DOCTORATE IN PHILOSOPHY ENVIRONMENTAL ENGINEERING

Summary

- Degree offered: Doctorate in Philosophy (PhD)
- Registration status options: Full-time
- Language of instruction: English

  Most of the courses in this program are offered in English. Research activities can be conducted in English, French, or both, depending on the language used by the professor and the members of his or her research group.

- Program option (expected duration of the program):
  - within four years
- Academic units: Faculty of Engineering (http://engineering.uottawa.ca/), Ottawa-Carleton Institute of Environmental Engineering (http://www.ociene.ca/).

Program Description

Ottawa-Carleton Joint Program

Established in 2000, the Ottawa-Carleton Institute of Environmental Engineering (OCIENE) combines the teaching and research strengths of the Department of Civil Engineering and the Department of Chemical Engineering at the University of Ottawa with that of the Department of Civil and Environmental Engineering at Carleton University.

The Institute offers graduate programs leading to the degrees of Master of Applied Science in Environmental Engineering (MASc), Master of Applied Science in Environmental Engineering (MASc), a Master of Engineering (MEng) and Doctor of Philosophy (PhD) in Environmental Engineering.

Main Areas of Research

- Biofilms and biofilm technologies for water and wastewater treatment
- Drinking water: membrane treatment and climate change adaptation technologies
- Ecological engineering and agricultural waste management • Mining impacted water management
- Northern, rural and First Nation water and wastewater
- Sustainable municipal waste management, groundwater, and remediation technologies
- Water resources and management

Note: Further information is posted on the departmental website.

Learning Outcomes

- Autonomy in conducting research
- Autonomy in preparing scholarly publications

Other Programs Offered Within the Same Discipline or in a Related Area

- Master of Applied Science Environmental Engineering (MASc)
- Master of Applied Science Civil Engineering (MASc)
- Master of Applied Science Civil Engineering Specialization in Science, Society and Policy (MASc)
- Master of Engineering Environmental Engineering (MEng)
- Master of Engineering Civil Engineering (MEng)
- Doctorate in Philosophy Civil Engineering (PhD)

Fees and Funding

- Program fees:

  The estimated amount for university fees (https://www.uottawa.ca/university-fees/) associated with this program are available under the section Finance your studies (http://www.uottawa.ca/graduate-studies/programs-admission/finance-studies/).

  International students enrolled in a French-language program of study may be eligible for a differential tuition fee exemption (https://www.uottawa.ca/university-fees/differential-tuition-fee-exemption/).

- To learn about possibilities for financing your graduate studies, consult the Awards and financial support (https://www.uottawa.ca/graduate-studies/students/awards/) section.

Notes

- Programs are governed by the academic regulations (https://www.uottawa.ca/about-us/leadership-governance/policies-regulations/) in effect for graduate studies and by the general regulations of the Ottawa-Carleton Institute of Environmental Engineering (OCIENE).
- In accordance with the University of Ottawa regulation, students have the right to complete their assignments, examinations, research papers, and theses in French or in English.

Program Contact Information

Graduate Studies Office, Faculty of Engineering (https://engineering.uottawa.ca/graduate-studies-office/)
STE 1024
800 King Edward Ave.
Ottawa ON Canada
K1N 6N5

Tel.: 613-562-5347
Fax.: 613-562-5129
Email: engineering.grad@uottawa.ca

Twitter | Faculty of Engineering (https://twitter.com/uOttawaGenie/?lang=en)
Facebook | Faculty of Engineer (https://www.facebook.com/uottawa.engineering/)

Admission Requirements

For the most accurate and up to date information on application deadlines, language tests and other admission requirements, please visit

the specific requirements (https://www.uottawa.ca/graduate-studies/programs-admission/apply/specific-requirements/) webpage.

To be eligible, candidates must:

- Hold a master's degree in environmental engineering or in an engineering discipline with an environmental specialization with a minimum average of 75% (B+)

  Note: International candidates must check the admission equivalencies (https://www.uottawa.ca/graduate-studies/international/study-uottawa/admission-equivalencies/) for the diploma they received in their country of origin.

- Demonstrate a good academic research performance.
- Identify at least one professor who is willing to supervise your research and thesis.
  - We recommend that you contact potential thesis supervisors as soon as possible.
  - To register, you need to have been accepted by a thesis supervisor.
  - The supervisor's name is required at the time of application.

Language Requirements

Applicants must be able to understand and fluently speak the language of instruction (French or English) in the program to which they are applying. Proof of linguistic proficiency may be required.

Applicants whose first language is neither French nor English must provide proof of proficiency in the language of instruction.

Note: Candidates are responsible for any fees associated with the language tests.

Notes

- The admission requirements listed above are minimum requirements and do not guarantee admission to the program.
- Admissions are governed by the general regulations (http://www.uottawa.ca/graduate-studies/students/general-regulations/) in effect for graduate studies and by the general regulations of the Ottawa-Carleton Institute of Environmental Engineering (OCIENE).
- Research facilities are shared between the two campuses. Students have access to the professors, courses and facilities at both universities; however, the choice of research supervisor will determine the primary campus location of the student. It will also determine which university awards the degree.

Program Requirements

Requirements for this program have been modified. Please consult the 2024-2025 calendars (http://catalogue.uottawa.ca/en/archives/) for the previous requirements.

Candidates in the PhD program are expected to demonstrate a broad knowledge of the following areas within environmental engineering through coursework (undergraduate and graduate) already completed:

- Air pollution
- Water resources management, groundwater management and contaminant transport
- Water and wastewater treatment
- Management of solid, hazardous, and radioactive waste and pollution prevention
- Environmental impact assessment, Sustainability and Climate Change

The Department may require students to take additional courses, depending on their backgrounds.

Students must meet the following requirements:

Compulsory Courses:		
9 optional course units from the list of optional courses		9 Units
Seminar:		
EVG 5801	Seminar for Doctoral Candidates in Environmental Engineering	3 Units
Comprehensive Examination:		
EVG 9998	Thesis Proposal and Comprehensive Examination [1]	
Thesis:		
THD 9999	Doctoral Thesis [2, 3]	

Note(s)

1

The comprehensive examination should be completed within the first 16 months (or the equivalent of four full-time terms) of the student's enrollment in the PhD program.

2

Presentation and defense of a thesis based on original research carried out under the direct supervision of a research faculty member in the Department.

3

Students are responsible for ensuring they have met all of the thesis requirements (http://www.uottawa.ca/graduate-studies/students/theses/).

List of Optional Courses

Course selection is subject to the approval of the advisor or the advisory committee. Students may choose courses offered at either university from among those listed below.

The courses listed below are grouped by area of study. Course descriptions may be found in the departmental sections of the calendars concerned.

Air Pollution		
CHG 8132	Adsorption Separation Processes	3 Units
EVG 7101	Air Pollution Control	3 Units
EVG 7104	Indoor Environmental Quality	3 Units
EVG 7105	Atmospheric Aerosols	3 Units
EVG 7106	Atmospheric Chemical Transport Modelling	3 Units
Water Resources Management, Groundwater Management, and Contaminant Transport		
CVG 5112	Numerical modelling in water resources	3 Units
CVG 5124	Coastal Engineering	3 Units
CVG 5160	Sediment Transport	3 Units
CVG 5162	River Hydraulics	3 Units
EVG 5125	Statistical Methods in Hydrology	3 Units

EVG 5182	Water Resources Management	3 Units
EVG 5183	Mixing and Transport in Water Bodies	3 Units
EVG 5301	Soil and Water Conservation Engineering	3 Units
EVG 7301	Contaminant Hydrology	3 Units
EVG 7303	Multiphase Flow in Soils	3 Units
GEO 5143	Environmental Isotopes and Groundwater Geochemistry	3 Units
GEO 5147	Aqueous Inorganic Geochemistry and Modelling	3 Units
GEO 5153	Computer Techniques in the Earth Sciences	3 Units
Management of Solid, Hazardous, and Radioactive Waste and Pollution Prevention		
CVG 5314	Geotechnical Hazards	3 Units
EVG 5133	Solid Waste Management	3 Units
EVG 5179	Anaerobic Digestion	3 Units
EVG 7132	Sludge Treatment and Disposal	3 Units
EVG 7134	Resource Industry Waste Management	3 Units
EVG 7201	Geo-Environmental Engineering	3 Units
Water and Wastewater Treatment		
CHG 8192	Membranes in Clean Processes	3 Units
EVG 5001	Biofilm Processes in Wastewater Treatment	3 Units
EVG 5130	Wastewater Treatment Process Design	3 Units
EVG 5132	Unit Operations of Water Treatment	3 Units
EVG 5134	Chemistry for Environmental Engineering	3 Units
EVG 5137	Water and Wastewater Treatment Process Analysis	3 Units
EVG 5138	Advanced Water Treatment	3 Units
EVG 5302	Decentralized Wastewater Management	3 Units
EVG 7007	Filtration and Membranes in Water Treatment	3 Units
EVG 7144	Advanced Wastewater Treatment	3 Units
Environmental Impact Assessment, Sustainability and Climate Change		
EVG 5139	Environmental Assessment of Civil Engineering Projects	3 Units
EVG 5212	Climate Change Impacts on Water Resources	3 Units
EVG 7107	Radiative Transfer and Remote Sensing	3 Units
EVG 7200	Climate Change and Engineering	3 Units
EVG 7206	Energy and Resources from waste	3 Units
EVG 7207	Energy and the Critical Zone	3 Units
Other Courses		
CHG 8194	Membrane Liquid Separation Processes and Materials	3 Units
CHG 8195	Advanced Numerical Methods in Chemical and Biological Engineering	3 Units
CHG 8196	Interfacial Phenomena in Engineering	3 Units
EVG 5192	Characterization Methods for Materials	3 Units
EVG 5333	Research Methodology	3 Units
EVG 6108	Directed Studies I	3 Units
EVG 6109	Directed Studies II	3 Units
EVG 6300	Special Topics in Environmental Engineering	3 Units
EVG 6301	Special Topics in Environmental Engineering	3 Units
EVG 6302	Special Topics in Environmental Engineering	3 Units
EVG 6303	Special Topics in Environmental Engineering	3 Units
EVG 6304	Special Topics in Environmental Engineering	3 Units
EVG 7001	Topics in Environmental Engineering	3 Units
EVG 7002	Topics in Environmental Engineering	3 Units
EVG 7003	Topics in Environmental Engineering	3 Units
EVG 7004	Topics in Environmental Engineering	3 Units
EVG 7005	Topics in Environmental Engineering	3 Units
GNG 5121	Taguchi methods for efficient Engineering RD	3 Units
GNG 5122	Operational Excellence and Lean Six Sigma	3 Units

Minimum Requirements

The passing grade in all courses is B.

Students who fail 6 units, or whose research progress is deemed unsatisfactory are required to withdraw from the program.

Transfer from Master's to PhD

Master's students with outstanding performance in the master's courses may request transfer into the PhD program without completing the master's degree. Students who are permitted to do so must successfully complete a total of 24 course units (15 at the Master's and 9 at the PhD) for a PhD.

Research

Research at the University of Ottawa

Located in the heart of Canada's capital, a few steps away from Parliament Hill, the University of Ottawa ranks among Canada's top 10 research universities. Our research is founded on excellence, relevance and impact and is conducted in a spirit of equity, diversity and inclusion.

Our research community thrives in four strategic areas:

- Creating a sustainable environment
- Advancing just societies
- Shaping the digital world
- Enabling lifelong health and wellness

From advancing healthcare solutions to tackling global challenges like climate change, the University of Ottawa's researchers are at the forefront of innovation, making significant contributions to society and beyond.

Research at the Faculty of Engineering

Areas of research:

- Environmental Engineering
- Chemical and Biological Engineering
- Civil Engineering
- Electrical Engineering and Computer Science
- Mechanical Engineering

For more information, refer to the list of faculty members and their research fields on **Uniweb**.

IMPORTANT: Candidates and students looking for professors to supervise their thesis or research project can also consult the website of the faculty or department **(**https://www.uottawa.ca/study/graduate-studies/academic-unit-contact-information/**) of their program of choice. Uniweb does not list all professors authorized to supervise research projects at the University of Ottawa.**

Courses

Course selection is subject to the approval of the advisor or the advisory committee. Students may choose courses offered at either university from among those listed below.

The courses listed below are grouped by area of study. Students must complete at least one course in three of the five areas. The director will decide when a course offered under a special topics or directed studies heading can be considered to meet the requirements of a given area. Course descriptions may be found in the departmental sections of the calendars concerned. Only a selection of courses given in a particular academic year.

EVG 5001 Biofilm Processes in Wastewater Treatment (3 crédits / 3 units)
Volet / Course Component: Cours magistral / Lecture

EVG 5125 Statistical Methods in Hydrology (3 units)
Concepts of probability and random variables applied to hydrology. Statistical distributions, their approximation and analysis. Statistical inference, including tests of significance and estimation theory. Linear and multivariate correlation and regression techniques. Data generation and simulation techniques for design of water-resource systems. Introduction to hydrologic and meteorologic time series. This course is equivalent to CIVJ 5601 at Carleton University.
Course Component: Lecture

EVG 5130 Wastewater Treatment Process Design (3 units)
The physical, chemical and biological processes involved in the treatment of domestic and industrial wastes. Waste characteristics, stream assimilation, biological oxidation, aeration, sedimentation, anaerobic digestion, sludge disposal. This course is equivalent to ENVJ 5900 at Carleton University.
Course Component: Lecture
Previously CVG 5130.

EVG 5132 Unit Operations of Water Treatment (3 units)
Unit operations and unit processes involved in the treatment of a water supply for various uses. Topics included are water quality, water microbiology, sedimentation, chemical treatment, disinfection, water chemistry, flocculation. This course is equivalent to ENVJ 5901 at Carleton University.
Course Component: Lecture
Previously CVG 5132.

EVG 5133 Solid Waste Management (3 units)
Collection and disposal of solid wastes. Sanitary landfill, composting, incineration and other methods of disposal. Material and energy recovery. This course is equivalent to ENVJ 5906 at Carleton University.
Course Component: Lecture
Previously CVG 5133.

EVG 5134 Chemistry for Environmental Engineering (3 units)
Dilute aqueous solution chemistry of water and wastewater treatment. Chemical kinetics and equilibrium. Carbonate, phosphate and chlorine chemistry. Precipitation and complex formation. Corrosion. Analytical techniques and applications. This course is equivalent to ENVJ 5907 at Carleton University.
Course Component: Lecture
Previously CVG 5134.

EVG 5137 Water and Wastewater Treatment Process Analysis (3 units)
Mass balancing in complex systems. Reaction kinetics and kinetic data analysis: classical and computer based methods. Reactor design: ideal reactors and real reactors. Analysis of tracer tests. Interfacial mass transfer: common theories. Mass transfer models. This course is equivalent to ENVJ 5905 at Carleton University.
Course Component: Lecture
Previously CVG 5137.

EVG 5138 Advanced Water Treatment (3 units)
Scope, limitations and design procedures for water treatment processes for the removal of toxic and non-standard contaminants. Current water treatment problems and regulations, activated carbon treatment, ion exchange, disinfection practices and oxidation via advanced oxidation processes (ozonation and UV oxidation), iron and manganese removal, recent developments in coagulation, membranes, air stripping. This course is equivalent to ENVJ 5902 at Carleton University.
Course Component: Lecture
Previously CVG 5138.

EVG 5139 Environmental Assessment of Civil Engineering Projects (3 units)
Procedures and methods for systematic evaluation of the environmental impact of civil engineering projects including wastewater disposal systems, solid waste disposal systems, and water resource development systems. This course is equivalent to ENVJ 5700 at Carleton University.
Course Component: Lecture
Previously CVG 5139.

EVG 5179 Anaerobic Digestion (3 units)
Advanced theoretical, biological, and practical aspects of anaerobic digestion processes. Principles to be applied to the design and application of conventional and advanced anaerobic processes used for treatment of municipal and industrial wastewaters. Topics to include microbiology and biochemistry fundamentals, techniques for monitoring anaerobic digestion performance, municipal sludge stabilization, anaerobic composting, anoxic/anaerobic bioremediation, Andrew's dynamic model. Design of the following: two-phase digestion; Downflow Stationary Fixed Film (DSFF) reactors; Upflow Anaerobic Sludge Blanket (UASB); Upflow Blanket Filter (UBF) reactors; and Anaerobic Sequencing Batch Reactors (ASBR). This course is equivalent to ENVJ 5908 at Carleton University.
Course Component: Lecture
Previously CVG 5179.

EVG 5182 Water Resources Management (3 units)
Global water supply and demand; Integrated water resources management; Modeling and optimization of water resources systems; Reservoir Management; Uncertainty modeling; Climate Change and water; Decision under uncertainty. This course is equivalent to ENVJ 5182 at Carleton University.
Course Component: Lecture
Courses CVG 5182, EVG 5182 cannot be combined for units.

EVG 5183 Mixing and Transport in Water Bodies (3 units)
Typical models for selected water resources systems : Rivers, lakes, estuaries; Water quality parameters; Conservative parameters; Non conservative parameters; Laminar and turbulent flows; Dispersion; Pollution sources; Modeling; Simplified (integral) models; Dilution models; Three Dimensional models; Advection-Diffusion Equation; Analytical solution; Numerical solution; Non-conservative transport and Multi-component systems; Modeling approaches based on conservative and non-conservative transport and kinetics; Certain water quality parameters (Temperature, Salinity, etc.). This course is equivalent to ENVJ 5183 at Carleton University.
Course Component: Lecture
Courses CVG 5183, EVG 5183 cannot be combined for units.

EVG 5192 Characterization Methods for Materials (3 units)
Modern materials characterization techniques especially with respect to civil engineering materials. Choosing the right characterization methods in order to determine the properties of materials such as chemical composition, atomic structure, and surface properties used in their research. Interpreting the results of each method as well as the insight into the interrelationships between characterization methods and their interdependency.
Course Component: Lecture

EVG 5203 Hazardous and Radioactive Waste Management (3 units)
This course is equivalent to ENVE 5203 at Carleton University.
Course Component: Lecture

EVG 5212 Climate Change Impacts on Water Resources (3 units)
Spatiotemporal distribution of water and its impact on human activities, including domestic and municipal consumption, hydropower generation, rain-fed and irrigated agriculture, design and operation of sewer systems, floodplain zoning, navigation, etc. Critical assessment of methodologies for climate change impacts estimation. Theoretical knowledge and hands-on application experience needed to perform climate change analysis on a water resources system. This course is equivalent to ENVJ 5212 at Carleton University.
Course Component: Lecture
Courses CVG 5212, EVG 5212 cannot be combined for units.

EVG 5301 Soil and Water Conservation Engineering (3 units)
The design, water quality and climate change impacts of soil and water conservation systems. Topics include: urban storm water management (including LID) erosion control practices, subsurface and surface drainage systems and irrigation technologies. This course is equivalent to ENVJ 5301 at Carleton University.
Course Component: Lecture
Courses CVG 5301, EVG 5301 cannot be combined for units.

EVG 5302 Decentralized Wastewater Management (3 units)
This course covers fundamental principles and practical design applications of decentralized wastewater treatment for domestic and industrial sources. Topics include: management of decentralized wastewater systems, pre-treatment systems, soil infiltration systems, advanced onsite technologies, constructed wetlands, alternative collection systems, wastewater reuse and septage management.
Course Component: Lecture

EVG 5333 Research Methodology (3 units)
Key components and strategies required to build a robust scientific research program in environmental engineering including research questions, literature review, experiment design, data interpretation, scientific manuscripts, public speaking, ethics, and plagiarism.
Course Component: Lecture

EVG 5800 Seminar for Master's Candidates in Environmental Engineering (1 crédit)
Ce cours est équivalent à ENVE 5800 à la Carleton University.
Volet : Recherche

EVG 5801 Seminar for Doctoral Candidates in Environmental Engineering (3 crédits)
Ce cours est équivalent à ENVE 7800 à la Carleton University.
Volet : Recherche

EVG 6001 Projet en génie de l'environnement / Environmental Engineering Project (6 crédits / 6 units)
Ce cours est équivalent à ENVE 5900 à la Carleton University. / This course is equivalent to ENVE 5900 at Carleton University.
Volet / Course Component: Recherche / Research

EVG 6108 Directed Studies I (3 units)
This course is equivalent to ENVE 5906 at Carleton University.
Course Component: Research

EVG 6109 Directed Studies II (3 units)
This course is equivalent to ENVE 5907 at Carleton University.
Course Component: Research

EVG 6300 Special Topics in Environmental Engineering (3 units)
Course Component: Lecture

EVG 6301 Special Topics in Environmental Engineering (3 units)
This course is equivalent to ENVE 5701 at Carleton University.
Course Component: Lecture

EVG 6302 Special Topics in Environmental Engineering (3 units)
This course is equivalent to ENVE 5702 at Carleton University.
Course Component: Lecture

EVG 6303 Special Topics in Environmental Engineering (3 units)
Course Component: Lecture

EVG 6304 Special Topics in Environmental Engineering (3 units)
Course Component: Lecture

EVG 6508 Études dirigées I (3 crédits)
Volet : Cours magistral

EVG 6509 Études dirigées II (3 crédits)
Volet : Cours magistral

EVG 7001 Topics in Environmental Engineering (3 crédits / 3 units)
This course is equivalent to ENVE 5701 at Carleton University.
Volet / Course Component: Laboratoire / Laboratory, Cours magistral / Lecture

EVG 7002 Topics in Environmental Engineering (3 crédits / 3 units)
This course is equivalent to ENVE 5702 at Carleton University.
Volet / Course Component: Cours magistral / Lecture

EVG 7003 Topics in Environmental Engineering (3 crédits / 3 units)
This course is equivalent to ENVE 5703 at Carleton University.
Volet / Course Component: Cours magistral / Lecture

EVG 7004 Topics in Environmental Engineering (3 crédits / 3 units)
This course is equivalent to ENVE 5704 at Carleton University.
Volet / Course Component: Cours magistral / Lecture

EVG 7005 Topics in Environmental Engineering (3 crédits / 3 units)
This course is equivalent to ENVE 5705 at Carleton University.
Volet / Course Component: Cours magistral / Lecture

EVG 7007 Filtration and Membranes in Water Treatment (3 crédits / 3 units)
Filtration is a key process for removal of contaminants from water sources. This course discusses various filtration processes including slow sand filtration, conventional filtration, biological filtration, and low and high pressure membrane applications in a lecture and seminar format. Previous water related course knowledge expected.
Volet / Course Component: Cours magistral / Lecture

EVG 7101 Air Pollution Control (3 units)
Air quality and pollution; definitions, measurement and monitoring methods. Criteria pollutants, air toxics, particulate matter, secondary pollutants. Pollutant formation mechanisms. Major sources and control methods. Meteorology and principles of dispersion modelling. Principles of receptor modelling. Indoor air quality.
Course Component: Laboratory, Lecture
Previously CVG 7101.

EVG 7104 Indoor Environmental Quality (3 units)
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. Modeling of and design for indoor environmental quality. This course is equivalent to ENVE 5104 at Carleton University.
Course Component: Laboratory, Lecture

EVG 7105 Atmospheric Aerosols (3 units)
Atmospheric aerosol characterization and size distribution, theoretical fundamentals of physical and chemical processes that govern formation and transformation of aerosols in the atmosphere such as nucleation, coagulation, condensation/evaporation, and aerosol thermodynamics; interactions between aerosols and climate, aerosol sampling and measurement. This course is equivalent to ENVE 5105 at Carleton University.
Course Component: Lecture

EVG 7106 Atmospheric Chemical Transport Modelling (3 units)
Fundamentals of Eulerian atmospheric modelling; overview of global and regional atmospheric models, basic principles of numerical methods used in air quality models; applications of air quality models; uncertainty and sensitivity analysis in air quality modelling. This course is equivalent to ENVE 5106 at Carleton University.
Course Component: Lecture

EVG 7107 Radiative Transfer and Remote Sensing (3 units)
Exploration of interactions between light, Earth's surface, and the atmosphere. Topics include the radiative transfer equation, scattering and phase functions, and inverse theory. Applications to atmospheric science, climate, hydrology, and land use. This course is equivalent to ENVE 5107 at Carleton University.
Course Component: Lecture

EVG 7132 Sludge Treatment and Disposal (3 units)
Aspects of sludge treatment, management, and disposal; sludge generation and characterization, thickening, preliminary treatment processes, aerobic and anaerobic digestion, lime stabilization, conditioning, dewatering, composting, land application and other disposal options, and thermal processes. This course is equivalent to ENVE 5205 at Carleton University.
Course Component: Lecture

EVG 7134 Resource Industry Waste Management (3 units)
Application of geotechnique and hydraulics to management of resource extraction residuals such as tailings, waste rock, and sludge from hard rock mines and bitumen extraction operations. Geotechnique of conventional and high density tailings disposal. Pipeline transport of concentrated suspensions. Closure technologies for mine waste impoundments. This course is equivalent to ENVE 5204 at Carleton University.
Course Component: Lecture

EVG 7144 Advanced Wastewater Treatment (3 units)
Fundamentals, applications, and design of biological, physical, and chemical treatment processes employed for advanced treatment of domestic and industrial wastewater. Reuse applications and guidelines. This course is equivalent to ENVE 5004 at Carleton University.
Course Component: Lecture

EVG 7200 Climate Change and Engineering (3 units)
This course will cover broad environmental and climate change issues affecting engineered systems.
Course Component: Laboratory, Lecture

EVG 7201 Geo-Environmental Engineering (3 units)
This course is equivalent to ENVE 5201 at Carleton University.
Course Component: Lecture

EVG 7202 Contaminant Fate Mechanisms (3 units)
This course is equivalent to ENVE 5202 at Carleton University.
Course Component: Lecture

EVG 7206 Energy and Resources from waste (3 units)
Principles, design and application of biochemical and thermal processes for recovery of energy and value-added materials from different solid wastes and wastewater. Biochemical processes;#biotransformation pathways, reactor analysis and chemical kinetics. Thermal treatment systems; process design, thermodynamics of material recovery. This course is equivalent to ENVE 5206 at Carleton University.
Course Component: Lecture

EVG 7207 Energy and the Critical Zone (3 units)
Survey of the environmental impacts of current and future energy resource development including groundwater, surface water and soil contamination and greenhouse gas emissions. Application of relevant theory (multiphase flow, mass transfer, fate and transport) to describe key environmental processes, detection, monitoring, and mitigation. This course is equivalent to ENVE 5207 at Carleton University. Course Component: Lecture.
Course Component: Lecture

EVG 7301 Contaminant Hydrology (3 units)
This course is equivalent to ENVE 5301 at Carleton University.
Course Component: Laboratory, Lecture

EVG 7303 Multiphase Flow in Soils (3 units)
This course is equivalent to ENVE 5303 at Carleton University.
Course Component: Lecture

EVG 7401 Environmental Impact Assessment of Major Projects (3 units)
This course is equivalent to ENVE 5401 at Carleton University.
Course Component: Lecture

EVG 9998 Proposition de thèse et examen de synthèse / Thesis Proposal and Comprehensive Examination
Volet / Course Component: Recherche / Research