Nanoscience

This section presents the requirements for programs in:

- Nanoscience B.Sc. Honours

**Program Requirements**

**Nanoscience B.Sc. Honours (20.0 credits)**

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

1. **5.0 credits in:**
   - CHEM 1001 [0.5] General Chemistry I
   - CHEM 1002 [0.5] General Chemistry II
   - CHEM 2103 [0.5] Physical Chemistry I
   - CHEM 2501 [0.5] Introduction to Inorganic and Bioinorganic Chemistry
   - CHEM 3100 [0.5] Physical Chemistry II
   - CHEM 3107 [0.5] Experimental Methods in Nanoscience
   - CHEM 3503 [0.5] Inorganic Chemistry I
   - CHEM 3600 [0.5] Introduction to Nanotechnology
   - CHEM 4908 [1.0] Research Project and Seminar

2. **1.0 credit from:**
   - CHEM 2203 [0.5] Organic Chemistry I
   - CHEM 2204 [0.5] Organic Chemistry II
   - CHEM 2302 [0.5] Analytical Chemistry I
   - CHEM 2303 [0.5] Analytical Chemistry II

3. **1.0 credit from:**
   - CHEM 4103 [0.5] Surface Chemistry and Nanostructures
   - CHEM 4104 [0.5] Physical Methods of Nanotechnology
   - CHEM 4201 [0.5] Macromolecular Nanotechnology

4. **3.5 credits in:**
   - ELEC 2501 [0.5] Circuits and Signals
   - ELEC 2507 [0.5] Electronics I
   - ELEC 3908 [0.5] Physical Electronics
   - ELEC 3105 [0.5] Electromagnetic Fields
   - ELEC 4609 [0.5] Integrated Circuit Design and Fabrication
   - ELEC 4700 [0.5] The Physics and Modeling of Advanced Devices and Technologies
   - ELEC 4704 [0.5] Nanoscale Technology and Devices

5. **1.0 credit from:**
   - ELEC 2607 [0.5] Switching Circuits
   - ELEC 3500 [0.5] Digital Electronics
   - ELEC 3509 [0.5] Electronics II
   - ELEC 3909 [0.5] Electromagnetic Waves

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

6. **2.5 credits in:**
   - MATH 1004 [0.5] Calculus for Engineering or Physics
   - MATH 1005 [0.5] Differential Equations and Infinite Series for Engineering or Physics
   - MATH 1104 [0.5] Linear Algebra for Engineering or Science
   - MATH 2004 [0.5] Multivariable Calculus for Engineering or Physics

7. **1.0 credits in:**
   - PHYS 1003 [0.5] Introductory Mechanics and Thermodynamics
   - PHYS 1004 [0.5] Introductory Electromagnetism and Wave Motion

8. **1.5 credits in:**
   - NSCI 1000 [0.5] Seminar in Science

9. **0.5 credit in:**
   - Science Continuation (not CHEM)

10. **0.5 credit in:**
    - Probability and Statistics

**Total Credits**

- 20.0

**B.Sc. Regulations**

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

**Breadth Requirement for the B.Sc.**

Students in 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 published in the relevant Calendar entry. 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.

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>Subject</th>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biochemistry</td>
<td>BIOC 2200</td>
<td>Cellular Biochemistry</td>
</tr>
<tr>
<td></td>
<td>BIOC 4001</td>
<td>Methods in Biochemistry</td>
</tr>
<tr>
<td></td>
<td>BIOC 4201</td>
<td>Advanced Cell Culture and Tissue Engineering</td>
</tr>
<tr>
<td>Biology</td>
<td>BIOL 1103</td>
<td>Foundations of Biology I</td>
</tr>
<tr>
<td></td>
<td>BIOL 1104</td>
<td>Foundations of Biology II</td>
</tr>
<tr>
<td></td>
<td>BIOL 2001</td>
<td>Animals: Form and Function</td>
</tr>
<tr>
<td></td>
<td>BIOL 2002</td>
<td>Plants: Form and Function</td>
</tr>
<tr>
<td></td>
<td>BIOL 2104</td>
<td>Introductory Genetics</td>
</tr>
<tr>
<td></td>
<td>BIOL 2200</td>
<td>Cellular Biochemistry</td>
</tr>
<tr>
<td></td>
<td>BIOL 2600</td>
<td>Ecology</td>
</tr>
<tr>
<td>Chemistry</td>
<td>CHEM 1001</td>
<td>General Chemistry I</td>
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<td>CHEM 1002</td>
<td>General Chemistry II</td>
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<td>CHEM 1005</td>
<td>Elementary Chemistry I</td>
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<td>CHEM 1006</td>
<td>Elementary Chemistry II</td>
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<td></td>
<td>CHEM 2103</td>
<td>Physical Chemistry I</td>
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<tr>
<td></td>
<td>CHEM 2203</td>
<td>Organic Chemistry I</td>
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<tr>
<td></td>
<td>CHEM 2204</td>
<td>Organic Chemistry II</td>
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<td>CHEM 2302</td>
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<td></td>
<td>CHEM 2303</td>
<td>Analytical Chemistry II</td>
</tr>
<tr>
<td></td>
<td>CHEM 2800</td>
<td>Foundations for Environmental Chemistry</td>
</tr>
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Earth Sciences

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>ERTH 1006</td>
<td>Exploring Planet Earth</td>
</tr>
<tr>
<td>ERTH 1009</td>
<td>The Earth System Through Time</td>
</tr>
<tr>
<td>ERTH 2102</td>
<td>Mineralogy to Petrology</td>
</tr>
<tr>
<td>ERTH 2404</td>
<td>Engineering Geoscience</td>
</tr>
<tr>
<td>ERTH 2802</td>
<td>Field Geology I</td>
</tr>
<tr>
<td>ERTH 3111</td>
<td>Vertebrate Evolution: Mammals, Reptiles, and Birds</td>
</tr>
<tr>
<td>ERTH 3112</td>
<td>Vertebrate Evolution: Fish and Amphibians</td>
</tr>
<tr>
<td>ERTH 3204</td>
<td>Mineral Deposits</td>
</tr>
<tr>
<td>ERTH 3205</td>
<td>Physical Hydrogeology</td>
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<tr>
<td>ERTH 3806</td>
<td>Structural Geology</td>
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Food Sciences

<table>
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<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>FOOD 3001</td>
<td>Food Chemistry</td>
</tr>
<tr>
<td>FOOD 3002</td>
<td>Food Analysis</td>
</tr>
<tr>
<td>FOOD 3005</td>
<td>Food Microbiology</td>
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</tbody>
</table>

Geography

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<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>GEOG 1010</td>
<td>Global Environmental Systems</td>
</tr>
<tr>
<td>GEOG 3108</td>
<td>Soil Properties</td>
</tr>
</tbody>
</table>

Neuroscience

<table>
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<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>NEUR 3206</td>
<td>Sensory and Motor Neuroscience</td>
</tr>
<tr>
<td>NEUR 3207</td>
<td>Systems Neuroscience</td>
</tr>
<tr>
<td>NEUR 4600</td>
<td>Advanced Lab in Neuroanatomy</td>
</tr>
</tbody>
</table>

Physics

<table>
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<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>PHYS 1001</td>
<td>Foundations of Physics I</td>
</tr>
<tr>
<td>PHYS 1002</td>
<td>Foundations of Physics II</td>
</tr>
<tr>
<td>PHYS 1003</td>
<td>Introductory Mechanics and Thermodynamics</td>
</tr>
<tr>
<td>PHYS 1004</td>
<td>Introductory Electromagnetism and Wave Motion</td>
</tr>
<tr>
<td>PHYS 1007</td>
<td>Elementary University Physics I</td>
</tr>
<tr>
<td>PHYS 1008</td>
<td>Elementary University Physics II</td>
</tr>
<tr>
<td>PHYS 2202</td>
<td>Wave Motion and Optics</td>
</tr>
<tr>
<td>PHYS 2604</td>
<td>Modern Physics I</td>
</tr>
<tr>
<td>PHYS 3007</td>
<td>Third Year Physics Laboratory: Selected Experiments and Seminars</td>
</tr>
<tr>
<td>PHYS 3606</td>
<td>Modern Physics II</td>
</tr>
<tr>
<td>PHYS 3608</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>Course Title</th>
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</thead>
<tbody>
<tr>
<td>GEOG 1010</td>
<td>Global Environmental Systems</td>
</tr>
<tr>
<td>GEOG 2006</td>
<td>Introduction to Quantitative Research</td>
</tr>
<tr>
<td>GEOG 2013</td>
<td>Weather and Water</td>
</tr>
<tr>
<td>GEOG 2014</td>
<td>The Earth's Surface</td>
</tr>
<tr>
<td>GEOG 3003</td>
<td>Quantitative Geography</td>
</tr>
</tbody>
</table>
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)
- ISAP (Interdisciplinary Science Practice)
- MATH (Mathematics)
- NEUR (Neuroscience)
- PHYS (Physics), except PHYS 2903

Advanced 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), Science Geography courses (see list above), Science Psychology (see list above), and STAT (Statistics) courses. 

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

Any course is allowable as an approved course 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.

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.

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

- BIOL (Biology) Biology & Biochemistry students may use BIOL 1010 and BIOL 2005 only as free electives
- CHEM (Chemistry) except CHEM 1003, CHEM 1004 and CHEM 1007
- COMP (Computer Science) except COMP 1001
- ERTH (Earth Sciences) except ERTH 1010, ERTH 1011
- TSES (Technology, Society, Environment) Biology students may use these courses.

Additional Advanced Courses Outside the Faculties of Science and Engineering and Design

- TSES 2305
- STAT (Statistics)

TSES (Technology, Society, Environment) Biology students may use these courses only as free electives.
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 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.

B.Sc. Major Program

B.Sc. Program

First Year
The Ontario Secondary School Diploma (OSSSD) 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.