CHEMICAL ENGINEERING

Courses

CHE 1112 Introduction to the Engineering of Coffee (LN)
Description: A non-mathematical introduction to the engineering aspects of roasting and brewing coffee. Simple engineering concepts are used to study methods for roasting and processing of coffee. The course will investigate techniques for brewing coffee such as a drip coffee, pour-over, French press, AeroPress, and espresso. Laboratory experiences focus on roasting and brewing coffee to teach introductory engineering concepts to both engineers and non-engineers.
Credit hours: 2
Contact hours: Lecture: 1 Lab: 2 Contact: 3
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Chemical Engineering
General Education and other Course Attributes: Scientific Investigation, Natural Sciences

CHE 2023 Introduction to Chemical Engineering Thermodynamics
Prerequisites: CHEM 1314, CHEM 1414 or CHEM 1515, MATH 2144, PHYS 2014 with a grade of "C" or better.
Description: Systems approach to modeling industrial process, application of first and second laws, properties of substances, separate strategies using thermodynamic principles, and power generation cycles. May not be used for degree credit with ENSC 2213.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 2033 Introduction to Chemical Process Engineering
Prerequisites: CHEM 1515, (CHE 2023 or ENSC 2213), ENGR 1412, ENGL 1113, ENGR 1111 with grades of "C" or better and concurrent enrollment in MATH 2233 or MATH 3263.
Description: Application of mathematics and scientific principles to solving chemical engineering problems. Simple material and energy balances applied to process design. The nature and application of unit operations and unit processes to the development of chemical processes.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3 Other: 0
Levels: Undergraduate
Schedule types: Discussion, Combined lecture & discussion, Lecture
Department/School: Chemical Engineering

CHE 2581 Chemical Engineering Seminar I
Prerequisites: CHE majors.
Description: Through guest lectures and home assignments, preparation and planning for a CHE career and success in the CHE curriculum. Professional growth topics oriented to students in the sophomore-level courses.
Credit hours: 1
Contact hours: Lecture: 1 Contact: 1
Levels: Undergraduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 3013 Rate Operations I
Prerequisites: CHE 2033, (CHEM 3112 & CHEM 3153) OR (BIOC 3653 & BIOC 3723), ENSC 3233, and PHYS 2114 with grades of "C" or better.
Description: Development and application of phenomenological and empirical models to the design and analysis of fluid processing and heat transfer unit operations.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 3113 Rate Operations II
Prerequisites: CHE 3013, CHE 3333, CHE 3473, ENSC 3231, and CHE 3543 with grades of "C" or better.
Description: Development and application of phenomenological and empirical models to the design and analysis of mass transfer and separations unit operations.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 3123 Chemical Reaction Engineering
Prerequisites: CHE 3013, CHE 3333, CHE 3473, ENSC 3231, and CHE 3543 with grades of "C" or better.
Description: Principles of chemical kinetics rate concepts and data treatment. Elements of reactor design principles for homogeneous systems; introduction to heterogeneous systems. Course previously offered as CHE 4473.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 3202 Interdisciplinary Design and Build for Chemical Systems I
Prerequisites: CEAT major or consent of instructor.
Description: Interdisciplinary design course that provides independent work experience, professional development, and assigned design-build problems.
Credit hours: 2
Contact hours: Lecture: 2 Contact: 2
Levels: Undergraduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 3211 Interdisciplinary Design and Build for Chemical Systems II
Prerequisites: CEAT major and CHE 3202 or consent of instructor.
Description: Continuation of CHE 3202. Interdisciplinary design course that provides independent work experience, professional development, and assigned design-build problems.
Credit hours: 1
Contact hours: Lecture: 1 Contact: 1
Levels: Undergraduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 3333 Introduction to Transport Phenomena
Prerequisites: CHE 2033, (CHEM 3112 & CHEM 3153) OR (BIOC 3653 & BIOC 3723), ENSC 3233, and PHYS 2114 with grades of "C" or better.
Description: Molecular concepts of mass, momentum, and thermal energy diffusion. Theories and correlations for transport properties of viscosity, thermal conductivity, and diffusivity. Shell balance techniques to derive differential equations of change. Application of ODEs to simple transport phenomena problems. Turbulent flow analysis. Use of CFD software for analysis. Course previously offered as CHE 4333.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 3473 Chemical Engineering Thermodynamics
Prerequisites: CHE 2033, (CHEM 3112 & CHEM 3153) OR (BIOC 3653 & BIOC 3723), ENSC 3233, and PHYS 2114 with grades of "C" or better.
Description: Application of thermodynamics to chemical process calculations. Behavior of fluids, including estimation of properties by generalized methods. Study of chemical thermodynamics, including heats of reaction, chemical reaction, and phase equilibria.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 3543 Introduction to Chemical Process Analytics
Prerequisites: ENGR 1412, CHE 2033.
Description: Data generation and analysis methods from chemical processes and experiments. Model development using programming. Data interpretation.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 3581 Chemical Engineering Seminar II
Prerequisites: CHE 2033, CHE 2581, ENGR 1111.
Description: Through guest lectures and home assignments, preparation and planning for a CHE career and success in the CHE curriculum. Professional growth topics oriented to students in the junior-level CHE courses.
Credit hours: 1
Contact hours: Lecture: 1 Contact: 1
Levels: Undergraduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 4002 Chemical Engineering Laboratory I
Prerequisites: CHE 3013, CHE 3333, CHE 3473, ENSC 3231, CHE 3543 with grades of "C" or better.
Description: Application of CHE fundamentals and unit operation principles to the analysis of bench and pilot-scale equipment. Primarily fluid processing and heat exchange. Design of experiments on non-ideal units to generate credible data useful for validation of principles and for engineering decisions. Interpretation of experimental data and presentation of results.
Credit hours: 2
Contact hours: Lab: 4 Contact: 4
Levels: Undergraduate
Schedule types: Lab
Department/School: Chemical Engineering

CHE 4073 Introduction to Tissue Engineering
Prerequisites: Senior standing or higher and ENSC 3233 and ENSC 3313 and MATH 2153; or by consent of instructor.
Description: An overview of the principles of tissue engineering and regenerative medicine, including a general understanding of tissue growth and development, and an investigation of the engineering principles needed to design tissues and organs. May not be used for degree credit with CHE 5073.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 4112 Chemical Engineering Laboratory II
Prerequisites: CHE 3113, CHE 3123, CHE 4002 with grades of "C" or better.
Description: A continuation of CHE 4002. Primary reaction and mass transfer processes.
Credit hours: 2
Contact hours: Lab: 4 Contact: 4
Levels: Undergraduate
Schedule types: Lab
Department/School: Chemical Engineering

CHE 4124 Chemical Engineering Design I
Prerequisites: CHE 3113, CHE 3123, CHE 4002 with grades of "C" or better.
Description: Economic analysis of process plants and systems of equipment; methods for estimating plant investment requirements and operating costs; economic evaluation and optimal design of chemical process systems; basic equipment and process design calculations.
Credit hours: 4
Contact hours: Lecture: 3 Lab: 2 Contact: 5
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Chemical Engineering

CHE 4133 Introduction to Catalysis and Photocatalysis
Prerequisites: Senior standing or higher and CHE 3123 or consent of instructor.
Description: Molecular level insight into catalysis and photocatalysis from the basics of chemistry and chemical engineering. Topics covered include homogeneous catalysis, heterogeneous catalysis, molecular photocatalysis, and photocatalysis on metals and metal oxides. The rational design of catalysts using first-principle (e.g., density functional theory) calculations is covered. Advancements made in the experimental and computational catalysis fields to convert renewable natural resources such as solar light and cellulosic biomass into electricity, fuels, valuable chemicals and pharmaceuticals. May not be used for degree credit with CHE 5133.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 4183 Drug Delivery
Prerequisites: Senior standing or higher; or by consent of instructor.
Description: The future of medicine seems focused on the technologies for drug delivery and on large, macromolecular drugs such as genes and proteins. This course is intended to give you an overview of macromolecular drugs (i.e., genes and proteins) and the methods for their delivery. May not be used for degree credit with CHE 5183.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 4224 Chemical Engineering Design II
Prerequisites: CHE 4112 and CHE 4124.
Description: A continuation of CHE 4124. Economic analysis of process plants and equipment. Design of chemical processing equipment and chemical plants. Application of computer techniques to chemical engineering design.
Credit hours: 4
Contact hours: Lecture: 3 Lab: 2 Contact: 5
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Chemical Engineering

CHE 4283 Bioprocess Engineering
Prerequisites: CHE 3123 (or instructor consent).
Description: Application of fundamental engineering principles to biochemical and biological processes. Introduction to cellular processes, fermentation technology, biological mass transfer and kinetics, bioreactor design and scale-up and downstream processing. Same course as BAE 4283.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 4293 Biomedical Engineering
Prerequisites: ENSC 3233, (CHE 2023 or ENSC 2213); or consent of instructor.
Description: Introduction to engineering principles applied to biomedical applications. Biomaterials, drug delivery, artificial organs, transport in biological systems, tissue engineering and modeling of biological systems.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 4303 Introduction to Science and Engineering Research
Prerequisites: Senior level or by consent of instructor.
Description: This course is designed to expose senior level undergraduate students to principles and practice common to research in science and engineering, and accelerate student development towards independent and creative research prowess upon entering a graduate program. May not be used for degree credit with CHE 5303 or CHE 5302. Previously offered as CHE 4302.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 4323 Electrochemical Engineering
Prerequisites: ENSC 2213 or CHE 2023, ENSC 3233; or consent of instructor.
Description: An introduction to the fundamental principles of electrochemistry and its applications in different engineering systems for energy, chemical, biomedical, and electronics industries. May not be used for degree credit with CHE 5323.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 4343 Environmental Engineering
Prerequisites: CHE 3123 or consent of instructor.
Description: Application of science and engineering principles to minimize the adverse effects of human activities on the environment. National and state environmental regulations. Predictive movement and fate of chemicals in the geospheres. Multi-media pollution assessment, analysis and control. Consideration of safety, health and environmental issues from a process standpoint.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 4493 Introduction to Molecular Modeling and Simulation
Prerequisites: Senior standing or higher and any one of the following courses – CHE 3473, CHEM 3433, CHEM 3553, MAE 3223, MAE 5683, MAE 5693, BIOC 3223 or consent of instructor.
Description: Theory of statistical mechanics and its application to computing thermodynamic, transport and phase equilibria properties of fluids. Modeling of matter at molecular level and atomistic simulation methods such as Monte Carlo and molecular dynamics. Quantum calculation of thermodynamics for industrially relevant reactions. Software used: Cassandra, Gromacs, LAMMPS, and Gaussian. May not be used for degree credit with CHE 5493.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 4523 Introduction to Colloid Processing
Prerequisites: MATH 2153 and CHEM 1515.
Description: The physics and chemistry governing the behavior of microscopic particles in dilute and concentrated suspensions. Interparticle interaction influence on viscosity, viscoelasticity, yield stress, and shear thinning. Practical applications of colloids principles in industrial practice. No credit for students with credit in CHE 5523. Same course as MSE 4523.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 4533 Colloidal and Interfacial Phenomena
Prerequisites: Senior standing.
Description: This course surveys applications and fundamental aspects of colloidal and interfacial phenomena, industrial applications include pharmaceuticals, energy, agriculture, and food/beverage, and will explore systems such as surfactants, polymers, emulsions, dispersions, foams, and particles at interfaces. The course includes explorations of emulsion stability mechanisms, interparticle interactions, surfactant behavior, and interfacial stability mechanisms. Experimental techniques used to characterize these systems such as interfacial tenslometry and dispersion sizing will be discussed. May not be used for degree credit with CHE 5533.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 4543 Machine Learning for Chemical Processes
Prerequisites: MATH 2144, CHE 3543, or Consent of Instructor.
Description: The emphasis of the course will be to utilize concepts from statistics, calculus, and linear algebra to develop machine learning models applicable to a wide range of problems in engineering, natural and social sciences, and finance. Special emphasis will be given to the application of methods in the chemical engineering domain. However, students from other disciplines will find the methods broadly applicable to their areas of interest. Homework assignments and project will provide opportunities to apply the knowledge in a broader context. May not be used for degree credit with CHE 5543.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 4581 Chemical Engineering Seminar III
Prerequisites: Senior standing, CHE 3581.
Description: Through guest lectures and home assignments, preparation and planning for a ChE career and success in the ChE curriculum. Professional growth topics oriented to students in the senior-level ChE courses.
Credit hours: 1
Contact hours: Lecture: 1 Contact: 1
Levels: Undergraduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 4603 Introduction to Membrane Separations
Prerequisites: Senior standing or higher and CHE 3113 or consent of instructor.
Description: Basic principles of membrane technology: membrane synthesis processes and molecular separation mechanisms for different types of membranes. General overview of many different membrane processes. Basic transport equations and fundamental concepts with examples and industrial applications. Includes a project/discussion for a membrane reactor model. May not be used for degree credit with CHE 5603.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 4753 Introduction to Applied Numerical Computing for Scientists and Engineers
Prerequisites: Senior standing or higher, and MATH 2233 or MATH 3263, and knowledge of programming, or consent of instructor.
Description: Practical software tools for computational problem solving in science and engineering: version control (e.g., Git), mathematical typesetting (e.g., LaTeX), graphical user interfaces, and high level program languages with libraries of solvers and visualization tools (e.g., Python and MATLAB). Application of numerical computing methods to solve systems of differential and algebraic equations and to estimate model parameters using optimization. May not be used for degree credit with CHE 5753.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 4773 Introduction to Computational Fluid-Particle Dynamics
Prerequisites: Senior standing or higher and CHE 3333 or consent of instructor.
Description: Computational fluid-particle dynamics (CFPD) modeling strategies and simulation of multiphase flow transport phenomena such as particle tracking, deposition, reaction, and erosion. Detailed flow visualization using multiphase flow models on ANSYS CFX and Fluent platforms. Application of numerical techniques to simulate processes defined by first-principles. Application of CFPD for drug formulation optimization, lung aerosol dynamics, separation processes, reactions in stirred tanks and plug flow reactors. May not be used for degree credit with CHE 5773.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 4783 Nanomaterial Synthesis and Characterization
Prerequisites: Senior standing or consent of instructor.
Description: Exposing students to the principles and concepts of nanoscience and nanotechnology with focus on nanomaterial synthesis and characterization, and accelerating student development towards an effective literature review on a selected topic. May not be used for degree credit with CHE 5783.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 4843 Chemical Process Instrumentation and Control
Prerequisites: ENSC 2613, ENGR 2421 with grades of "C" or better, CHE 4112 and CHE 4124.
Description: Process instrumentation for measurement and control. Process dynamics and modeling. Linearization. Classical control system analysis and design. Tuning. Communication through block diagrams and P&IDs.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 4880 Special Topics
Prerequisites: Senior standing.
Description: Training in independent work, study of relevant literature, and experimental investigation of an assigned problem. Offered for variable credit, 1-5 credit hours, maximum of 5 credit hours.
Credit hours: 1-5
Contact hours: Contact: 1-5 Other: 1-5
Levels: Undergraduate
Schedule types: Independent Study
Department/School: Chemical Engineering

CHE 4990 Special Problems
Prerequisites: Senior standing.
Description: Training in independent work, study of relevant literature, and experimental investigation of an assigned problem. Offered for variable credit, 1-5 credit hours, maximum of 5 credit hours.
Credit hours: 1-5
Contact hours: Contact: 1-5 Other: 1-5
Levels: Undergraduate
Schedule types: Independent Study
Department/School: Chemical Engineering

CHE 5000 Master's Thesis
Prerequisites: Approval of major professor.
Description: Methods used in research and thesis writing. Offered for variable credit, 1-6 credit hours, maximum of 6 credit hours.
Credit hours: 1-6
Contact hours: Contact: 1-6 Other: 1-6
Levels: Graduate
Schedule types: Independent Study
Department/School: Chemical Engineering

CHE 5030 Professional Practice
Prerequisites: Senior standing and consent of instructor.
Description: Application of chemical engineering principles to the solution of real-life engineering problems in an actual or simulated industrial environment. Includes application of design and testing procedures, economic evaluation and reporting on one or more assigned projects. Offered for variable credit, 2-6 credit hours, maximum of 8 credit hours.
Credit hours: 2-6
Contact hours: Contact: 2-6 Other: 2-6
Levels: Graduate
Schedule types: Independent Study
Department/School: Chemical Engineering

CHE 5073 Tissue Engineering
Prerequisites: Graduate standing and permission of instructor.
Description: Tissue engineering (TE) and the material strategy for different tissue constructs in bone TE, liver TE, neural TE, intestine TE, etc. will be discussed in this course. Same as MSE 5073. May not be used for degree credit with CHE 4703.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 5110 Special Topics in Chemical Engineering
Prerequisites: Consent of instructor.
Description: Small group and individual projects in unit operations, unit procedures, chemical kinetics, computer applications, process modeling, or any of a wide range of chemical engineering topics. May be repeated for credit if subject matter varies. Offered for variable credit, 2-3 credit hours, maximum of 6 credit hours.
Credit hours: 2-3
Contact hours: Contact: 2-3 Other: 2-3
Levels: Graduate
Schedule types: Independent Study
Department/School: Chemical Engineering

CHE 5123 Advanced Chemical Reaction Engineering
Prerequisites: CHE 4473.
Description: Advanced principles and applications of chemical kinetics in catalysis, heterogeneous systems, non-ideal reactions, polymerization, and biological reactions.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 5133 Catalysis and Photocatalysis
Prerequisites: Graduate standing or CHE 3123 or consent of instructor.
Description: Molecular level insight into catalysis and photocatalysis from the basics of chemistry and chemical engineering. Topics covered include homogeneous catalysis, heterogeneous catalysis, molecular photocatalysis, and photocatalysis on metals and metal oxides. The rational design of catalysts using first-principle (e.g., density functional theory) calculations is covered. Advancements made in the experimental and computational catalysis fields to convert renewable natural resources such as solar light and cellulosic biomass into electricity, fuels, valuable chemicals and pharmaceuticals. May not be used for degree credit with CHE 4133.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 5183 Drug Delivery
Prerequisites: Graduate standing or consent of instructor.
Description: The future of medicine seems focused on the technologies for drug delivery and on large, macromolecular drugs such as genes and proteins. This course is intended to give you an overview of macromolecular drugs (i.e., genes and proteins) and the methods for their delivery. May not be used for degree credit with CHE 4183.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 5213 Advanced Transport Phenomena
Prerequisites: CHE 3333 (or equivalent), or graduate student standing in the School of Chemical Engineering, or a closely related, calculus-based STEM discipline, or consent of instructor.
Description: Mechanisms and modeling of mass, momentum and heat transport with an emphasis on chemical, petroleum, and biomedical engineering applications.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 5233 Bioseparations
Prerequisites: BAE 3013 or CHE 3013.
Description: Study of separations important in food and biochemical engineering such as leaching, extraction, expression, absorption, ion exchange, filtration, centrifugation, membrane separation, and chromatographic separations. Course available online only through AG*IDEA consortium.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 5263 Advanced Biomaterials Science and Engineering
Prerequisites: Graduate standing or consent of instructor.
Description: Engineering issue that are implicit in understanding the interactions of living tissue and processed materials will be introduced. Emphasis is on identifying the processes in which cells interact with surfaces and particulate matter and the outcome of these interactions. Highlighted biological responses will include inflammation and coagulation. Also, biomaterial issues related to drug delivery and tissue engineering will be discussed. Same course as MAE 5003.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 5273 Basic Physiology and Physiological System Analysis for Engineers
Prerequisites: Graduate standing or consent of instructor.
Description: The goals of this class are: 1) to introduce the basic physiology concepts used widely in biomedical engineering research; 2) to introduce and develop engineering concepts and approaches for quantitative analysis of physiological systems. Engineering principles will be applied to study mechanical properties of various tissue and organ systems under normal and diseased conditions. Knowledge obtained from this class can help engineers to apply engineering principles to the design and development of medical devices for disease treatments. Same course as MAE 5013.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 5283 Advanced Bioprocess Engineering
Prerequisites: Consent of instructor.
Description: Application of fundamental engineering principles to biochemical and biological processes. Introduction to cellular processes, fermentation technology, biological mass transfer and kinetics, bioreactor design and scale-up, and downstream processing. Same course as BAE 5283.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 5293 Advanced Biomedical Engineering
Prerequisites: Consent of instructor.
Description: Principles and engineering analysis of biomedical processes. Artificial organs, biomaterials, tissue engineering, transport in biological systems, biomedical imaging and drug delivery systems. Same course as MAE 5033.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 5303 Introduction to Science and Engineering Research
Prerequisites: Graduate level or by consent of instructor.
Description: This course is designed to expose new graduate students to principles and practice common to research in science and engineering, and accelerate student development towards independent and creative research prowess. May not be used for degree credit with CHE 4302, CHE 4303, and PETE 6813.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 5323 Electrochemical Engineering
Prerequisites: Graduate standing.
Description: An introduction to the fundamental principles of electrochemistry and its applications in different engineering systems for energy, chemical, biomedical, and electronics industries. May not be used for degree credit with CHE 4323.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 5343 Advanced Environmental Engineering
Prerequisites: Consent of instructor.
Description: Science and engineering principles to minimize the adverse effects of human activities on the environment. National and state regulations. Predictive movement and fate of chemicals in the geospheres. Multi-media pollution assessment, analysis, and control. Consideration of safety, health, and environment issues from a process standpoint. Special project required. Credit not allowed if CHE 4343 was taken.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 5373 Process Simulation
Prerequisites: CHE 5843 or concurrent enrollment or with professor's consent.
Description: Computer-aided process synthesis, simulation, analysis and optimization. Systematic tools for developing and screening potential chemical process flow sheets. Use of commercial process simulators to aid in evaluating process designs. Practical problems will be used as examples and case studies.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 5493 Molecular Modeling and Simulation
Prerequisites: Graduate standing and any one of the following courses: CHE 3473, CHEM 3433, CHEM 3553, MAE 3223, MAE 5683, MAE 5693, BIOC 3224 or consent of instructor.
Description: Theory of statistical mechanics and its application to computing thermodynamic, transport and phase equilibria properties of fluids. Modeling of matter at molecular level and atomistic simulation methods such as Monte Carlo and molecular dynamics. Quantum calculation of thermodynamics for industrially relevant reactions. Software used: Cassandra, Gromacs, LAMMPS, and Gaussian. May not be used for degree credit with CHE 4493.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 5523 Colloid Processing
Prerequisites: Graduate standing in engineering, physics, or chemistry or consent of instructor.
Description: The physics and chemistry governing the behavior of microscopic particles in dilute and concentrated suspensions. Interparticle interaction influence on viscosity, viscoelasticity, yield stress, and shear thinning. Practical application of colloids principles in industrial practice.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 5533 Colloidal and Interfacial Phenomena
Prerequisites: Consent of instructor.
Description: Individual report topics in chemical engineering involving operations, processes, equipment, experiments, literature search, theory, computer use or combinations of these. May not be used for degree credit with CHE 4533.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 5543 Machine Learning for Chemical Processes
Prerequisites: Graduate standing, MATH 2144, and CHE 3543; or Consent of Instructor.
Description: The emphasis of the course will be to utilize concepts from statistics, calculus, and linear algebra to develop machine learning models applicable to a wide range of problems in engineering, natural and social sciences, and finance. Special emphasis will be given to the application of methods in the chemical engineering domain. However, students from other disciplines will find the methods broadly applicable to their areas of interest. May not be used for degree credit with CHE 4543. Previously offered as CHE 5990.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 5603 Membrane Separations
Prerequisites: Graduate standing and CHE 3113 or consent of instructor.
Description: Basic principles of membrane technology: membrane synthesis processes and molecular separation mechanisms for different types of membranes. General overview of many different membrane processes. Basic transport equations and fundamental concepts with examples and industrial applications. Includes a project/discussion for a membrane reactor model. May not be used for degree credit with CHE 4603.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 5633 Stagewise Operations
Description: Stagewise separation in binary and multicomponent systems. Development of theoretical techniques with application to typical situations in vapor-liquid, liquid-liquid and solid-liquid systems. Use of digital and analog techniques.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 5703 Optimization Applications
Prerequisites: Graduate standing.
Description: A survey of various methods of unconstrained and constrained linear and non-linear optimization. Applications of these methodologies using hand-worked examples and available software packages. Intended for engineering and science students. Same course as ECEN 5703, IEM 5023 & MAE 5703.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 5723 Plasmonic Photocatalysis
Prerequisites: CHE 5123; or by consent of instructor.
Description: The field of plasmonic photocatalysis grew tremendously in the last decade. In this course, the current state of the art plasmonic photocatalysis are reviewed through the rigorous collection of literature. The advantages of the visible-light-driven plasmonic photocatalysis over the conventional thermal energy-driven heterogeneous catalysis will be discussed. The fundamental insight into photocatalytic mechanisms by which the charge carriers (electrons and holes) are formed and transferred to adsorbates to drive chemical transformations on the surface of plasmonic nanocatalysts will also be discussed. The computational methods used to predict and understand the photocatalytic activity and selectivity in plasmonic photocatalysis will also be reviewed. Finally, the current challenges, new opportunities, and future outlook for plasmonic photocatalysis will be presented.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 5733 Neural Networks
Prerequisites: Graduate standing.
Description: Introduction to mathematical analysis of networks and learning rules and on the application of neural networks to certain engineering problems, image and signal processing and control systems. Same course as ECEN 5733 & MAE 5733.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 5743 Chemical Engineering Process Modeling
Description: Chemical engineering systems and process models. Analytical and numerical methods of solution of resulting equations with computer methods in a chemical engineering context.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 5753 Applied Numerical Computing for Scientists and Engineers
Prerequisites: Graduate standing, and MATH 2233 or MATH 3263, and knowledge of programming, or consent of instructor.
Description: Practical software tools for computational problem solving in science and engineering: version control (e.g., Git), mathematical typesetting (e.g., LaTeX), graphical user interfaces, and high level program languages with libraries of solvers and visualization tools (e.g., Python and MATLAB). Application of numerical computing methods to solve systems of differential and algebraic equations and to estimate model parameters using optimization. May not be used for degree credit with CHE 4753.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 5773 Computational Fluid-Particle Dynamics
Prerequisites: Graduate standing and CHE 3333 or consent of instructor.
Description: Computational fluid-particle dynamics (CFPD) modeling strategies and simulation of multiphase flow transport phenomena such as particle tracking, deposition, reaction, and erosion. Detailed flow visualization using multiphase flow models on ANSYS CFX and Fluent platforms. Application of numerical techniques to simulate processes defined by first-principles. Application of CFPD for drug formulation optimization, lung aerosol dynamics, separation processes, reactions in stirred tanks and plug flow reactors. May not be used for degree credit with CHE 4773.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 5783 Nanomaterial Synthesis and Characterization
Description: Exposing students to the principles and concepts of nanoscience and nanotechnology with focus on nanomaterial synthesis and characterization, and accelerating student development towards an effective literature review to come up with novel idea on a selected topic. May not be used for degree credit with CHE 4783.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 5843 Principles of Chemical Engineering Thermodynamics
Description: Principles of thermodynamics. Properties of fluids and prediction of thermodynamic properties. Phase and chemical equilibrium. Thermodynamics in unit operations.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 5850 Advanced Process Control Laboratory
Prerequisites: Graduate standing and permission of instructor.
Description: Instrumentation systems and control strategies on pilot-scale chemical processes. Calibration, filtering, dynamic modeling, tuning, advanced control, and method evaluation. Students will learn industrial practices and cope with many non-idealities. Offered for variable credit, 2-3 credit hours, maximum of 6 credit hours.
Credit hours: 2-3
Contact hours: Lecture: 1 Lab: 2-4 Contact: 3-5
Levels: Graduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Chemical Engineering

CHE 5853 Advanced Chemical Process Control
Prerequisites: CHE 4843 or equivalent.
Description: General concepts and approaches of model-based control. Studies in the application of process-model-based control and model-predictive control on multivariable, nonlinear, nonstationary, noisy processes.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 5873 Air Pollution Control Engineering
Description: Causes, effects and control of atmosphere pollution. Same course as CIVE 5873.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 5880 Special Problems
Prerequisites: Consent of instructor.
Description: Individual report topics in chemical engineering involving operations, processes, equipment, experiments, literature search, theory, computer use or combinations of these. Offered for variable credit, 1-3 credit hours, maximum of 9 credit hours.
Credit hours: 1-3
Contact hours: Contact: 1-3 Other: 1-3
Levels: Graduate
Schedule types: Independent Study
Department/School: Chemical Engineering

CHE 5990 Special Problems
Prerequisites: Consent of instructor.
Description: Individual report topics in chemical engineering involving operations, processes, equipment, experiments, literature search, theory, computer use or combinations of these. Offered for variable credit, 1-4 credit hours, maximum of 9 credit hours.
Credit hours: 1-4
Contact hours: Contact: 1-4 Other: 1-4
Levels: Graduate
Schedule types: Independent Study
Department/School: Chemical Engineering

CHE 6000 Doctoral Thesis
Prerequisites: Consent of major professor.
Description: The doctoral candidate registers for a minimum of 1 semester credit hour to a maximum of 15 semester credit hours in each semester during which dissertation work is in process. Methods used in research and thesis writing. An original investigation of a problem in chemical engineering and its report in a dissertation. Offered for variable credit, 1-15 credit hours, maximum of 54 credit hours.
Credit hours: 1-15
Contact hours: Contact: 1-15 Other: 1-15
Levels: Graduate
Schedule types: Independent Study
Department/School: Chemical Engineering

CHE 6010 Chemical Engineering Seminar
Prerequisites: Consent of major professor.
Description: Advanced research and development topics. Offered for variable credit, 1 credit hour, maximum of 10 credit hours.
Credit hours: 1
Contact hours: Contact: 1 Other: 1
Levels: Graduate
Schedule types: Independent Study
Department/School: Chemical Engineering

CHE 6223 Advanced Chemical Engineering Thermodynamics
Prerequisites: CHE 5843.
Description: Phase equilibrium in multicomponent systems. Irreversible processes. Properties of fluids and the prediction of properties by statistical methods. Application of thermodynamics to unit operations.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Chemical Engineering

CHE 6440 Advanced Topics in Chemical Engineering
Description: Topics in chemical engineering unit operations in design. Advanced mathematical techniques in chemical engineering problems. May be repeated for credit if subject matter varies. Offered for variable credit, 3-6 credit hours, maximum of 9 credit hours.
Credit hours: 3-6
Contact hours: Contact: 3-6 Other: 3-6
Levels: Graduate
Schedule types: Independent Study
Department/School: Chemical Engineering

CHE 6703 Research Methods in Chemical Engineering
Prerequisites: MS or PhD candidacy in chemical engineering or consent of instructor.
Description: Methods and skills required to successfully conduct chemical engineering research projects. Maintaining research records, experiment design, data validation, results presentation and research ethics.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Chemical Engineering