ENVE 446 Biological Unit Processes
3 Credits
Offered As Demand Warrants
Theoretical and applied aspects of biological wastewater treatment, including waste-activated sludge processes, trickling filters, lagoons, sludge digestion and processing, nutrient removal, biology of polluted waters, state and federal regulations.
Prerequisites: MATH F302.
Recommended: CE F341.
Stacked with ENVE F646.
Lecture + Lab + Other: 3 + 0 + 0
Grading System: Letter Grades with option of Plus/Minus

ENVE 641 Aquatic Chemistry
3 Credits
Offered As Demand Warrants
Chemistry of aquatic systems, including the development of equilibrium and kinetic models to understanding the speciation, transformation and partitioning of inorganic chemical species in aqueous systems. Emphasis is on the study of acid-base chemistry, complexation, precipitation-dissolution and reduction-oxidation reactions.
Prerequisites: Graduate standing.
Cross-listed with CHEM F605.
Lecture + Lab + Other: 3 + 0 + 0
Grading System: Letter Grades with option of Plus/Minus

ENVE 642 Contaminant Hydrology
3 Credits
Offered Spring Odd-numbered Years
Theoretical and applied aspects of the movement of contaminants through saturated and unsaturated soil.
Recommended: CE F683 or equivalent; graduate standing.
Lecture + Lab + Other: 3 + 0 + 0
Grading System: Letter Grades with option of Plus/Minus

ENVE 643 Air Pollution Management
3 Credits
Offered Spring Odd-numbered Years
Major principles and problems associated with air quality, stationary and moving sources, air pollution effects; major air pollution legislation and compliance calculations; meteorology and modeling of pollutant concentrations near a source; greenhouse gas emissions and climate change; control equipment and design of control strategies for specific air pollution problems.
Prerequisites: CHEM F106X; graduate standing.
Recommended: MATH F252X.
Stacked with CE F443.
Lecture + Lab + Other: 3 + 0 + 0
Grading System: Letter Grades with option of Plus/Minus

ENVE 644 Environmental Management and Permitting
3 Credits
Offered Spring Odd-numbered Years
Topics of environmental impact statements, environmental law (local, state and federal), public involvement and environmental quality. Impact from projects of mining, highways, airports, pipelines, industrial development, water, wastewater and solid waste, and others—theoretical considerations and case studies.
Recommended: Graduate standing.
Lecture + Lab + Other: 3 + 0 + 0
Grading System: Letter Grades with option of Plus/Minus

ENVE 645 Unit Processes: Chemical and Physical
3 Credits
Offered As Demand Warrants
Theory and design of chemical and physical unit processes for water and wastewater. Sedimentation, coagulation, flocculation, filtration, ion exchange, adsorption/absorption, gas transfer and other special topics. Emphasis on Arctic applications and design.
Recommended: MATH F252X; CHEM F108X or equivalent; graduate standing.
Lecture + Lab + Other: 3 + 0 + 0
Grading System: Letter Grades with option of Plus/Minus

ENVE 646 Biological Unit Processes
3 Credits
Offered As Demand Warrants
Theoretical and applied aspects of biological wastewater treatment, including waste-activated sludge processes, trickling filters, lagoons, sludge digestion and processing, nutrient removal, biology of polluted waters, state and federal regulations.
Recommended: Graduate standing.
Stacked with ENVE F446.
Lecture + Lab + Other: 3 + 0 + 0
Grading System: Letter Grades with option of Plus/Minus

ENVE 647 Biotechnology
3 Credits
Offered As Demand Warrants
Theoretical and applied aspects of bioengineering. Issues studied include microbiology, metabolism, genetics, genetic engineering, enzymes and catalysis, stoichiometry and kinetics, biological reactor design and bioremediation.
Recommended: Graduate standing.
Lecture + Lab + Other: 3 + 0 + 0
Grading System: Letter Grades with option of Plus/Minus

ENVE 648 Hazardous and Toxic Waste Management
3 Credits
Offered Fall Odd-numbered Years
Course provides in-depth coverage of hazardous and toxic substance management including legal, economic and technical issues. Topics will include characterization of hazardous materials, economics of toxics minimization, hazardous materials use, storage and disposal, basics of municipal solid waste and technical aspects of landfill sitting, and selection and design of treatment technologies. Includes case studies of current waste management issues.
Recommended: Bachelor's degree in science or engineering.
Lecture + Lab + Other: 3 + 0 + 0
Grading System: Letter Grades with option of Plus/Minus
ENVE F651 Environmental Risk Assessment
3 Credits
Offered Spring Odd-numbered Years
The characterization of population exposures and the evidence used to identify environmental substances that may pose a human health risk. The theory and methods for estimating risk: hazard identification, dose-response assessment, exposure assessment and risk characterization.
Recommended: Undergraduate degree in engineering or natural science.
Lecture + Lab + Other: 3 + 0 + 0
Grading System: Letter Grades with option of Plus/Minus

ENVE F652 Introduction to Toxicology for Engineers and Scientists
3 Credits
Offered Fall Even-numbered Years
Introduction to the science of toxicology for graduate students in fields that use information about hazardous chemicals for input into decisions. Topics include an overview of the effects of chemicals on cells, organs and organ systems, and the toxic effects of classes of chemicals such as pesticides, metals and solvents. Use of data from animal testing and common lists, factors and extrapolation are reviewed.
Recommended: Undergraduate degree in engineering or natural science.
Lecture + Lab + Other: 3 + 0 + 0
Grading System: Letter Grades with option of Plus/Minus

ENVE F653 Environmental Measurements Laboratory
1 Credit
Offered Spring
Introduction to analytical methods and measurement techniques used in environmental engineering and environmental quality science. Students will design, conduct and report on a laboratory experiment. Includes sample preparation techniques and analytical methods such as microscopy, atomic adsorption spectroscopy, gas chromatography, liquid chromatography and mass spectrometry.
Recommended: ENVE F641.
Lecture + Lab + Other: 0 + 3 + 0
Grading System: Letter Grades with option of Plus/Minus

ENVE F698 Non-thesis Research/Project
1-9 Credits
Lecture + Lab + Other: 0 + 0 + 1-9
Grading System: Pass/Fail Grades
Repeatable for Credit: May be taken 15 times for up to unlimited credits

ENVE F699 Thesis
1-12 Credits
Lecture + Lab + Other: 0 + 0 + 1-12
Grading System: Pass/Fail Grades
Repeatable for Credit: May be taken 15 times for up to unlimited credits