2012/2013 SGS Calendar entry

Physical and Environmental Sciences

Faculty Affiliation
University of Toronto Scarborough

Degree Programs Offered

Environmental Science – MEnvSc, PhD
Fields (MEnvSc):
  Biophysical Interactions in Terrestrial and Aquatic Systems
Concentrations (PhD):
  Contaminant Flux
  Urban Geoscience
  Remediation and Restoration of Degraded Environmental Systems
  Great Lakes Ecosystems
  Climate Change and the Environment
  Environmental Science in Transitional Economies

Overview
The Graduate Department of Physical and Environmental Sciences offers opportunities for graduate studies in environmental science, leading to the degrees of Master of Environmental Science (MEnvSc) and Doctor of Philosophy (PhD) in Environmental Science.

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Degree Programs

Environmental Science

Master of Environmental Science
The department offers a 12-month coursework Master of Environmental Science (MEnvSc) degree program. Courses within the program fall within the designated field of study: Biophysical Interactions in Terrestrial and Aquatic Systems. Although the program base is broad, a major focus for training professionals is understanding the flux of contaminants through surface and subsurface environments and the methods/solutions needed to remediate contaminated or damaged environmental systems. The program is committed to the development of well-trained practitioners in environmental science to meet the needs primarily of industry and government.

The MEnvSc program offers three enrolment options:
  • Research
  • Internship
  • Part-time studies
Minimum Admission Requirements

- Students are expected to satisfy all requirements for entry into the School of Graduate Studies at the University of Toronto within a competitive selection process. Applicants educated outside Canada should pay particular attention to the English language competency requirements.
- An appropriate bachelor’s degree from a recognized university, either in science or engineering, with a minimum mid-B grade average in the last two years of the undergraduate program. Ideal applicants will have a science background consisting of at least two half courses or one full course in each of chemistry, physics, calculus, and biology.
- Applicants must submit a written statement explaining their objectives for entering the program and the suitability of their background. Appropriate post-graduate work experiences will be considered as part of the admission application.

Program Requirements

- In all enrolment options, coursework consists of 5.5 full-course equivalents (FCEs).
- It is anticipated that students will complete all instructional courses in two sessions and will complete field and research-focused courses or the internship during the summer.
- The research option requires successful completion of EES 1101Y Research Paper. (NOTE: EES 1114H Directed Readings in Environmental Science must be completed prior to registration in EES1101Y). Each student is required to have a Research Supervisor. For full-time students, the intensive research necessary for the Research Paper will normally be completed in the final summer semester. The final Research Paper needs to be written in scientific journal format and will be presented and defended orally in front of an examination committee. The committee will include the supervisor and two other members of the graduate faculty.
- The internship option requires successful completion of EES 1116Y Internship Placement. For full-time students, the placement in private industry, government or a non-governmental organization (NGO) will normally be completed in the final summer semester. It will consist of a minimum of 4 consecutive months. Successful completion of the internship is based on an assessment completed by the student’s work supervisor and on an assessment of a written placement project report.
- A final grade below 70% in any course equates to a FZ, which is an insufficient grade. If a MEnvSc student receives more than one final grade of FZ (i.e. two or more), they will be asked to withdraw from the MEnvSc program.

Normal Program Length: 3 sessions full-time; 6 sessions part-time
Time Limit: 3 years full-time; 6 years part-time

Course List

Please note that not all courses are offered every year.
EES 1100H Advanced Seminar in Environmental Science
EES 1101Y Research Paper in Environmental Science
EES 1102H Analytical Chemistry for Geoscientists
EES 1103H Air and Water Quality Sampling and Monitoring
EES 1104H Microorganisms and the Environment
EES 1105H Soil Contamination Chemistry
EES 1106H Environmental Challenges in Urban Areas
EES 1107H Remediation Methods
EES 1108H Environmental Science Field Camp
EES 1109H Advanced Techniques in Geographic Information Systems
EES 1110H Sediment and Contaminant Transport in Aquatic Systems
EES 1111H Freshwater Ecology and Biomonitoring
EES 1112H Boundary Layer Climates and Contaminant Fate
EES 1113H Groundwater Hydrochemistry and Contaminant Transport
EES 1114H Directed Readings in Environmental Science I
EES 1115H Directed Readings in Environmental Science II
EES 1116Y Internship
EES 1117H Climate Change Impact Assessment
EES 1118H Fundamentals of Ecological Modelling
EES 1119H Quantitative Environmental Analysis
EES 1120H The Dynamics of Contaminant Dispersal in Fluids
EES 1121H Modelling the Fate of Organic Chemicals in the Environment
Program Requirements

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1. Engineering, forestry and social sciences. Research is clustered into six major concentrations:

- Contaminant Flux
- Urban Geoscience
- Remediation and Restoration of Degraded Environmental Systems
- Great Lake Ecosystems
- Climate Change and the Environment
- Environmental Science in Transitional Economies

Minimum Admission Requirements

Students may be accepted into the PhD program through one of three routes:

1. Following completion of the MEnvSc degree, an MSc degree in environmental science, or a related discipline, or the MAsc degree in environmental engineering or related discipline, or equivalent from a recognized university with a minimum of B+ average in all work completed in the master’s program.

2. By requesting transfer from a suitable master’s program (see above); students may reclassify from the master’s program after 12 months of full-time study.

3. In the case of exceptional students, by direct entry; that is, after completing an honours BSc degree in a bachelor’s program in a related discipline with a minimum University of Toronto average of A- or equivalent.

Program Requirements

- A total of 2.0 full-course equivalents (FCEs) as follows: a mandatory 0.5 FCE (ENV 2200H Advanced Seminar on Environmental Research) plus 1.5 FCEs from an approved course list in the graduate program. The courses are required to provide background for the student’s research. Courses selected must be approved by the Graduate Chair/Associate Graduate Chair. In some cases, additional courses may be required if a student’s preparedness is assessed as being insufficient.
  - Students may apply to take a number of PhD-level courses taught by the core faculty both within the Department of Physical and Environmental Sciences (DPES) and outside DPES that can be considered for the PhD degree (see examples in the Course List section below) as part of their 1.5 FCEs credits for the degree. However, all courses for PhD degree credit must be approved by the Graduate Chair/Associate Graduate Chair.

- The execution of an original piece of research in environmental science carried out under faculty supervision and presented in thesis form. The program requires the development and submission of a thesis proposal, and its examination in an oral thesis proposal appraisal (before the end of the second year), a departmental oral examination of the completed thesis, and a Doctoral Final Oral Examination carried out under the auspices of the School of Graduate Studies involving examination by an appropriate at-arms-length external examiner.
  - The PhD Proposal appraisal consists of a 20 minute presentation given by the student on the proposed thesis work followed by a question period of approximately two hours. The emphasis will be on the theory and proposed approach, rather than on progress to date. A negative outcome requires that the student retake the exam within four months by considering suggestions offered by the committee for improving the thesis research proposal. The outcome of the second exam will be either a pass or withdrawal from the program.

Doctor of Philosophy

Research and teaching are focused on the interfaces between traditional disciplines in dealing with fundamental scientific issues. Faculty members are cross-appointed from several departments including physical sciences, biological sciences, engineering, forestry and social sciences. Research is clustered into six major concentrations:

- Contaminant Flux
- Urban Geoscience
- Remediation and Restoration of Degraded Environmental Systems
- Great Lake Ecosystems
- Climate Change and the Environment
- Environmental Science in Transitional Economies

Graduate Studies involving examination by an appropriate at-arms-length external examiner. The outcome of the second exam will be either a pass or withdrawal from the program.

Graduate Chair.
In some cases, additional courses may be required if a student's preparedness is assessed as being insufficient.

Students may apply to take a number of PhD-level courses taught by the core faculty both within the Department of Physical and Environmental Sciences (DPES) and outside DPES that can be considered for the PhD degree (see examples in the Course List section below) as part of their 1.5 FCEs credits for the degree. However, all courses for PhD degree credit must be approved by the Graduate Chair/Associate Graduate Chair.

The execution of an original piece of research in environmental science carried out under faculty supervision and presented in thesis form. The program requires the development and submission of a thesis proposal, and its examination in an oral thesis proposal appraisal (before the end of the second year), a departmental oral examination of the completed thesis, and a Doctoral Final Oral Examination carried out under the auspices of the School of Graduate Studies involving examination by an appropriate at-arms-length external examiner.

The PhD Proposal appraisal consists of a 20 minute presentation given by the student on the proposed thesis work followed by a question period of approximately two hours. The emphasis will be on the theory and proposed approach, rather than on progress to date. A negative outcome requires that the student retake the exam within four months by considering suggestions offered by the committee for improving the thesis research proposal. The outcome of the second exam will be either a pass or withdrawal from the program.

By request, the School of Graduate Studies issues an official record of the student's progress and confers the degree of Doctor of Philosophy in Environmental Science on those who meet the program requirements.

Course List

EES 1122H Global Environmental Security and Sustainable Development
EES 1123H Environmental Regulations
EES 1124H Environmental Project Management
EES 1125H Contaminated Site Remediation
EES 1126H Environmental Tracer
EES 1127H Geomicrobiology and Biogeochemistry
EES 1128H Biophysical Interactions in Managed Environments
EES 1129H Brownfields Redevelopment
EES 1130H Ontario BioGeospheres Field Course
EES 1131H Applied Climatology
EES 1701H Environmental Legislation and Policy
EES 1704H Environmental Risk Assessment
The Physical & Environmental Science PhD program requires that all PhD candidates complete two thesis defenses: a Departmental Thesis Defense and a Final Oral Exam with the School of Graduate Studies. For the Departmental Thesis Defense, the examination committee will consist of at least four faculty members (normally including the members of the Supervisory Committee). One or more members can be from outside the Department. Normally, the Departmental Thesis Defense will be held at least eight weeks prior to the SGS PhD Final Oral Examination. The committee will notify the Graduate Chair that the thesis is ready to be forwarded to SGS for the final oral examination (FOE). If the PhD candidate does not pass the Departmental Defense, the committee may recommend that the PhD candidate postpone their SGS Final Oral Examination (FOE).

- The degree program has been designed so that it can be completed within:
  - **four years** for students who have completed a related master’s degree
  - **five years** from the start of enrolment in the MSc program for students transferring from the master’s program
  - **five years** for direct-entry students from a bachelor’s program
- Progress through the PhD program for students admitted with a master’s degree:
  - Year I: complete coursework, develop thesis research ideas
  - Year II: complete and defend thesis proposal; thesis research
  - Year III: thesis research and associated writing
  - Year IV: thesis research, thesis writing and defense

**Normal Program Length**: 4 years full-time; 5 years direct-entry

**Time Limit**: 6 years full-time; 7 years direct-entry

## Course List

### Core Course

EES 2200H  Advanced Seminar in Environmental Science

The following are courses that are offered within the Department of Physical and Environmental Sciences. With the approval of the Graduate Chair/Associate Graduate Chair, relevant courses from other graduate departments can be applied to the required 1.5 FCEs.

Please note that not all courses are offered every year.

### Elective Courses

EES 1102H  Analytical Chemistry for Geoscientists
EES 1103H  Air and Water Quality Sampling and Monitoring
EES 1104H  Microorganisms and the Environment
EES 1105H  Soil Contamination Chemistry
EES 1106H  Environmental Challenges in Urban Areas
EES 1107H  Remediation Methods
EES 1109H  Advanced Techniques in Geographic Information Systems
EES 1110H  Sediment and Contaminant Transport in Aquatic Systems
EES 1111H  Freshwater Ecology and Biomonitoring
EES 1112H  Boundary Layer Climates and Contaminant Fate
EES 1113H  Groundwater Hydrochemistry and Contaminant Transport
EES 1117H  Climate Change Impact Assessment
EES 1118H  Fundamentals of Ecological Modelling
EES 1119H  Quantitative Environmental Analysis
EES 1120H  The Dynamics of Contaminant Dispersal in Fluids
EES 1121H  Modeling the Fate of Organic Chemicals in the Environment
EES 1122H  Global Environmental Security and Sustainable Development
EES 1126H  Environmental Tracers
EES 1127H  Geomicrobiology and Biogeochemistry
EES 1128H  Biophysical Interactions in Managed Environments
EES 1131H  Applied Climatology
EES 2201H  Advanced Readings in Environmental Science