ENVIRONMENTAL ENGINEERING (ENVE)

ENVE 501
Environmental Chemistry
Chemical processes in environmental systems with an emphasis on equilibrium conditions in aquatic systems. Processes examined include acid-base, dissolution precipitation, air-water exchange, and oxidation-reduction reactions. Methods presented for describing chemical speciation include analytical and graphical techniques as well as computer models.
Prerequisite(s): ENVE 402 or CAE 402
Lecture: 3 **Lab:** 0 **Credits:** 3

ENVE 503
Occupational and Environmental Health and Safety
This course is intended to introduce students to the basics of occupational and environmental safety and health. Topics include fundamental principles in industrial hygiene and occupational and environmental safety based in the anticipation, recognition, evaluation, and control of chemical, biological, physical, and ergonomic hazards that can be encountered in the workplace and other settings. Applications include indoor air pollution control, natural disaster mitigation, and infectious disease transmission and control.
Lecture: 3 **Lab:** 0 **Credits:** 3

ENVE 506
Chemodynamics
Processes that determine the fate and transport of contaminants in the environment. Upon successful completion of this course, students should be able to formulate creative, comprehensive solutions to transport problems, critically evaluate proposed solutions to transport problems, and acquire and integrate new information to build on these fundamentals.
Prerequisite(s): ENVE 402 or CAE 402
Lecture: 3 **Lab:** 0 **Credits:** 3

ENVE 513
Biotechnological Processes in Environmental Engineering
Fundamentals and applications of biological mixed culture processes for air, water, wastewater, and hazardous waste treatment. Topics include biochemical reactions, stoichometry, enzyme and microbial kinetics, detoxification of toxic chemicals, and suspended growth and attached growth treatment processes. The processes discussed include activated sludge process and its modifications, biofilm processes including trickling filters and biofilters, nitrogen and phosphorous removal processes, sludge treatment processes including mesophilic and thermophilic systems, and natural systems including wetlands and lagoons.
Lecture: 3 **Lab:** 0 **Credits:** 3

ENVE 522
Global Environmental Change and Sustainability Analysis
This course introduces students to concepts of global biogeochemistry and environmental sustainability, including the practice of life cycle assessment (LCA). The course begins with an overview of the global energy, water, carbon, and nitrogen cycles and their relationships to human activities. The focus then shifts to LCA, which is an analytical approach for quantifying the relationships between economic activities and environmental issues. LCA is often used to develop sustainability metrics to compare alternative approaches to meet economic needs such as transportation, food provision, and building construction. This course is open to all majors with familiarity in basic chemistry, but students will be expected to conduct quantitative analyses and perform basic engineering calculations.
Lecture: 3 **Lab:** 0 **Credits:** 3

ENVE 528
Modeling of Environmental Systems
To introduce students to mathematical modeling as a basic tool for problem solving in engineering and research. Environmental problems will be used as examples to illustrate the procedures of model development, solution techniques, and computer programming. These models will then be used to demonstrate the application of the models including simulation, parameter estimation, and experimental design. The goal is to show that mathematical modeling is not only a useful tool but also an integral part of process engineering.
Lecture: 3 **Lab:** 0 **Credits:** 3

ENVE 542
Physicochemical Processes in Environmental Engineering
Fundamentals and applications of physicochemical processes used in air, water, wastewater, and hazardous waste treatment systems. Topics include reaction kinetics and reactors, particle characterization, coagulation and flocculation, sedimentation, filtration, membrane separation, adsorption, and absorption.
Prerequisite(s): ENVE 404
Lecture: 3 **Lab:** 0 **Credits:** 3

ENVE 543
Carbon Capture, Utilization, and Storage
To address the climate impacts of anthropogenic sources of carbon dioxide (CO2), it has become increasingly important to focus on solutions for CO2 removal processes, especially directly from CO2 emission sources. Carbon capture and sequestration/storage (CCS) is the process of capturing CO# formed during power generation and other industrial processes and sequestering it so that it is not emitted into the atmosphere. CCS technologies have significant potential to reduce CO2 emissions in energy systems. This course will review and explore, in detail, the engineering design principles for solutions of carbon capture at the source or direct air capture (DAC) from the atmosphere, utilization, and storage. Topics include an overview of the importance current and future potential of CCS and other technologies such as direct air capture; power generation fundamentals related to carbon emissions and our reliance on fossil energy; current state of research and development on carbon capture technologies; storage, monitoring, and utilization of CO2; CO2 transportation (e.g., pipeline and marine modes); and economics of technologies for removing CO2 from the atmosphere and additional methods of reducing CO2 concentrations and other greenhouse gases in the atmosphere.
Lecture: 3 **Lab:** 0 **Credits:** 3

ENVE 551
Industrial Waste Treatment
Industrial waste sources and characteristics, significance of industrial waste as environmental pollutants; applications of standard and special treatment processes including physical, chemical, and biological systems.
Prerequisite(s): ENVE 513* with min. grade of C or ENVE 542* with min. grade of C, An asterisk (*) designates a course which may be taken concurrently.
Lecture: 3 **Lab:** 0 **Credits:** 3

ENVE 561
Design of Environmental Engineering Processes
Design of water and wastewater treatment systems. System economics and optimal design principles.
Prerequisite(s): ENVE 513* with min. grade of C or ENVE 542* with min. grade of C, An asterisk (*) designates a course which may be taken concurrently.
Lecture: 3 **Lab:** 0 **Credits:** 3

ENVE 570
Air Pollution Meteorology
Physical processes associated with the dispersion of windborne materials from industrial and other sources. Atmospheric motion including turbulence and diffusion, mathematical models, and environmental impact assessment.
Lecture: 3 **Lab:** 0 **Credits:** 3

ENVE 576
Indoor Air Pollution
Indoor air pollution sources, indoor pollutant levels, monitoring instruments and designs, and indoor pollution control strategies; source control, control equipment and ventilation; energy conservation and indoor air pollution; exposure studies and population time budgets; effects of indoor air population; risk analysis; models for predicting source emission rates and their impact on indoor air environments.
Lecture: 3 **Lab:** 0 **Credits:** 3

ENVE 577
Design of Air Pollution Control Devices
Principles and modern practices employed in the design of engineering systems for the removal of pollutants. Design of control devices based on physical and chemical characteristics of polluted gas streams.
Lecture: 3 **Lab:** 0 **Credits:** 3

ENVE 578
Physical and Chemical Processes for Industrial Gas Cleaning
Application of physical and chemical processes in the design of air treatment systems; fundamentals of standard and special treatment processes.
Lecture: 3 **Lab:** 0 **Credits:** 3

ENVE 580
Hazardous Waste Engineering
Sources and characteristics of hazardous wastes, legal aspects of hazardous waste management, significance of hazardous wastes as air, water, and soil pollutants. Principles and applications of conventional and specialized hazardous waste control technologies.
Prerequisite(s): ENVE 506* with min. grade of C, An asterisk (*) designates a course which may be taken concurrently.
Lecture: 3 **Lab:** 0 **Credits:** 3

ENVE 591
Research and Thesis M.S.
Graduate research.
Credit: Variable

ENVE 597
Special Problems
Independent study and project. (Variable credit)
Credit: Variable

ENVE 691
Research and Thesis Ph.D.
Graduate research.
Credit: Variable