

# MASTER OF ENGINEERING ENVIRONMENTAL ENGINEERING

## Summary

- Degree offered: Master of Engineering (MEng)
- Registration status options: Full-time; Part-time
- Language of instruction: English

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

- Program options (expected duration of the program):
  - within two years of full-time study
- For immigration purposes, the summer term (May to August) for this program is considered a regularly scheduled break approved by the University. Students should resume full-time studies in September.
- 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 Departments 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), 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
- 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 Civil Engineering (MEng)
- Doctorate in Philosophy Environmental Engineering (PhD)
- 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 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).
- 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](mailto: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:

- Have one of the following:
  - An honours bachelor's degree with a specialization or a major in environmental engineering (or equivalent) with a minimum average of 70% (B);
  - An honours bachelor's degree with a specialization or a major in related engineering disciplines (civil, chemical, mechanical, etc.) with a minimum average of 70% (B);
  - An honours bachelor's degree with specialization or a major in environmental science disciplines with a minimum average of 70% (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 performance in previous studies as shown by official transcripts, research reports, abstracts or any other documents demonstrating research skills.
- Meet the following additional requirements:
  - All students entering the program are required to have courses in mathematics, probability and statistics equivalent to courses required in undergraduate engineering programs.
  - All students entering the program are also required to have taken three undergraduate courses equivalent to the following University of Ottawa courses:
    - CHG 2312 or CVG 2116
    - CVG 2132
    - CVG 3132
  - These courses are considered to provide the minimum background in fluid mechanics, and in physical, chemical, and biochemical treatment principles, necessary to adequately follow environmental engineering courses at the graduate level. Depending on their background, students may have been exposed to these principles through a different combination of courses in their undergraduate curriculum. Students entering the program without an equivalent background in these topics are expected to take these courses early in their studies and they are considered additional to those normally required for the degree. The undergraduate courses required are specified in the certificate of admission.

## 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 (OCIEE).

## Program Requirements Master's with Coursework and Project

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

Candidates transferring from another university must take at least half their units at the Institute.

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

To receive this Master's degree, a student enrolled in the program must successfully complete 30 course units.

Students must meet the following requirements:

### Compulsory Courses

|          |  |         |
|----------|--|---------|
| GNG 5301 | Professional Skills and Responsibility | 3 Units |
|----------|--|---------|

### Optional Courses

|                               |         |
|-------------------------------|---------|
| 3 optional course units from: | 3 Units |
|-------------------------------|---------|

|          |  |
|----------|--|
| GNG 5100 | Introduction to Engineering Management |
|----------|--|

|          |   |
|----------|---|
| GNG 5120 | Technology entrepreneurship for Engineers and Computer Scientists |
|----------|---|

|          |   |
|----------|---|
| GNG 5130 | Communication and Influence for Engineers |
|----------|---|

|          |                    |
|----------|--------------------|
| GNG 5140 | Engineering Design |
|----------|--------------------|

|   |          |
|---|----------|
| 18 optional course units from the list of optional courses <sup>1</sup> | 18 Units |
|---|----------|

### Coursework or Project:

One option from the following:

#### Option 1:

|          |                                   |         |
|----------|-----------------------------------|---------|
| EVG 6001 | Environmental Engineering Project | 6 Units |
|----------|-----------------------------------|---------|

#### Option 2:

|          |   |         |
|----------|---|---------|
| GNG 5902 | Industry Project (6 course units from the list of optional courses) | 6 Units |
|----------|---|---------|

#### Option 3:

|   |         |
|---|---------|
| 6 course units from the list of optional courses <sup>1</sup> | 6 Units |
|---|---------|

Note(s)

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A minimum of 3 course units must be selected from at least three of the following areas of study:

- 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

## 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.

## Fast-track from Master's to PhD

Students enrolled in the master's program in environmental engineering at the University of Ottawa may be eligible to fast-track directly into the doctoral program without writing a master's thesis. For additional information, please contact the graduate studies office of the Faculty of Engineering.

## 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 (<https://uniweb.uottawa.ca/#!arts/themes>).

## 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