# Environmental Science

This section presents the requirements for programs in:

- Environmental Science B.Sc. Honours
- Environmental Science with Concentration in Chemistry B.Sc. Honours
- Environmental Science with Concentration in Earth Sciences B.Sc. Honours
- Environmental Science with Concentration in Ecology, Biodiversity and Conservation B.Sc. Honours
- Environmental Science with Concentration in Geomatics B.Sc. Honours
- Environmental Science B.Sc. Major

## 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
- Chemistry
- Computer Science
- Earth Science
- Environmental Science
- Geography
- 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 (11.5 credits)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENSC 1500 [0.5]</td>
<td>Environmental Science Seminar</td>
<td>0.5</td>
</tr>
<tr>
<td>ENSC 2000 [0.5]</td>
<td>Environmental Science Field Methods</td>
<td>0.5</td>
</tr>
<tr>
<td>ENSC 2001 [0.5]</td>
<td>Earth Resources and Natural Hazards: Environmental Impacts</td>
<td>0.5</td>
</tr>
<tr>
<td>ENSC 2002 [0.5]</td>
<td>Methods and Analysis in Environmental Science</td>
<td>0.5</td>
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</tbody>
</table>

### B. Credits Not Included in the Major CGPA (8.5 credits)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
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<tbody>
<tr>
<td>MATH 1007 [0.5]</td>
<td>Elementary Calculus I</td>
<td>0.5</td>
</tr>
<tr>
<td>STAT 2507 [0.5]</td>
<td>Introduction to Statistical Modeling I</td>
<td>0.5</td>
</tr>
<tr>
<td>BIOL 1103 [0.5]</td>
<td>Foundations of Biology I</td>
<td>0.5</td>
</tr>
<tr>
<td>BIOL 1104 [0.5]</td>
<td>Foundations of Biology II</td>
<td>0.5</td>
</tr>
<tr>
<td>CHEM 1001 [0.5]</td>
<td>General Chemistry I</td>
<td>0.5</td>
</tr>
<tr>
<td>CHEM 1002 [0.5]</td>
<td>General Chemistry II</td>
<td>0.5</td>
</tr>
<tr>
<td>ERTH 1006 [0.5]</td>
<td>Exploring Planet Earth</td>
<td>0.5</td>
</tr>
<tr>
<td>PHIL 2380 [0.5]</td>
<td>Introduction to Environmental Ethics</td>
<td>0.5</td>
</tr>
</tbody>
</table>

### Total Credits

- 20.0

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### Environmental Science with Concentration in Chemistry

#### B.Sc. Honours (20.0 credits)

**A. Credits Included in the Major CGPA (13 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. **1.0 credit in:**
   - ENSC 4906 [1.0] Honours Research Project

   Or
   - ENSC 4901 [0.5] and [0.5] credit Science faculty elective or science continuation at the 4000 level

3. **2.0 credits in:**
   - BIOL 2600 [0.5] Ecology
   - CHEM 2302 [0.5] Analytical Chemistry I
   - CHEM 2800 [0.5] Foundations for Environmental Chemistry
   - GEOG 2013 [0.5] Weather and Water

4. **1.0 credit from:**
   - GEOG 3102 [0.5] Geomorphology
   - GEOG 3103 [0.5] Watershed Hydrology
   - GEOG 3104 [0.5] Principles of Biogeography
   - GEOG 3105 [0.5] Climate and Atmospheric Change
   - GEOG 3106 [0.5] Aquatic Science and Management
   - GEOG 3108 [0.5] Soil Properties

5. **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

6. **0.5 credit from:**
   - BIOL 2107 [0.5] Fundamentals of Genetics
   - BIOL 2201 [0.5] Cell Biology and Biochemistry

7. **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

8. **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

9. **0.5 credit in:**
   - CHEM 4800 [0.5] Atmospheric Chemistry

**B. Credits not included in the Major CGPA (7.0 credits)**

10. **1.5 credits in:**
    - MATH 1007 [0.5] Elementary Calculus I
    - MATH 1107 [0.5] Linear Algebra I
    - STAT 2507 [0.5] Introduction to Statistical Modeling I

11. **2.5 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
    - ERTH 1006 [0.5] Exploring Planet Earth

12. **0.5 credit in:**
    - PHIL 2380 [0.5] Introduction to Environmental Ethics

13. **1.5 credits in** approved courses outside the faculties of Science and Engineering and Design (may include NSCI 1000)

14. **1.0 credit in** free elective

**Total Credits 20.0**

### Environmental Science with Concentration in Earth Sciences

#### B.Sc. Honours (20.0 credits)

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

1. **3.0 credits from:**
   - 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. **1.0 credit in:**
   - ENSC 4906 [1.0] Honours Research Project

   Or
   - ENSC 4901 [0.5] and [0.5] credit Science faculty elective or science continuation at the 4000 level

3. **2.0 credits in:**
   - BIOL 2600 [0.5] Ecology
   - CHEM 2800 [0.5] Foundations for Environmental Chemistry
   - GEOG 2013 [0.5] Weather and Water

4. **1.0 credit from:**
   - GEOG 3102 [0.5] Geomorphology
   - GEOG 3103 [0.5] Watershed Hydrology
   - GEOG 3104 [0.5] Principles of Biogeography
   - GEOG 3105 [0.5] Climate and Atmospheric Change
   - GEOG 3106 [0.5] Aquatic Science and Management
   - GEOG 3108 [0.5] Soil Properties

5. **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

6. **0.5 credit from:**
   - BIOL 2107 [0.5] Fundamentals of Genetics
   - BIOL 2201 [0.5] Cell Biology and Biochemistry

7. **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

8. **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

9. **0.5 credit in:**
   - CHEM 4800 [0.5] Atmospheric Chemistry

**B. Credits not included in the Major CGPA (7.0 credits)**

10. **1.5 credits in:**
    - MATH 1007 [0.5] Elementary Calculus I
    - MATH 1107 [0.5] Linear Algebra I
    - STAT 2507 [0.5] Introduction to Statistical Modeling I

11. **2.5 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
    - ERTH 1006 [0.5] Exploring Planet Earth

12. **0.5 credit in:**
    - PHIL 2380 [0.5] Introduction to Environmental Ethics

13. **1.5 credits in** approved courses outside the faculties of Science and Engineering and Design (may include NSCI 1000)

14. **1.0 credit in** free elective

**Total Credits 20.0**
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
5.  0.5 credit from:
ERTH 3203 [0.5]  Sedimentology
ERTH 3206 [0.5]  Sedimentary Depositional Systems
6.  1.0 credit in ERTH at the 4000-level

B. Credits Not Included in the Major CGPA (8.5 credits)
7.  1.5 credits in:
MATH 1007 [0.5]  Elementary Calculus I
MATH 1107 [0.5]  Linear Algebra I
STAT 2507 [0.5]  Introduction to Statistical Modeling I
8.  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
ERTH 1006 [0.5]  Exploring Planet Earth
PHYS 1007 [0.5]  Elementary University Physics I
9.  1.5 credits from:
CHEM 2302 [0.5]  Analytical Chemistry I
ERTH 2402 [0.5]  Climate Change: An Earth Sciences Perspective
ERTH 2403 [0.5]  Introduction to Oceanography
ERTH 2802 [0.5]  Field Geology I
ERTH 2312 [0.5]  Paleontology
ERTH 3203 [0.5]  Sedimentology
ERTH 3204 [0.5]  Mineral Deposits
ERTH 3206 [0.5]  Sedimentary Depositional Systems
ERTH 3207 [0.5]  Metamorphic Petrology and Processes
ENSC 3906 [0.5]  Project Planning for Environmental Research
GEOG 3102 [0.5]  Geomorphology
GEOG 3103 [0.5]  Watershed Hydrology
GEOG 3104 [0.5]  Principles of Biogeography
GEOG 3105 [0.5]  Climate and Atmospheric Change
GEOG 3106 [0.5]  Aquatic Science and Management
ENSC 4906 [1.0]  Honours Research Project

10. 1.5 credits in approved courses outside the faculties of Science and Engineering and Design (may include NSCI 1000), including:
PHIL 2380 [0.5]  Introduction to Environmental Ethics
11.  1.0 credit in:
GEOM 1004 [0.5]  Maps, Satellites and the Geospatial Revolution
GEOM 3002 [0.5]  Introduction to Remote Sensing

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 (12.5 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
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.  1.0 credit in:
ENSC 4906 [1.0]  Honours Research Project

3.  2.0 credits in:
Biol 2600 [0.5]  Ecology
CHEM 2302 [0.5]  Analytical Chemistry I
CHEM 2800 [0.5]  Foundations for Environmental Chemistry
GEOG 2013 [0.5]  Weather and Water

4.  1.0 credit from:
GEOG 3102 [0.5]  Geomorphology
GEOG 3103 [0.5]  Watershed Hydrology
GEOG 3104 [0.5]  Principles of Biogeography
GEOG 3105 [0.5]  Climate and Atmospheric Change
GEOG 3106 [0.5]  Aquatic Science and Management
GEOG 3108 [0.5]  Soil Properties

5.  1.0 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

6.  0.5 credit from Science faculty elective or science continuation at the 4000 level

7.  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]  Statistics for Biologists
ii)  1.0 credit from:
BIOL 3601 [0.5]  Ecosystems and Environmental Change
BIOL 3602 [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
Or
Microbiology/genetics focus:
Environmental Science with Concentration in Geomatics

B.Sc. Honours (20.0 credits)

A. Credits Included in the Major CGPA (13.0 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. 1.0 credit in:
   - ENSC 4906 [1.0] Honours Research Project
   - ENSC 4901 [0.5] Directed Projects
   - GEOM 4005 [0.5] Directed Studies in Geomatics

3. 2.0 credit in:
   - BIOL 2600 [0.5] Ecology
   - CHEM 2302 [0.5] Analytical Chemistry I
   - CHEM 2800 [0.5] Foundations for Environmental Chemistry

4. 1.0 credit from:
   - GEOG 2013 [0.5] Weather and Water
   - GEOG 3102 [0.5] Geomorphology
   - GEOG 3103 [0.5] Watershed Hydrology
   - GEOG 3104 [0.5] Principles of Biogeography
   - GEOG 3105 [0.5] Climate and Atmospheric Change
   - GEOG 3106 [0.5] Aquatic Science and Management
   - GEOG 3108 [0.5] Soil Properties

5. 1.0 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

6. 3.5 credits in:
   - GEOM 1000 [0.5] Maps, Satellites and the Geospatial Revolution
   - GEOM 2005 [0.5] Introduction to Geospatial Programming
   - GEOM 2007 [0.5] Points, Lines and Polygons
   - GEOM 2008 [0.5] Pixels and Grids
   - GEOM 3002 [0.5] Introduction to Remote Sensing
   - GEOM 3005 [0.5] Geospatial Analysis
   - GEOM 3003 [0.5] Quantitative Geography

7. 1.5 credits from:
   - GEOM 4001 [0.5] Special Topics in Geomatics
   - GEOM 4003 [0.5] Remote Sensing of the Environment
   - GEOM 4008 [0.5] Advanced Topics in Geographic Information Systems
   - GEOM 4009 [0.5] Applications in Geographic Information Systems

B. Credits Not Included in the Major CGPA (7.5 credits)

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

9. 2.5 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
   - ERTH 1006 [0.5] Exploring Planet Earth

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

11. 0.5 credit from:
    - BIOL 2107 [0.5] Fundamentals of Genetics

12. 1.5 credits in approved courses outside the faculties of Science and Engineering and Design (may include NSCI 1000)

13. 1.5 credit in free electives.

Total Credits: 20.0
### Environmental Science
**B.Sc. Major (20.0 credits)**

**A. Credits Included in the Major CGPA (10.0 credits)**

1. **2.5 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

2. **2.0 credit in:**
   - BIOL 2600 [0.5] Ecology
   - CHEM 2800 [0.5] Foundations for Environmental Chemistry
   - CHEM 2302 [0.5] Analytical Chemistry I
   - GEOG 2013 [0.5] Weather and Water

3. **1.0 credit from:**
   - GEOG 3102 [0.5] Geomorphology
   - GEOG 3103 [0.5] Watershed Hydrology
   - GEOG 3104 [0.5] Principles of Biogeography
   - GEOG 3105 [0.5] Climate and Atmospheric Change
   - GEOG 3106 [0.5] Aquatic Science and Management
   - GEOG 3108 [0.5] Soil Properties

4. **1.0 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. **0.5 credit from:**
   - BIOL 2107 [0.5] Fundamentals of Genetics
   - BIOL 2201 [0.5] Cell Biology and Biochemistry

6. **1.0 credits from Science faculty electives or science continuation courses at the 4000 level**

7. **2.0 credits from Science faculty electives or science continuation courses**

**B. Credits Not Included in the Major CGPA (10.0 credits)**

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

9. **2.5 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
   - ERTH 1006 [0.5] Exploring Planet Earth

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

11. **1.5 credits in approved courses outside the faculties of Science and Engineering and Design (may include NSCI 1000)**

12. **4.5 credits in free electives.**

**Total Credits** 20.0

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### 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 a Bachelor of Science program 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 a B.Sc. degree program 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>Category</th>
<th>Course Code</th>
<th>Course Name</th>
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</thead>
<tbody>
<tr>
<td>Biochemistry</td>
<td>BIOC 2200</td>
<td>Cellular Biochemistry</td>
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<td></td>
<td>BIOC 4001</td>
<td>Methods in Biochemistry</td>
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<tr>
<td></td>
<td>BIOC 4201</td>
<td>Advanced Cell Culture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>and Tissue Engineering</td>
</tr>
<tr>
<td>Biology</td>
<td>BIOL 1103</td>
<td>Foundations of Biology I</td>
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<td></td>
<td>BIOL 1104</td>
<td>Foundations of Biology II</td>
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<tr>
<td></td>
<td>BIOL 2001</td>
<td>Animals: Form and Function</td>
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<td>BIOL 2002</td>
<td>Plants: Form and Function</td>
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<td>BIOL 2104</td>
<td>Introductory Genetics</td>
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<td>BIOL 2200</td>
<td>Cellular Biochemistry</td>
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<td>General Chemistry II</td>
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<td>CHEM 2800</td>
<td>Foundations for</td>
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<td>Earth Sciences</td>
<td>ERTH 1006</td>
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<td>ERTH 1009</td>
<td>The Earth System Through Time</td>
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<td>Mineralogy to Petrology</td>
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<td>ERTH 2404</td>
<td>Engineering Geoscience</td>
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<td>ERTH 2802</td>
<td>Field Geology I</td>
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<tr>
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<td>ERTH 3111</td>
<td>Vertebrate Evolution:</td>
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<td></td>
<td></td>
<td>Mammals, Reptiles, and Birds</td>
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<td>ERTH 3112</td>
<td>Vertebrate Evolution:</td>
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<tr>
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<td>Fish and Amphibians</td>
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<td>ERTH 3204</td>
<td>Mineral Deposits</td>
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<td>ERTH 3205</td>
<td>Physical Hydrogeology</td>
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<td>Food Microbiology</td>
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<td>Geography</td>
<td>GEG 1010</td>
<td>Global Environmental Systems</td>
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<td>Neuroscience</td>
<td>NEUR 3206</td>
<td>Sensory and Motor</td>
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<td>Neuroanatomy</td>
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<td>Physics</td>
<td>PHYS 1001</td>
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<td>Introductory Mechanics</td>
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<td>and Thermodynamics</td>
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<td>PHYS 1004</td>
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<td>PHYS 1007</td>
<td>Elementary University Physics I</td>
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<td>PHYS 1008</td>
<td>Elementary University Physics II</td>
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<td>PHYS 2202</td>
<td>Wave Motion and Optics</td>
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<td>PHYS 2604</td>
<td>Modern Physics I</td>
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<td>PHYS 3007</td>
<td>Third Year Physics</td>
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<td></td>
<td>Laboratory: Selected Experiments and Seminars</td>
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<td>PHYS 3606</td>
<td>Modern Physics II</td>
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Course Categories for B.Sc. Programs

<table>
<thead>
<tr>
<th>Category</th>
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<tbody>
<tr>
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<td>Global Environmental Systems</td>
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<td>GEG 2006</td>
<td>Introduction to Quantitative Research</td>
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<td></td>
<td>GEG 2013</td>
<td>Weather and Water</td>
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<td>GEG 2014</td>
<td>The Earth’s Surface</td>
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<td>Quantitative Geography</td>
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<td>Field Methods in Physical Geography</td>
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<td></td>
<td>GEG 3102</td>
<td>Geomorphology</td>
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<td></td>
<td>GEG 3103</td>
<td>Watershed Hydrology</td>
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<td></td>
<td>GEG 3104</td>
<td>Principles of Biogeography</td>
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<td></td>
<td>GEG 3105</td>
<td>Climate and Atmospheric Change</td>
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<td></td>
<td>GEG 3106</td>
<td>Aquatic Science and Management</td>
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<td></td>
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<td>Soil Properties</td>
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<td>GEG 4000</td>
<td>Field Studies</td>
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<td>GEG 4005</td>
<td>Directed Studies in Geography</td>
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<td>GEG 4013</td>
<td>Cold Region Hydrology</td>
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<td>GEG 4017</td>
<td>Global Biogeochemical Cycles</td>
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<td></td>
<td>GEG 4101</td>
<td>Two Million Years of Environmental Change</td>
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<td>GEG 4103</td>
<td>Water Resources Engineering</td>
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Food Sciences

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<tr>
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<tr>
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<td>Food Analysis</td>
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Geography

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</tr>
<tr>
<td>GEG 3108</td>
<td>Soil Properties</td>
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Neuroscience

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<tbody>
<tr>
<td>NEUR 3206</td>
<td>Sensory and Motor Neuroscience</td>
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<tr>
<td>NEUR 3207</td>
<td>Systems Neuroscience</td>
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<tr>
<td>NEUR 4600</td>
<td>Advanced Lab in Neuroanatomy</td>
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Physics

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<tr>
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<tr>
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<td>Modern Physics II</td>
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<tr>
<td>PHYS 3608</td>
<td>Modern Applied Physics</td>
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Environmental Science
GEOG 4104 [0.5]  Microclimatology  
GEOG 4108 [0.5]  Permafrost

**Science Psychology Courses**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
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<tr>
<td>PSYC 2001</td>
<td>Introduction to Research Methods in Psychology</td>
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<tr>
<td>PSYC 2002</td>
<td>Introduction to Statistics in Psychology</td>
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<tr>
<td>PSYC 2700</td>
<td>Introduction to Cognitive Psychology</td>
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<tr>
<td>PSYC 3000</td>
<td>Design and Analysis in Psychological Research</td>
</tr>
<tr>
<td>PSYC 3506</td>
<td>Cognitive Development</td>
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<tr>
<td>PSYC 3700</td>
<td>Cognition (Honours Seminar)</td>
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<tr>
<td>PSYC 3702</td>
<td>Perception</td>
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<tr>
<td>PSYC 2307</td>
<td>Human Neuropsychology I</td>
</tr>
<tr>
<td>PSYC 3307</td>
<td>Human Neuropsychology II</td>
</tr>
</tbody>
</table>

**Science Continuation Courses**

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:

- BIOC (Biochemistry)
- BIOL (Biology)
- 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)
  - ISAP (Interdisciplinary Science Practice)
  - 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 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**

- BIOL 4810 [0.5]  Education Research in Biology
- CHEM 1003 [0.5]  The Chemistry of Food, Health and Drugs
- CHEM 1004 [0.5]  Drugs and the Human Body
- CHEM 1007 [0.5]  Chemistry of Art and Artifacts
- ERTH 1010 [0.5]  Our Dynamic Planet Earth
- ERTH 1011 [0.5]  Evolution of the Earth
- ERTH 2415 [0.5]  Natural Disasters
- ISCI 1001 [0.5]  Introduction to the Environment
- ISCI 2000 [0.5]  Natural Laws
- ISCI 2002 [0.5]  Human Impacts on the Environment
- MATH 0107 [0.5]  Algebra and Geometry
- PHYS 1901 [0.5]  Planetary Astronomy
- PHYS 1902 [0.5]  From our Star to the Cosmos

2021-2022 Carleton University Undergraduate Calendar 7
Students will have access to this course a minimum of two

**COOP 1000**  
Participation Requirements

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

**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
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:**

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**Legend**
- S: Study
- W: Work
- O: Optional
- * indicates recommended work study pattern
- ** indicates student finds own employer for this work-term.

**Admissions Information**
Admission Requirements are for the 2021-22 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. (Major)
- B.Sc.

**Admission Requirements**

**B. Sc. 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 Biochemistry, Bioinformatics, Biotechnology, Chemistry, Combined Honours in Biology and Physics, Chemistry and Physics, Computational Biochemistry, Food Science, Nanoscience, Neuroscience, Neuroscience and Mental Health, 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 Earth Sciences, Environmental Science, Geomatics, Interdisciplinary Science and Practice, and Physical Geography, 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 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 B.Sc. or B.Sc. 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.

**B.Sc. Major Program**

**B.Sc. 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 B.Sc. or B.Sc. 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 B.Sc. or B.Sc. 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. Includes: Experiential Learning Activity

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. Includes: Experiential Learning Activity
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. Includes: Experiential Learning Activity
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. Includes: Experiential Learning Activity
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. Includes: Experiential Learning Activity
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. May include field work during class time or on weekends. Includes: Experiential Learning Activity
Prerequisite(s): third-year standing in the Honours 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. Includes: Experiential Learning Activity
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. Includes: Experiential Learning Activity
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. Includes: Experiential Learning Activity
Prerequisite(s): fourth-year standing in the Environmental Science program.
practicum
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.
Includes: Experiential Learning Activity
Prerequisite(s): third-year standing in any B.Sc. program or permission of the Institute.
Workshops three hours per week.

ENSC 4003 [0.5 credit]
Food Systems and the Environment
This course explores issues of food systems and their sustainability. We will discuss aspects of food systems, including production, distribution, consumption, waste management, and their impact on communities and the environment.
Includes: Experiential Learning Activity
Prerequisite(s): third year standing in B.Sc. or B.HSc. program or permission of the Institute.
Lecture 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.
Includes: Experiential Learning Activity
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.
Includes: Experiential Learning Activity
Prerequisite(s): fourth-year standing in the Honours Environmental Science program, a major CGPA 8.0 and permission of the Institute.