

# Environmental Engineering (ENVE)

---

## Department of Civil and Environmental Engineering

### Faculty of Engineering and Design

#### **ENVE 1001 [0.5 credit]**

##### **Architecture and the Environment**

Impacts of the environment on architecture; deterioration, freeze/thaw, solar heat, air pollution, moisture; Impacts of architecture on the environment; ecologic footprint, energy consumption, air quality, waste generation; designing with the environment; renewable energy, effective siting and landscape, passive solar energy, natural lighting, energy efficiency.

Lectures three hours a week.

#### **ENVE 2001 [0.5 credit]**

##### **Process Analysis for Environmental Engineering**

Material and energy balances for reacting and non-reacting systems. Applications in mining, metallurgy, pulp and paper, power generation, energy utilization. Emissions to the environment per unit product or service generated. Introduction to life cycle analysis, comparative products and processes.

Prerequisite(s): CHEM 1002 or CHEM 1101 or equivalent, and MAAE 2400 (may be taken concurrently).

Lectures two hours a week, problem analysis three hours a week.

#### **ENVE 2002 [0.5 credit]**

##### **Microbiology**

The biology of the Bacteria, Archaea, Viruses and Protozoans, from the fundamentals of cell chemistry, molecular biology, structure and function, to their involvement in ecological and industrial processes and human disease.

Also listed as BIOL 2303.

Precludes additional credit for BIOL 3301.

Prerequisite(s): BIOL 1003 or CHEM 1002 or CHEM 1101 or equivalent.

Lectures three hours a week.

#### **ENVE 3001 [0.5 credit]**

##### **Water Treatment Principles and Design**

Theoretical aspects of unit operations for water treatment with design applications. Topics include water characteristics and contaminants, coagulation, flocculation, sedimentation, filtration, adsorption, ion exchange, membrane processes, disinfection and disinfection by-products, and management of water treatment residuals. Laboratory procedures: settling operations, filtration, aeration, and adsorption.

Prerequisite(s): ENVE 3002.

Lectures three hours a week, problem analysis one hour a week, laboratory three hours alternate weeks.

#### **ENVE 3002 [0.5 credit]**

##### **Environmental Engineering Systems Modeling**

Engineered systems for pollution abatement; chemical reaction engineering; reaction kinetics and rate data analysis; design and modeling of reactors; single and multiple reactions; ideal and nonideal reactors; single and multi-parameter models; biochemical reaction engineering; process control. Laboratory procedures: reactor systems performance: Batch, CSTR and PFR.

Prerequisite(s): CHEM 1002 or CHEM 1101 or equivalent and MATH 2004. Additional recommended background: ENVE 2001.

Lectures three hours a week, problem analysis one hour a week, laboratory three hours alternate weeks.

#### **ENVE 3003 [0.5 credit]**

##### **Water Resources Engineering**

A quantitative analysis of natural water systems and the development of these systems as a resource.

Components of the hydrologic cycle. Quantitative analysis of stream flow. Probability concepts in water resources.

Reservoir design and operation. Hydraulic properties and availability of groundwater. Storm water management.

Prerequisite(s): recommended background: MAAE 2300.

Lectures three hours a week, problem analysis one hour a week.

#### **ENVE 3004 [0.5 credit]**

##### **Contaminant and Pollutant Transport in the Environment**

Physical phenomenon governing the transport of contaminants in the environment: diffusion, advection, dispersion, sorption, interphase transfer. Derivation and application of transport equations in air, surface and groundwater pollution; analytical and numerical solutions. Equilibrium partitioning of contaminants among air, water, sediment, and biota.

Prerequisite(s): CHEM 1002 or CHEM 1101 or equivalent; ENVE 3002.

Lectures three hours a week, problem analysis one hour a week.

#### **ENVE 3909 [0.5 credit]**

##### **Work Term 3**

#### **ENVE 3999 [0.0 credit]**

##### **Co-operative Work Term**

**ENVE 4002 [0.5 credit]****Environmental Geotechnical Engineering**

Landfill design; hydrogeologic principles, water budget, landfill liners, geosynthetics, landfill covers, quality control/quality assurance, clay leachate interaction, composite liner design and leak detection. Landfill operation, maintenance and monitoring. Case studies of landfill design and performance. Geotechnical design of environmental control and containment systems.

Prerequisite(s): ENVE 3004, CIVE 3208.

Also offered at the graduate level, with different requirements, as ENVE 5201/EVG 7201, for which additional credit is precluded.

Lectures three hours a week, problem analysis one hour a week.

**ENVE 4003 [0.5 credit]****Air Pollution and Emissions Control**

Air pollutants, classification, sources, and effects. Ambient air quality objectives and monitoring. Pollutant formation mechanisms in combustion. Major pollutant categories and control methods. Indoor air quality. Laboratory procedures: emissions from boilers and IC engines, particulate size distribution and control, IAQ parameters.

Prerequisite(s): ENVE 2001 and fourth-year status in Engineering or permission of the department.

Also offered at the graduate level, with different requirements, as ENVE 5101/EVG 5101, for which additional credit is precluded.

Lectures three hours a week, problem analysis one hour a week, laboratory three hours alternate weeks.

**ENVE 4005 [0.5 credit]****Wastewater Treatment Principles and Design**

Theoretical aspects of unit operations and processes for wastewater treatment with design applications. Topics include wastewater characteristics, flow rates, primary treatment, chemical unit processes, biological treatment processes, advanced wastewater treatment, disinfection, and biosolids treatment and disposal. Laboratory procedures: activated sludge, anaerobic growth, chemical precipitation, disinfection.

Prerequisite(s): BIOL 1003 or ENVE 2002, ENVE 3001, ENVE 3002.

Lectures three hours a week, problem analysis one hour a week, laboratory three hours alternate weeks.

**ENVE 4006 [0.5 credit]****Contaminant Hydrogeology**

Theory of flow through porous media. Site investigation: geology, hydrology and chemistry. Contaminant transport. Unsaturated and multiphase flow. Numerical modeling. Site remediation and remediation technologies.

Prerequisite(s): ENVE 3004 and MAAE 2300. Additional recommended background: ENVE 3003.

Also offered at the graduate level, with different requirements, as ENVE 5301/EVG 7301, for which additional credit is precluded.

Lectures three hours a week, problem analysis three hours alternate weeks.

**ENVE 4101 [0.5 credit]****Waste Management**

Municipal, hazardous, and mine waste management. Waste composition and potential impacts, collection and transport, recycling and reuse, biological and thermal treatments, isolation. Integrated waste management planning.

Prerequisite(s): ENVE 3001, ENVE 3002 and ENVE 3004.

Also offered at the graduate level, with different requirements, as ENVE 5203/EVG 5203, for which additional credit is precluded.

Lectures three hours a week, problem analysis one hour a week.

**ENVE 4104 [0.5 credit]****Environmental Planning and Impact Assessment**

Canada and U.S. environmental regulations. Framework for Environmental Impact Assessment, survey techniques for impact assessment and EIA review process. Case studies of selected engineering projects. Environmental planning, management of residuals and environmental standards. Risk assessment, policy development and decision-making. Fault-tree analysis.

Prerequisite(s): ENVE 3004 and fourth-year status in Engineering.

Lectures three hours a week, problem analysis three hours alternate weeks.

**ENVE 4105 [0.5 credit]****Green Building Design**

Concepts, calculations, modeling; design of green buildings and their components; sustainable sites and landscaping; passive design; building envelope; building materials; daylighting; heating, cooling, and ventilation; building-integrated renewable energy systems; indoor environmental quality; overview of building standards and codes.

Prerequisite(s): fourth-year status in B.Eng. Architectural Conservation and Sustainability Engineering, Environmental Engineering or Civil Engineering or fourth-year standing in B.A.S. concentration in Conservation and Sustainability.

Lectures three hours a week, problem analysis one hour per week.

**ENVE 4106 [0.5 credit]****Indoor Environmental Quality**

Indoor environmental quality (air quality, thermal, visual, and acoustic comfort); physical and chemical parameters for characterization. Types and sources of indoor air pollution and discomfort; measurement techniques. Heating, ventilation, air conditioning, lighting practices and issues. Modelling of and design for indoor environmental quality.

Prerequisite(s): fourth year status in B.Eng. Architectural Conservation and Sustainability Engineering or B.Eng. Environmental Engineering or fourth year standing in B.A.S. concentration in Conservation and Sustainability. Also offered at the graduate level, with different requirements, as ENVE 5104, for which additional credit is precluded.

Lectures three hours a week, problem analysis and laboratory three hours alternate weeks.

**ENVE 4907 [1.0 credit]****Engineering Project**

A major project in engineering analysis, design, development or research carried out by individual students or small teams, for an opportunity to develop initiative, self-reliance, creative ability and engineering judgment and is intended for students with high CGPAs and an interest in graduate studies.

Prerequisite(s): fourth-year status in Engineering and permission of the department.

**ENVE 4918 [1.0 credit]****Design Project**

Teams of students develop professional level experience through a design project that incorporates fundamentals acquired in previous mathematics, science, engineering, and complementary studies courses. A final report and oral presentations are required.

Prerequisite(s): fourth-year Status in Engineering.

Lectures two hours alternate weeks, problem analysis three hours a week.

**Summer session:** some of the courses listed in this Calendar are offered during the summer. Hours and scheduling for summer session courses will differ significantly from those reported in the fall/winter Calendar. To determine the scheduling and hours for summer session classes, consult the class schedule at [central.carleton.ca](http://central.carleton.ca)

Not all courses listed are offered in a given year. For an up-to-date statement of course offerings for the current session and to determine the term of offering, consult the class schedule at [central.carleton.ca](http://central.carleton.ca)