Geomatics

Program Requirements
Course Categories for B.Sc. Geomatics
See Academic Regulations for the Bachelor of Science Degree for a list of courses in these categories.

- Science Continuation
- Experimental Science Electives
- Science Faculty Electives
- Approved Courses Outside the Faculties of Science and Engineering and Design
- Science Geography courses

Geomatics
B.A. Honours (20.0 credits)

A. Credits Included in the Major CGPA (10.0 credits)
1.  1.0 credit in:
   GEOG 1010 [0.5] Global Environmental Systems
   GEOG 1020 [0.5] People, Places and Environments

2.  1.5 credits in:
   GEOM 1004 [0.5] Maps, Satellites and the Geospatial Revolution
   GEOG 2006 [0.5] Introduction to Quantitative Research
   or STAT 2507 [0.5] Introduction to Statistical Modeling I
   GEOM 2007 [0.5] Geographic Information Systems

3.  2.5 credits in:
   GEOG 3000 [0.5] Honours Field Course
   or GEOG 3010 [0.5] Field Methods in Physical Geography
   GEOM 3002 [0.5] Air Photo Interpretation and Remote Sensing
   GEOG 3003 [0.5] Quantitative Geography
   GEOM 3005 [0.5] Geospatial Analysis
   GEOM 3007 [0.5] Cartographic Theory and Design

4.  1.5 credits from:
   GEOM 4003 [0.5] Remote Sensing of the Environment
   GEOM 4005 [0.5] Directed Studies in Geomatics
   GEOM 4008 [0.5] Advanced Topics in Geographic Information Systems
   GEOM 4009 [0.5] Applications in Geographic Information Systems

5.  1.0 credit from:
   GEOG 4000 [0.5] Field Studies
   GEOG 4004 [0.5] Environmental Impact Assessment
   GEOG 4005 [0.5] Directed Studies in Geography
   GEOG 4013 [0.5] Cold Region Hydrology
   GEOG 4017 [0.5] Global Biogeochemical Cycles
   GEOG 4101 [0.5] Two Million Years of Environmental Change
   GEOG 4103 [0.5] Water Resources Engineering
   GEOG 4104 [0.5] Microclimatology
   GEOG 4108 [0.5] Permafrost
   GEOG 4408 [0.5] Practicum II

6.  1.0 credit from:
   Any of the courses listed in Item 5 above, or:
   GEOG 1010 [0.5] Global Environmental Systems
   GEOG 2014 [0.5] The Earth's Surface
   GEOG 3003 [0.5] Quantitative Geography
   GEOG 3010 [0.5] Field Methods in Physical Geography
   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 3108 [0.5] Soil Properties

B. Credits not included in the Major CGPA (10.0 credits)
8.  8.0 credits in electives not in Geomatics

Total Credits 20.0

Geomatics
B.Sc. Honours (20.0 credits)

A. Credits Included in the Major CGPA (10.0 credits)
1.  0.5 credit from:
   GEOG 1010 [0.5] Global Environmental Systems
   ERTH 1006 [0.5] Exploring Planet Earth

2.  2.0 credits from:
   GEOM 1004 [0.5] Maps, Satellites and the Geospatial Revolution
   GEOG 2013 [0.5] Weather and Water
   GEOG 2006 [0.5] Introduction to Quantitative Research
   or STAT 2507 [0.5] Introduction to Statistical Modeling I
   GEOM 2007 [0.5] Geographic Information Systems

3.  2.5 credits in:
   GEOM 3003 [0.5] Quantitative Geography
   GEOM 3005 [0.5] Geospatial Analysis
   GEOM 3007 [0.5] Cartographic Theory and Design

4.  1.5 credits from:
   GEOM 4003 [0.5] Remote Sensing of the Environment
   GEOM 4005 [0.5] Directed Studies in Geomatics
   GEOM 4008 [0.5] Advanced Topics in Geographic Information Systems
   GEOM 4009 [0.5] Applications in Geographic Information Systems

5.  1.0 credit from:
   GEOG 4000 [0.5] Field Studies
   GEOG 4004 [0.5] Environmental Impact Assessment
   GEOG 4005 [0.5] Directed Studies in Geography
   GEOG 4013 [0.5] Cold Region Hydrology
   GEOG 4017 [0.5] Global Biogeochemical Cycles
   GEOG 4101 [0.5] Two Million Years of Environmental Change
   GEOG 4103 [0.5] Water Resources Engineering
   GEOG 4104 [0.5] Microclimatology
   GEOG 4108 [0.5] Permafrost
   GEOG 4408 [0.5] Practicum II

6.  1.0 credit from:
   Any of the courses listed in Item 5 above, or:
   GEOG 1010 [0.5] Global Environmental Systems
   GEOG 2014 [0.5] The Earth's Surface
   GEOG 3003 [0.5] Quantitative Geography
   GEOG 3010 [0.5] Field Methods in Physical Geography
   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 3108 [0.5] Soil Properties

7.  0.5 credit in:

Total Credits 20.0
GEOM 4406 [0.5] Practicum I

8. 1.0 credit in: 1.0
  GEOM 4906 [1.0] Honours Research Project

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

9. 1.0 credit in Experimental Science Electives 1.0
10. 1.5 approved credits in Computer Science 1.5
11. 2.0 credits in Science Continuation not in GEOM 2.0
12. 1.0 credit in Science Faculty Electives 1.0
13. 0.5 credit in: 0.5
  NSCI 1000 [0.5] Seminar in Science (or approved courses outside the faculties outside the faculties of Science and Engineering and Design)

14. 1.5 credits in approved courses outside the faculties of Science and Engineering and Design 1.5
15. 2.5 credits in free electives 2.5

Total Credits 20.0

Minor in Geomatics (4.0 credits)

Only students pursuing undergraduate programs requiring at least 20.0 credits to graduate may be admitted to the minor in Geomatics.

Requirements

1. 1.0 credit in: 1.0
   GEOM 1004 [0.5] Maps, Satellites and the Geospatial Revolution
   GEOM 2007 [0.5] Geographic Information Systems

2. 0.5 credit from: 0.5
   GEOG 2006 [0.5] Introduction to Quantitative Research
   STAT 2507 [0.5] Introduction to Statistical Modeling I

3. 1.5 credits from: 1.5
   GEOM 3002 [0.5] Air Photo Interpretation and Remote Sensing
   GEOG 3003 [0.5] Quantitative Geography
   GEOM 3005 [0.5] Geospatial Analysis
   GEOM 3007 [0.5] Cartographic Theory and Design

4. 1.0 credit from: 1.0
   GEOM 4003 [0.5] Remote Sensing of the Environment
   GEOM 4005 [0.5] Directed Studies in Geomatics
   GEOM 4008 [0.5] Advanced Topics in Geographic Information Systems
   GEOM 4009 [0.5] Applications in Geographic Information Systems

5. The remaining requirements of the major discipline(s) and degree must be satisfied.

Total Credits 4.0

Note: Familiarity with computers is assumed. Students with little computer experience may wish to take one of the following courses as part of their program of study:

BUSI 1402 [0.5] Introduction to Business Information and Communication Technologies

COMP 1001 [0.5] Introduction to Computational Thinking for Arts and Social Science Students

COM 1004 [0.5] Introduction to Computers for the Sciences

B.A. Regulations

The regulations presented below apply to all Bachelor of Arts 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 (consult the Academic Regulations of the University section of this Calendar).

First-Year Seminars

B.A. degree students are strongly encouraged to include a First-Year Seminar (FYSM) during their first 4.0 credits of registration. Students are limited to 1.0 credit in FYSM and can only register in a FYSM while they have first-year standing in their B.A. program. Students who have completed the Enriched Support Program (ESP) or who are required to take a minimum of one English as a Second Language (ESLA) credit are not permitted to register in a FYSM.

Breadth Requirement

Among the credits presented at graduation, students in both the B.A. General and the B.A. Honours degrees and B.Co.M.S. are required to include 3.0 breadth credits, including 1.0 credit from each of three of the four Breadth Areas identified below. Credits that fulfill requirements in the Major, Minor, Concentration or Specialization may be used to fulfill the Breadth Requirement.

Students admitted with a completed university degree are exempt from breadth requirements.

Students in the following interdisciplinary programs are exempt from the B.A. breadth requirement.

- African Studies
- Criminology and Criminal Justice
- Environmental Studies
- Human Rights

Breadth Area 1: Culture and Communication

American Sign Language, Art History, Art and Culture, Communication and Media Studies, Comparative Literary Studies, English, Film Studies, French, Journalism, Music, and Languages (Arabic, English as a Second Language, German, Greek, Hebrew, Indigenous Languages, Italian, Japanese, Korean, Latin, Mandarin, Portuguese, Russian, Spanish)

Subject codes: ARAB, ARTH, ASLA, CHIN, CLST, COMS, ENGL, ESLA, FILM, FINS, FREN, GERM, GREK, HEBR, ITAL, JAPA, JOUR, LANG, LATN, MUSI, PORT, RUSS, SPAN

Breadth Area 2: Humanities

Modern Studies, Philosophy, Religion, Sexuality Studies, South Asian Studies, and Women’s and Gender Studies.

Subject codes: AFRI, ALDS, CDNS, CHST, CLCV, DBST, DIST, EURR, HIST, HUMR, HUMS, INDG, LACS, LING, MEMS, PHIL, RELI, SAST, SXST, WGST

Breadth Area 3: Science, Engineering, and Design

Subject codes: AERO, ARCC, ARCH, ARCN, ARCS, ARCU, BIOC, BIOL, CHEM, CIVE, CMPS, COMP, ECOR, ELEC, ENSC, ENVE, ERTH, FOOD, HLTH, IDES, ISCI, ISCS, ISYS, MAAE, MATH, MECH, NEUR, NSCI, PHYS, SREE, STAT, SYSC, TSES

Breadth Area 4: Social Sciences

Subject codes: ANTH, BUSI, CGSC, CRCJ, ECON, ENST, GEOG, GEOM, GINS, GPOL, INAF, IPAF, LAWS, MGDS, PADM, PAPM, POLM, PSCI, PSYC, SOCI, SOWK

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.A. degree without being registered in a program. These students are referred to as Undeclared. The recommended course pattern for Undeclared students is outlined under Undeclared in the Programs section of this Calendar. Undeclared students must apply to enter a program before beginning their second year of study. The Student Academic Success Centre offers support to Undeclared students in making this decision.

Change of Program Within the B.A. Degree
Students may transfer to a program within the B.A. degree, if upon entry to the new program they would be in Good Standing. Other applications for change of program will be considered on their merits; students may be admitted to the new program in Good Standing or on Academic Warning. Students may apply to declare or change their program within the B.A. Degree at the Registrar’s Office according to the published deadlines. Acceptance into a program or into a program element or option is subject to any enrollment limitations, specific program, program element or option requirements, as published in the relevant Calendar entry.

Minors, Concentrations and Specializations
Students may apply to the Registrar’s Office to be admitted to a minor, concentration or specialization during their first or subsequent years of study. Acceptance into a minor, concentration or specialization is subject to any specific requirements of the intended Minor, Concentration or Specialization as published in the relevant Calendar entry. Acceptance into a Concentration or Specialization requires that the student be in Good Standing.

Mention : Français
Students registered in certain B.A. programs may earn the notation Mention : Français by completing part of their requirements in French and by demonstrating a knowledge of the history and culture of French Canada. The general requirements are listed below. For more specific details consult the departmental program entries.

Students in a B.A. Honours program must present:
1. 1.0 credit in French language;
2. 1.0 credit devoted to the history and culture of French Canada;
3. 1.0 credit at the 2000- or 3000-level and 1.0 credit at the 4000-level in the Honours discipline taken in French.

Students in a B.A. General program must present:
1. 1.0 credit in advanced French;
2. 1.0 credit devoted to the history and culture of French Canada;
3. 1.0 credit at the 2000- or 3000-level in the Major discipline taken in French.

Students in Combined Honours programs must fulfil the Mention : Français requirement in both disciplines.

Courses taught in French (Item 3, above) may be taken at Carleton, at the University of Ottawa on the Exchange Agreement, or at a francophone university on a Letter of Permission. Students planning to take courses on exchange or on a Letter of Permission should take careful note of the residence requirement for a minimum number of Carleton courses in their programs. Consult the Academic Regulations of the University section of this Calendar for information regarding study on Exchange or Letter of Permission.

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 or disciplines;
2. 2.0 credits in approved 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 approved 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 approved 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>Department</th>
<th>Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biochemistry</td>
<td>BIOC 2200 [0.5] Cellular Biochemistry</td>
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<tr>
<td></td>
<td>BIOC 4001 [0.5] Methods in Biochemistry</td>
</tr>
<tr>
<td></td>
<td>BIOC 4201 [0.5] Advanced Cell Culture and Tissue Engineering</td>
</tr>
<tr>
<td>Biology</td>
<td>BIOL 1103 [0.5] Foundations of Biology I</td>
</tr>
<tr>
<td></td>
<td>BIOL 1104 [0.5] Foundations of Biology II</td>
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<tr>
<td></td>
<td>BIOL 2001 [0.5] Animals: Form and Function</td>
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<td></td>
<td>BIOL 2002 [0.5] Plants: Form and Function</td>
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<td></td>
<td>BIOL 2104 [0.5] Introductory Genetics</td>
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<td></td>
<td>BIOL 2200 [0.5] Cellular Biochemistry</td>
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<td>BIOL 2600 [0.5] Introduction to Ecology</td>
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<tr>
<td>Chemistry</td>
<td>CHEM 1001 [0.5] General Chemistry I</td>
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<tr>
<td></td>
<td>CHEM 1002 [0.5] General Chemistry II</td>
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<tr>
<td></td>
<td>CHEM 1005 [0.5] Elementary Chemistry I</td>
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<td></td>
<td>CHEM 1006 [0.5] Elementary Chemistry II</td>
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<td></td>
<td>CHEM 2103 [0.5] Physical Chemistry I</td>
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<tr>
<td></td>
<td>CHEM 2203 [0.5] Organic Chemistry I</td>
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<td></td>
<td>CHEM 2204 [0.5] Organic Chemistry II</td>
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<tr>
<td></td>
<td>CHEM 2206 [0.5] Organic Chemistry IV</td>
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<tr>
<td></td>
<td>CHEM 2302 [0.5] Analytical Chemistry I</td>
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<td></td>
<td>CHEM 2303 [0.5] Analytical Chemistry II</td>
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<tr>
<td></td>
<td>CHEM 2800 [0.5] Foundations for Environmental Chemistry</td>
</tr>
<tr>
<td>Earth Sciences</td>
<td>ERTH 1006 [0.5] Exploring Planet Earth</td>
</tr>
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<td></td>
<td>ERTH 1009 [0.5] The Earth System Through Time</td>
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<td></td>
<td>ERTH 2102 [0.5] Mineralogy to Petrology</td>
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<tr>
<td></td>
<td>ERTH 2404 [0.5] Engineering Geoscience</td>
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<td></td>
<td>ERTH 2802 [0.5] Field Geology I</td>
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<td>ERTH 3111 [0.5] Vertebrate Evolution I</td>
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<td></td>
<td>ERTH 3112 [0.5] Vertebrate Evolution I</td>
</tr>
<tr>
<td></td>
<td>ERTH 3204 [0.5] Mineral Deposits</td>
</tr>
<tr>
<td></td>
<td>ERTH 3205 [0.5] Physical Hydrogeology</td>
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<tr>
<td></td>
<td>ERTH 3806 [0.5] Structural Geology</td>
</tr>
<tr>
<td>Food Sciences</td>
<td>FOOD 3001 [0.5] Food Chemistry</td>
</tr>
<tr>
<td></td>
<td>FOOD 3002 [0.5] Food Analysis</td>
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<tr>
<td></td>
<td>FOOD 3005 [0.5] Food Microbiology</td>
</tr>
<tr>
<td>Geography</td>
<td>GEOG 1010 [0.5] Global Environmental Systems</td>
</tr>
<tr>
<td></td>
<td>GEOG 3108 [0.5] Soil Properties</td>
</tr>
<tr>
<td>Neuroscience</td>
<td>NEUR 3206 [0.5] Sensory and Motor Neuroscience</td>
</tr>
<tr>
<td></td>
<td>NEUR 3207 [0.5] Integrative Neuroscience</td>
</tr>
<tr>
<td></td>
<td>NEUR 4600 [0.5] Advanced Lab in Neuroanatomy</td>
</tr>
</tbody>
</table>
### Physics

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td>PHYS 1001 [0.5]</td>
<td>Foundations of Physics I</td>
</tr>
<tr>
<td>PHYS 1002 [0.5]</td>
<td>Foundations of Physics II</td>
</tr>
<tr>
<td>PHYS 1003 [0.5]</td>
<td>Introductory Mechanics and Thermodynamics</td>
</tr>
<tr>
<td>PHYS 1004 [0.5]</td>
<td>Introductory Electromagnetism and Wave Motion</td>
</tr>
<tr>
<td>PHYS 1007 [0.5]</td>
<td>Elementary University Physics I</td>
</tr>
<tr>
<td>PHYS 1008 [0.5]</td>
<td>Elementary University Physics II</td>
</tr>
<tr>
<td>PHYS 2202 [0.5]</td>
<td>Wave Motion and Optics</td>
</tr>
<tr>
<td>PHYS 2604 [0.5]</td>
<td>Modern Physics I</td>
</tr>
<tr>
<td>PHYS 3007 [0.5]</td>
<td>Third Year Physics Laboratory: Selected Experiments and Seminars</td>
</tr>
<tr>
<td>PHYS 3606 [0.5]</td>
<td>Modern Physics II</td>
</tr>
<tr>
<td>PHYS 3608 [0.5]</td>
<td>Modern Applied Physics</td>
</tr>
</tbody>
</table>

### Course Categories for B.Sc. Programs

#### Science Geography Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEOG 1010 [0.5]</td>
<td>Global Environmental Systems</td>
</tr>
<tr>
<td>GEOG 2006 [0.5]</td>
<td>Introduction to Quantitative Research</td>
</tr>
<tr>
<td>GEOG 2013 [0.5]</td>
<td>Weather and Water</td>
</tr>
<tr>
<td>GEOG 2014 [0.5]</td>
<td>The Earth's Surface</td>
</tr>
<tr>
<td>GEOG 3003 [0.5]</td>
<td>Quantitative Geography</td>
</tr>
<tr>
<td>GEOG 3010 [0.5]</td>
<td>Field Methods in Physical Geography</td>
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<tr>
<td>GEOG 3102 [0.5]</td>
<td>Geomorphology</td>
</tr>
<tr>
<td>GEOG 3103 [0.5]</td>
<td>Watershed Hydrology</td>
</tr>
<tr>
<td>GEOG 3104 [0.5]</td>
<td>Principles of Biogeography</td>
</tr>
<tr>
<td>GEOG 3105 [0.5]</td>
<td>Climate and Atmospheric Change</td>
</tr>
<tr>
<td>GEOG 3106 [0.5]</td>
<td>Aquatic Science and Management</td>
</tr>
<tr>
<td>GEOG 3108 [0.5]</td>
<td>Soil Properties</td>
</tr>
<tr>
<td>GEOG 4000 [0.5]</td>
<td>Field Studies</td>
</tr>
<tr>
<td>GEOG 4005 [0.5]</td>
<td>Directed Studies in Geography</td>
</tr>
<tr>
<td>GEOG 4013 [0.5]</td>
<td>Cold Region Hydrology</td>
</tr>
<tr>
<td>GEOG 4017 [0.5]</td>
<td>Global Biogeochemical Cycles</td>
</tr>
<tr>
<td>GEOG 4101 [0.5]</td>
<td>Two Million Years of Environmental Change</td>
</tr>
<tr>
<td>GEOG 4103 [0.5]</td>
<td>Water Resources Engineering</td>
</tr>
<tr>
<td>GEOG 4104 [0.5]</td>
<td>Micrometeorology</td>
</tr>
<tr>
<td>GEOG 4108 [0.5]</td>
<td>Permafrost</td>
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</tbody>
</table>

#### Science Psychology Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
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<tbody>
<tr>
<td>PSYC 2001 [0.5]</td>
<td>Introduction to Research Methods in Psychology</td>
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<tr>
<td>PSYC 2002 [0.5]</td>
<td>Introduction to Statistics in Psychology</td>
</tr>
<tr>
<td>PSYC 2700 [0.5]</td>
<td>Introduction to Cognitive Psychology</td>
</tr>
<tr>
<td>PSYC 3000 [1.0]</td>
<td>Design and Analysis in Psychological Research</td>
</tr>
<tr>
<td>PSYC 3506 [0.5]</td>
<td>Cognitive Development</td>
</tr>
<tr>
<td>PSYC 3700 [1.0]</td>
<td>Cognition (Honours Seminar)</td>
</tr>
<tr>
<td>PSYC 3702 [0.5]</td>
<td>Perception</td>
</tr>
<tr>
<td>PSYC 2307 [0.5]</td>
<td>Human Neuropsychology I</td>
</tr>
<tr>
<td>PSYC 3307 [0.5]</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:

- BIOL (Biology)
- CHEM (Chemistry)
- 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.
- 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.
- Engineering. Students wishing to register in Engineering courses must obtain the permission of the Faculty of Engineering and Design.
- ENSC (Environmental Science)
- FOOD (Food Science and Nutrition)
- GEOM (Geomatics)
- HLTH (Health Sciences)
- MATH (Mathematics)
- NEUR (Neuroscience)
- PHYS (Physics), except PHYS 2903
- Science Geography Courses (see list above)
- Science Psychology Courses (see list above)
- STAT (Statistics)
- 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.

### Science Faculty Electives

Science Faculty Electives are courses at the 1000-4000 level chosen from:

- BIOL (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)
Co-operative Education

Co-operative Education is based on the principle that academic study combined with alternating work periods is an effective method of professional preparation. Work periods at various points in the academic program allow students to acquire experience within their discipline. The Co-operative Education program is a complement to the students’ academic studies.

Application 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

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.

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.

**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.

**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.

**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. Failure to be registered in the Co-op Work Term course
8. Dismissal from a work term by the co-op employer
9. Leaving a work term without approval by the Co-op manager
10. Receipt of an unsatisfactory work term evaluation
11. 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.

**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.

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.

**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 employment 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 permission to work in Canada. The number of four-month work terms a student accepts. 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. 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Business Law and Law, Policy and Government only), Political Science, Psychology and Sociology

To obtain the co-op designation in these programs students must successfully complete three (3) work terms.

**B.A. General Co-op Admission and Continuation Requirements**

For admission to and continuation in the co-op option, all students must:

- 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]

**B.A. Program-Specific Admission and Continuation Requirements**

**Geography and Environmental Studies**

1. Registered in the B.A. Honours Environmental Studies, Geography, Geography with a Concentration in Physical Geography, or Geomatics;
2. Obtained and maintained an overall minimum CGPA of 9.5 and a minimum major CGPA of 9.5;
3. Have obtained third-year standing;
4. Successfully completed, by the start date of the first work term:
   a. the required second-year methods courses in their program (GEOG/ENST 2005, GEOG/ENST 2006)
   b. the required field course in their program (ENST 3900, GEOG 3000, GEOG 3010, GEOG 3030)
5. Be registered as a full-time student.

**Work-Study Patterns**

Co-op work term courses: ENST 3999, GEOG 3999, GEOM 3999

**Geography, Geography with Concentration in Physical Geography, Environmental Studies, Geomatics**

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<tr>
<th>Year 1</th>
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**Legend**

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

**Co-operative Education**

Co-operative Education is based on the principle that academic study combined with alternating work periods is an effective method of professional preparation. Work periods at various points in the academic program allow students to acquire experience within their discipline. The Co-operative Education program is a complement to the students’ academic studies.

**Application 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**

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.

**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.

**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.

**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.

**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. Failure to be registered in the Co-op Work Term course
8. Dismissal from a work term by the co-op employer
9. Leaving a work term without approval by the Co-op manager
10. Receipt of an unsatisfactory work term evaluation
11. 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.

**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. 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.

**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.

**Co-operative Education - Bachelor of Science**

The following programs in the Bachelor of Science Honours offer a co-operative education option:

- Applied Physics, Biochemistry (including computational), Bioinformatics, Biology (including computational), Biotechnology, Chemistry (including computational), Earth Sciences, Environmental Science, Food Science and Nutrition, Geomatics, Neuroscience, Neuroscience and Mental Health, Physical Geography and Physics.

Students in all streams of the Bachelor of Science must successfully complete three (3) work terms to obtain the co-op designation.

**Co-op Admission and Continuation Requirements for Students in the Bachelor of Science**

For admission to and continuation in the co-op option, all students must:
Program-Specific Admission and Continuation Requirements:

Applied Physics, Biochemistry (including computational), Bioinformatics, Biology (including computational), Biotechnology, Chemistry (including computational), Earth Sciences, Environmental Science, Neuroscience, Neuroscience and Mental Health and Physics:

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 9.0 or higher and an overall CGPA of 7.5 or higher in the first three years of academic study;
4. Have obtained third-year standing;
5. Successfully completed, by the start date of the first work term, at least 2.0 credits from the following list of courses: FOOD 3001, FOOD 3002, FOOD 3003, FOOD 3004, and FOOD 3005

Geomatics and Physical Geography:

1. Registered in the Bachelor of Science Honours in Food Science and Nutrition;
2. Registered as a full-time student in the Bachelor of Science Honours degree program;
3. Obtained and maintained an overall minimum CGPA of 9.5 and a major CGPA of 9.5;
4. Have obtained third-year standing;
5. Successfully completed, by the start-date of the first work term:
   a. the required second-year methods courses in their program (GEOG/ENST 2005, GEOG/ENST 2006);
   b. the required field course in their program (ENST 3900/GEOG 3000/GEOG 3010/GEOG 3030);
6. Be registered as a full-time student.

Co-op Work Term Courses

Physics, Applied Physics, Biology and Physics, Chemistry and Physics, Mathematics and Physics

PHYS 3999 [0.0] Co-operative Work Term Report

Biochemistry and Computational Biochemistry

BIOC 3999 [0.0] Co-operative Work Term

Biotechnology, Bioinformatics, Biology, Biotechnology, Computational Biology, Biology and Physics

BIOL 3999 [0.0] Co-operative Work Term Report

Chemistry, Chemistry and Physics, Computational Chemistry

CHEM 3999 [0.0] Co-operative Work Term

Earth Sciences

ERTH 3999 [0.0] Co-operative Work Term

Food Science

FOOD 3999 [0.0] Co-operative Work Term

Environmental Science

ENSC 3999 [0.0] Co-operative Work Term

Geomatics

GEOM 3999 [0.0] Co-operative Work Term

Neuroscience and Neuroscience Mental Health

NEUR 3999 [0.0] Co-operative Work Term

Physical Geography

GEOG 3999 [0.0] Co-operative Work Term

Work-Study Patterns

Applied Physics, Biochemistry, Bioinformatics, Biology, Biotechnology, Chemistry, Computational Biochemistry, Computational Biology, Computational Chemistry, Earth Sciences, Environmental Science, Neuroscience, Neuroscience and Mental Health, Physics

Year 1 Year 2 Year 3 Year 4 Year 5

Term Pattern Term Pattern Term Pattern Term Pattern Pattern

Fall S Fall S Fall S Fall *W/S Fall S
Winter S Winter S Winter S WinterW/S WinterS
Summ**O/ S/W

Food Science and Nutrition

Year 1 Year 2 Year 3 Year 4 Year 5

Term Pattern Term Pattern Term Pattern Term Pattern Pattern

Fall S Fall S Fall S Fall W/S Fall S
Winter Winter Winter WinterW/S WinterS
Summ Summ SummO/W SummO/W

Physical Geography, Geomatics

Year 1 Year 2 Year 3 Year 4 Year 5

Term Pattern Term Pattern Term Pattern Term Pattern Pattern

Fall S Fall S Fall S Fall S/W Fall O
Winter Winter Winter WinterW/S WinterS
Summ Summ SummW SummS/W

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 2017-2018 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.

Admission Requirements

Degrees
- Bachelor of Arts (B.A.)(Honours)
- Bachelor of Arts (B.A.)(General)

First Year

For B.A. (General) and B.A. (Honours)
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 a 4U course in English (or anglais ). For applicants whose first language is not English, the requirement of English can also be met under the conditions outlined in the section “English Language Requirements” in the Admissions Requirements and Procedures section of this Calendar.

The cut-off average for admission will be set annually and will normally be above the minimum requirement. Applicants falling slightly below the cut-off average will be considered on an individual basis to determine whether there are special circumstances that would permit their admission. Students who feel that their high school grade average does not reflect their potential may apply to the Enriched Support Program (see the Enriched Support Program section of this Calendar).

Advanced Standing

B.A. (General and Honours) Program
Applications for admission to the second or subsequent years will be assessed on their merits. Advanced standing will be granted only for those courses that are determined to be appropriate.

Admissions Information

Admission Requirements are for the 2017-2018 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.

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 double Honours in Mathematics and Physics, Calculus and Vectors is required in addition to Advanced Functions and one of Calculus, Physics, Biology, or Earth and Space Sciences. For all programs in Physics, Calculus and Vectors are 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.

Geomatics (GEOM) Courses

GEOM 1004 [0.5 credit]
Maps, Satellites and the Geospatial Revolution
Introduction to the creation and use of maps using a variety of geospatial tools to better understand and resolve physical, social and environmental problems. Overview of geomatics (cartography and map design, geographic information systems, GPS, remote sensing).
Precludes additional credit for GEOM 2004 (no longer offered).
Lectures and laboratory, four hours a week.

GEOM 2007 [0.5 credit]
Geographic Information Systems
Data in a spatial context; spatial data structures, georeferencing, data query; mapping; creating spatial databases; selected topics in GIS application to environmental, land-use planning and market analysis issues.
Lectures and laboratory, four hours a week.

GEOM 3002 [0.5 credit]
Air Photo Interpretation and Remote Sensing
Aerial photography and digital remote sensing; visual interpretation of land use, landforms, and surficial materials; introduction to digital image processing and analysis.
Prerequisite(s): GEOM 1004 and second-year standing, or permission of the Department.
Lectures two hours a week, laboratory two hours a week.

GEOM 3005 [0.5 credit]
Geospatial Analysis
Acquisition, manipulation, and display of spatially referenced information using Geographic Information Systems (GIS). Spatial modeling, site selection, and routing analysis in raster and vector GIS.
Prerequisite(s): GEOM 2007.
Workshop three hours a week.

GEOM 3007 [0.5 credit]
Cartographic Theory and Design
Principles of and issues in cartography, cartographic communication and map design; practical aspects of cartographic representation using multimedia and online mapping.
Prerequisite(s): GEOM 1004 or GEOM 2007 or permission of the Department.
Lectures and laboratory four hours a week.

GEOM 3999 [0.0 credit]
Co-operative Work Term
Work term

GEOM 4003 [0.5 credit]
Remote Sensing of the Environment
Advanced image enhancement; land cover classification for thematic mapping; biophysical modeling; applications in resources, environment, and urban mapping.
Prerequisite(s): GEOM 3002 and Honours standing, or permission of the Department.
Lectures two hours a week, laboratory two hours a week.

GEOM 4005 [0.5 credit]
Directed Studies in Geomatics
Students pursue their interest in a selected theme in Geomatics on a tutorial basis with a member of the Department.
Prerequisite(s): fourth-year Honours standing in Geomatics and permission of the Department.

GEOM 4008 [0.5 credit]
Advanced Topics in Geographic Information Systems
Advanced methods and techniques in GIS applications including: positional and attribute error analysis, multiple criteria decision making, interpolation, elevation modeling and ortho-imaging, and spatial pattern measurement.
Prerequisite(s): GEOM 3005 and Honours standing.
Lectures two hours a week, laboratory two hours a week.
GEOM 4009 [0.5 credit]
Applications in Geographic Information Systems
Project design and customization, application development within a GIS, digital atlas compilation and geomatics education.
Prerequisite(s): GEOM 3005.
Workshop three hours a week.

GEOM 4406 [0.5 credit]
Practicum I
Experience in an employment environment through field placement. Observation and involvement in issues and research methods used by professional geographers. May be taken for credit in addition to GEOG/GEOM 4408.
Also listed as GEOG 4406.
Prerequisite(s): fourth-year Honours standing in Geomatics or Geography and permission of the Department.
Field placement one day a week.

GEOM 4408 [0.5 credit]
Practicum II
Experience in an employment environment through field placement. Observation and involvement in issues and research methods used by professional geographers. May be taken for credit in addition to GEOG/GEOM 4406.
Also listed as GEOG 4408.
Prerequisite(s): fourth-year Honours standing in Geomatics or Geography and permission of the Department.
Field placement one day a week.

GEOM 4906 [1.0 credit]
Honours Research Project
Candidates for B.Sc. with Concentration in Geomatics undertake a research project within their area of specialization. The project is supervised by a member of the department and a written report must be submitted. The candidate may be examined orally on the report.
Precludes additional credit for GEOG 4904/GEOM 4904 (no longer offered), GEOG 4906, GEOG 4909, GEOM 4909, ENST 4906, and ENST 4907.
Prerequisite(s): fourth-year Honours standing in BSc Geomatics, and an approved research topic and adviser.
Hours to be arranged with faculty adviser.

GEOM 4909 [1.0 credit]
Honours Research Thesis
Independent design and implementation of a research project leading to the submission of a research thesis. Students work with an individual faculty adviser. The subject for research is decided upon in consultation with the supervisor.
Precludes additional credit for GEOG 4904 / GEOM 4904 (no longer offered), GEOG 4906, GEOG 4906, GEOM 4909, ENST 4906 and ENST 4907.
Prerequisite(s): fourth-year Honours standing in B.A. Geomatics, a minimum CGPA of 9.00 in the major or permission of the Department, and an approved research topic and adviser.
Hours to be arranged with faculty adviser.

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