CHEMICAL ENGINEERING (CHEG)

CHEG 5001. Advanced Chemical Engineering Fundamentals. (3 Credits)
This course will provide graduate-level introduction to thermodynamics, transport phenomena, and kinetics within the context of chemical engineering applications. Primary attention will be paid to developing an understanding of the fundamentals of each of these topic areas. As the course progresses, integration and application of thermodynamics, transport phenomena, and reaction kinetics will be discussed.
Enrollment Requirements: Instructor consent.

CHEG 5013. Principles of Regenerative Engineering and Applications. (3 Credits)
Foundations, principles, and technologies of regenerative engineering.
Enrollment Requirements: Instructor consent.

CHEG 5301. Chemical Engineering Thermodynamics I. (3 Credits)
An advanced study of classical thermodynamics with emphasis on phase and chemical equilibria and applications to the chemical process industries. Kinetic theory and statistical thermodynamics with emphasis on the prediction and correlation of physical and chemical properties of gases and liquids, including mixtures. Theory and application of flames, plasmas, and shock waves.

CHEG 5315. Transfer Operations I. (3 Credits)
An advanced study of momentum, heat and mass transfer with application to complex problems. Cartesian tensors, non-Newtonian flow, statistical theory of turbulence. Mass transfer in multicomponent systems and with chemical reaction. Mass transfer in drops and bubbles; two-phase flow and fluidization.

CHEG 5321. Reaction Kinetics I. (3 Credits)
Chemical kinetics and reactor design. An advanced study of chemical reaction engineering with emphasis on catalysis. Applications to stirred-tanks, fixed-bed, and fluidized bed reactors.

CHEG 5323. Surface Chemistry and Heterogeneous Catalysis. (3 Credits)
Quantum Mechanics, Physical Chemistry. Grading Basis: Graded The course will serve as an in-depth introduction to heterogeneous catalysis from a surface chemistry perspective. The course will cover topics of modern catalysis as well as the fundamental physics, chemistry, and engineering of catalysis and catalytic reactors.
Enrollment Requirements: Instructor consent. Recommended preparation: CHEM 1128; Math 1132; CHEG 2103 or equivalent.

CHEG 5330. Applied Machine Learning in Chemical Engineering. (3 Credits)
This course is an applied machine learning algorithms course tailored for the chemical/process engineers. The focus of this course from is on case studies and real-world examples seen by chemical engineers. The course will include exposure to machine learning, data science & analytics, and big data in a chemical engineering context. Students are taught to identify descriptors, and predict and optimize system properties using a machine learning approach.
Enrollment Requirements: Instructor consent.

CHEG 5333. Computer Simulation in Chemical Engineering. (3 Credits)
Learning and applying modern tools for computer simulation of chemical engineering processes. Covers the basic equations required to simulate generic types of processes and interactive Computer Labs where we solve examples from the course textbook. You will integrate theory with modeling, determine other solutions and find bugs, and identify inaccuracies or problems in the proposed solution. Short introductions to the Interface of each Software (Aspen Plus, Matlab, Comsol) will be given. The Computer Labs structure will be based on a step-by-step solution of chemical engineering problems. Will work with PowerPoint slides to perform a step for a simulation, while working with the instructor to ensure understanding before proceeding to the next slide.
Enrollment Requirements: Instructor consent. Recommended preparation: CHEG 5001 or equivalent.

CHEG 5336. Optimization. (3 Credits)
Advanced topics in optimization such as linear and nonlinear programming, mixed-integer linear and nonlinear programming, deterministic and stochastic global optimization, and interval global optimization. Example applications drawn from engineering.

CHEG 5339. Uncertainty Analysis, Robust Design, and Optimization. (3 Credits)
(Also offered as SE 5102.) Provides students with a thorough understanding of mathematical optimization and uncertainty analysis for the robust design of cyber-physical systems. Topics include optimization theory and practice, uncertainty modeling, sensitivity analysis, and formal and classical model-based robust design methodologies.
Enrollment Requirements: Recommended preparation: competency in numerical analysis and programming language (MATLAB).

CHEG 5341. Fuel Processing. (3 Credits)
Concepts and principles of energy and fuel resources, production and processing by applying energy and mass balances. Fundamentals of fuels processing in refinery and biorefinery processes and industrial (catalytic and non-catalytic) processes by constructing and analyzing systems level flow diagrams. Develop, solve and analyze chemical engineering systems and processes by applying fundamental concepts of thermodynamics and reaction kinetics as well as fundamental concepts from physics, biology, chemistry and mathematics. Analyze, propose solutions and present modern challenges in chemical engineering processes which involve fuel processing.
Enrollment Requirements: Instructor consent. Recommended preparation: Coursework taken from the Process Engineering Certificate. May be repeated for a total of 3 credits

CHEG 5351. Polymer Physics. (3 Credits)
Modern concepts relating to glassy, rubbery and organized states of bulk polymers. Considers rubber elasticity, glass-to-rubber transitions, networks, elements of crystallization, blends and interfacial phenomena.

CHEG 5352. Polymer Properties. (3 Credits)
(Also offered as POLY 5352.) Interrelationships between solid state structure, dynamics, and mechanical properties of non-crystalline and semi-crystalline polymers. Considers polymer viscoelasticity, diffusion, failure mechanism, and elementary polymer rheology.

CHEG 5367. Polymer Rheology. (3 Credits)
(Also offered as POLY 5367.) Analysis of the deformation and flow of polymeric materials. Topics include non-Newtonian flow, viscoelastic behavior and melt fracture with application to polymer processing.

CHEG 5373. Biochemical Engineering. (3 Credits)
Principles and design of processes involving biochemical reactions. Nature of biological materials, biochemical kinetics, heat and mass transfer, application to fermentation and other biological processes.

CHEG 5375. Fermentation and Separation Technology Laboratory. (3 Credits)
Introduction to techniques used for industrial mass culture of prokaryotic and eukaryotic cells, and methods used to extract useful products from these cultures. Metabolic processes, energentics, growth kinetics and nutrition of microorganisms. Synthesis of cellular material and end products. Heat exchange, oxygen transfer, pH control, sterilization and design of fermentors. Culture of eukaryotic cell mass. Immobilized enzyme and cell reactors. Product recovery methods of precipitation centrifugation, extraction filtration and chromatography. Formerly CHEG 384. Also offered as MCB 384.
Enrollment Requirements: Instructor consent.

CHEG 5376. Bioseparations. (3 Credits)
Introduction to bioseparations, review of mass transport, adsorption, chromatography, filtration, extraction, electrophoresis, and field flow fractionation.
Enrollment Requirements: Instructor consent; enrollment in the School of Engineering.

CHEG 5393. Seminar. (0 Credits)
May be repeated for a total of 0 credits
Grading Basis: Registered

CHEG 5394. Seminar. (0 Credits)
May be repeated for a total of 0 credits
Grading Basis: Registered

CHEG 5395. Investigation of Special Topics. (1-3 Credits)
Designed for special topics, or for individual students who desire to pursue investigations in a specialized field.
May be repeated for a total of 12 credits

CHEG 5399. Independent Study. (1-3 Credits)
Independent study under the supervison of a Chemical Engineering faculty member.
May be repeated for a total of 6 credits