow of viscoelastic fluids, integral and differential constitutive equations from continuum and molecular considerations, methods of experimental evaluations.  
Prerequisite(s): CHE 406 with min. grade of C  
Lecture: 3 Lab: 0 Credits: 3

CHE 577  
Bioprocess Engineering  
Application of engineering principles to the biological production processes. Enzyme kinetics, cell culture kinetics, transport phenomena in cells, membranes, and biological reactors, genetics, bioseparation and downstream processing, energetics of metabolic pathways, operation modes of cell cultures, mixed and their applications.  
Lecture: 3 Lab: 0 Credits: 3

CHE 580  
Biomaterials  
Metal, ceramic, and polymeric implant materials. Structure-property relationships for biomaterials. Interactions of biomaterials with tissue. Selection and design of materials for medical implants.  
Lecture: 3 Lab: 0 Credits: 3
CHE 582  
Interfacial and Colloidal Phenomena with Applications  
Applications of the basic principles of physical chemistry, surfactants and interfacial phenomena, surface and interfacial tension, adsorption of surfactants from solutions, spreading, contact angles, wetting, electro kinetic phenomena, rheology, dynamic interfacial properties, mass transport across interfaces. Applications include emulsions, foams, dispersions, tribology, detergency, flotation, enhanced oil recovery, suspension, emulsion polymerization and liquid membranes.  
Prerequisite(s): (CHE 351 with min. grade of C or CHE 451 with min. grade of C) and CHE 406 with min. grade of C  
Lecture: 3 Lab: 0 Credits: 3

CHE 583  
Pharmaceutical Engineering  
Lecture: 3 Lab: 0 Credits: 3

CHE 584  
Tissue Engineering  
Lecture: 3 Lab: 0 Credits: 3

CHE 585  
Drug Delivery  
Lecture: 3 Lab: 0 Credits: 3

CHE 591  
Research and Thesis for M.S. Degree  
Credit: Variable

CHE 593  
Seminar in Chemical Engineering  
Presentations on recent developments in the field by academic and industrial visitors.  
Lecture: 0 Lab: 1 Credits: 1

CHE 594  
Special Projects  
Advanced projects involving computer simulation, modeling or laboratory work. (Credit: 1-6 hours.)  
Credit: Variable

CHE 597  
Special Problems  
Independent study and project. (Credit: variable)  
Credit: Variable

CHE 600  
Continuance of Residence  
Lecture: 0 Lab: 1 Credits: 1

CHE 691  
Research and Thesis for Ph.D. Degree  
Credit: Variable