UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE & ENGINEERING

Proposed calendar changes 2009-10

Minor in Environmental Engineering

The Minor in Environmental Engineering will enhance students' understanding of the role of technology in society and allow them to be better prepared for careers, including graduate programs, in the areas of environmental engineering. The program definition of environmental engineering is broad, reaching to all areas at the interface of engineering and the environment. It is estimated that the program will have an enrolment of approximately 40 to 50 students.

Learning outcomes: Students in the program will receive depth of understanding about ecology, sustainable design, risk assessment and environmental impact. This includes ecology and ecological impacts, waste management, water and wastewater treatment, environmental microbiology, water resources engineering, hydrology, preventive engineering, life cycle analysis, design for the environment, and extends to the social and environmental impacts of technology.

Program requirements: The core courses are proposed to consist of APS 301 (Technology in Society and the Biosphere) and one of a set of 4 specified environmental courses. Of the 4 elective courses, at least 2 courses are to be at an advanced level:

One (1) core courseAPS301H1 F – Technology in Society and the Biosphere I

At least one (1) of the following courses
CIV220H1 F – Urban Environmental Ecology
MIE380H1 S—Ecological Systems
CIV360H1S - Environmental Impact and Risk Assessment
CHE467H1F - Environmental Engineering

Four (4) other electives from the list of Environmental Engineering designated courses (below) or departmental thesis and design courses

Subject to the following constraints:

1. Students must ensure they meet the requirements of their chosen engineering-degree program or Option therein.
2. Of the six (half year) environmental engineering courses required, one (half year) course can also be a core course in a student's Program, if applicable.
3. Of the four elective courses, at least two must be from the Advanced category.
4. Either a Thesis or Design course can count for up to two (half year) courses towards the six required courses IF the Thesis or Design course is strongly related to environmental engineering. This requires approval by the Environmental Engineering Minor Director.

5. Availability of the courses (including the foundational courses) for timetabling purposes is not guaranteed; the onus is on the student to ensure compatibility with their timetable.
6. Arts and Science Courses listed may be considered eligible electives for students taking the Environmental Engineering Minor, subject to the student meeting any prerequisite requirements. Students must seek the approval of their home program to ensure that they meet their degree requirements. In situations where these courses don't meet those of their home program, students can elect to take these as extra courses.
7. Students must secure approval from their home department before selecting any elective outside their departmental approved list.

Environmental Engineering Designated Courses
(Introductory = I; Advanced = A)

Course Code	Course Title	Weight	I/A
APS302S	Technology in Society and the Biosphere II	0.5	A
APS304F	Preventive Engineering and Social Development	0.5	A
CHE460S	Environmental Pathways and Impact Assessment	0.5	I
CHE466S	Bioprocess Engineering	0.5	A
CHE467F	Environmental Engineering	0.5	I
CHE564S	Pulp and Paper Processes	0.5	A
CHE565F	Aqueous Process Engineering	0.5	A
CHE568S	Nuclear Engineering	0.5	A
CHM410F	Analytical Environmental Chemistry	0.5	A
CHM415S	Atmospheric Chemistry	0.5	A
CIV220F	Urban Engineering Ecology	0.5	I
CIV250S	Hydraulics and Hydrology	0.5	I
CIV300F	Terrestrial Energy Systems	0.5	I
CIV360S	Environmental Impact and Risk Assessment	0.5	I
CIV375F	Building Science	0.5	I
CIV3XXS	Introduction to Water and Wastewater Treatment Processes	0.5	I
CIV531F	Transport III - Planning	0.5	A
CIV549F	Groundwater Flow and Contamination	0.5	A
CIV550F	Water Resources Engineering	0.5	A
CIV576H	Sustainable Buildings	0.5	A
CIV5XXH	Infrastructure for Sustainable Cities	0.5	A
MIE315S	Design for the Environment	0.5	I
MIE380S	Ecological Systems	0.5	I
MIE515F	Alternative Energy Systems	0.5	A
MIN430F	Mining Environmental Management	0.5	A
MSE315S	Environmental Degradation of Materials	0.5	I
MSE504S	Advanced Physical Properties of Structural Nanomaterials	0.5	A
ENV350H	Energy Policy and Environment	0.5	I

Minor in Sustainable Energy

The Undergraduate Sustainable Energy minor is open to Engineering students interested in learning more about energy, its sustainable use, energy demand management, and the public policy context in which energy use and production is regulated. The Faculty's definition of sustainable energy is broad, reaching to all areas of energy use, production, distribution, transmission, storage, and development. It is estimated that the program will have an enrolment of approximately 75 to 100 students.

Learning outcomes: Students in the Sustainable Energy Minor will receive depth of understanding about energy, its sustainable use, energy demand management, and the public policy context in which energy use and production is regulated. This includes energy use and production for transportation, for space cooling and heating demands, and electrical production (from both alternative and conventional sources), energy distribution and storage, and extends to energy conservation, price, greenhouse gas production and control, and aspects of public policy.

Program requirements: The core courses will consist of CIV 300 (Terrestrial Energy Systems) and one of a set of two specified courses touching on energy policy. Of the four elective courses, at least two are to be at an advanced level. The minor will consist of the following six half courses:

One (1) core course
CIV300H1F - Terrestrial Energy Systems

At least one (1) of the following courses
APS305H1S - Energy Policy (CS)
ENV350H1F Energy Policy & Environment (A&S HSS)

Four (4) other electives from the list of Sustainable Energy designated courses or departmental thesis and design courses

Subject to the following constraints:

1. Students must ensure they meet the requirements of their chosen engineering-degree program or Option therein.
2. Of the 6 (half year) sustainable energy courses required, one (half year) course can also be a core course in a student's Program, if applicable.
3. Of the 4 elective courses, at least 2 must be from the Advanced category.
4. Either a Thesis or Design course can count for up to two (half year) courses towards the 6 required courses IF the Thesis or Design course is strongly related to sustainable energy. This requires approval by the Sustainable Energy Minor Director.
5. Availability of the courses (including the foundational courses) for timetabling purposes is not guaranteed; the onus is on the student to ensure compatibility with their timetable.
6. Arts and Science Courses listed may be considered eligible electives for students taking the Sustainable Energy Minor, subject to the student meeting any prerequisite requirements. Students must also seek the approval of their home program to ensure that they meet their degree requirements. In situations where these courses don't meet those of their home program, students can elect to take these as extra courses.
7. Students must secure approval from their home department before selecting any elective outside their departmental approved list.

Sustainable Energy Designated Courses
(Introductory = I; Advanced = A)

Course Code	Course Title	Weight	I/A
APS301F	Technology in Society and the Biosphere I	0.5	I
APS510F	Innovative Technologies and Organizations in Global Energy Systems	0.5	I
CHE4XX	Petroleum Engineering	0.5	A
CHE469S	Fuel Cells and Electrochemical Conversion Devices	0.5	A
CHE553F	Electrochemistry	0.5	A
CHE568S	Nuclear Engineering	0.5	A
CIV360S	Environmental Impact and Risk Assessment	0.5	I
CIV375F	Building Science	0.5	I
CIV576	Sustainable Buildings	0.5	A
CIV5XX	Infrastructure for Sustainable Cities	0.5	A
CIV5xxS	Sustainable Energy Systems	0.5	A
ECE315F	Switch-Mode Energy Conversion	0.5	I
ECE413S	Energy Systems and Distributed Generation	0.5	A
ECE510F	Introduction to Lighting Systems	0.5	A
ECE533F	Advanced Power Electronics	0.5	A
MIE313S	Heat and Mass Transfer	0.5	I
MIE4XX	Reactor Physics and the Nuclear Fuel Cycle	0.5	A
MIE4XY	Thermal and Mechanical Design of Nuclear Power Reactors	0.5	A
MIE411F	Thermal Energy Conversion	0.5	A
MIE447S	Electromechanical Energy Conversion	0.5	A
MIE515F	Alternative Energy Systems	0.5	A
MIE516F	Combustion and Fuels	0.5	A
MIE517S	Fuel Cell Systems	0.5	A
MSE318F	Phase Transformations	0.5	I
MSE332F	Heat and Mass Transfer for Materials Processing	0.5	I
MSE355S	Materials Processing and Sustainable Development	0.5	I
MSE408S	Energy Management of Metals Extraction and Recycling Processes	0.5	A
MSE504F	Extractive Metallurgy	0.5	A
MSE558S	Nanotechnology in Alternate Energy Systems	0.5	A
PHY359H	Physics of the Earth	0.5	I
FOR310H	Bioenergy from Sustainable Forest Management	0.5	I
FOR410H	Bioenergy and Biorefinery Technology	0.5	A
JGE347F	Efficient Use of Energy	0.5	I
JGE348S	Carbon-Free Energy	0.5	I

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Engineering Science Program Major in Electrical and Computer Engineering

The following eight major programs are currently offered within the Engineering Science Program: Aerospace, Biomedical, Computer, Electrical, Energy Systems, Infrastructure, Nanoengineering, and Physics. The Faculty proposes to merge the Computer and Electrical majors into one program, "Electrical and Computer Engineering", that recognizes the increasing degree to which these two areas converge. The combined program is particularly well suited to the Engineering Science program that includes extensive breadth and depth of coverage in the two foundation years that enables students them to take advantage of the greater diversity of subjects available to both the Electrical and Computer Engineering disciplines.

The proposed new Electrical and Computer Engineering Major will continue to require 10 half courses per academic year and a final-year thesis. The focus of the program will be sharpened by the addition of four new courses, three of which are mandatory, and a requirement that all students take Engineering Economics. It is estimated that the program will have an enrolment of approximately 45 to 55 students.

Learning Outcomes: The Electrical and Computer Engineering Major aligns with the Engineering Sciences program's degree level expectations, providing students with both a breadth and depth of exposure to the two closely-aligned fields resulting in:

- A solid foundation in the basic principles of electrical and computer engineering
- Ability to integrate the principles of electrical and computer engineering leading to the innovative solution of complex problems
- Ability to demonstrate the ways in which the specialization intersects with other Engineering Science disciplines
- Ability to carry out original research within area of specialization
- Ability to demonstrate awareness of new and emerging technologies
- Ability to undertake graduate programs in electrical and computer engineering or to embark upon careers in industry or the public sector

Program requirements (New courses are underlined):

3F: ECE355 (Signal Analysis and Communication)
ECE360 (Electronics)
ECE352 (Computer Organization)
MAT389 (Complex Analysis)
<u>ECE349 (Introduction to Energy Systems)</u>

3S: ECE356 (Linear Systems and Control)
ECE357 (Electromagnetic Fields)
<u>ECE353 (Systems Software)</u>
ECE Elective
ECE Elective

4F: ESC499 (Thesis)
CS/HSS Elective
Technical Elective
Technical Elective
ECE Elective

4S: ESC499 (Thesis) OR Technical Elective
CS/HSS Elective
ECE Elective
ECE Elective
ECE Elective

"ECE Elective" includes an extensive list of year 3 and 4 ECE courses, and "Technical Electives" are a superset of ECE electives: any ECE elective as well as certain non-ECE technical courses. As an ECE Elective, it is proposed that students *must take at least two of*:

ECE358H1S (Foundations of Computing)
ECE362H1S (Digital Signal Processing)
ECE350H1S (Physical Electronics, proposed to move from term F to term S)

In addition to the list of courses above, students must take CHE374 (Engineering Economics) in any of the four terms.