Environmental Science

Program Requirements

Course Categories

The Environmental Science program description makes use of the following course categories:
- Approved Courses Outside the Faculties of Science and Engineering and Design (approved by the Environmental Science Institute)
- Approved Environmental Science Electives (approved by the Environmental Science Institute)
- Free Electives (see Academic Regulations for the B.Sc.)

Approved Science for Environmental Science

Courses approved by the Institute of Environmental Science include the following that comply with the Academic Regulations for the B.Sc.:
- Biochemistry
- Biology
- Computer Science
- Earth Science
- Environmental Science
- Geomatics
- Mathematics and Statistics
- Physics

Prohibited and Restricted Courses

Technology, Society, Environment Studies (TSES) courses are not accepted as Science Continuation courses in these programs, but may be used as Approved Environmental Science Specialization courses or as free electives.

Environmental Science

B.Sc. Honours (20.0 credits)

A. Credits Included in the Major CGPA (11.0 credits)

1. 3.0 credits in:
   - ENSC 1500 [0.5] Environmental Science Seminar
   - ENSC 2000 [0.5] Environmental Science Field Methods
   - ENSC 2001 [0.5] Earth Resources and Natural Hazards: Environmental Impacts
   - ENSC 2002 [0.5] Methods and Analysis in Environmental Science
   - ENSC 3000 [0.5] Environmental Science and Management: Theory and Practice
   - ENSC 3509 [0.5] Group Research in Environmental Science

2. 0.5 credit in:
   - Approved Environmental Science Electives

3. 1.0 credit in:
   - ENSC 4906 [1.0] Honours Research Project
   - ENSC 4901 [0.5] Directed Projects

   and 0.5 credit 4000-level Approved Science for Environmental Science

4. 1.0 credit in:
   - BIOL 2600 [0.5] Ecology
   - CHEM 2800 [0.5] Foundations for Environmental Chemistry

5. 0.5 credit from:
   - GEOG 3103 [0.5] Watershed Hydrology
   - GEOG 3104 [0.5] Principles of Biogeography
   - GEOG 3105 [0.5] Climate and Atmospheric Change
   - GEOG 3108 [0.5] Soil Properties

6. 0.5 credit from:
   - ERTH 2402 [0.5] Climate Change: An Earth Sciences Perspective
   - ERTH 2403 [0.5] Introduction to Oceanography
   - ERTH 3205 [0.5] Physical Hydrogeology

7. 1.0 credit in:
   - Approved Science for Environmental Science at the 4000-level excluding:
     - ENSC 4001 [0.5] Environmental Science Practicum

8. 1.5 credits in:
   - Approved Science for Environmental Science

B. Credits Not Included in the Major CGPA (9.0 credits)

8. 1.0 credit in:
   - MATH 1007 [0.5] Elementary Calculus I
   - STAT 2507 [0.5] Introduction to Statistical Modeling I

9. 3.0 credits in:
   - BIOL 1103 [0.5] Foundations of Biology I
   - BIOL 1104 [0.5] Foundations of Biology II
   - BIOL 1101 [0.5] General Chemistry I
   - BIOL 1102 [0.5] General Chemistry II
   - BIOL 2006 [0.5] Exploring Planet Earth
   - GEOG 2013 [0.5] Weather and Water

10. 0.5 credit in:
    - PHIL 2380 [0.5] Introduction to Environmental Ethics

11. 0.5 credit in:
    - CHEM 2302 [0.5] Analytical Chemistry I

12. 0.5 credit from:
    - BIOL 2107 [0.5] Fundamentals of Genetics
    - or BIOL 2201 [0.5] Cell Biology and Biochemistry

13. 0.5 credit from:
    - GEOG 3103 [0.5] Watershed Hydrology
    - GEOG 3104 [0.5] Principles of Biogeography
    - GEOG 3105 [0.5] Climate and Atmospheric Change
    - GEOG 3108 [0.5] Soil Properties

14. 0.5 credit from:
    - ERTH 2402 [0.5] Climate Change: An Earth Sciences Perspective
    - ERTH 2403 [0.5] Introduction to Oceanography
    - ERTH 3205 [0.5] Physical Hydrogeology

15. 1.5 credits in:
    - Approved courses outside the faculties of Science and Engineering and Design (may include NSCI 1000)

16. 1.0 credit in:
    - Free electives

Total Credits: 20.0
Environmental Science with Concentration in Ecology, Biodiversity and Conservation
B.Sc. Honours (20.0 credits)

A. Credits Included in the Major CGPA (11.0 credits)

1. 3.0 credits in:
   - ENSC 1500 [0.5] Environmental Science Seminar
   - ENSC 2000 [0.5] Environmental Science Field Methods
   - ENSC 2001 [0.5] Earth Resources and Natural Hazards: Environmental Impacts
   - ENSC 2002 [0.5] Methods and Analysis in Environmental Science
   - ENSC 3000 [0.5] Environmental Science and Management: Theory and Practice
   - ENSC 3509 [0.5] Group Research in Environmental Science

2. 0.5 credit in 3000 level Approved Environmental Science Electives

3. 1.0 credit in:
   - ENSC 4906 [1.0] Honours Research Project
   - ENSC 4901 [0.5] and 0.5 credit 4000-level Approved Science for Environmental Science

4. 1.0 credit in:
   - BIOL 2600 [0.5] Introduction to Ecology
   - CHEM 2800 [0.5] Foundations for Environmental Chemistry

5. 0.5 credit from:
   - GEOG 3103 [0.5] Watershed Hydrology
   - GEOG 3104 [0.5] Principles of Biogeography
   - GEOG 3105 [0.5] Climate and Atmospheric Change
   - GEOG 3108 [0.5] Soil Properties

6. 0.5 credit from:
   - ERTH 2402 [0.5] Climate Change: An Earth Sciences Perspective
   - ERTH 2403 [0.5] Introduction to Oceanography
   - ERTH 3205 [0.5] Physical Hydrogeology

7. 0.5 credit in Approved Science for Environmental Science at the 4000-level, excluding:
   - ENSC 4001 [0.5] Environmental Science Practicum

8. 4.0 credits in:
   a. 1.5 credit in:
      - BIOL 2001 [0.5] Animals: Form and Function
      - BIOL 2002 [0.5] Plants: Form and Function
      - BIOL 2201 [0.5] Cell Biology and Biochemistry
   b. 0.5 credit from:
      - BIOL 2303 [0.5] Microbiology
      - BIOL 3004 [0.5] Insect Diversity
      - BIOL 3102 [0.5] Mycology
      - BIOL 3205 [0.5] Plant Biochemistry and Physiology
   c. 2.0 credits in a focus:
      Ecology focus:
      i) 0.5 credit in:
         - BIOL 3604 [0.5] Analysis of Ecological Relationships
      ii) 1.0 credit from:
         - BIOL 3601 [0.5] Ecosystems and Environmental Change
   - BIOL 3502 [0.5] Conservation Biology
   - BIOL 3605 [0.5] Field Course I
   - BIOL 3606 [0.5] Field Course II
   iii) 0.5 credit BIOL at the 4000-level

9. Microbiology/genetics focus:
   i) 1.0 credit from:
      - BIOL 3104 [0.5] Molecular Genetics
      - BIOL 4103 [0.5] Population Genetics
   ii) 0.5 credit from:
      - BIOL 2303 [0.5] Microbiology
      - BIOL 3102 [0.5] Mycology
      - BIOL 3303 [0.5] Experimental Microbiology
   iii) 0.5 credit BIOL at the 4000-level

B. Credits Not Included in the Major CGPA (9.0 credits)

8. 1.0 credit in:
   - MATH 1007 [0.5] Elementary Calculus I
   - STAT 2507 [0.5] Introduction to Statistical Modeling I

9. 3.0 credits in:
   - BIOL 1103 [0.5] Foundations of Biology I
   - BIOL 1104 [0.5] Foundations of Biology II
   - CHEM 1001 [0.5] General Chemistry I
   - CHEM 1002 [0.5] General Chemistry II
   - GEOG 2013 [0.5] Weather and Water
   - ERTH 1006 [0.5] Exploring Planet Earth

10. 0.5 credit in:
    - PHIL 2380 [0.5] Introduction to Environmental Ethics

11. 0.5 credit in:
    - CHEM 2302 [0.5] Analytical Chemistry I

12. 0.5 credit in:
    - BIOL 2107 [0.5] Fundamentals of Genetics

13. 0.5 credit from:
    - GEOG 3103 [0.5] Watershed Hydrology
    - GEOG 3104 [0.5] Principles of Biogeography
    - GEOG 3105 [0.5] Climate and Atmospheric Change
    - GEOG 3108 [0.5] Soil Properties

14. 0.5 credit from:
    - ERTH 2402 [0.5] Climate Change: An Earth Sciences Perspective
    - ERTH 2403 [0.5] Introduction to Oceanography
    - ERTH 3205 [0.5] Physical Hydrogeology

15. 1.5 credits in approved courses outside the faculties of Science and Engineering and Design (may include NSCI 1000)

16. 1.0 credit in free electives.

Total Credits: 20.0

Environmental Science with Concentration in Chemistry
B.Sc. Honours (20.0 credits)

A. Credits Included in the Major CGPA (11.5 credits)

1. 3.0 credits in:
   - ENSC 1500 [0.5] Environmental Science Seminar
   - ENSC 2000 [0.5] Environmental Science Field Methods
   - ENSC 2001 [0.5] Earth Resources and Natural Hazards: Environmental Impacts

2. 0.5 credit in:
   - ENSC 2002 [0.5] Methods and Analysis in Environmental Science
   - ENSC 3000 [0.5] Environmental Science and Management: Theory and Practice
   - ENSC 3509 [0.5] Group Research in Environmental Science

Total Credits: 11.5
ENSC 2002 [0.5] Methods and Analysis in Environmental Science
ENSC 3000 [0.5] Environmental Science and Management: Theory and Practice
ENSC 3509 [0.5] Group Research in Environmental Science
2. 0.5 credit in 3000 level Approved Environmental Science Electives

ENSC 4906 [1.0] Honours Research Project
Or
ENSC 4901 [0.5] and 0.5 credit 4000-level Approved Science for Environmental Science
2. 1.0 credit in:
   BIOL 2600 [0.5] Introduction to Ecology
   CHEM 2800 [0.5] Foundations for Environmental Chemistry
3. 0.5 credit from:
   GEOG 3103 [0.5] Watershed Hydrology
   GEOG 3104 [0.5] Principles of Biogeography
   GEOG 3105 [0.5] Climate and Atmospheric Change
   GEOG 3108 [0.5] Soil Properties
4. 0.5 credit from:
   ERTH 2402 [0.5] Climate Change: An Earth Sciences Perspective
   ERTH 2403 [0.5] Introduction to Oceanography
   ERTH 3205 [0.5] Physical Hydrogeology
5. 3.0 credits in:
   CHEM 2203 [0.5] Organic Chemistry I
   CHEM 2204 [0.5] Organic Chemistry II
   CHEM 2303 [0.5] Analytical Chemistry II
   CHEM 2501 [0.5] Introduction to Inorganic and Bioinorganic Chemistry
   CHEM 3305 [0.5] Advanced Analytical Chemistry Laboratory
   CHEM 3800 [0.5] The Chemistry of Environmental Pollutants
6. 1.5 credits in:
   Organic focus:
   CHEM 3201 [0.5] Advanced Organic Chemistry I
   CHEM 3202 [0.5] Advanced Organic Chemistry II
   CHEM 3205 [0.5] Experimental Organic Chemistry
   Or
   Inorganic focus:
   i) 1.0 credit in:
      CHEM 3503 [0.5] Inorganic Chemistry I
      CHEM 3504 [0.5] Inorganic Chemistry II
   ii) 0.5 credit in CHEM at the 4000-level
7. 0.5 credit in:
   CHEM 4800 [0.5] Atmospheric Chemistry
8. B. Credits not included in the Major CGPA (8.5 credits)

ENSC 2000 [0.5] Environmental Science Field Methods
ENSC 2001 [0.5] Earth Resources and Natural Hazards: Environmental Impacts
ENSC 3000 [0.5] Environmental Science and Management: Theory and Practice
ENSC 4906 [1.0] Honours Research Project
Or
ENSC 4901 and 0.5 credit 4000-level Approved Science for Environmental Science
2. 1.5 credits in:
   BIOL 2600 [0.5] Introduction to Ecology
   CHEM 2800 [0.5] Foundations for Environmental Chemistry
   GEOG 3108 [0.5] Soil Properties
3. 4.0 credits in:
   ERTH 2102 [0.5] Mineralogy to Petrology
   ERTH 2104 [0.5] Igneous Systems, Geochemistry and Processes
   ERTH 2314 [0.5] Sedimentation and Stratigraphy
   ERTH 2406 [0.5] Geology and Map Interpretation
   ERTH 3003 [0.5] Geochemistry and Geochronology
   ERTH 3205 [0.5] Physical Hydrogeology
   ERTH 3405 [0.5] Geophysical Methods
   ERTH 3806 [0.5] Structural Geology
4. 0.5 credit from:
Environmental Science
B.Sc. Major (20.0 credits)

A. Credits Included in the Major CGPA (11.0 credits)

<table>
<thead>
<tr>
<th>Credits</th>
<th>Course Description</th>
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<tbody>
<tr>
<td>3.5</td>
<td>ENSC 1500 [0.5] Environmental Science Seminar</td>
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<td>ENSC 2000 [0.5] Environmental Science Field Methods</td>
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<td>MATH 1107 [0.5] Linear Algebra I</td>
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B. Credits Not Included in the Major CGPA (9.0 credits)

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Total Credits: 20.0

Environmental Science
B.Sc. Major (20.0 credits)

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<td>ENSC 2002 [0.5] Methods and Analysis in Environmental Science</td>
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</tbody>
</table>

Total Credits: 20.0
B.Sc. Regulations

The regulations presented in this section apply to all Bachelor of Science programs. In addition to the requirements presented here, students must satisfy the University regulations common to all undergraduate students including the process of Academic Performance Evaluation (see the Academic Regulations of the University section of this Calendar).

Breadth Requirement for the B.Sc.

Students in Bachelor of Science Honours, Major, or General programs must present the following credits at graduation:

1. 2.0 credits in Science Continuation courses not in the major discipline; students completing a double major are considered to have completed this requirement providing they have 2.0 credits in science continuation courses in each of the two majors
2. 2.0 credits in courses outside of the faculties of Science and Engineering and Design (but may include NSCI 1000)

In most cases, the requirements for individual B.Sc. programs, as stated in this Calendar, contain these requirements, explicitly or implicitly.

Students admitted to B.Sc. programs by transfer from another institution must present at graduation (whether taken at Carleton or elsewhere):

1. 2.0 credits in courses outside of the faculties of Science and Engineering and Design (but may include NSCI 1000) if, on transfer, the student received credit for fewer than 10.0 credits.
2. 1.0 credit in courses outside of the faculties of Science and Engineering and Design (but may include NSCI 1000) if, on transfer, the student received credit for 10.0 or more credits.

Declared and Undeclared Students

Students who are registered in a program within the degree are called Declared students. Most students designate a program of study when they first apply for admission and so begin their studies as Declared students. Students may also choose to begin their studies within the B.Sc. degree without being registered in a program. These students are referred to as Undeclared students. The recommended course pattern for Undeclared students is provided in the Undeclared entry of the Programs section of this Calendar. Undeclared students normally must apply to enter a program before beginning their second year of study. The Science Student Success Centre (SSSC) provides Undeclared students guidance to the appropriate support services in making this decision.

Change of Program within the B.Sc. Degree

Students may transfer to a program within the B.Sc. degree if upon entry to the new program they would be in good academic standing.

Other applications for change of program will be considered on their merits; students may be accepted in the new program in Good Standing or on Academic Warning.

Applications to declare or change their program within the B.Sc. Degree must be made online through Carleton Central by completing a Change of Program Elements (COPE) application form within the published deadlines. Acceptance into a program or into a program element or option is subject to any enrolment, and/or specific program, program element or option requirements as published in the relevant Calendar entry.

Minors, Concentrations and Specializations

Students may add a minor, concentration or specialization by completing a Change of Program Elements (COPE) application form online through Carleton Central. Acceptance into a minor, concentration or specialization requires that the student be in Good Standing and is subject to any specific requirements of the intended Minor, Concentration or Specialization as published in the relevant Calendar entry.

Experimental Science Requirement

Students in B.Sc. Honours, Major, or General degree programs must present at graduation at least two full credits of experimental science chosen from two different departments or institutes from the list below:

Approved Experimental Science Courses

<table>
<thead>
<tr>
<th>Biochemistry</th>
<th>Biology</th>
<th>Chemistry</th>
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</thead>
<tbody>
<tr>
<td>BIOC 2200 [0.5]</td>
<td>BIOL 1103 [0.5]</td>
<td>CHEM 1001 [0.5]</td>
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<td>BIOC 4001 [0.5]</td>
<td>BIOL 1104 [0.5]</td>
<td>CHEM 1002 [0.5]</td>
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<tr>
<td>BIOC 4201 [0.5]</td>
<td>BIOL 2001 [0.5]</td>
<td>CHEM 2204 [0.5]</td>
</tr>
</tbody>
</table>

Total Credits 20.0

16. 2.0 credits in free electives.
<table>
<thead>
<tr>
<th>Course Categories for B.Sc. Programs</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Earth Sciences</strong></td>
<td><strong>Science Faculty Electives</strong></td>
</tr>
<tr>
<td>ERTH 1006 [0.5] Exploring Planet Earth</td>
<td>GEOG 4017 [0.5] Global Biogeochemical Cycles</td>
</tr>
<tr>
<td>ERTH 1009 [0.5] The Earth System Through Time</td>
<td>GEOG 4101 [0.5] Two Million Years of Environmental Change</td>
</tr>
<tr>
<td>ERTH 2102 [0.5] Mineralogy to Petrology</td>
<td>GEOG 4103 [0.5] Water Resources Engineering</td>
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<tr>
<td>ERTH 2404 [0.5] Engineering Geoscience</td>
<td>GEOG 4104 [0.5] Microclimatology</td>
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<td>ERTH 2802 [0.5] Field Geology I</td>
<td>GEOG 4108 [0.5] Permafrost</td>
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<td>ERTH 3111 [0.5] Vertebrate Evolution II</td>
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<td>ERTH 3112 [0.5] Vertebrate Evolution I</td>
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<tr>
<td>ERTH 3204 [0.5] Mineral Deposits</td>
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<td>ERTH 3205 [0.5] Physical Hydrogeology</td>
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<tr>
<td>ERTH 3806 [0.5] Structural Geology</td>
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<tr>
<td><strong>Food Sciences</strong></td>
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<tr>
<td>FOOD 3001 [0.5] Food Chemistry</td>
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<td>FOOD 3002 [0.5] Food Analysis</td>
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<td>FOOD 3005 [0.5] Food Microbiology</td>
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<tr>
<td><strong>Neuroscience</strong></td>
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<tr>
<td>NEUR 3206 [0.5] Sensory and Motor Neuroscience</td>
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<tr>
<td>NEUR 3207 [0.5] Integrative Neuroscience</td>
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<tr>
<td>NEUR 4600 [0.5] Advanced Lab in Neuroanatomy</td>
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<tr>
<td><strong>Physics</strong></td>
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<tr>
<td>PHYS 1001 [0.5] Foundations of Physics I</td>
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<tr>
<td>PHYS 1002 [0.5] Foundations of Physics II</td>
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<tr>
<td>PHYS 1003 [0.5] Introductory Mechanics and Thermodynamics</td>
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<td>PHYS 1004 [0.5] Introductory Electromagnetism and Wave Motion</td>
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<td>PHYS 1007 [0.5] Elementary University Physics I</td>
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<td>PHYS 1008 [0.5] Elementary University Physics II</td>
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<td>PHYS 2202 [0.5] Wave Motion and Optics</td>
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<td>PHYS 2604 [0.5] Modern Physics I</td>
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<td>PHYS 3007 [0.5] Third Year Physics Laboratory: Selected Experiments and Seminars</td>
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<td>PHYS 3606 [0.5] Modern Physics II</td>
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<td>PHYS 3608 [0.5] Modern Applied Physics</td>
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<tr>
<td><strong>Science Geography Courses</strong></td>
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<tr>
<td>GEOG 1010 [0.5] Global Environmental Systems</td>
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<tr>
<td>GEOG 2006 [0.5] Introduction to Quantitative Research</td>
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<td>GEOG 2013 [0.5] Weather and Water</td>
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<td>GEOG 2014 [0.5] The Earth’s Surface</td>
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<td>GEOG 3003 [0.5] Quantitative Geography</td>
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<td>GEOG 3010 [0.5] Field Methods in Physical Geography</td>
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<td>GEOG 3102 [0.5] Geomorphology</td>
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<td>GEOG 3103 [0.5] Watershed Hydrology</td>
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<tr>
<td>GEOG 3104 [0.5] Principles of Biogeography</td>
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<tr>
<td>GEOG 3105 [0.5] Climate and Atmospheric Change</td>
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</tr>
<tr>
<td>GEOG 3106 [0.5] Aquatic Science and Management</td>
<td></td>
</tr>
<tr>
<td>GEOG 3108 [0.5] Soil Properties</td>
<td></td>
</tr>
<tr>
<td>GEOG 4000 [0.5] Field Studies</td>
<td></td>
</tr>
<tr>
<td>GEOG 4005 [0.5] Directed Studies in Geography</td>
<td></td>
</tr>
<tr>
<td>GEOG 4013 [0.5] Cold Region Hydrology</td>
<td></td>
</tr>
<tr>
<td><strong>Science Psychology Courses</strong></td>
<td></td>
</tr>
<tr>
<td>PSYC 2001 [0.5] Introduction to Research Methods in Psychology</td>
<td></td>
</tr>
<tr>
<td>PSYC 2002 [0.5] Introduction to Statistics in Psychology</td>
<td></td>
</tr>
<tr>
<td>PSYC 2700 [0.5] Introduction to Cognitive Psychology</td>
<td></td>
</tr>
<tr>
<td>PSYC 3000 [1.0] Design and Analysis in Psychological Research</td>
<td></td>
</tr>
<tr>
<td>PSYC 3506 [0.5] Cognitive Development</td>
<td></td>
</tr>
<tr>
<td>PSYC 3700 [1.0] Cognition (Honours Seminar)</td>
<td></td>
</tr>
<tr>
<td>PSYC 3702 [0.5] Perception</td>
<td></td>
</tr>
<tr>
<td>PSYC 2307 [0.5] Human Neuropsychology I</td>
<td></td>
</tr>
<tr>
<td>PSYC 3307 [0.5] Human Neuropsychology II</td>
<td></td>
</tr>
<tr>
<td><strong>Science Continuation Courses</strong></td>
<td></td>
</tr>
<tr>
<td>A course at the 2000 level or above may be used as a Science Continuation credit in a B.Sc. program if it is not in the student's major discipline, and is chosen from the following:</td>
<td></td>
</tr>
<tr>
<td>BIOC (Biochemistry)</td>
<td></td>
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<tr>
<td>BIOL (Biology)</td>
<td></td>
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<tr>
<td>CHEM (Chemistry)</td>
<td></td>
</tr>
<tr>
<td>COMP (Computer Science) A maximum of two half-credits at the 1000-level in COMP, excluding COMP 1001 may be used as Science Continuation credits.</td>
<td></td>
</tr>
<tr>
<td>ERTH (Earth Sciences), except ERTH 2415 which may be used only as a free elective for any B.Sc. program. Students in Earth Sciences programs may use ERTH 2401, ERTH 2402, and ERTH 2403 only as free electives.</td>
<td></td>
</tr>
<tr>
<td>Engineering. Students wishing to register in Engineering courses must obtain the permission of the Faculty of Engineering and Design.</td>
<td></td>
</tr>
<tr>
<td>ENSC (Environmental Science)</td>
<td></td>
</tr>
<tr>
<td>FOOD (Food Science and Nutrition)</td>
<td></td>
</tr>
<tr>
<td>GEOM (Geomatics)</td>
<td></td>
</tr>
<tr>
<td>HLTH (Health Sciences)</td>
<td></td>
</tr>
<tr>
<td>MATH (Mathematics)</td>
<td></td>
</tr>
<tr>
<td>NEUR (Neuroscience)</td>
<td></td>
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<tr>
<td>PHYS (Physics), except PHYS 2903</td>
<td></td>
</tr>
<tr>
<td>Science Geography Courses (see list above)</td>
<td></td>
</tr>
<tr>
<td>Science Psychology Courses (see list above)</td>
<td></td>
</tr>
<tr>
<td>STAT (Statistics)</td>
<td></td>
</tr>
<tr>
<td>TSES (Technology, Society, Environment) except TSES 2305. Biology General, Major, and Honours students may use these courses only as free electives. Integrated Science and Environmental Science students may include these courses in their programs but may not count them as part of the Science Sequence.</td>
<td></td>
</tr>
<tr>
<td><strong>Science Faculty Electives</strong></td>
<td></td>
</tr>
<tr>
<td>TSES (Technology, Society, Environment) except TSES 2305. Biology General, Major, and Honours students may use these courses only as free electives. Integrated Science and Environmental Science students may include these courses in their programs but may not count them as part of the Science Sequence.</td>
<td></td>
</tr>
</tbody>
</table>
Science Faculty Electives are courses at the 1000-4000 level chosen from:

- BIOC (Biochemistry)
- BIOL (Biology) Biology & Biochemistry students may use BIOL 1010 and BIOL 2005 only as free electives
- CHEM (Chemistry) except CHEM 1003, CHEM 1004 and CHEM 1007
- COMP (Computer Science) except COMP 1001
- ERTH (Earth Sciences) except ERTH 1010, ERTH 1011 and ERTH 2415. Earth Sciences students may use ERTH 2401, ERTH 2402, and ERTH 2403 only as free electives.
- Engineering
- ENSC 2001
- FOOD (Food Science and Nutrition)
- GEOM (Geomatics)
- HLTH (Health Science)
- MATH (Mathematics)
- NEUR (Neuroscience)
- PHYS (Physics) except PHYS 1901, PHYS 1902, PHYS 1905, PHYS 2903
- Science Geography (see list above)
- Science Psychology (see list above)
- STAT (Statistics)
- TSES (Technology, Society, Environment) Biology

General, Major and Honours students may use these courses only as free electives.

Advanced Science Faculty Electives

Advanced Science Faculty Electives are courses at the 2000-4000 level chosen from the Science Faculty Electives list above.

Approved Courses Outside the Faculties of Science and Engineering and Design (may include NSCI 1000)

All courses offered by the Faculty of Arts and Social Sciences, the Faculty of Public Affairs, and the Sprott School of Business are approved as Arts or Social Sciences courses EXCEPT FOR: All Science Geography courses (see list above), all Geomatics (GEOM) courses, all Science Psychology courses (see list above), NSCI 1000 may be used as an Approved Course Outside the Faculties of Science and Engineering and Design.

Free Electives

Any course is allowable as a Free Elective providing it is not prohibited (see below). Students are expected to comply with prerequisite requirements and enrolment restrictions for all courses as published in this Calendar.

Courses Allowable Only as Free Electives in any B.Sc. Program

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 1003</td>
<td>The Chemistry of Food, Health and Drugs</td>
</tr>
<tr>
<td>CHEM 1004</td>
<td>Drugs and the Human Body</td>
</tr>
<tr>
<td>CHEM 1007</td>
<td>Chemistry of Art and Artifacts</td>
</tr>
<tr>
<td>ERTH 1010</td>
<td>Our Dynamic Planet Earth</td>
</tr>
<tr>
<td>ERTH 1011</td>
<td>Evolution of the Earth</td>
</tr>
<tr>
<td>ERTH 2415</td>
<td>Natural Disasters</td>
</tr>
<tr>
<td>ISCI 1001</td>
<td>Introduction to the Environment</td>
</tr>
<tr>
<td>ISCI 2000</td>
<td>Natural Laws</td>
</tr>
<tr>
<td>ISCI 2002</td>
<td>Human Impacts on the Environment</td>
</tr>
<tr>
<td>MATH 0107</td>
<td>Algebra and Geometry</td>
</tr>
<tr>
<td>PHYS 1901</td>
<td>Planetary Astronomy</td>
</tr>
<tr>
<td>PHYS 1902</td>
<td>From our Star to the Cosmos</td>
</tr>
<tr>
<td>PHYS 1905</td>
<td>How Things Work: Physics in Everyday Life</td>
</tr>
<tr>
<td>PHYS 2903</td>
<td>Physics and the Imagination</td>
</tr>
</tbody>
</table>

Prohibited Courses

The following courses are not acceptable for credit in any B.Sc. program:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMP 1001</td>
<td>Introduction to Computational Thinking for Arts and Social Science Students</td>
</tr>
<tr>
<td>MATH 0005</td>
<td>Precalculus: Functions and Graphs</td>
</tr>
<tr>
<td>MATH 0006</td>
<td>Precalculus: Trigonometric Functions and Complex Numbers</td>
</tr>
<tr>
<td>MATH 1009</td>
<td>Calculus: with Applications to Business</td>
</tr>
<tr>
<td>MATH 1119</td>
<td>Linear Algebra: with Applications to Business</td>
</tr>
<tr>
<td>MATH 1401</td>
<td>Elementary Mathematics for Economics I</td>
</tr>
<tr>
<td>MATH 1402</td>
<td>Elementary Mathematics for Economics II</td>
</tr>
</tbody>
</table>

Co-operative Education

For more information about how to apply for the Co-op program and how the Co-op program works please visit the Co-op website.

All students participating in the Co-op program are governed by the Undergraduate Co-operative Education Policy.

Undergraduate Co-operative Education Policy

Admission Requirements

Students can apply to co-op in one of two ways; directly from high school or after beginning a degree program at Carleton.

If a student is admitted to co-op from high school, their grades will be reviewed two terms to one year prior to their first work term to ensure they continue to meet the academic requirements after their 1st or 2nd year of study. The time at which evaluation takes place depends on the program of study. Students will automatically be notified via their Carleton email account if they are permitted to continue.

Students not admitted to Carleton University with the co-op option on their degree can apply for admission via the co-operative education program website. To view application deadlines, visit carleton.ca/co-op.

Admission to the co-op option is based on the completion of 5.0 or more credits at Carleton University, the CGPA requirement for the students’ academic program as well as any course prerequisites. The articulated CGPA for each program is the normal standard for assessment. Please see the specific degree program sections for the unique admission and continuation requirements for each academic program.
English Language Proficiency
Students admitted to Carleton based on CAEL, IELTS or TOEFL assessments and who are required to take an ESL course must take and pass the Oral Proficiency in Communicative Settings (OPECs) Test. The test must be taken before being permitted to register in COOP 1000. Admission to the co-op program can be confirmed with a minimum score of 4+.

Participation Requirements
COOP 1000
Once a student has been given admission or continuation confirmation to the co-op option s/he must complete and pass COOP 1000 (a mandatory online 0.0 credit course). Students will have access to this course a minimum of two terms prior to their first work term and will be notified when to register.

Communication with the Co-op Office
Students must maintain contact with the co-op office during their job search and while on a work term. All email communication will be conducted via the students’ Carleton email account.

Employment
Although every effort is made to ensure a sufficient number of job postings for all students enrolled in the co-op option of their degree program, no guarantee of employment can be made. Carleton’s co-op program operates a competitive job search process and is dependent upon current market conditions. Academic performance, skills, motivation, maturity, attitude and potential will determine whether a student is offered a job. It is the student’s responsibility to actively conduct a job search in addition to participation in the job search process operated by the co-op office. Once a student accepts a co-op job offer (verbally or written), his/her job search will end and access to co-op jobs will be removed for that term. Students that do not successfully obtain a co-op work term are expected to continue with their academic studies. The summer term is the exception to this rule. Students should also note that hiring priority is given to Canadian citizens for co-op positions in the Federal Government of Canada.

Registering in Co-op Courses
Students will be registered in a Co-op Work Term course while at work. The number of Co-op Work Term courses that a student is registered in is dependent upon the number of four-month work terms that a student accepts. While on a co-op work term students may take a maximum of 0.5 credit throughout each four-month co-op work term. Courses must be scheduled outside of regular working hours.

Students must be registered as full-time before they begin their co-op job search (2.0 credits). All co-op work terms must be completed before the beginning of the final academic term. Students may not finish their degree on a co-op work term.

Work Term Assessment and Evaluation
To obtain a Satisfactory grade for the co-op work term students must have:

1. A satisfactory work term evaluation by the co-op employer;
2. A satisfactory grade on the work term report.

Students must submit a work term report at the completion of each four-month work term. Reports are due on the 16th of April, August, and December and students are notified of due dates through their Carleton email account.

Workplace performance will be assessed by the workplace supervisor. Should a student receive an unsatisfactory rating from their co-op employer, an investigation by the co-op program manager will be undertaken. An unsatisfactory employer evaluation does not preclude a student from achieving an overall satisfactory rating for the work term.

Graduation with the Co-op Designation
In order to graduate with the co-op designation, students must satisfy all requirements for their degree program in addition to the requirements according to each co-op program (i.e. successful completion of three or four work terms).

Note: Participation in the co-op option will add up to one additional year for a student to complete their degree program.

Voluntary Withdrawal from the Co-op Option
Students may withdraw from the co-op option of their degree program during a study term ONLY. Students at work may not withdraw from the work term or the co-op option until s/he has completed the requirements of the work term.

Students are eligible to continue in their regular academic program provided that they meet the academic standards required for continuation.

Involuntary or Required Withdrawal from the Co-op Option
Students may be required to withdraw from the co-op option of their degree program for one or any of the following reasons:

1. Failure to achieve a grade of SAT in COOP 1000
2. Failure to pay all co-op related fees
3. Failure to actively participate in the job search process
4. Failure to attend all interviews for positions to which the student has applied
5. Declining more than one job offer during the job search process
6. Continuing a job search after accepting a co-op position
7. Dismissal from a work term by the co-op employer
8. Leaving a work term without approval by the Co-op manager
9. Receipt of an unsatisfactory work term evaluation
10. Submission of an unsatisfactory work term report

Standing and Appeals
The Co-op and Career Services office administers the regulations and procedures that are applicable to all co-op program options. All instances of a student’s failure
during a work term or other issues directly related to their participation in the co-op option will be reported to the academic department.

Any decision made by the Co-op and Career Services office can be appealed via the normal appeal process within the University.

**International Students**

All International Students are required to possess a Co-op Work Permit issued by Citizenship and Immigration Canada before they can begin working. It is illegal to work in Canada without the proper authorization. Students will be provided with a letter of support to accompany their application. Students must submit their application for their permit before being permitted to view and apply for jobs on the Co-op Services database. Confirmation of a position will not be approved until a student can confirm they have received their permit. Students are advised to discuss the application process and requirements with the International Student Services Office.

**B.Sc. Environmental Science: Co-op Admission and Continuation Requirements**

- Maintain full-time status in each study term (2.0 credits);
- Be eligible to work in Canada (for off-campus work)
- Have successfully completed COOP 1000 [0.0]

In addition to the following:

1. Completion of 5.0 or more credits at Carleton University;
2. Registered as a full-time student in the Bachelor of Science Honours degree program;
3. Obtained and maintained a major CGPA of 8.0 or higher and an overall CGPA of 6.50 or higher

B.Sc. Honours Environmental Science students must successfully complete three (3) work terms to obtain the co-op designation.

**Work Term Course:** ENSC 3999

**Work/Study Pattern:**

<table>
<thead>
<tr>
<th>Term</th>
<th>Pattern Term</th>
<th>Term</th>
<th>Pattern Term</th>
<th>Term</th>
<th>Pattern Term</th>
<th>Term</th>
<th>Pattern Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>S</td>
<td>Fall</td>
<td>S</td>
<td>Fall</td>
<td>W/S</td>
<td>Fall</td>
<td>S</td>
</tr>
<tr>
<td>Winter</td>
<td>S</td>
<td>Winter</td>
<td>S</td>
<td>Winter</td>
<td>W/S</td>
<td>Winter</td>
<td>S</td>
</tr>
</tbody>
</table>

**Legend**

- S: Study
- W: Work
- O: Optional

* indicates recommended work study pattern

**student finds own employer for this work-term.

**Admissions Information**

Admission Requirements are for the 2018-2019 year only, and are based on the Ontario High School System. Holding the minimum admission requirements only establishes eligibility for consideration. The cut-off averages for admission may be considerably higher than the minimum. See also the General Admission and Procedures section of this Calendar. An overall average of at least 70% is normally required to be considered for admission. Some programs may also require specific course prerequisites and prerequisite averages and/or supplementary admission portfolios. Higher averages are required for admission to programs for which the demand for places by qualified applicants exceeds the number of places available. The overall average required for admission is determined each year on a program by program basis. Consult admissions.carleton.ca for further details.

Note: Courses listed as recommended are not mandatory for admission. Students who do not follow the recommendations will not be disadvantaged in the admission process.

**Degrees**

- B.Sc. (Honours)
- B.Sc. (General)
- B.Sc. (Major)

**Admission Requirements**

**Honours Program**

**First Year**

The Ontario Secondary School Diploma (OSSD) or equivalent including a minimum of six 4U or M courses. For most programs including Bioinformatics, Biology, Biochemistry, Biotechnology, Chemistry, combined Honours in Biology and Physics, Chemistry and Physics, Computational Biochemistry, Food Science and Nutrition, Neuroscience, Neuroscience and Mental Health, Nanoscience and Psychology, the six 4U or M courses must include Advanced Functions and two of Biology, Chemistry, Earth and Space Sciences or Physics. (Calculus and Vectors is strongly recommended).

**Specific Honours Admission Requirements**

For the Honours programs in Environmental Science, Geography, Geomatics and Earth Sciences, Calculus and Vectors may be substituted for Advanced Functions.

For the Honours programs in Physics and Applied Physics and for double Honours in Mathematics and Physics, Calculus and Vectors is required in addition to Advanced Functions and one of 4U Physics Chemistry, Biology, or Earth and Space Sciences. For all programs in Physics, 4U Physics is strongly recommended.

For the Combined Honours program in Chemistry and Computer Science, 4U Chemistry and Calculus and Vectors are strongly recommended.

For Honours in Psychology, a 4U course in English is recommended.

For Honours in Environmental Science, a 4U course in Biology and Chemistry is recommended.

**Advanced Standing**

For entry to an Honours program after the completion of 5.0 included credits, a student must have a major CGPA of 5.50 or higher, an overall CGPA of 4.50 or higher and the recommendation of the Honours department or committee. A student beginning the final 10.0 credits
towards an Honours degree must present a major CGPA of 6.00 or higher, an overall CGPA of 5.00 or higher and the recommendation of the Honours department or committee. A student beginning the final 5.0 credits towards an Honours degree must present a major CGPA of 6.50 or higher and an overall CGPA of 5.00 or higher, as calculated for graduation. Advanced standing will be granted for studies undertaken elsewhere when these are recognized as the equivalent of subjects offered at Carleton University.

Major Program

General Program

First Year
The Ontario Secondary School Diploma (OSSD) or equivalent including a minimum of six 4U or M courses. The six 4U or M courses must include Advanced Functions and two of Calculus and Vectors, Biology, Chemistry, Earth and Space Science or Physics (Calculus and Vectors is strongly recommended). For the B.Sc. Major in Physics. 4U Physics is strongly recommended. Equivalent courses may be substituted between the old and new Ontario mathematics curriculum.

Advanced Standing
For entry to a General or Major program after the completion of 5.0 included credits, a student must have a major and core CGPA of 3.50 or higher and an overall CGPA of 3.50 or higher. A student beginning the final 5.0 credits towards a General or Major degree must present a major and core CGPA of 4.00 or higher and an overall CGPA of 4.00 or higher, as calculated for graduation. Advanced standing will be granted for studies undertaken elsewhere when these are recognized as the equivalent of subjects offered at Carleton University.

Co-op Option

Direct Admission to the First Year of the Co-op Option
Applicants must:
1. meet the required overall admission cut-off average and prerequisite course average. These averages may be higher than the stated minimum requirements;
2. be registered as a full-time student in the Bachelor of Science Honours program;
3. be eligible to work in Canada (for off-campus work placements).

Note that meeting the above requirements only establishes eligibility for admission to the program. The prevailing job market may limit enrolment in the co-op option.

Note: continuation requirements for students previously admitted to the co-op option and admission requirements for the co-op option after beginning the program are described in the Co-operative Education Regulations section of this Calendar.

Environmental Science (ENSC) Courses

ENSC 1500 [0.5 credit]
Environmental Science Seminar
The purpose and nature of the program; society's view on the natural and human-modified environment; major environmental issues and their scientific aspects; preparation and presentation of paper and seminars. Prerequisite(s): enrolment in the Environmental Science program.
Lectures, seminars and workshops four hours a week.

ENSC 2000 [0.5 credit]
Environmental Science Field Methods
A field-based course introducing students to practical methods in environmental science. Topics will include earth sciences, geography, biology, and chemistry related aspects of environmental sciences and will focus on quantitative techniques to assess environmental impacts and management. A supplementary fee will apply. Prerequisite(s): ERTH 1006 and BIOL 1004 or BIOL 1104, CHEM 1001 and CHEM 1002 and permission of the Institute.
Field trips, lectures and workshops, seven hours per week (delivered on a single day and on up to two mandatory weekend trips).

ENSC 2001 [0.5 credit]
Earth Resources and Natural Hazards: Environmental Impacts
Environmental impact of mineral, energy and water resource exploitation and impact of hazardous Earth processes such as volcanic eruptions, earthquakes and others: their prediction and mitigation.
Lectures three hours per week.

ENSC 2002 [0.5 credit]
Methods and Analysis in Environmental Science
Study and application of qualitative and quantitative techniques in environmental science, including study design, data collection and assembly, database manipulation, data analysis, and critically evaluating scientific information. Prerequisite(s): STAT 2507 or permission from the Institute.
Lectures and seminars three hours a week.

ENSC 3000 [0.5 credit]
Environmental Science and Management: Theory and Practice
Theoretical and practical perspectives related to environmental science and management; Emphasis on real-world problems associated with human activities and development of solutions in natural and built environments; Hands-on experience with environmental monitoring and restoration. A supplementary fee will apply. Prerequisite(s): third-year standing in Environmental Science or permission of the Institute.
Field trips, lectures and workshops, 7 hours per week (delivered on a single day).
ENSC 3106 [0.5 credit]
Aquatic science and Management
Fundamentals of aquatic science. The physical, chemical, and biotic aspects of lake, river, and estuary systems including human impacts, management and conservation. Also listed as GEOG 3106.
Prerequisite(s): third-year standing and a second year science or engineering course.
Workshop four hours per week.

ENSC 3509 [0.5 credit]
Group Research in Environmental Science
Major project relating to an issue involving environmental science; effective methods of team research and presentation of group work.
Prerequisite(s): third-year standing in the Environmental Science program or permission of the Institute.
Lectures, seminars and workshops three hours a week.

ENSC 3700 [0.5 credit]
Topics in Environmental Science
Specific topics of current interest. Topics may vary from year to year.
Prerequisite(s): Third year standing in the Environmental Science program or permission of the Institute.

ENSC 3906 [0.5 credit]
Project Planning for Environmental Research
Independent or group study on the fundamentals of scientific investigation, which may include use of literature, learning of research techniques, and development of a research proposal, in consultation with a Faculty supervisor. May include directed reading, written assignments, tutorials, laboratory or field work.
Prerequisite(s): Good standing in third year Environmental Science and permission of the Institute.

ENSC 3999 [0.0 credit]
Co-operative Work Term
Practical experience for students enrolled in the Co-operative Option. To receive course credit a student must receive satisfactory evaluations from their work term employer. Written reports describing the work term project will be required. Graded Sat or Uns.
Prerequisite(s): registration in the Environmental Science Co-operative Option and permission of the Institute. Four-month work term.

ENSC 4001 [0.5 credit]
Environmental Science Practicum
Experience working in the environmental science sector, applying academic training to practical environmental issues. Graded Sat/Uns.
Prerequisite(s): fourth-year standing in the Environmental Science program.

ENSC 4002 [0.5 credit]
Environmental Decisions
The regulatory and scientific aspects of environmental management decisions, including risk analysis and mitigation, managing chronic and acute environmental impacts, and conservation of species and landscapes. Students will use real-world case studies to learn traditional and cutting-edge decision-making tools.
Prerequisite(s): third-year standing in any B.Sc. program or permission of the Institute.
Workshops three hours per week.

ENSC 4700 [0.5 credit]
Topics in Environmental Science
Prerequisite(s): third-year standing in the Environmental Science program or permission of the Institute.
Lectures and discussion three hours a week.

ENSC 4901 [0.5 credit]
Directed Projects
Independent or group study, for fourth-year students to explore a particular project, in consultation with a Faculty supervisor. May include directed reading, written assignments, tutorials, laboratory or field work.
Prerequisite(s): permission of the Institute. Students normally may not offer more than 1.0 credit of Directed Special Studies in their program.

ENSC 4906 [1.0 credit]
Honours Research Project
An independent investigation into an aspect of environmental science supervised by a member of the faculty. Approval of the topic and the research schedule must be obtained from the project supervisor and the course coordinator before the last date for registration.
Prerequisite(s): fourth-year standing in the Honours Environmental Science program, a major CGPA 8.0 and permission of the Institute.

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

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