CHEMICAL & BIOLOGICAL ENGINEERING (CBE-UY)

CBE-UY 401X SPECIAL TOPICS IN CBE (1-4 Credits)
Topics of special interest in chemical and biomolecular engineering are explored. | Prerequisites: CBE-UY 3313 or adviser's approval.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

CBE-UY 481X CHEMICAL ENGINEERING PROJECT (4 Credits)
Typically offered Fall, Spring, and Summer terms
Students and faculty supervisors select independent chemical and biomolecular engineering projects. Not open to honors or senior thesis students. (X = 1, 2, 3 or 4 and designates the number of credits.) May be repeated up to a maximum of 8 credits. | Prerequisite: Adviser's approval.
Grading: Satisfactory/Unsatisfactory
Repeatable for additional credit: Yes

CBE-UY 491X BACHELOR'S THESIS IN CHEMICAL & BIOMOLECULAR ENGINEERING (1-4 Credits)
Typically offered Fall and Spring
In this course, students plan original problem investigations in chemical and biomolecular engineering guided by a faculty supervisor. A thorough literature search is required. Special apparatus is constructed as required for experimental work. (X = 1, 2, 3 or 4 and designates the number of credits.) May be repeated up to a maximum of 8 credits. | Prerequisite: Adviser's approval.
Grading: Satisfactory/Unsatisfactory
Repeatable for additional credit: Yes

CBE-UY 495X Chemical Engineering Internship (1-3 Credits)
Typically offered Fall and Spring
An internship is a supervised, professional work experience at a company. Qualifying internships must be engineering in nature. Internships taken for credit must be approved by a student's academic advisor, and can be completed year-round and over multiple semesters. Students are required to submit reports as agreed upon with their academic advisor and company supervisor. | Prerequisites:adviser's approval.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: Yes

CBE-UY 1002 INTRODUCTION TO CHEMICAL & BIOMOLECULAR ENGINEERING (2 Credits)
Typically offered Spring
This course introduces dynamic modeling of chemical processes, their automated control, and associated hardware including controllers, actuators, and sensors. Dynamic models of chemical processes are developed, and the modeling and optimization of common control strategies including feed-back, feed-forward, and cascaded loops is described, as are processes characterized by multiple inputs and outputs. Process safety topics and strategies for management of process hazards are also covered. | Prerequisites: CM-UY 1003 and First-year standing
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

CBE-UY 2124 Analysis of Chemical and Biomolecular Processes (4 Credits)
Typically offered Fall
This course prepares students to formulate and solve material and energy balances on chemical and biomolecular process systems and lays the foundation for subsequent courses in thermodynamics, unit operations, kinetics and process dynamics, and control. The course introduces the fundamental engineering approach to problem solving: breaking down a process into its components, establishing the relations between known and unknown process variables, assembling the information needed to solve for the unknowns and, finally, obtaining the solution using relevant computational methods. | Prerequisites: CM-UY 1003 and MA-UY 1024 (B- or better).
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

CBE-UY 2233 CHEMICAL ENGINEERING COMPUTATION (3 Credits)
Typically offered Spring
The course introduces applications of computer programming and numerical methods of interest to chemical engineers, based on examples taken from across the chemical engineering curriculum. The course covers basic programming logic and design, as well as applications to plotting, curve fitting, statistical analysis, solutions of algebraic and differential equations, and optimization problems. | Prerequisites: MA-UY 2034
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

CBE-UY 3153 Chemical and Biomolecular Engineering Thermodynamics (3 Credits)
Typically offered Fall
The course covers thermodynamics of flow systems. Topics include properties of fluids with advanced equations of state; properties of non-ideal mixtures; activity-coefficient models for non-electrolyte and electrolyte solutions; phase-equilibrium calculations at low and elevated pressures by computer procedures; and chemical reaction equilibria. | Prerequisites: MA-UY 2034
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

CBE-UY 3173 Polymeric Materials (3 Credits)
Typically offered Spring
The course examines processing, structure, properties and applications of polymers as engineering materials, including renewable-resource based biopolymers. Topics include fundamentals of processing-morphology/property correlations in materials, basic concepts of viscoelasticity, fracture behavior, and thermal and electrical properties of engineering polymeric materials. | Prerequisite: MA-UY 2034, CM-UY 2213 and CBE-UY 2124.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

CBE-UY 3223 KINETICS AND REACTOR DESIGN (3 Credits)
Typically offered Spring
This course provides the fundamentals of thermodynamics and kinetics of chemical and biomolecular reactions and the development of skills to analyze and design reactor systems. Topics include homogeneous and heterogeneous reactors of various types, catalyzed and non-catalyzed reactors, and the design of single and cascaded chemical and bio-reactors. Safety information pertinent to reactor design, including runaway reactions and several case studies, is also covered. | Prerequisites: CBE-UY 3153, CBE-UY 3313.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

CBE-UY 3233 CHEM & BIOMOLECULAR ENG SEPARATIONS (3 Credits)
Typically offered Spring
The course introduces processes for chemical and biomolecular separations. Topics include thermodynamics of separation processes, and the analysis and design of processes such as distillation, absorption, extraction and crystallization. Analytical and computer techniques are emphasized. | Prerequisites: CBE-UY 3153, CBE-UY 3313.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

CBE-UY 3313 Transport I (3 Credits)
Typically offered Fall
The course builds understanding of mass and heat transfer, and introduces engineering aspects of transport. Topics in mass transfer include diffusion-limited reactions with applications in biomolecular systems, transport in porous media, and mass transfer across membranes with applications in chemical and biomolecular systems. Topics in heat transfer include the basic mechanisms of conduction and convection. Topics in engineering aspects of transport include flow in closed conduits, heat-transfer equipment, and examples of simultaneous heat and mass transfer. | Prerequisites: MA-UY 2132 or MA-UY 2034.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

CBE-UY 3323 Transport II (3 Credits)
Typically offered Spring
This course establishes fundamental concepts in momentum transfer, fluid mechanics, fluid statics, and their applications in chemical and biomolecular systems. Topics include viscosity, laminar and turbulent fluid flow, macroscopic (integral) balances on finite control volumes of fluids (determination of inflow, outflow quantities), and microscopic (differential) balances on infinitesimal volumes of fluids (determination of fluid velocity profiles and pressure profiles). Students enrolled in this course will learn about Newtonian and non-Newtonian fluids and the concepts of viscosity and stress tensor; understand molecular origins of momentum transport and its macroscopic mathematical description via vector, tensor algebra, and calculus; they will learn how to non dimensionalize and solve the Navier Stokes equations and be able to use geometric and dynamic similarity and dimensionless numbers to solve problems that are of interest to chemical engineers. | Prerequisite: MA-UY 2034 and MA-UY 2114.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No
Prerequisites: MA-UY 2034 and MA-UY 2114.

CBE-UY 3474 Introduction to Modern Optics (4 Credits)
Typically offered Spring
This course covers the physics of optics using both classical and semi-classical descriptions. The classical and quantum interactions of light with matter. Diffraction of waves and wave packets by obstacles. Fourier transform optics, holography, Fourier transform spectroscopy. Coherence and quantum aspects of light. Geometrical optics. Matrix optics. Crystal optics. Introduction to electro-optics and nonlinear optics. | Prerequisite: PH-UY 2033
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

CBE-UY 4113 Engineering Laboratory I (3 Credits)
Typically offered Fall
This course introduces the performance of experiments in unit operations, transport processes and unit processes. Students analyze and design experiments to meet stated objectives. Results are presented in written and oral form. | Prerequisite: CBE-UY 3233.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

CBE-UY 4143 Process Dynamics and Control (3 Credits)
Typically offered Fall
This course introduces dynamic modeling of chemical processes, their automated control, and associated hardware including controllers, actuators, and sensors. Dynamic models of chemical processes are developed, and the modeling and optimization of common control strategies including feed-back, feed-forward, and cascaded loops is described, as are processes characterized by multiple inputs and outputs. Process safety topics and strategies for management of process hazards are also covered. | Prerequisites: CBE-UY 3223.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

CBE-UY 4163 Chemical and Biomolecular Process Design I (3 Credits)
Typically offered Fall
This is a capstone course and thus requires usage of all knowledge accrued so far in the chemical engineering curriculum. In this course, students will learn the elements involved in process ideation, scale-up, and large-scale implementation. Students will study usage of process diagrams (PFDs, P&IDs, BFDs, etc.), energy optimization, process safety, capital costs and equipment cost estimates. Coursework will include discussions of current socio-economic and political pressures as well as safety, environmental and ethical considerations involved in design; these aspects are expected to be integrated into student project work. Extensive usage of AspenPlus will be expected in the final design project. The course will employ several team-focused projects to advance these concepts and will culminate in a final design project that will continue in the spring semester. | Prerequisites: CBE-UY 3223 and CBE-UY 3233
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No
Prerequisites: CBE-UY 3223 and CBE-UY 3233.

CBE-UY 4213 Engineering Laboratory II (3 Credits)
Typically offered Spring
This course deals with continued experiments in unit operations, transport processes and process control. Students analyze and design experiments to meet stated objectives. Results are presented in writing and orally. | Prerequisites: CBE-UY 4113 and CBE-UY 4143.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

CBE-UY 4223 BIOCHEMICAL ENGINEERING (3 Credits)
Typically offered Spring
This course covers applications of chemical engineering concepts in biochemical and biological systems. Topics include biochemical & bioprocess engineering; enzyme kinetics; cellular control systems; genetic and protein engineering; metabolism; stoichiometry and metabolic engineering; cell growth kinetics; bioreactor design & operation; heat and mass transfer in biological systems; and biological product purification & characterization. | Prerequisites: CBE-UY 3223, CBE-UY 3313, or adviser's permission.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

CBE-UY 4263 Chemical and Biomolecular Process Design II (3 Credits)
Typically offered Spring
This course is a continuation of CBE-UY 4163. Students will continue working in teams on the capstone design project selected towards the end of the fall semester. Students will be expected to regularly meet with the instructor to report on their progress. The design teams will also compile a thorough final engineering report and prepare various presentations. Teams will make extensive use of the AspenPlus suite in creating their processes. The course also includes a series of seminars to be delivered by industry leaders in the areas of process safety, waste mitigation, environmental impact studies, human health considerations, regulatory and enforcement practices, and process engineering. | Prerequisites: CBE-UY 4163 and CBE-UY 4143.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No