CHEMICAL ENGINEERING (CENG)

*** CENG 1200a / ENAS 1200a / ENVE 1200a, Introduction to Environmental Engineering** Colby Buehler

Introduction to engineering principles related to the environment, with emphasis on causes of problems and technologies for abatement. Topics include air and water pollution, global climate change, hazardous chemical and emerging environmental technologies. Prerequisites: high school calculus and chemistry or CHEM 161, 165 or CHEM 163, 167 (may be taken concurrently) or permission of instructor. QR, SC

CENG 2100a / ENVE 2100, Principles of Chemical Engineering and Process Modeling Peijun Guo

Analysis of the transport and reactions of chemical species as applied to problems in chemical, biochemical, and environmental systems. Emphasis on the interpretation of laboratory experiments, mathematical modeling, and dimensional analysis. Lectures include classroom demonstrations. Prerequisite: MATH 115 or permission of instructor. QR, SC RP 0 Course cr

CENG 3010b, Chemical Kinetics and Chemical Reactors Shu Hu

Physical-chemical principles and mathematical modeling of chemical reactors. Topics include homogeneous and heterogeneous reaction kinetics, catalytic reactions, systems of coupled reactions, selectivity and yield, chemical reactions with coupled mass transport, nonisothermal systems, and reactor design. Applications from problems in environmental, biomedical, and materials engineering. Prerequisite: ENAS 194 or permission of instructor. QR, SC

CENG 3140a / ENVE 3140a, Transport Phenomena I Kyle Vanderlick

First of a two-semester sequence. Unified treatment of momentum, energy, and chemical species transport including conservation laws, flux relations, and boundary conditions. Topics include convective and diffusive transport, transport with homogeneous and heterogeneous chemical reactions and/or phase change, and interfacial transport phenomena. Emphasis on problem analysis and mathematical modeling, including problem formulation, scaling arguments, analytical methods, approximation techniques, and numerical solutions. Prerequisite: ENAS 194 or permission of the instructor. QR, SC RP

CENG 3150b / ENVE 3150b, Transport Phenomena II Michael Loewenberg

Unified treatment of momentum, energy, and chemical species transport including conservation laws, flux relations, and boundary conditions. Topics include convective and diffusive transport, transport with homogeneous and heterogeneous chemical reactions and/or phase change, and interfacial transport phenomena. Emphasis on problem analysis and mathematical modeling, including problem formulation, scaling arguments, analytical methods, approximation techniques, and numerical solutions. Prerequisite: ENAS 194 or permission of instructor. QR, SC

*** CENG 3450b / ENAS 3450b, Principles and Applications of Interfacial Phenomena** Kyle Vanderlick

This course covers the nature and consequences of both flexible and rigid interfaces, such as those associated with liquids and solids respectively. We examine the properties of interfaces as they exist alone, as a collective (e.g., colloids), and also as they interact

demonstrably with one another. An integral part of this course is the introduction and application of engineering analysis to calculate and predict behaviors central to technological applications. This course is designed for engineering majors. Other STEM majors are welcome but physics and multivariable calculus are prerequisites. Ideally, students should also have taken thermodynamics but this is not formally required. SC

CENG 3730a / CENG 373 / ENVE 3730a, Air Pollution Control Drew Gentner
An overview of air quality problems worldwide with a focus on emissions, chemistry, transport, and other processes that govern dynamic behavior in the atmosphere. Quantitative assessment of the determining factors of air pollution (e.g., transportation and other combustion–related sources, chemical transformations), climate change, photochemical "smog," pollutant measurement techniques, and air quality management strategies. Prerequisite: ENVE 120. QR, SC RP

*** CENG 3770b / ENVE 3770b, Water-Energy Nexus** Lea Winter
This course explores processes and technologies at the water-energy nexus. We utilize chemical and environmental engineering fundamentals to explore the links between maintaining clean water supply and energy security globally, as well as implications for environmental contamination and climate change. We develop a quantitative understanding of water chemistry and energy considerations for topics including traditional water and wastewater treatment, energy recovery from wastewater, membrane processes, water electrolysis for energy storage and electrochemical contaminant conversion, industrial water consumption and wastewater production, underground water sources and water for oil and gas, opportunities for reuse of nontraditional source waters and contaminant valorization, and considerations for decentralization, resilience, and electrification. Quantitative understanding of these processes will be attained based on mass and energy balances, systems engineering, thermodynamics, and kinetics. Prerequisite: ENVE 120 or permission of instructor. The course is primarily designed for juniors and seniors majoring in environmental engineering, but students in other engineering majors are welcome. Students in non-engineering majors are also welcome but are encouraged to communicate with the instructor to make sure they have sufficient background knowledge in required mathematics. QR, SC

CENG 4110a, Separation and Purification Processes Mingjiang Zhong
Theory and design of separation processes for multicomponent and/or multiphase mixtures via equilibrium and rate phenomena. Topics include single-stage and cascaded absorption, adsorption, extraction, distillation, partial condensation, filtration, and crystallization processes. Applications to environmental engineering (air and water pollution control), biomedical-chemical engineering (artificial organs, drug purification), food processing, and semiconductor processing. Prerequisite: CENG 300 or 315 or permission of instructor. QR, SC RP

CENG 4120Lb, Chemical Engineering Laboratory and Design Lisa Pfefferle
An introduction to design as practiced by chemical and environmental engineers. Engineering fundamentals, laboratory experiments, and design principles are applied toward a contemporary chemical process challenge. Sustainability and economic considerations are emphasized. SC

CENG 4160b / ENVE 4160b, Chemical Engineering Process Design Yehia Khalil
Study of the techniques for and the design of chemical processes and plants, applying the principles of chemical engineering and economics. Emphasis on flowsheet development and equipment selection, cost estimation and economic analysis, design strategy and optimization, safety and hazards analysis, and environmental and ethical considerations. Enrollment limited to seniors majoring in Chemical Engineering or Environmental Engineering. QR, SC RP

CENG 4710a or b, Independent Research Paul Van Tassel
Faculty-supervised individual student research and design projects. Emphasis on the integration of mathematics with basic and engineering sciences in the solution of a theoretical, experimental, and/or design problem. May be taken more than once for credit.

CENG 4800a, Chemical Engineering Process Control Michael Loewenberg
Transient regime modeling and simulations of chemical processes. Conventional and state-space methods of analysis and control design. Applications of modern control methods in chemical engineering. Course work includes a design project. Prerequisite: ENAS 194 or permission of instructor. QR, SC

* **CENG 4900a or b, Senior Research Project** Paul Van Tassel
Individual research and/or design project supervised by a faculty member in Chemical Engineering, or in a related field with permission of the director of undergraduate studies.