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Members of the Faculty

Officers of the Faculty

Dean
RE Peter, PhD, FRSC

Associate Deans
GA Chambers, PhD
WAG Graham, PhD, FRSC
S Nelson, PhD
Assistant Dean
A Adam, BSc

Student Services Officer
JM Stanley, BA

Director of Biological Sciences Animal Service
DG McGay, PhD

Distinguished University Professor
RE Taylor, PhD

Honorary Professors of Science
JA Jacobs, DSc

Institute for Molecular Biology

Chair
RW Stewart, PhD, FRSC, FRS

Professor and Associate Chair
JA Jacobs, DSc

Profsessors
MA Armour, PhD
JA Addie, PhD
JC Samson, PhD
RA Creaser, PhD

Associate Professors
MD Sacchi, PhD
DF Hube, PhD
JC Samson, PhD

Assistant Professors
MG Hube, PhD
MR Freeman, PhD

A Friedman, PhD

Chemistry

Professor and Chair
G Horlick, PhD, FRSC

Faculty Service Officer IV

MA Armour, PhD

Faculty Service Officer IV and Assistant Chair
MA Armour, PhD

Professors
KJ Devito, PhD
MW Armstrong, PhD

Assistant Professors
SE Burcher, PhD
EA Elmaghraby, PhD

SC Mendham, PhD

Associate Professors
MD Sacchi, PhD

Assistant Professors
J Drummond, PhD (Nursing)

Physics

Professor and Chair
JC Samson, PhD

Assistant Professors
Y Wu, PhD

Mathematical Sciences

Faculty Service Officer IV

Chair
MA Armour, PhD

Professor and Chair
SD Redmerski, PhD

Professors
Y Frolov, PhD

Associate Professors
VC Frolov, PhD

Assistant Professors
GM Vincter, PhD

Y Frolov, PhD

J Crozier, BSc (Alumni Affairs)

AJ Crozier, BSc (Alumni Affairs)

MA Henderson, BSc

Earth and Atmospheric Sciences

Professor and Chair
B Jones, PhD

Assistant Professors
DH Vitt, PhD

AR Weis, PhD, FRSC

G Bisanz, PhD

Psychology

Professor and Acting Chair
CHH Beck, PhD

Professor
G Bisanz, PhD

161 The Professors

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Professor and Acting Chair
CHH Beck, PhD

Professor
G Bisanz, PhD

161 The Professors
162 Faculty Regulations

162.1 Faculty Overview

The Faculty of Science offers degrees in Actuarial Science, Applied Mathematics, Atmospheric Sciences, Biochemistry, Biological Sciences (Cell Biotechnology, Environmental Biology, Invertebrate Biology, Microbiology, Molecular Genetics, Physiology and Developmental Biology, Plant Biology (Systematics and Evolution)), Chemistry, Cell Biology, Computing Science, Computing Science with a Business Minor, Environmental Earth Sciences, Environmental Physical Sciences, Geology, Geophysics, Mathematical Physics, Mathematics, Mathematics and Economics, Mathematics and Finance, Neuroscience, Paleontology, Pharmacology, Physics, Physiology, Psychology, and Statistics.

A Business Minor and an Arts Minor are available in the BSc General programs.

An Industrial Internship option is available in BSc Honors and Specialization programs. Students enrolled in the Honors or Specialization program have an opportunity to enhance their studies with an Industrial Internship. The Faculty of Science offers an Industrial Internship Program designed to provide the honors and specialization students a relevant industrial experience. Students must complete a 12- or 16-month work experience term at the end of their third year to receive Industrial Internship designation on their degree certificate. For more details, please see individual departmental listings.

Preprofessional (e.g., Pre-Medicine, Pre-Dentistry, Pre-Optometry, Pre-Pharmacy) patterns may be taken in the Faculty (see §163.20).

162.2 Degrees and Certificates

The Faculty offers three programs leading to the Bachelor of Science (BSc) degree: Honors, Specialization, and General.

The four-year Honors programs are primarily for students who seek careers in scientific research. In addition, they prepare students for admission to graduate school, leading to a Master of Science (MSc) or a Doctor of Philosophy (PhD) degree.

The four-year Specialization programs do not concentrate on one subject to the same extent as the Honors programs. This allows students to choose from a broader range of courses and to take a greater number of courses in a secondary area of interest. They can provide the background necessary for admission to graduate schools, in some cases, and permit attainment of professional status in others.

The four-year General program provides a general education with a scientific emphasis for students who seek careers in business, teaching, medicine, dentistry, etc.

In many cases, transfer from one degree program to another can be easily arranged to suit students’ changing ambitions, needs, or academic qualifications.

Regulations governing the Honors, Specialization, and General degree programs are found in §163.1, followed by descriptions of each degree program under the subject headings (§163.1 to §163.19). Special Certificates are offered for students who already hold a BSc degree from this university.

162.3 Admission

General admission requirements for the University are set out in §§13 and 14. Specific admission information for the Faculty of Science is detailed in §15.16.

162.4 Definitions

The following terms, definitions, and abbreviations are used throughout this section of the Calendar. Also see the Calendar’s Glossary.

(1) Approved Option

In the Faculty of Science section, the term “approved option” appears only within the description of Honors and Specialization programs. For students registered in an Honors or Specialization BSc program, an “approved option” is a course (from Arts, Science, or another Faculty) approved in writing by the department directing the student’s program. General program students interested in taking courses from Faculties other than Arts or Science should see §162.B(1).

(2) Arts Option

Those courses offered by the Faculty of Arts for which the student is eligible and Christian Theology courses listed in §201, Course Listings. Note: Students registered in the Faculty of Science may not take ECON 395, 396, POL S 316, SOC 210, 315 for degree credit.

(3) Courses Attempted

Refers to university or university transfer courses completed with a final grade and excludes courses from which a student has withdrawn with permission.

(4) Courses Successfully Completed

Refers to university or university transfer courses with a final grade of 4.0 or higher.

(5) Course Weight

A unit of course weight indicates the instructional credit assigned to a course and is designated by the ★ symbol after the course number and name. Units of course weight form a part of the degree requirements and are also used to calculate a student’s Grade Point Average (GPA) and Quality Index (QI).

(6) Fall/Winter

The instructional period of September to April.

(7) Two-term Course

A two-term course is a single course with ★6.

(8) Term

The instructional periods from September to December and January to April. In Spring/Summer, the instructional periods of May/June (Spring Term) and July/August (Summer Term).

(9) Single-term Course

A single-term course is a single course with ★3.

(10) Junior Courses

Those courses numbered 199 or lower.

(11) Normal Course Load

A normal, full academic course load is ★30 during Fall/Winter.

(12) Option

The term “option” where it appears in programs means a course chosen by the student from offerings by the Faculties of Arts or Science if the necessary prerequisites have been met.

(13) Science Option

Those courses offered by the Faculty of Science for which the student is eligible. Note: Not all courses offered by the Faculty of Science are available to students registered in the Faculty of Science.

(14) Term

Refers to Fall, Winter, Spring, or Summer Term.

(15) Spring/Summer

The instructional periods of May/June (Spring Term) and July/August (Summer Term).

(16) Year of Program

Year of program, as referred to throughout the Science section, is defined below. Students who are applying to, or continuing in, the Faculty of Science are considered to be in

a. Year 1 if they have successfully completed up to ★29 of their degree program;

b. Year 2 if they have successfully completed between ★30 and ★59 of their degree program;

c. Year 3 if they have successfully completed between ★60 and ★89 of their degree program;

d. Year 4 if they have successfully completed at least ★90 of their degree program.

162.5 Grade Point Average (GPA)

Following are the rules for computation of the GPA:

\[
\text{GPA} = \frac{\text{sum of (grade x units of course weight)}}{\text{sum of units of course weight}}
\]
162.6 Academic Standing

Academic Record

Students should be aware that their academic record (transcript) is a continuing one and that all matters relating to courses, grades, academic standing, and probation will permanently appear on the academic record.

Academic Standing

In all programs in the Faculty of Science, academic standing is assessed on the basis of Grade Point Average. An assessment of academic standing is conducted for each student at the end of the student's registration in the Fall/Winter regardless of the number of credits attempted and regardless whether the student registered in one or both terms. Decisions regarding academic standing will be based on courses attempted during the previous Fall/Winter only.

162.6.1 Continuation in an Honors Program

Continuation in an Honors Program is by recommendation of the department concerned and requires a minimum GPA of 6.5 on a full course load (∗30) in the preceding Fall/Winter. Some departments have higher or additional requirements. See the description of Honors programs in individual department sections for details.

Those Honors students who do not meet the continuation requirements of their program may apply to transfer to a BSc Specialization program or to the BSc General program, provided they meet the continuation requirements of those programs.

162.6.2 Continuation in a Specialization Program

Continuation in a Specialization program is by recommendation of the department concerned and requires a GPA of at least 5.5 in the preceding Fall/Winter. Some departments have higher or additional requirements. See the description of Specialization programs in individual department sections for details.

Those Specialization students who do not meet the continuation requirements of their program may apply to transfer to the General program if they meet the minimum continuation requirements of the General program. Students whose CGPA is between 4.5 and 4.9 may be permitted to continue in the BSc General program on Academic Warning.

Students in a Specialization program whose CGPA at the end of Fall/Winter is below 4.5 will be required to withdraw. Such students can only apply for readmission after attending another postsecondary institution, at which time they can apply for admission as a transfer student under the conditions described in §14.2.1(3).

162.6.3 Continuation in the General Program

Continuation in the General program requires a GPA of at least 5.0 in the preceding Fall/Winter.

Unsatisfactory Standing—Required to Withdraw

Students, whether in an Honors, Specialization, or the General program, whose GPA at the end of Fall/Winter is below 4.5, will be required to withdraw. Any registration in Summer Term and in the subsequent Fall/Winter will be cancelled.

Such students can only apply for readmission after attending another postsecondary institution, at which time they can apply for admission as a transfer student under the conditions described in §14.2.1(3) and 15.16.1.

2) Probation

Students who have been required to withdraw and who have successfully appealed that decision will be placed on Probation in the BSc General program. (See also §23.6.1(3).)

Probationary students are given one Fall/Winter in which to clear probation and are not eligible for any extension of Probation beyond one Fall/Winter.

Probationary students must successfully complete ∗24 during their one Probationary Fall/Winter. Probationary students may also be subject to specific course and program requirements. To clear Probation, they must achieve a GPA of at least 5.0 on all work attempted during that Fall/Winter.

Probationary students who fail to complete successfully at least ∗24 with at least a 5.0 GPA on all work attempted during that Fall/Winter will fail Probation and be required to withdraw. Students who fail Probation are not normally readmitted to the Faculty.

Only one period of Probation is allowed while registered in the Faculty of Science. Students who have cleared Probation and whose GPA at the end of a subsequent Fall/Winter falls below 5.0 will not be permitted to continue on Academic Warning, nor will they be allowed a second period of Probation. Such students are required to withdraw and are not normally readmitted to the Faculty of Science.

3) Scholarship

The basis for scholarship consideration is passing grades in all courses on load of at least ∗30.

4) First-Class Standing

First-class standing in a given year is awarded to any student who obtains a GPA of not less than 7.5 while enrolled in a full, normal academic load (∗30) during the Fall/Winter. This is also referred to as the Dean’s Honor Roll.

5) Continuation in Programs

Students are normally permitted to continue in their degree program if the degree requirements for the year’s work are met. These requirements vary among the programs; consequently, the appropriate program should be consulted for further details.

6) Marginal Standing—Academic Warning

Students whether in an Honors, Specialization, or the General program, whose GPA at the end of Fall/Winter is between 4.5 and 4.9 will be deemed to have a Marginal Standing. Subject to the next paragraphs, they will be allowed to continue in the BSc General program for one further Fall/Winter on Academic Warning.

Only one period of attendance on Academic Warning will be allowed while registered in the Faculty of Science. Students who have received an Academic Warning in any previous Fall/Winter and whose current Fall/Winter GPA is between 4.5 and 4.9 will be required to withdraw from the Faculty. Such students can only apply for readmission after attending another postsecondary institution at which time they can apply for admission as a transfer student under the conditions described in §14.2.1(3) and 15.16.1.

Note: Students under Academic Warning are only permitted to interrupt their programs with the prior written approval of the Associate Dean. If students on Academic Warning interrupt their programs for more than 12 months without prior approval, readmission will normally not be granted unless the student meets the current readmission criteria. (This provision regarding permission to interrupt their program does not apply to Marginal students who attend another postsecondary institution in the interim. Such students must reapply as transfer applicants, see §15.16.8.)

162.6.4 Graduation Year

Students who have completed ∗120 or more and who have either not applied to graduate, or who have applied but have not met graduation requirements, are permitted to register only in those courses necessary to complete their current program as quickly as possible. Such students must have the written approval of the Associate Dean of Science for each course beyond ∗120 in which they register. Students in Honors or Specialization programs must also have the written approval of their Departmental Advisor.
162.7 Courses

(1) Selection of Courses
Students are responsible for familiarizing themselves with program requirements and limitations as specified in the Calendar, for ensuring their programs are properly planned in accordance with degree specifications, and for the completeness and accuracy of their registration. Please read the Calendar carefully before registering in courses, and if you are in doubt about any regulations pertaining to your program, consult the Faculty of Science Office (CW 223 Biological Sciences) for clarification.

Students registered in the Faculty of Science must select courses offered by the Faculty of Arts or by the Faculty of Science. In some instances, courses from other faculties may be permitted by permission of the Dean or designee. Written approval from the Faculty of Science is required if more than 30 are taken in a Fall/Winter, except in those Honors and Specialization programs requiring more than 30 in a given year.

(2) Selection of First-Year Courses
Beginning first-year students who have completed no credits toward their programs must restrict their registration to junior courses. Such students may take senior courses in first year only with the written consent of the Department concerned and the written approval of the Dean or designee.

(3) Withdrawal from Courses
Courses from which the student withdraws up to and including the last day for registration in the Fall and Winter Terms will not appear on the student’s record. Courses from which the student withdraws after the last day of registration and up to and including the last day for dropping courses will appear with a grade of “W” (Withdraw with permission) on the transcript.

Students who withdraw from a course after the deadline and who receive a grade of withdraw-failing (WF) will have a grade of 1.0 applied in arriving at the GPA for the purpose of determining the CGPA.

Deadlines for withdrawing from courses are listed in §11.

(4) Prerequisites
Courses with prerequisites may only be used for degree credit if the prerequisite requirements are met.

A grade of 4.0 is the minimum grade acceptable in a course which is to be used as a prerequisite.

Where a prerequisite is stated, it is understood that equivalent courses may be used to satisfy the requirement. In addition, the department offering a course with prerequisite requirements may waive the prerequisite in writing. (Prerequisite waiver forms are available from the Faculty of Science office and the Department offices).

Students who are unsure if they meet the prerequisite requirements in a course, or who wish to obtain permission to have a prerequisite waived, should consult the department offering the course.

(5) Repeating Courses
No student will be permitted to repeat any University course, whether a failed course or a course having a grade of W, more than once except for reasons deemed sufficient by the Council of the faculty in which the student is enrolled. For Science students, the Faculty will withhold credit or indicate the course is extra to degree on any course that contravenes this regulation.

Normally, a student will not be permitted to repeat a course in which a grade of 4.0 or more has been received.

Only two exceptions are permitted, and each requires written approval of the Dean or designee:

a. When a higher grade is necessary for a course that is required in one of the degree programs

b. When a student in the last year of a degree program repeats a course(s) to raise the GPA to the level required by the degree program

A student who repeats a course in which a grade of 4.0 or more has been received, without written permission of the Faculty of Science, will have the grade attained on the initial passing of the course used for the purpose of meeting degree requirements, and no credit will be assigned to the repeated course.

(6) Reexamination
See §23.5.5.

162.8 Graduation

(1) Application for Graduation
Students who intend to receive a BSc (General, Specialization, or Honors) Degree or Special Certificate must apply for the Degree or Certificate at the Faculty Office by February 1 for Spring Convocation or by September 1 for Fall Convocation.

(2) Degree Requirements
All BSc Degrees require a minimum of 120. Courses with weights of 4.0 are offered for credit only, and, although they may be required in specific degree programs, cannot be used to meet the minimum units of course weight requirement in any degree program.

(3) Convocation
All requirements for graduation at Spring Convocation must be met by the end of Fall/Winter. Those completing degree requirements during Spring/Summer will graduate at the Fall Convocation.

(4) First-Class Honors
First-class Honors Degrees are awarded to any student in an Honors program who obtained a GPA of not less than 7.5 over the last two Fall/Winter sessions if the student was enrolled in a full academic load (30) during each Fall/Winter.

(5) With Distinction
The notation “With Distinction” is inscribed on the parchment of a candidate for a General or Specialization degree if the candidate has obtained a GPA of not less than 7.5 over the last two years and if the student was enrolled in a full academic load (30) during each Fall/Winter of the last two years.

Further regulations regarding academic standing, promotion, and graduation vary from program to program within the Faculty of Science, and are therefore given in §163 below. Regulations for Honors, Specialization, and General programs are found in §163.1, regulations for preprofessional patterns in §163.20.

162.9 Appeals and Grievances

A copy of Faculty of Science regulations regarding appeals on grades, academic standing and early readmission may be obtained from the Faculty Office (CW 223 Biological Sciences Building). Certain academic standing decisions made by the Faculty Academic Appeals Committee may be appealed to the General Faculties Council Academic Appeals Committee. See §23.8.

Note: Deadlines exist for submission of appeals. Contact the Faculty for details.

162.10 Visiting Student Status

Permission to attend another institution as a Visiting Student depends on the student remaining in good academic standing in the Faculty of Science at the University of Alberta.

A student while registered in the Faculty of Science will not receive permission to register as a Visiting Student at another institution if the equivalent course is given on campus in the same term, except in the case of formal exchange programs.

163 Programs of Study

163.1 BSc in the Honors, Specialization, and General Programs

163.1.1 Honors Programs

A minimum of 120 normally taken in four consecutive academic years is required to complete the Honors program for the degree of BSc with Honors. These programs provide specialization in the chosen subject or subjects as well as the higher standard implied by the term “Honors.”
Honors programs are available in the Departments of Biochemistry, Biological Sciences, Chemistry, Computing Science, Geography, Geology, Mathematical Sciences, Pharmacology, Physics, Physiology, and Psychology. Honors is the preferred program for students who plan graduate study.

### Admission

See §15.16.3 for admission requirements.

### Selection of Courses

The following regulations govern Honors programs:

1. In each year, an Honors student’s program must be approved by an Honors advisor in the student’s department and by the Faculty Office.
2. A minimum of ★72 in Science is required in most Honors programs. Certain departments may require more than ★72 in Science courses.
3. A student normally must take at least ★18 in Arts courses as part of the requirements for the Honors degree.
4. Normally, no more than ★42 in junior (100-level) courses are permitted in Honors programs.
5. Certain non-Arts and non-Science courses appropriate to the program may be permitted in Honors programs with the written approval of the Department directing the student’s program.

### Course Load Requirements

Students in Honors programs must take at least ★30 during the Fall/Winter of each year of the program. Exceptions to this requirement must be approved by the Department and the Faculty Office.

### Academic Standings and Graduation

The following regulations govern Honors programs:

1. Continuation in an Honors program is by recommendation of the department concerned and requires a GPA of at least 6.5 in each of the preceding Fall/Winter sessions. See description of Honors programs of individual departments for additional requirements relating to continuation in the Honors program.
2. A student who fails to attain the standard necessary for continuance in Honors must withdraw from the Honors program. In so doing, the student may transfer to a Specialization program with the appropriate department’s approval or to the General program in the Faculty of Science. Students applying to transfer from an Honors program to Specialization or General must meet the continuation standards for the program concerned.
3. A student who fails to complete the requirements for a degree with Honors in the fourth year may be granted the Specialization degree or the General degree on application if the courses taken and the standing attained are satisfactory. Such students must apply to transfer to a Specialization or General program.
4. Degrees with Honors are awarded in two classes: First-Class Honors and Honors. For First-Class Honors, a GPA of at least 7.5 on the ★60 for the last two Fall/Winter sessions is required. For Honors, a GPA of at least 6.5 on ★30 in each Fall/Winter is required.
5. Students transferring to Honors from Specialization or General programs or from other faculties or universities with less than ★30 are allowed to make up the deficiency or deficiencies, i.e., ★3 to ★27, during or after taking the full program of courses in each Fall/Winter after entering the Honors program.

### Residence Requirement

A student transferring to the Faculty of Science with advanced standing must complete at least ★60 (normally the last 60) while registered in the Faculty of Science at the University of Alberta.

### Time Limits for Program Completion

Normally, an Honors program must be completed in four consecutive Fall/Winter periods. An Honors program may be interrupted only by special permission of the Department and the Dean.

### 163.1.2 Specialization Programs

Four-year programs, comprising a minimum of ★120, provide education to a professional level and lead to the degree of BSc with Specialization.

Specialization programs are available in the Departments of Biochemistry, Biological Sciences, Chemistry, Computing Science, Earth and Atmospheric Sciences, Mathematical Sciences, Pharmacology, Physics, Psychology, and Physiology. A five-year (★150) Ed/BSc (Specialization in Science and Education) program with majors and minors in Biological, Mathematical, and Physical Sciences is also available (see §§15.5.2 and 65.5).

### Admission

See §15.16.4 for admission requirements.

### Selection of Courses

The following regulations govern Specialization programs:

1. In each year, a Specialization student’s program must be approved by a Specialization advisor in the appropriate Department and by the Faculty Office.
2. A minimum of ★72 in Science is required in most Specialization programs. Certain Departments may require more than ★72.
3. A student must take at least ★18 in Arts courses as part of the requirements for most Specialization degrees.
4. Normally, no more than ★42 in junior courses are permitted in Specialization programs.
5. Certain non-Arts and non-Science courses appropriate to the program may be permitted in Specialization programs with the prior written approval of the Department directing the student’s program.

### Course Load Requirements

Students in Specialization programs should normally take at least ★30 during the Fall/Winter of each year of the program. Exceptions must be approved by the Department and the Faculty of Science.

### Academic Standings and Graduation

The following regulations govern Specialization programs:

1. Continuation in a Specialization program is by recommendation of the Department concerned and requires a GPA of at least 5.5 in each of the preceding Fall/Winter periods. See description of Specialization programs of individual departments for additional requirements relating to promotion in the Specialization program.
2. A student who fails to attain the standard necessary for continuation in the Specialization program will be required to withdraw from that program. In so doing, the student may apply to transfer to the General program in the Faculty. Students applying to transfer from a Specialization to the General program must meet the continuation CGPA of 5.0.
3. A student who fails to complete the requirements for a Specialization degree in the fourth year may be granted the General degree forthwith on application if the courses taken and the standing attained are satisfactory. Such students must apply to transfer to the General program.
4. For graduation, a program of at least ★120 credited to the degree.
5. BSc Specialization degrees with Distinction are awarded when students achieve a GPA of at least 7.5 on the ★60 if the student was enrolled in a normal course load (★30) during each Fall/Winter of the last two years.

### Residence Requirement

A student transferring to the Faculty of Science with advanced standing must complete at least ★60 applicable to the BSc program while registered at the University of Alberta. At least ★30 of the last ★60 must be completed while registered in the Faculty of Science.

### Time Limits for Completion of Program

The Faculty of Science and the Department may permit a student to complete the requirements for a Specialization degree over a period longer than four years.

### 163.1.3 General Programs

The BSc General program provides students with a diverse education in more than one branch of study and includes a major and minor subject or area of concentration. Students must major in a Science subject or area of concentration. Students may elect to minor in a Science subject or area of
concentration or in an Arts subject of concentration. In addition to providing a BSc General Degree, this program allows for subsequent transfer to Specialized and Honors programs. Students who intend to transfer to an Honors program must complete ★30 in each Fall/Winter preceding admission to the Honors program. Students enrolled in the General program who intend to transfer to another program should consult the appropriate admission requirements for the particular program of interest in §15.16 and carefully select their first-year core courses in accordance with the requirements of the specific program.

Students who tentatively plan to transfer to an honors or specialization program should initially complete courses toward a Science or Arts minor in accordance with BSc General regulations.

Admission

See §15.16.1 for admission requirements for the BSc (General) programs. The following regulations govern the General program:

(1) In each year, a student’s program must be approved by an advisor in the student’s major subject or area of concentration and by the Faculty Office.

(2) To obtain a BSc General Degree, a student must receive credit in ★120. At least ★72 and not more than ★102 must be in Science. At least ★18 and not more than ★48 must be in Arts.

(3) Each student must complete a major subject or area of concentration. The major subject or area must be in Science. A minimum of ★36 and a maximum of ★48 are required in the major subject or area of concentration, with no more than ★18 at the junior level. Each student must also either:

a. complete a second major which also must be a subject or area of concentration in Science. Students who complete a second major in Science will have the Double Majors recorded on their transcripts and diplomas; or

b. complete a minor subject or area of concentration. The minor subject or area of concentration may be in Science, or a student may present a subject of concentration in Arts or Business. For a list of Arts subjects available as a minor, refer to “Minors” below. For information about admission to the Business minor, see §15.16.2. Requirements for a Business minor appear in §163.1.4. At least ★72 and not more than ★36 are required in the minor subject or area of concentration with no more than ★12 at the junior level. If the minor subject of concentration is in Arts, additional requirements as specified by the Arts Department may be required. Students are responsible for meeting any additional departmental requirements as specified in the Faculty of Arts (§43.1 to 43.29).

Majors

A major subject of concentration consists of Science courses taken in one of the following subjects: Chemistry, Mathematics, Physics, Science Psychology and Statistics.

A major area of concentration consists of Science courses taken from one of the following groups:

**Biological Sciences**: Biochemistry, Botany, Entomology, Genetics, Marine Science, Microbiology, Paleontology, Pharmacology, Physiology, Zoology, and courses titled Biology

**Physical Sciences**: Astronomy, Biochemistry, Chemistry, Geophysics, Mathematical Physics, and Physics

**Mathematical Sciences**: Computing Science, Mathematics, Statistics and Applied Probability

**Earth and Atmospheric Sciences**: EAS courses (see §163.7), Geophysics and Paleontology

Minors

A minor subject of concentration consists of Science courses taken in one of the following subjects: Chemistry, Computing Science, Mathematics, Physics, Science, Psychology, Statistics, or in one of the subjects or areas in the Faculty of Arts noted below. For information about the minor in Computing Science, see §163.6.5. A minor area of concentration may be chosen from one of the areas noted above, i.e., Biological Sciences, Physical Sciences, Mathematical Sciences, or Earth Sciences. A BSc General–Minor in Business is also available.

If the minor subject of concentration chosen is from Arts, the above requirements and any further requirements as specified by the Arts Department must be met. (See the Faculty of Arts §54.1 to 54.26 for specific requirements for minors, by Department.) The following Arts subjects may be offered as a minor subject of concentration:

- Anthropology
- Art and Design
- Canadian Studies
- Central/East European Studies
- Chinese
- Classics

Comparative Literature; Drama; East Asian Studies; Economics; English; Film Studies; French; Geography; German; Greek and Latin; History; Honors or Medieval History; and Women’s History; Italian; Japanese; Latin American Studies; Linguistics; Music; Native Studies; Philosophy; Political Science; Psychology; Religious Studies; Russian; Scandinavian; Spanish; Ukrainian; Women’s Studies.

**The major subject or area of concentration and minor subject of concentration may not share courses from the same department. The following combinations are not allowed:**

- Earth Sciences/Arts Geography
- Science Psychology/Arts Psychology

Courses in a major or minor subject of concentration may not overlap. For example, if the major area of concentration is the Mathematical Sciences, and the minor subject of concentration is Statistics, the major may be made up of Mathematics courses and Computing Science courses, but no Statistics courses. The minor would consist exclusively of Statistics courses.

(4) The General program features a first-year core of courses which must include the following:

a. ★6 from among junior courses offered by the Department of English (normally ENGL 101)

b. ★6 from among junior courses offered by the Departments of Computing Science, Mathematical Sciences (MATH 113 or 114 or 117; MATH 115 or 118; MATH 120 or 122; MATH 121 or 128; MATH 153; CMPUT 101 or 114; CMPUT 102 or 115; STAT 141 or 151)

c. ★6 from among junior courses in the Departments of Chemistry or Physics (CHEM 101; CHEM 102; CHEM 161; CHEM 163; PHYS 100 or 109; PHYS 101 or 102 or 108; ASTRO 120; ASTRO 122)

d. ★6 from among junior Science courses titled Biology, Earth and Atmospheric Sciences, or Science Psychology (Biol 107; Biol 108; EAS 101; EAS 102; EAS 103; PSYCO 104)

e. ★6 from among 100-level courses in Arts or Science (Students interested in the Business Minor must take ECON 101 and 102)

(5) Normally, at least ★30 at the junior level must be successfully completed before a student may register in senior-level courses.

(6) Not more than ★42 of all courses taken can be at the junior level.

(7) Each student must successfully complete a minimum of ★12 at the 300-level (or higher) in the major subject or area of concentration and, in addition, at least ★6 at the 300-level (or higher) in the minor subject or area of concentration.

(8) Subject to receiving written approval from the Faculty of Science Office before registration, a maximum of ★12 may be taken from faculties other than Arts or Science. For applicants to the BSc General who have already taken courses from faculties other than Arts or Science, potential transfer credit for such courses will be assessed at the time of admission to the program.

Such subjects are not included as part of the major or minor Subject or Area of Concentration, nor toward the minimum requirement of ★18 in Arts, nor toward the minimum requirement of ★72 in Science.

Note: In Women’s Studies minor subject of concentration, courses not in Arts or Science but in the list of “cross-listed courses” may count toward the minor subject of concentration in Women’s Studies (see §54.26.2).

Course Load Requirements

Students in the General program should normally take ★30 during the Fall/Winter of each year of the program.

Academic Standings and Graduation

The following regulations govern General Programs:

(1) To obtain a BSc General degree, a GPA of at least 5.0 must be attained on the last ★60 credited to the degree. Moreover, a GPA of at least 5.5 must be attained in all courses in the major Subject or Area of Concentration.

(2) BSc General degrees with Distinction are awarded when students achieve a GPA of 7.5 or higher over the last ★60 if the students have satisfactorily completed at least a normal academic load of ★30 during the Fall/Winter periods of the last two years at the University of Alberta.

Residence Requirement

A student transferring to the Faculty of Science with advanced standing must complete at least ★60 applicable to the BSc program while registered at the University of Alberta. Normally, at least ★30 of the last ★60 must be completed while registered in the Faculty of Science.
163.1.8 Completion of a BSc Degree After Transfer to Another Faculty

Students who transfer to another faculty after completing part of a BSc program may reapply to the Faculty of Science after completing the degree from the other faculty. A former student transferring to the Faculty of Science normally must complete at least 45 while registered in the Faculty of Science at the University. Courses completed in the Faculty of Science before transfer may count toward the minimum 60 that must be completed while registered in the Faculty of Science. Science or Arts courses taken while in another faculty, which are clearly noted as “extra-to-degree” on the transcript, may fulfill specific subject requirements of a degree program in Science but will not fulfill the minimum residence requirement of the program.

163.2 Biochemistry

163.2.1 Honors in Biochemistry

Continuation in the Honors program in Biochemistry requires a GPA of at least 7.0 in each of the preceding Fall/Winter periods.

Graduation requires a minimum GPA of 7.0 on the last 60 credited to the degree.

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 101/102 and 161/163</td>
<td>BIOCH 203/205</td>
</tr>
<tr>
<td>BIOL 107/108</td>
<td>PHYS 100 and 101 or equivalent</td>
</tr>
<tr>
<td>6 in a junior Arts option (ENG1 101 recommended)</td>
<td>6 in an approved Science option</td>
</tr>
<tr>
<td></td>
<td>5 in Arts options</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year 3</th>
<th>Year 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOCH 401</td>
<td>BIOCH 450</td>
</tr>
<tr>
<td>6 in Biochemistry (normally selected from BIOCH 410, 420, 430, or 441)</td>
<td>6 in Biochemistry (selected from BIOCH 450, 455, or 460)</td>
</tr>
<tr>
<td>CHEM 211/213</td>
<td>CHEM 361 and 365</td>
</tr>
<tr>
<td>6 in approved Science options</td>
<td>15 in approved Science options</td>
</tr>
<tr>
<td>6 in Arts options</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
(1) For information about new Biological Sciences courses, consult your Department advisor.
(2) Recommended Science options for second year include BIOL 207, MICRB 265; MATH 214 and 215, GENET 270 and 275 or other approved Sciences courses.
(3) Recommended Science options for third and fourth year include BIOCH 450, 455, and 460; PHYS 201; MICRB 311 or 415; PHYSL 210.
(4) Students should consult the Department of Biochemistry regarding selecting options throughout the course of the program.
(5) Students must receive a grade of not less than 6.0 in all Biochemistry courses credited toward the minimal number required for the degree.
(6) 6 in a junior English is required as one of the 18 in Arts options within the Honors program in Biochemistry.
(7) BIOCH 410, 420, 430, 441, 450, 455, and 460 are offered only in alternating years. Check the Registration Procedures book for courses offered in the current year.

163.2.2 Specialization in Biochemistry

Continuation in the Specialization program in Biochemistry requires a minimum GPA of 6.0.

Graduation requires a minimum GPA of 6.0 on the last 60 credited to the degree.

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 101/102 and 161/163</td>
<td>BIOCH 203/205</td>
</tr>
<tr>
<td>BIOL 107/108</td>
<td>PHYS 100 and 101, or equivalent</td>
</tr>
<tr>
<td>6 in a junior Arts option (ENG1 101 recommended)</td>
<td>6 in an approved Science option</td>
</tr>
<tr>
<td></td>
<td>5 in Arts options</td>
</tr>
</tbody>
</table>

Notes:
(1) For information about new Biological Sciences courses, consult your Department advisor.
(2) Recommended Science options for second year include BIOL 207, MICRB 265; MATH 214 and 215, GENET 270 and 275 or other approved Sciences courses.
(3) Recommended Science options for third and fourth year include BIOCH 450, 455, and 460; PHYS 201; MICRB 311 or 415; PHYSL 210.
(4) Students should consult the Department of Biochemistry regarding selecting options throughout the course of the program.
(5) Students must receive a grade of not less than 6.0 in all Biochemistry courses credited toward the minimal number required for the degree.
(6) 6 in a junior English is required as one of the 18 in Arts options within the Honors program in Biochemistry.
(7) BIOCH 410, 420, 430, 441, 450, 455, and 460 are offered only in alternating years. Check the Registration Procedures book for courses offered in the current year.

163.1.7 Transfers Between Programs

A student may transfer from an Honors program to either the corresponding Specialization program or to the General program, or from a Specialization program to the General program at any time in the program, by submitting a readmission form to the Faculty Office subject to appropriate deadlines. Transfers from the General program to a Specialization program or an Honors program or from one Specialization program to another or to an Honors program may be made according to the dates listed in §12. Also, transfers to Honors and Specialization programs require approval of the Department responsible for the new program.
**Notes**

(1) For information about new Biological Sciences courses, consult your Department advisor.

(2) Recommended Science options for second year include BIOL 207; MICRB 265; GENET 270 and 275 or other approved Science courses.

(3) Recommended Mathematical or Physical Science options include MATH 214 and 215; CHEM 271 and 273; PHYS 201; or other approved Mathematical or Physical Science courses.

(4) Other recommended Science options for third and fourth year include BIOCH 430, 435, 440; PHYS 201; MICRB 311 or 415; PHYSL 210 or other approved Science courses.

(5) Students should consult the Department of Biochemistry regarding selecting options throughout the course of the program.

(6) Students must receive a grade of not less than 6.0 in BIOCH 203 and 205 and 5.0 in all other Biochemistry courses credited toward the minimal number required for the degree.

(7) *6 in a junior English is required as one of the *18 in Arts options within the Specialization in Biochemistry program.

(8) During the first term of their first year, as the *6 Science Option.

(9) *6 in approved Science options

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### 163.3 Biological Sciences

The Honors and Specialization programs formerly offered in the Biological Sciences Department were replaced with the programs below, effective Fall/Winter 1996/97. All students in Honors and Specialization programs in Biological Science now take a common core of courses in the first and second years. Thereafter, they follow the course sequence of one of eight areas of concentration in either Honors or Specialization in Biological Sciences identified in §163.3.4 and 163.3.5. Students must declare an area of concentration and follow the appropriate course sequence. The title of the area of concentration will appear on their degree.

The Department of Biological Sciences offered programs in Honors and Specialization in Botany, Cell Biotechnology, Entomology, Environmental Biology, Genetics, Microbiology, and Zoology until 1995/96. Effective September 1996, these programs were no longer available. Students who began the old programs before 1996 may complete the programs if there has been no break in attendance. These students should consult the 1995/96 edition of the Calendar for program details. Students entering the Biological Sciences programs in September 1996 and thereafter are admitted to the new programs.

Students may receive Transfer in the Biological Sciences at the University of Calgary or the University of Lethbridge if the appropriate courses are completed. Interested students may contact the Department of Biological Sciences for details.

#### 163.3.1 Honors in Biological Sciences

Admission to the BSc Honors in Biological Sciences program directly from high school requires a minimum average of 80% on the following required courses: English 30, Mathematics 30, Biology 30, Chemistry 30, and a subject from group A, B, or C (Physics 30 recommended). Admission on transfer requires a minimum GPA of 6.5 on a minimum of *30 in the preceding Fall/Winter.

Continuation in the Honors Biological Sciences program requires a minimum GPA of 6.5 in the preceding Fall/Winter. Graduation requires a minimum GPA of 6.5 on the last *60 credited to the degree. Students in Honors programs must take at least *30 during the Fall/Winter of each year of the program. Exceptions to this requirement must be approved by the Department and the Faculty Office.

#### 163.3.2 Specialization in Biological Sciences

Admission to the BSc Specialization in Biological Sciences program directly from high school requires a minimum average of 75% on the following required courses: English 30, Math 30, Biology 30, Chemistry 30, and a subject from group A, B, or C (Physics 30 recommended). Admission on transfer requires a minimum GPA of 5.5 in the preceding Fall/Winter.

Continuation in the Specialization program requires a GPA of 5.5 in the preceding Fall/Winter. Graduation requires a minimum GPA of 5.5 on all courses credited to the degree.

#### 163.3.3 First-Year Core for BSc Honors and Specialization in Biological Sciences

**First Year:** BIOL 107, 108; CHEM 101,161; STAT 151; MATH 113 or 114 or 120; *6 Arts option (English recommended); *6 Science Option.

**Notes**

(1) Students intending to complete their degree in the areas of Cell Biotechnology, Microbiology, or Molecular Genetics must also take both CHEM 102 and 163, normally in the second term of their first year, as the *6 Science Option.

(2) Students intending to complete their degree in Physiology and Developmental Biology, or those who wish to incorporate BIOCH 203/205 in place of BIOCH 220 in their Animal Biology program, are required to take CHEM 163 in the first year.

(3) The rest of the Biological Sciences program core consists of BIOL 207, 208, and BIOCH 203 or 220, which would be completed in the second year.

(4) Students intending to complete their degree in the areas of Cell Biotechnology, Microbiology, Molecular Genetics, or Physiology and Developmental Biology require BIOCH 203/205, not BIOCH 220.

(5) Students in Honors Biological Sciences must successfully complete BIOL 499.

#### 163.3.4 Course Sequence for Honors in Biological Sciences

See Science Chart 1.

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**Science Chart 1** Course Sequence for Honors in Biological Sciences

<table>
<thead>
<tr>
<th>Animal Biology</th>
<th>Year 2</th>
<th>Year 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOCH 220; BIOL 201, 207, 208; ZOOL 224, 225; ZOOL 250 or ENT 220; ZOOL 241 or 242</td>
<td>*3 Approved option</td>
<td>BIOCH 321, 499; BIOL 331 or ZOOL 332; ENT 220 or ZOOL 250; GENET 275; ZOOL 302 or 303; ZOOL 392; ZOOL 370 or 371</td>
</tr>
<tr>
<td>*3 Arts option</td>
<td>*12 from List A</td>
<td>*9 Arts options</td>
</tr>
<tr>
<td>List A: Recommended options include but are not restricted to the following: BIOL 335, 380, 420, 430, 435, 467; EAS 230; ENT 280, 321, 392; MA SC 410, 412, 430, 440; PALEO 318, 319; ZOOL 340, 341, 352, 351, 405, 407, 408, 427.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>List B: BIOL 445, 448; ZOOL 402, 441, 442, 472; or a 500-level graduate seminar.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Note: MA SC courses on this list are offered at Bamfield Marine Station.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Cell Biotechnology

**Year 2**

<table>
<thead>
<tr>
<th>Course</th>
<th>Year 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOCH 203, 205; BIOL 201, 207; GENET 270; MICRB 265</td>
<td>BIOL 208, 499; CHEM 361, 363; GENET 301, 304, 395; GENET 420 or MICRB 343 and 345; MICRB 311, 313, 406, 415, 450</td>
</tr>
<tr>
<td>★6 Approved Science options</td>
<td>★6 Approved options from list below</td>
</tr>
<tr>
<td>★3 Arts options</td>
<td>★9 Arts options</td>
</tr>
</tbody>
</table>

Note: A minimum grade of 6 is required in MICRB 265 to stay in the Cell Biotechnology Honors program.

### Environmental Biology

**Year 2**

<table>
<thead>
<tr>
<th>Course</th>
<th>Year 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 208, 499; CHEM 361, 363; GENET 301, 304, 395; GENET 420 or MICRB 343 and 345; MICRB 311, 313, 406, 415, 450</td>
<td>BIOL 321, 380, 499; BIOL 430 or STATS 337</td>
</tr>
<tr>
<td>★9 from BIOL 331, BOT 332, FOR 322 or SOILS 330; ZOOL 332, 371</td>
<td>★9 from list below</td>
</tr>
<tr>
<td>★6 from BOT 240, 250, 306, 308, 320; ZOOL 224, 241, 242, ENT 321, 329; GENET 270, 275; MICRB 265; ZOOL 241, 242</td>
<td>★9 Arts options</td>
</tr>
<tr>
<td>★12 Approved Options</td>
<td>★9 Approved Options</td>
</tr>
</tbody>
</table>

Recommended options include, but are not restricted to the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Year 3 and 4</th>
</tr>
</thead>
</table>

### Evolutionary Biology

**Year 2**

<table>
<thead>
<tr>
<th>Course</th>
<th>Year 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOCH 220; BIOL 207, 208, 380</td>
<td>BIOL 321, 335, 420, 435, 499</td>
</tr>
<tr>
<td>★3 from BOT 201, 210; ENT 220; ZOOL 224, 225, 250.</td>
<td>★3 from BOT 411, PALEO 318, 319.</td>
</tr>
<tr>
<td>★3 from BOT 240; ZOOL 241, 242; ENT 321.</td>
<td>★3 from BIOL 331, BOT 332, ZOOL 332,</td>
</tr>
<tr>
<td>★6 from BOT 302, 305, 306, 320; ZOOL 224, 241, 405, 407, 408, 427; ENT 280; MICRB 265.</td>
<td>★9 Arts options</td>
</tr>
<tr>
<td>★12 Approved Options</td>
<td>★9 Approved Options</td>
</tr>
</tbody>
</table>

Recommended options include, but are not restricted to the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Year 3 and 4</th>
</tr>
</thead>
</table>

### Microbiology

**Year 2**

<table>
<thead>
<tr>
<th>Course</th>
<th>Year 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOCH 203, 205; BIOL 201, 207; GENET 270; MICRB 265</td>
<td>BIOL 208, 499; MICRB 311, 313, 343, 345; CHEM 211, 213</td>
</tr>
<tr>
<td>★6 Science option</td>
<td>★6 Arts options from list below</td>
</tr>
<tr>
<td>★3 Arts options</td>
<td>★9 Approved options (List A)</td>
</tr>
</tbody>
</table>

Note: A minimum grade of 6 is required in MICRB 311 to stay in the Microbiology Honors program.

### Molecular Genetics

**Year 2**

<table>
<thead>
<tr>
<th>Course</th>
<th>Year 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOCH 203, 205; BIOL 207, 208; CHEM 102; GENET 270, 275, MICRB 265</td>
<td>BIOL 201, 380, 499; GENET 301, 302, 304, 390</td>
</tr>
<tr>
<td>★6 Arts Options</td>
<td>★12 from GENET 364, 408, 412, 418, 420</td>
</tr>
</tbody>
</table>

Note: GENET 270 and 275 must be taken during the second year to permit completion of the program in four years.
### Science Chart 1  
Course Sequence for Honors in Biological Sciences (cont’d)

#### Physiology and Developmental Biology

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Year 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOCH 203, 205</td>
<td>BIOL 499; ZOOL 302, 303, 344</td>
</tr>
<tr>
<td>BIO 201, 207, 208</td>
<td>3 of ZOOL 402 or 441 or 442</td>
</tr>
<tr>
<td>ZOOL 225, 241, 242, 250</td>
<td>12 from list below</td>
</tr>
<tr>
<td>3 Science option</td>
<td>9 Approved options</td>
</tr>
<tr>
<td></td>
<td>Recommended options include, but are not restricted to the following:</td>
</tr>
</tbody>
</table>
|                                             | ANAT 415; BIOL 445; BOT 240, 306, 340, 431; CELL 300, 301; ENT 321; INT D 371, 452, 543, 544;  
|                                             | GENET 301, 302, 304, 412; MICRB 265, 311, 313; PHYSL 372, 401, 402, 404; PMCOL 371; ZOOL  
|                                             | 340, 341, 342, 343, 352, 355, 370, 402, 441,  
|                                             | 442, 452.                                        |
| 3 Arts option                              |                                                  |
| 3 Arts option                              |                                                  |

#### Plant Biology

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Year 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOCH 220; BIOL 207, 208; CHEM 102; CHEM 163 or 263; BOT 201, 210, 240</td>
<td>BIOL 201, 499; BOT 250, 309, 303, 320, 332; MICRB 265</td>
</tr>
<tr>
<td>3 Science option</td>
<td>3 GENET</td>
</tr>
<tr>
<td></td>
<td>3 Approved option</td>
</tr>
<tr>
<td></td>
<td>18 from list below</td>
</tr>
<tr>
<td></td>
<td>15 Approved options</td>
</tr>
<tr>
<td></td>
<td>List A: Recommended options include but are not restricted to the following:</td>
</tr>
<tr>
<td></td>
<td>BIOL 335, 380, 420, 430, 435, 467, 498, 499; EAS 230; ENT 280, 321, 392; MA SC 410, 412, 430, 440; PALEO 318, 318; ZOOL 340, 341, 342, 351, 405, 407, 408, 427.</td>
</tr>
<tr>
<td></td>
<td>List B: BIOL 445, 468; ZOOL 402, 441, 442, 472.</td>
</tr>
<tr>
<td></td>
<td>Note: MA SC courses on this list are offered at Bamfield Marine Station.</td>
</tr>
<tr>
<td>3 Arts option</td>
<td></td>
</tr>
</tbody>
</table>

### 163.3.5 Course Sequence for Specialization in Biological Sciences

See Science Chart 2.

### Science Chart 2  
Course Sequence for Specialization in Biological Sciences

#### Animal Biology

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Year 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOCH 220; BIOL 201, 207, 208; ZOOL 224, 225; ZOOL 250 or ENT 220; ZOOL 241 or 242</td>
<td>BIOL 321; BIOL 331 or ZOOL 332; ENT 220 or ZOOL 250; GENET 275; ZOOL 302 or 303; ZOOL 352; ZOOL 370 or 371</td>
</tr>
<tr>
<td>3 Approved option</td>
<td>5 from BIOL 331; BOT 322; FOR 322; or SOILS 330; ZOOL 332, 371.</td>
</tr>
<tr>
<td>3 Arts option</td>
<td>6 from BOT 240, 250, 382; ENT 321; GENET 270, 275; MICRB 265; ZOOL 241, 242.</td>
</tr>
<tr>
<td>6 Approved Science options</td>
<td>9 from list below</td>
</tr>
<tr>
<td>6 Arts options</td>
<td>18 Approved options</td>
</tr>
<tr>
<td></td>
<td>Recommended options include, but are not restricted to the following:</td>
</tr>
</tbody>
</table>
|                                             | BIOL 361, 366, 430, 433, 435, 484, 467, 468, 498, 499, 520; BOT 365, 306, 333, 431, 433; EAS 250;  
|                                             | ENT 460; INT D 421; ZOOL 361, 340, 405, 467, 408, 427, 434. |

#### Cell Biotechnology

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Year 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOCH 203, 205; BIOL 201, 207, 208; ZOOL 224; ZOOL 250 or ENT 220</td>
<td>BIOL 208; GENET 301, 304, 390; GENET 420 or MICRB 343 and 345; MICRB 311, 313, 415, 450</td>
</tr>
<tr>
<td>6 Approved Science options</td>
<td>6 from BIOL 331; BOT 322; FOR 322; or SOILS 330; ZOOL 332, 371.</td>
</tr>
<tr>
<td>6 Arts options</td>
<td>9 from list below</td>
</tr>
<tr>
<td></td>
<td>18 Approved options</td>
</tr>
<tr>
<td></td>
<td>Recommended options include, but are not restricted to the following:</td>
</tr>
</tbody>
</table>
|                                             | BIOCH 410, 420, 430, 450; BIOL 490, 498, 499; BOT 250, 380, 382; CHEM 211, 213, 361, 363;  
|                                             | GENET 303, 364, 375; INT D 224, 371; MMI 351, 352, 405, 415, 425, 520; MICRB 316, 391, 410; NU FS 363, 402. [Other options may be approved if suitable] |

#### Environmental Biology

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Year 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOCH 220; BIOL 207, 208; BOT 201 or 210; CHEM 163 or 263; EAS 102; MATH 115 or 120; ZOOL 224; ZOOL 250 or ENT 220</td>
<td>BIOL 430 or STATS 337; BIOL 321, 380</td>
</tr>
<tr>
<td>3 Arts option</td>
<td>8 from BIOL 331; BOT 322; FOR 322; or SOILS 330; ZOOL 332, 371.</td>
</tr>
<tr>
<td></td>
<td>6 from BOT 240, 250, 382; ENT 321; GENET 270, 275; MICRB 265; ZOOL 241, 242.</td>
</tr>
<tr>
<td></td>
<td>9 from list below</td>
</tr>
<tr>
<td></td>
<td>18 Approved options</td>
</tr>
<tr>
<td></td>
<td>Recommended options include, but are not restricted to the following:</td>
</tr>
</tbody>
</table>
|                                             | BIOL 361, 366, 430, 433, 435, 484, 467, 468, 498, 499, 520; BOT 365, 306, 333, 431, 433; EAS 250;  
|                                             | ENT 460; INT D 421; ZOOL 361, 340, 405, 467, 408, 427, 434. |
### Evolutionary Biology

**Year 2**
- BIOCH 220; BIOL 207, 208, 380
- 6 from BOT 201, 210; ENT 220; ZOOL 224, 225, 250
- 3 from BOT 240; ENT 321; ZOOL 241, 242
- 3 Arts option
- 6 Approved options

**Year 3 and 4**
- BIO 321, 335, 420, 435
- 3 from BOT 411; PALEO 318, 319
- 3 from BIOL 331, BOT 352, ZOOL 332
- 6 from BOT 302, 305, 306, 320; ZOOL 224, 405, 407, 408, 427; ENT 280; MICRB 265
- 9 Arts options
- 12 from list below
- 15 Approved options

Recommended options include, but are not restricted to the following:
- BIO 331, 430, 433, 498, 499, 520; BOT 250, 303, 309, 409, 431, 504, 505, 506, 511; ENT 321, 378; EAS 101, 203, 230; MA SC 410, 412, 420, 430, 440, 445; PALEO 520; ZOOL 302, 303, 340, 352, 354, 355, 434, 472; PHYS 100 or 108

Note: A minimum grade of 6 is required in MICRB 265 in order to stay in Microbiology Honors program.

### Microbiology

**Year 2**
- BIOCH 203, 205; BIOL 201, 207; GENET 270; MICRB 265
- 6 Science options
- 6 Arts options

**Year 3 and 4**
- BIO 208; CHEM 211, 213; MICRB 311, 313
- 6 Arts options
- 12 MICRB options (List A)
- 12 Science options (List A or B)
- 15 Approved options (List A, B or C)

Note: A minimum grade of 6 is required in MICRB 311 in order to stay in Microbiology Honors program.

Recommended options include, but are not restricted to the following:
- A. Microbiology options:
- B. Science options:
  - BIOCH 410, 420, 430, 441, 450, 455, 460; BOT 390, 398, 399, 400, 406; CHEM 271, 273, 303, 361, 363; CMPUT 101 or 114; ENT 378; GENET 275, 391, 392, 404, 486; PHYS 100, 101; ZOOL 352, 452.
- C. Approved options:
  - BIO 380; BOT 380, 382, 383; CELL 300, 301; EAS 201, 203; PHYS 210; PSYCO 104; SOILS 210, 430. (Some of these approved options actually count as science courses, see §164).

### Molecular Genetics

**Year 2**
- BIOCH 203, 205; BIOL 207, 208; CHEM 102; GENET 270, 275; MICRB 265
- 6 Arts Options

**Year 3 and 4**
- BIO 201, 380; GENET 301, 302, 304, 390
- 3 from GENET 364, 408, 412, 418, 420
- 6 Arts options
- 12 Approved options
- 12 from list below

Recommended options include, but are not restricted to the following:

Note: GENET 270 and 275 must be taken during the second year to permit completion of the program in four years.

### Physiology and Developmental Biology

**Year 2**
- BIOCH 203, 205; BIOL 201, 207, 208; ZOOL 225, 241, 242, 250
- 3 Science option

**Year 3 and 4**
- ZOOL 302, 303, 344
- 3 from ZOOL 402 or 441 or 442
- 12 Arts options
- 12 Approved options
- 24 from list below

Recommended options include, but are not restricted to the following:

### Plant Biology

**Year 2**
- BOT 201, 210, 240; BIOCH 220; BIOL 207, 208; CHEM 102; CHEM 183 or 263
- 3 Arts option
- 3 Science option

**Year 3 and 4**
- BIOL 201; BOT 250, 303, 309, 320, 332; MICRB 265
- 3 GENET
- 9 Arts options
- 9 Approved options
- 18 Senior Botany Courses
163.3 Industrial Internship Program

The Department of Biological Sciences offers an educational opportunity for students to augment their program of study with a period of paid, discipline-related work in cooperating organizations. An Industrial Internship Program is offered for students in the Specialization or Honors programs in Biological Sciences. Only students who are in good standing in the Specialization or Honors program, and who are Canadian citizens or hold landed immigrant status in Canada, are eligible to compete for places in these programs. The Industrial Internship designation will appear on the diplomas of students who have participated in the program.

The Industrial Internship stream extends a student’s program of study by one academic year. Students approved to enter this stream register for a continuous sequence of WKEXP courses 941 through 943. During the program, students are considered full-time students of the University.

**Note:** The first four months of the internship are a trial period after which the student or the employer may opt out of the program. WKEXP 941–943 are 0 credit courses graded on a credit/no credit basis and recorded on the student’s transcript. The graduation requirements for the Industrial Internship program designation include successful completion of at least WKEXP 941 and 942 plus BIOL 400 Industrial Internship Practicum. BIOL 400 must be taken in the first term immediately following WKEXP 942 or 943.

The table below shows the normal sequence of courses for the Industrial Internship. Students registered in the Industrial Internship program are helped to find suitable Internship employment. Placements are based on the employer’s selection. There is no guarantee that all qualified students can be placed. Interested students should see the Industrial Internship program coordinator in the Department of Biological Sciences for more information.

**Industrial Internship Stream**

<table>
<thead>
<tr>
<th>Year 4</th>
<th>Course</th>
<th>Year 5</th>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>WKEXP 941</td>
<td>Fall</td>
<td>Courses + BIOL 400</td>
</tr>
<tr>
<td>Winter</td>
<td>WKEXP 942</td>
<td>Winter</td>
<td>Courses</td>
</tr>
<tr>
<td>Summer</td>
<td>WKEXP 943</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

163.3.7 General Program in Biological Sciences

A major or a minor area of concentration in the Biological Sciences is available in the BSc General program. Courses which may be used toward a Biological Sciences major or minor include BIOL; BOT; ENT; GENET; MA SC; MICROB; PALEO; ZOOL: CELL 300, 301; INT D 224, 371, 372, 421, 452, 455; MIMI 351, 352; NU FS 363; PHYSL 210, 372, 401, 404, 410; PMCOL 201, 305, 331, 333, 336, 371, 392, 403, 409, 412, 415.

Courses in Biochemistry (see 164.2) may be used for a concentration in Biological Sciences or Physical Sciences but not for both.

The following previously offered courses may be used for a concentration in Biological Sciences: BOT 199, ENT 120, GENET 197, MICROB 193, and ZOOL 120.

The following previously offered courses may not be used for a concentration in Biological Sciences: BIOL 110, BOT 130, GENET 165, and PMCOL 101.

**Note:** Effective September 1996, it is not possible to combine a major or minor in the Biological Sciences with a minor or major in one of the specific subject disciplines in the Biological Sciences. For example, students may not select a major in the Biological Sciences and a minor in Microbiology. Students who choose Biological Sciences as a subject of concentration should consult the Department of Biological Sciences or the Faculty of Science Student Services Office.

163.4 Cell Biology

163.4.1 Honors in Cell Biology

Continuation in the Honors Cell Biology program requires a minimum GPA of 6.5 in the preceding Fall/Winter. Graduation requires a minimum GPA of 6.5 on the last 120 credited to the degree.

**Year 1**

CHEM 161/163
CHEM 101/102
MATH 113 or 114, and 115
BIOL 107, 108
*6 in an Arts option (English 101 recommended)*

**Year 2**

BIOL 201
BIOD 203/205
PHYS 100, 101
GENET 270
BIOL 207, 208
MICROB 265
*3 in an Arts option*

163.4.2 Specialization in Cell Biology

Continuation in the Specialization Cell Biology program requires a minimum GPA of 6.0 in the preceding Fall/Winter. Graduation requires a minimum GPA of 6.0 in all courses credited to the degree.

**Year 1**

CHEM 161/163
CHEM 101/102
MATH 113 or 114, and 115
BIOL 107, 108
*6 in an Arts option (English 101 recommended)*

**Year 2**

BIOL 201
BIOD 203/205
PHYS 100, 101
GENET 270
BIOL 207, 208
MICROB 265
*3 in an Arts option*

163.5 Chemistry

163.5.1 Honors in Chemistry

Honors students in Chemistry must take a core of Chemistry and auxiliary courses. The core consists of 42 credits in Chemistry courses, 12 in Mathematics courses, 9 in Physics courses, and 18 in Arts courses. In addition to the core courses, honors students must complete at least six 3 credits in senior courses in Chemistry. Four of these must be from Group A and the other two from either Group A or Group B. Finally, the honors student must include seven 3 credits in discipline-related work in cooperating organizations. An Industrial Internship for students to augment their program of study with a period of paid, discipline-related work in cooperating organizations.

Continuation in the Honors Chemistry program requires a GPA of 6.5 in the preceding Fall/Winter. Graduation requires a minimum GPA of 6.0 on the last 30 credits.
The Department of Chemistry may approve variations in the above program on application.

163.5.2 Specialization in Chemistry

The complete Specialization program consists of 120 and must include CHEM 101, 102, 161 (or 261), 163, (or 263), 211, 213, 241, 271, 273, 341, 361, 363, 381, 383; PHYS 100, 102, 230; MATH 113 (or 114), 115, 214, 215; *6 in junior English or *3 in English and *3 in Arts option, *12 in Arts options, and *39 in approved options. These options are normally chosen from within the Faculty of Science. All options must be selected in consultation with the Department of Chemistry. The honors curriculum can be used as a guide in planning a specialization program.

Continuation in the Specialization in Chemistry program requires a GPA of 5.5 on all Chemistry courses and a GPA of 5.5 on all courses beyond the first 30. Graduation requires a minimum GPA of 5.5 on the last 90 credits to the degree.

163.5.3 Industrial Internship Program

The Department of Chemistry offers an Industrial Internship program for students in the Honors or Specialization programs. Eligible students must have good standing in their program and be Canadian citizens or permanent residents. In May, after completing Year 3, students spend one year in paid employment. The Department provides interested students with approved job descriptions. Interviewing students and final selection is the company’s responsibility. At the end of the first three months of employment, the placement is reviewed by the employer, the student, and the Program Advisor. If all parties are satisfied, the employment continues for nine more months, and the Program Advisor maintains contact at approximately three-month intervals with the student and the person designated by the employer to be responsible for the student’s progress. This arrangement ensures satisfaction on all sides. Although the student and employer may choose to keep the association for the four summer months following the internship, this stage is not part of the formal Internship program. If the review shows the situation is not satisfactory, the internship is terminated and the student may return to classes in September to complete Year 4. In this way, the student’s academic program is not delayed.

During the final eight months of the work experience, the students register in work experience (WKEXP) courses in the Fall/Winter and are considered full-time students at the University. The first four months of the work experience (the “trial period”) do not appear on the student’s transcript. These courses have no weight and are graded credit or no credit. CHEM 400 (*3), graded on the normal 9-point grading scale, comprises the academic component of the Internship program. In the Fall term immediately following the third month of employment, each student submits a report to the Program Advisor describing the project(s) undertaken and makes an oral presentation to the Program Committee. If required by the employer, the employer’s report or oral presentation may be confidential. The employer also assesses the student’s performance during the work term. Based on these reports and the presentation, the Program Committee awards the student a grade in CHEM 400. A student must successfully complete WKEXP 401, 402, CHEM 400, and the final year of their academic program to graduate with an Honors or Specialization Degree in Chemistry with the Industrial Internship designation on their degree certificate.

It will not be possible to guarantee that all students wishing to do an internship will be able to do so. However, the Department will make every effort to find suitable employment for those students wishing to take part in the program. Interested students should contact the Department of Chemistry for further information.

Courses Related to the Industrial Internship Programs

<table>
<thead>
<tr>
<th>Year 4</th>
<th>Course</th>
<th>Weight</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>WKEXP 401</td>
<td>0</td>
<td>CR/F</td>
</tr>
<tr>
<td>Winter</td>
<td>WKEXP 402</td>
<td>0</td>
<td>CR/F</td>
</tr>
<tr>
<td>Spring/Summer</td>
<td>WKEXP 403</td>
<td>0</td>
<td>CR/F</td>
</tr>
</tbody>
</table>

163.5.4 Concentration in Chemistry

Students in the BSc General program with a major in Chemistry should complete CHEM 100, 102, 161 (or 261), 163 (or 263); MATH 113 (or 114), 115, and *6 of junior physics during the first two years of their programs. CHEM 101, 102, MATH 113 (or 114) and 115 should be taken in Year 1 because these provide maximum flexibility for course selection in Year 2 and subsequent years of the program. To complete a major in Chemistry, students should select from the following senior courses: CHEM 211, 213, 271, 273, 331, 332, 361, 363, 375 and 313. Students majoring in Chemistry should consult the Chemistry Department Advisor before registering in second and later years of the program to plan a course of study and have their programs approved by the Advisor.

Students in the BSc General program with a minor in Chemistry should include CHEM 101, 102, 161 (or 261), and 163 (or 263) in their program. Other Chemistry courses to complete the minor may be selected from CHEM 211, 213, 271, 273, 303, 313, 332, 361, 363, and 375.

163.5.5 Certificate of Specialization After a BSc Degree

All outstanding requirements of the Specialization Degree must be completed with an average of 5.5 or higher in all chemistry courses taken after the general degree. See 163.13.

163.6 Computing Science

For admission requirements, see §15.16. The Computing Science program has a limit on enrolment in the second year. Senior Computing Science courses (300- and 400-level) are restricted to third- and fourth-year Science Honors and Specialization students.

163.6.1 Honors in Computing Science

Continuation in the Honors program requires a GPA of at least 6.5 in the preceding Fall/Winter. Graduation requires a GPA of at least 6.5 on the last 90 credits to the degree and at least 6.5 on the last 60 credits to the degree.

Students must obtain departmental guidance in developing their program. All course selections and changes require approval by a departmental advisor.

Students should use the required Arts and approved options in Year 2 to build a foundation in disciplines related to Computing Science. Suggested programs of study in arts, business, electrical engineering, any applied mathematics are available from the Department.

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Course</th>
<th>Weight</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMPUT 201, 204, 229, 291</td>
<td></td>
<td>0</td>
<td>CR/F</td>
</tr>
<tr>
<td>MATH 120, 214 (or 217), 215</td>
<td></td>
<td>0</td>
<td>CR/F</td>
</tr>
<tr>
<td>STAT 221</td>
<td></td>
<td>0</td>
<td>CR/F</td>
</tr>
<tr>
<td>*3 in an Arts option</td>
<td></td>
<td>0</td>
<td>CR/F</td>
</tr>
<tr>
<td>*3 in an approved option</td>
<td></td>
<td>0</td>
<td>CR/F</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year 3</th>
<th>Course</th>
<th>Weight</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMPUT 301, 304, 325, 379, 391</td>
<td></td>
<td>0</td>
<td>CR/F</td>
</tr>
<tr>
<td>MATH 128 or 223</td>
<td></td>
<td>0</td>
<td>CR/F</td>
</tr>
<tr>
<td>STAT 222</td>
<td></td>
<td>0</td>
<td>CR/F</td>
</tr>
<tr>
<td>*3 in an Arts option</td>
<td></td>
<td>0</td>
<td>CR/F</td>
</tr>
<tr>
<td>*3 in an approved option</td>
<td></td>
<td>0</td>
<td>CR/F</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year 4</th>
<th>Course</th>
<th>Weight</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMPUT 366, 418 or 419, 417, 474, and at least 3 in CMPUT at the 300-level or higher</td>
<td></td>
<td>0</td>
<td>CR/F</td>
</tr>
<tr>
<td>*3 in approved options</td>
<td></td>
<td>0</td>
<td>CR/F</td>
</tr>
<tr>
<td>*6 in approved Science options</td>
<td></td>
<td>0</td>
<td>CR/F</td>
</tr>
<tr>
<td>*3 in an Arts option</td>
<td></td>
<td>0</td>
<td>CR/F</td>
</tr>
</tbody>
</table>

Notes:
(1) Honors students should take the Honors version of the Mathematics courses beginning in the first year.
(2) Honors students must take CMPUT 485 (Honors Seminar) during their degree program.

163.6.2 Specialization in Computing Science

Continuation in the Specialization program requires a GPA of at least 6.0 in the preceding Fall/Winter. Graduation requires a GPA of at least 6.0 on the last 90 credits to the degree.
The program gives students freedom to pursue specialized areas of interest in Computing Science and in other disciplines. Students should use the required Arts and approved option in Year 2 to build a foundation in disciplines related to Computing Science. Suggested programs of study in arts, business, electrical engineering, and applied mathematics are available from the Department. Students develop coherent programs in these and other applications areas with the assistance of the departmental advisor. Course selections in other departments and Faculties may be subject to enrolment management and GPA requirements.

### 163.6.3 Specialization in Computing Science—Minor in Business

**Note:** Requirements for the BSc Specialization program set out in §163.1.2 must be met.

Students who have been admitted to the Business minor and who maintain a minimum GPA of 6.0 in each Fall/Winter in the Specialization Computing Science program may continue with the designation "pursuing a Business Minor within Specialization Computing Science." Students who withdraw from the Specialization Computing Science program lose their status as "pursuing a Business Minor Within Specialization Computing Science." Should such students be admitted to the BSc General program and wish to pursue a Business minor within the BSc General program, they must reapply to the Business-Science Quota Committee for admission to the Business minor.

The Business minor in Computing Science consists of the following:

1. **ECON** 101, 102
2. **ACCTG** 311
3. **ORG A** 301
4. Two of **FIN** 301, **MARK** 301, **MGTSC** 352, and **ORG A** 321
5. A minimum of 6 in courses offered by the Faculty of Business and approved by the student's advisor

To graduate with the designation "Specialization in Computing Science with a Minor in Business," students must achieve a minimum GPA of 5.5 on all Business courses contributing to the minor. This calculation does not include the two economics courses.

### 163.6.4 Industrial Internship Program

The Department of Computing Science offers an Industrial Internship program (IIP) allowing students to augment their studies with periods of paid, discipline-related work at approved, cooperating corporations. Only students who are in good standing in the Specialization or Honors program, and who are Canadian citizens or hold landed immigrant status in Canada, are eligible to compete for places in this program.

The IIP Stream extends a student’s program of study by one academic year. To receive Industrial Internship designation on their degree certificate, students must complete a 12- or 16-month work experience term at the end of their third year. University of Alberta students are registered as full-time, off-campus during their internship period. Students approved to enter this stream are registered by the Department of Computing Science in WKEXP 921. The graduation requirements for the IIP stream designation include successful completion of WKEXP 921, 922, and 923, which are 0 credit courses. A grade of credit/fail will appear on the student's transcript for these courses. Students who have completed between four and eight months of the IIP may be given credit, if appropriate, for WKEXP 921. The graduation requirements for the IIP stream designation include successful completion of WKEXP 921, 922, and 923, plus CMPUT 400 (Industrial Internship Practicum). CMPUT 400 must be taken in the first term immediately following completion of their work experience year.

The table below illustrates the normal sequence of the required courses for the Industrial Internship stream of the Specialization and Honors programs.

#### Courses Related to the Industrial Internship Programs

**Year 2**
- **Fall:** Courses
- **Winter:** Courses

**Year 3**
- **Fall:** Courses
- **Winter:** Courses
- **Summer:** n/a

**Year 4**
- **Fall:** Courses
- **Winter:** Courses
- **Summer:** n/a

**Year 5**
- **Fall:** Courses
- **Winter:** Courses

### 163.6.5 BSc General—Computing Science Minor

The Computing Science minor requires between 24 and 38 in Computing Science, with a maximum of 18 at the 100-level. In addition, at least 6 must be at the 300-level or above.

The typical program will include the following:
- CMPUT 114/115 or 101/102/115 (see Note); CMPUT 272; CMPUT 201; CMPUT 204; CMPUT 291; CMPUT 3xx; CMPUT 3xx; plus up to three further CMPUT 3xx or 4xx as desired.

**Note:** Students without previous computing experience will require an extra 3 of Computing (101/102/115); students with previous experience are encouraged to complete 114/115.

### 163.6.6 BSc Program in Computer Engineering

A four-year program in Computer Engineering is offered jointly by the Faculty of Science and the Faculty of Engineering (see §72.5). For administrative purposes, students in the program will be registered in the Faculty of Engineering.

See admission requirements in §15.6.

Promotion and Graduation regulations are found in §73.3(2).

### 163.7 Earth and Atmospheric Sciences

Earth and Atmospheric Sciences encompass the study of the atmosphere, surface and interior of the earth. The Department administers eight academic programs: Honors and Specialization in Atmospheric Sciences, Honors and Specialization in Environmental Earth Science, Honors and Specialization in Geology, Honors in Paleontology, and BA Major in Human Geography. For details on Major and Minor in Human Geography, see Faculty of Arts listing.

#### 163.7.1 Honors in Atmospheric Sciences

Atmospheric science is the study of atmospheric composition, state and motion, from the small scale (e.g., the environment of a single leaf) through medium scales (e.g., a cumulus cloud) to the global scale (global pollution and warming). Most atmospheric scientists in Canada work for Environment Canada, providing weather forecasts or environmental information. Opportunities also arise with provincial governments and in the private sector.

Continuation in the Honors in Atmospheric Sciences program requires a GPA of at least 6.5 on at least 30 in the previous Fall/Winter. Graduation requires a GPA of at least 6.5 on the last 60 credited to the degree.

A student enrolling in the Honors program should consult the Atmospheric Sciences advisor before registration each year.
### 163.7.2 Specialization in Atmospheric Sciences

Continuation in the Specialization in Atmospheric Sciences program requires a GPA of at least 5.5 on at least 27 in the previous Fall/Winter. To graduate in four years, a student needs 30 per year.

Graduation requires a GPA of at least 5.5 on the last 60 credited to the degree.

A student enrolling in the Specialization program should confer with the Atmospheric Sciences program student advisor before registration each year.

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAS 101 and 102</td>
<td>ENGL 101</td>
</tr>
<tr>
<td>CHEM 101 and 102</td>
<td>MATH 110 or 111</td>
</tr>
<tr>
<td>MAT 113 or 114 and 115</td>
<td>MAT 120 or 125</td>
</tr>
<tr>
<td>PHYS 100 and 101</td>
<td>PHYS 244 and 281</td>
</tr>
</tbody>
</table>

### 163.7.3 Honors in Environmental Earth Sciences

Environmental Earth Science is the study of interactions between humans and Earth's natural environment. It encompasses the influence of human activities on the local and global environment, as well as how our actions are shaped and controlled by the geologic and geomorphic processes occurring around us. Environmental Earth Scientists are typically employed by consulting companies, large resource and industrial firms, and government organizations.

Continuation in the Honors in Environmental Earth Sciences program requires a GPA of at least 5.5 on at least 27 in the previous Fall/Winter.

Graduation requires a GPA of at least 6.5 on the last 60 credited to the degree.

A student enrolling in the Honors program should confer with the Environmental Earth Sciences Program student advisor before registration each year.

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAS 101 and 102</td>
<td>ENGL 101</td>
</tr>
<tr>
<td>CHEM 101 and 102</td>
<td>MATH 110 or 111</td>
</tr>
<tr>
<td>MAT 113 or 114 and 115</td>
<td>MAT 120 or 125</td>
</tr>
<tr>
<td>PHYS 100 and 101</td>
<td>PHYS 244 and 281</td>
</tr>
</tbody>
</table>

### 163.7.4 Specialization in Environmental Earth Sciences

Continuation in the Specialization in Environmental Earth Sciences program requires a GPA of at least 5.5 on at least 27 in the previous Fall/Winter. To graduate in four years, a student needs 30 per year.

Graduation requires a GPA of at least 5.5 on the last 60 credited to the degree.

A student enrolling in the Specialization program should confer with the Environmental Earth Sciences Program student advisor before registration.

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAS 101 and 102</td>
<td>ENGL 101</td>
</tr>
<tr>
<td>CHEM 101 and 102</td>
<td>MATH 110 or 111</td>
</tr>
<tr>
<td>MAT 113 or 114 and 115</td>
<td>MAT 120 or 125</td>
</tr>
<tr>
<td>PHYS 100 and 101</td>
<td>PHYS 244 and 281</td>
</tr>
</tbody>
</table>

### 163.7.5 Honors in Geology

Geology is the study of the planet Earth—the materials it is made of, the processes which affect these materials, and the origin and evolution of life. Geologists are employed by companies engaged in exploration for and production of minerals and fuels, by government agencies, by companies engaged in engineering and environmental projects, and by universities.

Continuation in the Honors in Geology program requires a GPA of 6.5 on at least 27 in the previous Fall/Winter.

Graduation requires a minimum GPA of 6.5 on the last 60 credited to the degree.

A student enrolling in the Honors program should confer with the Geology program student advisor before registration each year.

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAS 101 and 103</td>
<td>ENGL 101</td>
</tr>
<tr>
<td>CHEM 101 and 102</td>
<td>MATH 110 or 111</td>
</tr>
<tr>
<td>MAT 113 or 114 and 115</td>
<td>MAT 120 or 125</td>
</tr>
<tr>
<td>PHYS 100 and 101</td>
<td>PHYS 244 and 281</td>
</tr>
</tbody>
</table>

### 163.7.6 Specialization in Geology

Continuation in the Specialization in Geology program requires a GPA of at least 5.5 on at least 27 in the previous Fall/Winter. To graduate in four years, a student needs 30 per year.

Graduation requires a GPA of at least 5.5 on the last 60 credited to the degree.

A student enrolling in the Specialization program should confer with the Geology program student advisor before registration each year.
### 163.7.7 Professional Association

The practice of geology in Alberta is governed by provincial law and regulated by the Association of Professional Engineers, Geologists, and Geophysicists of Alberta (APEGGA). In the interest of public protection, the right to practise geology in Alberta and accept professional responsibility for geological work, as well as the right to use the title of Professional Geologist (PGeo), is limited to people registered by APEGGA.

Members of the PS Warren Society, the geology student society, are automatically student members of APEGGA and as such are introduced to the professional association. To meet the requirements of full registration, acceptable academic training and four years of full-time experience as a geologist-in-training following graduation are needed.

Students should plan their course program to meet the requirements for professional registration, in particular, the Science course requirements additional to calculus, introductory Physics, and introductory Chemistry. The Specialization in Geology and the Honors in Geology degrees can be accepted by APEGGA as satisfying the academic requirements if courses are chosen to cover the APEGGA syllabus. Holders of degrees that do not cover the APEGGA syllabus may be required, through the APEGGA Board of Examiners, to meet additional academic requirements before being accepted for registration.

Current syllabus and registration information is available in the Departmental Office or from APEGGA.

### 163.7.8 Honors in Paleontology

See §163.14, Paleontology, for details on the Honors in Paleontology program.

### 163.7.9 Industrial Internship Program

The Industrial Internship program (IIP) offers undergraduate students extended work experience in industry in addition to their academic courses. The 12- to 16-month work experience is undertaken after completion of the third year and consequently graduation is delayed by a full year. The program includes a four-month probationary appointment, normally from May to August, after which all parties involved decide whether to proceed with the additional 8- to 12-month program. Following completion of the work experience, students return to the department for their fourth year of studies. Work during the internship period is full time, for which the student is paid by the employer at competitive rates. Students in the BSc Honors and Specialization Programs in the Department of Earth and Atmospheric Sciences, who have completed three years of their program, have maintained good academic standing, and are Canadian citizens or permanent residents are eligible for the program. In the fall term of the student’s third academic year, the IIP Advisor provides approved position descriptions from companies wishing to employ IIP students. Companies are responsible for interviewing and final selection of the students for the positions. Student participation in the program is voluntary, but it is not possible to guarantee that all students wishing to do an internship will be able to do so.

During the Fall and Winter terms of the work experience, the student registers in WKEXP 411 and WKEXP 412 and is considered a full-time student at the University of Alberta. If the student’s work experience is 16 months in duration the student should enrol in WKEXP 413 offered during Spring/Summer (May-August). The work experience courses have no weight and are graded credit/no credit. In the Fall term immediately following the completion of the internship, each student submits a report to the Program Advisor and the Program Committee describing the project(s) undertaken, and makes an oral presentation to the department. If required by the employer, the report and oral presentation may be classified confidential, and, in that case, only the program committee attends the presentation. A written report from the employer is also used to assess the student’s performance during the work period. Based on the reports and presentation, the Program Committee awards the student a grade in EAS 401. A student must successfully complete WKEXP 411, WKEXP 412, WKEXP 413, EAS 401 and the final year of their academic program to graduate with an Honors or Specialization Degree in Earth and Atmospheric Sciences in the Industrial Internship program.

### Courses Related to the Industrial Internship Program

#### Year 4

<table>
<thead>
<tr>
<th>Course</th>
<th>Weight</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>WKEXP 411</td>
<td>0</td>
<td>CR/F</td>
</tr>
<tr>
<td>WKEXP 412</td>
<td>0</td>
<td>CR/F</td>
</tr>
<tr>
<td>WKEXP 413</td>
<td>0</td>
<td>CR/F</td>
</tr>
</tbody>
</table>

#### Year 5

<table>
<thead>
<tr>
<th>Course</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAS 401</td>
<td>3</td>
</tr>
</tbody>
</table>

**Notes:** Recommended Arts options include EAS 190, 191, 198, 290, 291, 390, 391, 392, 491, 493; for students in the Industrial Internship program: EAS 401, WKEXP 411, WKEXP 412, WKEXP 413.

### 163.8 Environmental Physical Sciences

#### 163.8.1 Specialization in Environmental Physical Sciences

Continuation in the Specialization in the Environmental Physical Sciences program requires a minimum GPA of 5.5 in the preceding Fall/Winter. Graduation requires a minimum of GPA of 5.5 on the last 90 credited to the degree.

#### Year 1

<table>
<thead>
<tr>
<th>Course</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 101</td>
<td>1.5</td>
</tr>
<tr>
<td>MATH 113</td>
<td>1.5</td>
</tr>
<tr>
<td>MATH 115</td>
<td>1.5</td>
</tr>
<tr>
<td>PHYS 100</td>
<td>1.5</td>
</tr>
<tr>
<td>PHYS 101</td>
<td>1.5</td>
</tr>
<tr>
<td>EAS 102</td>
<td>1.5</td>
</tr>
<tr>
<td>6 in English (ENGL 101 recommended)</td>
<td></td>
</tr>
</tbody>
</table>

#### Year 3

<table>
<thead>
<tr>
<th>Course</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEOPH 227</td>
<td>3.0</td>
</tr>
<tr>
<td>EAS 220</td>
<td>3.0</td>
</tr>
<tr>
<td>PHYS 102</td>
<td>3.0</td>
</tr>
<tr>
<td>CHEM 101</td>
<td>3.0</td>
</tr>
</tbody>
</table>

**Notes:**

1. In lieu of EAS 220, an approved course in computation, computing, or statistics may be taken.
2. If any of these courses are taken in Arts options or approved Science or other options, see Notes 2 and 3.
3. Additional 8- to 12-month program. Following completion of the work experience, students return to the department for their fourth year of studies.

### Year 4

<table>
<thead>
<tr>
<th>Course</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 101</td>
<td>1.5</td>
</tr>
<tr>
<td>MATH 113</td>
<td>1.5</td>
</tr>
<tr>
<td>MATH 115</td>
<td>1.5</td>
</tr>
<tr>
<td>PHYS 100</td>
<td>1.5</td>
</tr>
<tr>
<td>PHYS 101</td>
<td>1.5</td>
</tr>
<tr>
<td>EAS 102</td>
<td>1.5</td>
</tr>
<tr>
<td>6 in English (ENGL 101 recommended)</td>
<td></td>
</tr>
</tbody>
</table>

#### Year 5

<table>
<thead>
<tr>
<th>Course</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 101</td>
<td>1.5</td>
</tr>
<tr>
<td>MATH 113</td>
<td>1.5</td>
</tr>
<tr>
<td>MATH 115</td>
<td>1.5</td>
</tr>
<tr>
<td>PHYS 100</td>
<td>1.5</td>
</tr>
<tr>
<td>PHYS 101</td>
<td>1.5</td>
</tr>
<tr>
<td>EAS 102</td>
<td>1.5</td>
</tr>
<tr>
<td>6 in Arts options or approved Science or other options</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**

1. In lieu of EAS 220, an approved course in computation, computing, or statistics may be taken.
2. If any of these courses are taken in Arts options or approved Science or other options, see Notes 2 and 3.
3. Additional 8- to 12-month program. Following completion of the work experience, students return to the department for their fourth year of studies.

### 163.8.2 Industrial Internship Program

The Environmental Physical Sciences program offers an Industrial Internship Program which allows students to augment their undergraduate degree with approved work experience in industry. Students in the BSc Honors and Specialization Programs in the Department of Earth and Atmospheric Sciences, who have maintained good academic standing, and who are Canadian citizens or permanent residents are eligible to compete for places in the IIP. Employment will begin in May after completion of Year 3. After three months of employment, the Internship will be reviewed by the employer, and the IIP Coordinator will maintain contact periodically with the student and the person designated by the employer to supervise the student to ensure satisfaction on all sides for the remainder of the work term. If the review shows the situation is not satisfactory, the Internship is terminated and the student may return to classes in September to complete Year 4. In this way, the completion of the student’s academic program is not delayed.

During the Fall/Winter, a student in the IIP will register in work experience courses, WKEXP 421 and 422 and will be considered to be a full-time off-campus student of the University of Alberta. The WKEXP courses are graded credit or no credit. In the Fall term immediately following successful
163.9 Geophysics

The Department of Physics offers two programs dealing with solid earth physics and space physics. The Honors in Geophysics program (see §163.16.2) prepares students for graduate work in geophysics. The Specialization in Geophysics program prepares students with the conceptual and laboratory background required for employment at the BSc level in industry, government and technical schools. Also see §163.16 (Physics).

163.10 Marine Science

Excellent opportunities for the study of marine biology and related subjects exist at Bamfield Marine Station (BMS) on Vancouver Island, BC. An academic program operates at the station, in which summer study will provide credit toward degrees in Science. 

Prerequisite for all the MA SC courses is consent of the Department of Biological Sciences.

Students are expected to take a full course load of 15 credits during the fall term. Courses run Monday to Saturday.

A refundable deposit of $1000 is payable at the time of application. An extension fee of $1000 must be paid on arrival at BMS to cover the cost of field trips, lab supplies and course materials. 

There is a mandatory room and board charge of $1840 for the 13 weeks. Information concerning course prerequisites and application procedures for Marine Science may be obtained from the Department of Biological Sciences or the Office of the Dean of Science. Permission to register in these courses is available from the Director of the Bamfield Marine Station, to whom application should be made.

See §201 Course Listings for descriptions of available Marine Science courses.

163.11 Mathematics

163.11.1 Honors in Mathematics

Continuation in the Honors in Mathematics program requires a minimum GPA of 6.5 in the preceding Fall/Winter. Graduation requires a minimum GPA of 6.5 on 30 credits in each Fall/Winter.

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Years 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 117, 118, 125, 228</td>
<td>MATH 217, 225, 317, either 229 or 336</td>
<td>30 in Mathematics courses</td>
</tr>
<tr>
<td>3 in a Computing Science option</td>
<td>6 in approved Science options</td>
<td>6 in approved Science options</td>
</tr>
<tr>
<td>3 in an approved Science option</td>
<td>6 in approved Science options</td>
<td>6 in approved Science options</td>
</tr>
<tr>
<td>6 in approved Arts options</td>
<td>6 in approved Arts options</td>
<td>18 in approved options</td>
</tr>
<tr>
<td>6 in approved options</td>
<td>6 in approved options</td>
<td>6 in approved options</td>
</tr>
</tbody>
</table>

The program must include MATH 229, 336, 411, 417, 418, 426, 427, 447, 496; two of MATH 324, 347, 373, 412, 421, 486; one of MATH 325 or 329; and either MATH 446 or 448.

The Honors Seminar, MATH 496, should normally be taken in the fourth year. Note that several of the required courses are only given in alternate years.

Honors in Applied Mathematics

Continuation in the Honors in Applied Mathematics program requires a minimum GPA of 6.5 in the preceding Fall/Winter. Graduation requires a minimum GPA of 6.5 on 30 credits in each Fall/Winter.

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Years 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 117, 118, 125, either 229 or 229</td>
<td>MATH 217, 225, 317, 336</td>
<td>21 in Mathematics courses</td>
</tr>
<tr>
<td>3 in a Computing Science option</td>
<td>6 in approved Science options</td>
<td>12 in approved options at the 300-level in the field of application</td>
</tr>
<tr>
<td>3 in an approved Science option</td>
<td>6 in approved Science options</td>
<td>3 in an approved 300- or 400-level Mathematics and/or Mathematical Physics option</td>
</tr>
<tr>
<td>6 in approved Arts options</td>
<td>6 in approved options</td>
<td>12 in approved Science options</td>
</tr>
<tr>
<td>6 in approved options</td>
<td>6 in approved options</td>
<td>6 in approved options</td>
</tr>
</tbody>
</table>

The program must include the third and fourth years: MATH 337, 411, 417, 436, 486, 496; one of MATH 373 or 421. The Honors Seminar, MATH 496, should normally be taken in the fourth year. Note that several of the required courses are only given in alternate years.

Minor in Statistics

The degrees in Mathematics and Honors in Applied Mathematics can each be obtained with a minor in Statistics if the student’s program includes STAT 265, 268, 376, 396, 471, and two of STAT 368, 441, 472, 479.

Minor in Computing Science

The degrees in Mathematics and Honors in Applied Mathematics can each be obtained with a Minor in Computing Science. The student’s program must include COMP 114, 115, 201, 204, 272, 280, 285, 291, and at least 12 in Computing Science at the 300- or 400-level chosen with approval of both the Computing Science Department Honors Advisor and the Mathematical Sciences Department Honors Advisor.

The Department also offers a BA Honors in Mathematics (see §43.16.1).

Honors in Mathematical Physics

See §163.16.3 for details.

163.11.2 Specialization in Actuarial Science—Business Minor

Continuation in the program requires successful completion of at least 24 in the previous Fall/Winter with a GPA of at least 5.5, and a GPA of at least 5.5 on all MATH, ECON, and STAT courses in that Fall/Winter. Graduation requires a GPA of at least 5.5 on all courses credited toward the degree and a GPA of at least 5.5 on all MATH, FIN, ECON and STAT courses credited toward the degree. 

The program must contain the following courses. It is recommended that these courses be taken in the years indicated as follows:

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMPUT 101, 102 or 114, 115</td>
<td>ECON 101</td>
<td>ACCTG 311</td>
<td>STAT 453, 466, 471, 479</td>
</tr>
<tr>
<td>MATH 114, 115</td>
<td>MATH 125</td>
<td>FIN 301</td>
<td>9 options to be chosen from FIN 412, 413, 414, 416 and ACCTG 413</td>
</tr>
<tr>
<td>STAT 141 or 151</td>
<td>MATH 125</td>
<td>MATH 353, 354</td>
<td>9 options</td>
</tr>
<tr>
<td>6 in a junior English</td>
<td>STAT 265, 266</td>
<td>STAT 312, 378</td>
<td>3 in Arts</td>
</tr>
<tr>
<td>3 in Science</td>
<td>MATH 233</td>
<td>3 in Science</td>
<td>3 option</td>
</tr>
<tr>
<td>3 option</td>
<td>STAT 291</td>
<td>3 option from MATH or STAT</td>
<td>9 options</td>
</tr>
<tr>
<td>3 option from MGTSC 352, MARK 301 and ORG A 301</td>
<td>3 option</td>
<td>3 option from MATH or STAT</td>
<td>9 options</td>
</tr>
<tr>
<td>3 option</td>
<td>3 option</td>
<td>3 option</td>
<td>9 options</td>
</tr>
</tbody>
</table>

Notes

(1) Students are strongly encouraged to choose their Business options from the following list of recommended courses: ACCTG 332, 413, 414; FIN 412, 413, 414, 416, 423, 434, 442; MGTSC 352, 404, 405, 422; MARK 301, 412, 422; ORG A 301, 321, 402.
(2) Students are strongly encouraged to choose their other options from the following list of recommended courses: ECON 281, 282, 322, 341, 353, 378; CMPUT 201, 204, 207, 268, 285, 291; MATH 280, 300, 314, 334, 337, 373, 380; STAT 332, 454, 472.

(3) Each student’s program must have the approval of the Department of Mathematical Sciences and must include:
   a. ★18 Arts
   b. At least ★18 and not more than ★24 in Business
   c. ★69 in Science courses, of which ★60 must be MATH and STAT
   d. ★24 MATH and STAT courses at the 300-level or higher

163.11.3 Specialization in Mathematics

Continuation in the program normally requires, in the previous Fall/Winter, successful completion of at least ★24 with a GPA of at least 5.5, and a GPA of at least 5.5 on all Mathematics courses taken in that Fall/Winter. Graduation requires a GPA of at least 5.5 on all courses credited toward the degree and a GPA of at least 5.5 on all Mathematics courses credited toward the degree.

The program must contain the following courses, which should be taken in the years indicated:

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 114, 115</td>
<td>MATH 214, 215</td>
<td>MATH 314/414</td>
<td>MATH 353</td>
</tr>
<tr>
<td>★6 from CMPUT 101, 102 or 114, 115</td>
<td>★6 in approved options</td>
<td>★6 in Mathematics or Statistics courses</td>
<td>★3 in MATH options</td>
</tr>
<tr>
<td>★6 in a junior English</td>
<td>★3 in approved Science option</td>
<td>★6 in approved Science options</td>
<td>★6 in options</td>
</tr>
<tr>
<td>Year 3</td>
<td>Year 4</td>
<td>Year 3</td>
<td>Year 4</td>
</tr>
<tr>
<td>MATH 114, 115</td>
<td>MATH 214, 215</td>
<td>MATH 314/414</td>
<td>MATH 353</td>
</tr>
<tr>
<td>★6 in Science options</td>
<td>★6 in Science options</td>
<td>★12 in a 300- or 400-level Mathematics</td>
<td>★3 in MATH options</td>
</tr>
<tr>
<td>★6 in a junior English</td>
<td>★6 in an Arts option</td>
<td>★6 in approved options</td>
<td>★6 in options</td>
</tr>
<tr>
<td>★9 in an approved option</td>
<td>★12 in approved options</td>
<td>★9 in options</td>
<td>★9 in options</td>
</tr>
</tbody>
</table>

Notes
(1) A student must take ★6 in a Mathematics course in each year of the program.
(2) A corresponding Honors Mathematics course can be substituted for any Mathematics course listed. For example, MATH 117 can be substituted for MATH 114.

163.11.4 Mathematics and Economics

The Faculty of Science offers an Honors degree and a Specialization degree in Mathematics and Economics.

Honors in Mathematics and Economics

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Years 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECON 101, 102</td>
<td>ECON 281, 282</td>
<td>★24 in Economics</td>
</tr>
<tr>
<td>MATH 117, 118, 125, 228</td>
<td>MATH 214, 215</td>
<td>★24 in Mathematics or Statistics courses</td>
</tr>
<tr>
<td>★6 in a junior English</td>
<td>★6 in approved Science options</td>
<td>★6 in approved Science courses</td>
</tr>
<tr>
<td>★6 in Science options</td>
<td>★6 in options</td>
<td>★6 in options</td>
</tr>
</tbody>
</table>

The program must contain MATH 225; ECON 481, 482, 407, 408; and four of MATH 336, 373, 411, 417, 421, 422, 486. Credit is not given for ECON 386, 387, or 399.

Specialization in Mathematics and Economics

Continuation in the program normally requires, in the previous Fall/Winter, successful completion of at least ★24 with a GPA of at least 5.5, and a GPA of at least 5.5 on all Mathematics and Economics courses taken in that session.

Graduation requires a GPA of at least 5.5 on all courses credited toward the degree and a GPA of at least 5.5 on the aggregate of all Mathematics and Economics courses credited toward the degree.

The program must contain the following courses, which should be taken in the years indicated:

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Years 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECON 101, 102</td>
<td>ECON 281, 282</td>
<td>★24 in Economics including either ECON 399 or ECON 407, 408</td>
</tr>
<tr>
<td>MATH 114, 115</td>
<td>MATH 214, 215</td>
<td>★18 in Mathematics</td>
</tr>
<tr>
<td>MAT 115, 125</td>
<td>MATH 225</td>
<td>★18 in options</td>
</tr>
<tr>
<td>★6 in a junior English</td>
<td>★6 in Science options</td>
<td>★3 in option</td>
</tr>
<tr>
<td>★3 in Science options</td>
<td>★6 in options</td>
<td>★6 in options</td>
</tr>
<tr>
<td>Year 3</td>
<td>Year 4</td>
<td></td>
</tr>
<tr>
<td>ECON 101/102</td>
<td>ECON 281</td>
<td></td>
</tr>
<tr>
<td>ECON 281</td>
<td>MATH 214, 215</td>
<td></td>
</tr>
<tr>
<td>MATH 217, 317</td>
<td>MATH 225</td>
<td></td>
</tr>
<tr>
<td>STAT 265, 266</td>
<td>STAT 265 and 266</td>
<td></td>
</tr>
<tr>
<td>★6 in approved Science options</td>
<td>★6 in Science options</td>
<td>★6 in options</td>
</tr>
<tr>
<td>★3 in option</td>
<td>★3 in option</td>
<td></td>
</tr>
</tbody>
</table>

The program must contain at least ★36 in Economics, at least ★36 in Mathematics, and ★6 in Computing Science, chosen from either CMPUT 101, 102 or 114, 115. ★12 in Economics must be chosen from ECON 384, 385, 399 or courses at the 400-level or above. ★12 in Mathematics must be at the 300-level or above. Credit will not normally be given for ECON 299, 386, or 387. Students who are considering graduate work in Economics should take ECON 407 and ECON 408.

Each program must have approval of the Departments of Mathematical Sciences and Economics and must contain a minimum of ★63 in Science.

Notes
(1) A student must take at least ★6 in Mathematics and/or Economics in each year of the program.
(2) A corresponding Honors Mathematics course can be substituted for any Mathematics course listed. For example, MATH 117 can be substituted for MATH 114.

163.11.5 Specialization in Mathematics and Finance

Continuation in the program normally requires, in the previous Fall/Winter, successful completion of at least ★24 with a GPA of at least 5.5, and a GPA of at least 5.5 on the aggregate of all MATH, STATS, ACCTG, ECON, FIN, and MGTSC courses taken in that Fall/Winter.

Graduation requires a GPA of at least 5.5 on all courses credited toward the degree and a GPA of at least 5.5 on the aggregate of all MATH, STATS, ACCTG, ECON, FIN, and MGTSC courses credited toward the degree.

The program must contain the following courses, which should be taken in the years indicated:

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Years 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 114, 115</td>
<td>MATH 214/215</td>
<td>★24 in Economics</td>
</tr>
<tr>
<td>MATH 125</td>
<td>MATH 229</td>
<td></td>
</tr>
<tr>
<td>CMPUT 101, 102 or 114, 115</td>
<td>MATH 233</td>
<td>★24 in Mathematics or Statistics courses</td>
</tr>
<tr>
<td>ECON 101/102</td>
<td>One of MATH 228, 229</td>
<td></td>
</tr>
<tr>
<td>★6 of 300-level Mathematics</td>
<td>★6 in approved Science options</td>
<td>★6 in approved Science options</td>
</tr>
<tr>
<td>★3 in option</td>
<td>★6 in an Arts option</td>
<td>★6 in options</td>
</tr>
<tr>
<td>★9 in an approved option</td>
<td>★12 in approved options</td>
<td>★9 in options</td>
</tr>
</tbody>
</table>

Notes
(1) Approved ACCTG, ECON, FIN and MGTSC options include ACCTG 413; ECON 282, 384, 385, 427, 408, 481, 482, FIN 412, 413, 414, 416, 422, 434, 442; MGTSC 352, 404, 405, 428, 456.
(2) Students should choose some of their MATH and Science options from the following recommended courses: MATH 334, 337, 432, 470; MATH 280, 380; MATH 354; STAT 466, 471, 472, 479.
(3) Each program must have the approval of the Department of Mathematical Sciences and must include:
   a. ★18 in Arts Courses;
   b. ★63 in Science courses, including ★36 of MATH with at least ★12 of these at the 300-level or higher;
   c. ★36 in ECON, ACCTG, FIN, or MGTSC, including ★9 of 400-level FIN.
(4) A corresponding Honors Mathematics course can be substituted for any Mathematics course listed. For example, MATH 117 can be substituted for MATH 114.

163.11.6 Industrial Internship Program

The Industrial Internship program gives students who have finished their third year of study in the Department of Mathematical Sciences an opportunity for extended work experience. The program lasts 16 months, and, after completing the reporting requirements, a student can receive university credit for the experience.

A student must successfully complete WKEXP 951, 952, 953, and MATH 400, and the final year of their academic program to graduate with the Industrial Internship designation.

This program should appeal to Mathematics students studying Actuarial Science, Applied Mathematics, Economics, Finance, or Statistics.

Students’ participation in the program is voluntary. Although the Department makes every effort to find suitable employment, it is not possible to guarantee that all interested students can do an internship. Students should contact the Industrial Internship program coordinator in the Department of Mathematical Sciences for further information.

Courses Related to the Industrial Internship Program

| Year 4 Fall | WKEXP 951 | 0 | CR/F |
| Year 4 Winter | WKEXP 952 | 0 | CR/F |
| Year 4 Spring/Summer | WKEXP 953 | 0 | CR/F |
| Year 5 Fall | MATH 400 or STAT 400 | 3 | 9-point |

Note: A corresponding Honors Mathematics course can be substituted for any Mathematics course listed. For example, MATH 117 can be substituted for MATH 114, and MATH 127 can be substituted for MATH 120.
163.12 Neuroscience

163.12.1 Honors in Neuroscience

The Honors program in Neuroscience is an interdisciplinary program coordinated by the Division of Neuroscience and administered by the Faculty of Science. This program is for students planning a career in Neuroscience.

Neuroscience is a broadly based discipline covering all aspects of brain function. Some major areas are brain development, nerve cells and synapses, sensation and perception, learning and memory, control of movement, animal behavior, cognitive psychology, and disorders of the nervous system.

The honors program introduces the major areas of Neuroscience and allows students to explore topics of interest in their final year.

Continuation in the honors program requires a minimum GPA of 7.0 in the preceding Fall/Winter. Graduation requires a minimum GPA of 7.0 or 1.20 contributing to the degree. Each program of study must be approved by the coordinator in the Division of Neuroscience.

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 101, 161 BIOL 197, 198 MATH 113 or 114 MATH 115 or STAT 151 PHYS 108, 101 or PHYS 108, 109 ENGL 101</td>
<td>PMCOL 255, 256 PMCOL 305 PHYSL 210 or 211 PSYCO 104, 275 6 in Science options 3 in an Arts option</td>
</tr>
<tr>
<td>Year 3</td>
<td>Year 4</td>
</tr>
<tr>
<td>PMCOL 371 PHYSL 372 PSYCO 377 ZOOL 342 12 in approved Science options 6 in Arts options</td>
<td>PHYSL 210 or 211 PSYCO 104, 275 6 in Science options 3 in an Arts option</td>
</tr>
</tbody>
</table>

Note: In the fourth year, all students must successfully complete an individual study program with members of the Division of Neuroscience. This program consists of a reading course, NEURO 450, and a laboratory course, NEURO 451. Students must consult the Division of Neuroscience before the beginning of their fourth year to arrange an individual study program.

163.13 Northern Studies

Students interested in Canada’s North and especially those planning a career in northern Canada should include within their curriculum some of the following: ANTHR 246, 340, 355, 445, and 446; BIOL 366; CANST 302 and 408; EAS 453 and 455; ENCS 201; INT D 443; POL S 432. These courses may be taken within the framework of existing General, Specialization, or Honors programs in the Faculty of Science. Students interested in Northern Studies should mention this to their faculty advisor.

163.14 Paleontology

The Honors in Paleontology program is for Honors students in Geology, Zoology, and Anthropology interested in vertebrate and invertebrate paleobiology, including evolution and systematics, historical biogeography, functional morphology and stratigraphic distribution. The program may be entered through the framework of existing programs in the Departments of Earth and Atmospheric Sciences, Biological Sciences, and Anthropology. Interested students should consult their Honors advisor to prepare their programs.

Paleontology is a basic science concerned with the evolutionary history of life and drawing on biological and geological knowledge. Paleontologists usually hold advanced research degrees and work as research scientists and/or teachers in universities, museums, and government and industrial laboratories, in Canada and elsewhere.

Honors in Paleontology

Paleontology introduces at the undergraduate level the fossil history of invertebrate and vertebrate animals, thereby enabling students to secure a core of broad paleontological knowledge for later entry into more specialized postgraduate studies in invertebrate and vertebrate paleontology. The program also provides students with background in ancillary geological and biological sciences relevant to studies in paleontology.

Continuation in the Honors in Paleontology program requires a GPA of 6.5 in the preceding Fall/Winter.

Graduation requires a GPA of 6.5 calculated over the last two years. For First-Class Honors, an average of at least 7.5 is required. In addition, students must pass an oral examination, in their fourth year, on stratigraphic and biologic principles. The examining committee shall consist of three members of the academic staff of Earth and Atmospheric Sciences and/or Biological Sciences.

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 107 and 108 CHEM 101 and 161 or 102 EAS 101 and 103 ENGL 101 MATH 113 or 114 or 120 STAT 151</td>
<td>BIOL 297 and 208 BOT 210 EAS 230, 231, 233 and 234 ZOOL 224, 225 and 238</td>
</tr>
<tr>
<td>Year 3</td>
<td>Year 4</td>
</tr>
<tr>
<td>EAS 235 or BOT 411 EAS 225 and 330 PALEO 414 or approved option 6 approved Arts options 3 approved option</td>
<td>BIOL 335 or BOT 411 BIOL 499 or EAS 427 and 428 PALEO 318 and 319 PALEO 414 or approved option 3 Arts options 3 approved courses</td>
</tr>
</tbody>
</table>

Note: In the fourth year, all students must successfully complete an individual study program with members of the Division of Neuroscience. This program consists of a reading course, NEURO 450, and a laboratory course, NEURO 451. Students must consult the Division of Neuroscience before the beginning of their fourth year to arrange an individual study program.

163.15 Pharmacology

163.15.1 Honors in Pharmacology

The program leading to an Honors degree in Pharmacology prepares students for advanced study leading to academic or research careers.

Continuation and graduation from the Honors Pharmacology program requires a minimum GPA of 7.0 in the preceding Fall/Winter and a minimum GPA of 7.0 in all science courses taken, and a grade of 7.0 in all courses taken in the Department of Pharmacology.

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 197, 198 CHEM 101, 102 CHEM 161, 163 MATH 113 (or 114)</td>
<td>BIOL 203, 205 MICRB 265 PHYSL 210 or 211 PMCOL 261 6 in Science options from BIOC, BIOL, CHEM, GENET, MATH, MICRB, PHYS, PHYSL, PMCOL, or ZOOL</td>
</tr>
<tr>
<td>Year 3</td>
<td>Year 4</td>
</tr>
<tr>
<td>PMCOL 305 PMCOL 342 PMCOL 403 or 415 6 in Science options as indicated for Year 2 6 in approved Arts options 6 in approved options</td>
<td>PMCOL 337, 407, 409, 412, 403 or 415, 498 6 in Science options as indicated for Year 2 3 in an approved option</td>
</tr>
</tbody>
</table>

Note: Students must consult the Chair of the Department or designee for approval of options.

BSc Honors in Pharmacology is awarded to students who achieve a GPA of at least 6.5 in Year 4 and, in addition, a GPA of at least 7.0 for all courses taken in the Department of Pharmacology.

Students who fail to attain the GPAs necessary for an Honors degree in Pharmacology may be granted the Specialization degree if their standings are approved by the Department.

163.15.2 Specialization in Pharmacology

The program leading to a Specialization degree in Pharmacology is for students who want to pursue further studies in the health sciences and those who want to prepare for a career in the Pharmaceutical industry. Although not as rigorous as an Honors program, the Specialization program is a solid background for advanced study leading to a career in academia or research.

Continuation and graduation from the Specialization program in Pharmacology require a minimum GPA of 6.0 in the preceding Fall/Winter. In addition, a GPA of at least 6.0 is required in all Science courses taken and a minimum GPA of 6.0 is required in all courses in the Department of Pharmacology.
163.16 Physics

The Honors Programs offered by the Department of Physics provide a comprehensive education for students planning advanced degrees and a research or academic career.

Continuation in the Honors Physics programs requires a GPA of 6.5 in the preceding Fall/Winter. Graduation requires a GPA of 6.5 on the last 90 creditsed to the degree.

The Specialization programs provide greater flexibility for students who want a four-year degree in Physics or Geophysics without the full comprehensive training of the Honors Programs. Continuation in the Specialization program normally requires a GPA of at least 5.5 in the preceding Fall/Winter. Graduation requires a GPA of 5.5 on the last 90 creditsed to the degree.

Notes
(1) Students interested in the Engineering-Physics program should consult §72.7 of the Faculty of Engineering section.

(2) Honors and Specialization Physics students must consult an advisor in the Department of Physics regarding their programs. Note to third- and fourth-year students: Not all 300-level and 400-level courses are offered every year. Students must consult the Department, other courses may be taken for credit.

(3) Students wishing to qualify for an Honors degree must take a minimum of 18 from Pool A including PHYS 472 and 481.

163.16.1 Honors in Physics

Notes
(1) By the end of their programs, students must have taken 18 of Arts options.

(2) Students must take 27 from Pools A and B.


Pool B: All 300- and 400-level ASTRO, PHYS, MA PH, and GEOPH courses, unless otherwise indicated in the course descriptions, plus all 400-level MATH courses. With consent of the Department, other courses may be taken for credit.

(3) Students wishing to qualify for an Honors degree must take a minimum of 18 from Pool A including PHYS 472 and 481.

163.16.2 Honors in Geophysics

The Honors and Specialization (see §163.16.5) programs are identical except for the GPA requirements (see §162.6.1) and residency requirements (see §163.1). Notes
(1) Students must complete EAS 101 and CHEM 101 and 102 by the end of the second year.

(2) Students must take 18 from Geophysics Core courses and a minimum of 9 from Geophysics Pool courses.

Core: GEOPH 221, 232, 326, 426, 438, 429.

Year 1

<table>
<thead>
<tr>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 100, 102</td>
</tr>
<tr>
<td>MATH 115 (or 114, or 117)</td>
</tr>
<tr>
<td>MATH 120 (or 125 for more theoretically inclined students)</td>
</tr>
</tbody>
</table>

Year 2

<table>
<thead>
<tr>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 211, 244, 271, 281, 295, 297</td>
</tr>
<tr>
<td>MATH 225</td>
</tr>
<tr>
<td>PHYS 311 (or 214, 217, 215) (or 317)</td>
</tr>
</tbody>
</table>

Year 3

<table>
<thead>
<tr>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 311, 351, 372, 381, 397, 472, 481</td>
</tr>
<tr>
<td>MATH 311 (or 411), 334 (or 336), 337</td>
</tr>
</tbody>
</table>

Year 4

<table>
<thead>
<tr>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 311, 351, 372, 381</td>
</tr>
</tbody>
</table>

163.16.3 Honors in Mathematical Physics

Notes
(1) By the end of their programs, students must have taken 18 of Arts options.

(2) Students must take 27 from Pools A and B.


Pool B: All 300- and 400-level ASTRO, PHYS, MA PH, and GEOPH courses, unless otherwise indicated in the course descriptions, plus all 400-level MATH courses. With consent of the Department, other courses may be taken for credit.

(3) Students wishing to qualify for a Specialization degree must take a minimum of 9 from Pool A.

(4) The courses listed below comprise a minimum program. Students may, in consultation with the Department, select more advanced courses in place of those listed. A suitably enriched program can be used for admission to graduate work in Physics if satisfactory standing is obtained.

Year 1

<table>
<thead>
<tr>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 100, 102</td>
</tr>
<tr>
<td>MATH 115 (or 114, or 117)</td>
</tr>
</tbody>
</table>

Year 2

<table>
<thead>
<tr>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 211, 244, 271, 281, 295, 297</td>
</tr>
<tr>
<td>MATH 225</td>
</tr>
<tr>
<td>PHYS 311 (or 214, 217, 215) (or 317)</td>
</tr>
</tbody>
</table>

Year 3

<table>
<thead>
<tr>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 311, 351, 372, 381, 397, 472, 481</td>
</tr>
<tr>
<td>MATH 311 (or 411), 334 (or 336), 337</td>
</tr>
</tbody>
</table>

Year 4

<table>
<thead>
<tr>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 311, 351, 372, 381, 397</td>
</tr>
</tbody>
</table>

163.16.4 Specialization in Physics

Notes
(1) By the end of their programs, students must have taken 18 of Arts options.

(2) Students must take 27 from Pools A and B.


Pool B: All 300- and 400-level ASTRO, PHYS, MA PH, and GEOPH courses, unless otherwise indicated in the course descriptions, plus all 400-level MATH courses. With consent of the Department, other courses may be taken for credit.

(3) Students wishing to qualify for a Specialization degree must take a minimum of 9 from Pool A.

(4) The courses listed below comprise a minimum program. Students may, in consultation with the Department, select more advanced courses in place of those listed. A suitably enriched program can be used for admission to graduate work in Physics if satisfactory standing is obtained.

Year 1

<table>
<thead>
<tr>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 100, 102</td>
</tr>
<tr>
<td>MATH 115 (or 114, or 117)</td>
</tr>
</tbody>
</table>

Year 2

<table>
<thead>
<tr>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 211, 244, 271, 281, 295, 297</td>
</tr>
<tr>
<td>MATH 225</td>
</tr>
<tr>
<td>PHYS 311 (or 214, 217, 215) (or 317)</td>
</tr>
</tbody>
</table>

Year 3

<table>
<thead>
<tr>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 311, 351, 372, 381, 397, 472, 481</td>
</tr>
<tr>
<td>MATH 311 (or 411), 334 (or 336), 337</td>
</tr>
</tbody>
</table>

Year 4

<table>
<thead>
<tr>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 311, 351, 372, 381, 397</td>
</tr>
</tbody>
</table>

163.16.5 Specialization in Geophysics

The Honors (see §163.16.2) and Specialization programs are identical except for the GPA requirements (see §162.6.2) and residency requirements (see §163.1). Notes
(1) Students must complete EAS 101 and CHEM 101 and 102 by the end of the second year.

(2) Students must take 18 from Geophysics Core courses and a minimum of 9 from Geophysics Pool courses.

Core: GEOPH 221, 232, 326, 426, 438, 429.

Pool: GEOPH 421, 424, 437; MA PH 467; PHYS 372, 499; CMPUT 340; PET E 465; EAS 321.

Not all 300-level and 400-level courses are offered every year. Students must consult the Department of Physics for approval of third- and fourth-year programs.

(3) By the end of their programs, students must have taken 15 in Science options (at least 3 of which must be in Computing Science) and 12 in Arts options.
163.16.6 Industrial Internship Program

The Industrial Internship program provides students who have finished their third year of study in the Department of Physics an opportunity for extended work experience. The program lasts 12 or 16 months, and, after completing the reporting requirements, students can receive university credit for the experience.

Students must successfully complete WKEXP 421, WKEXP 422, WKEXP 423, and the final year of their academic program to receive the Industrial Internship designation on their degree certificate.

It will not be possible to guarantee that all students wishing to do an internship are able to do so. However, the Department will make every effort to find suitable employment for those students wishing to take part in the program. Interested students should contact the Industrial Internship program coordinator in the Department of Physics for further information.

Courses Related to the Industrial Internship Program

| Weight | Grade
|--------|--------|
| Year 4 | Fall WKS 421 0 CR/F
| Year 4 | Winter WKS 422 0 CR/F
| Year 4 | Fall/Winter WKS 423 0 CR/F
| Year 5 | Fall PHYS 400 3 9-point

163.16.7 Concentration in Physics

Students considering Physics as their major subject of concentration in the four-year General BSc program should include PHYS 100, 101, 201 and 208 as early as possible in their program. To complete a major in Physics, PHYS 204 is strongly recommended. Students majoring in Physics should normally select from PHYS 301, 302, 307, 309, 319, and 364. They must also consult a Physics Department advisor before registering in second or later years of the program to have their programs approved, as not all 300-level PHYS courses are offered each year. Students wishing to combine a major in Physics with a minor in Arts or Business should consult a Physics Department advisor. (M163.13 and 163.14)

163.17 Physiology

163.17.1 Honors in Physiology

The program leading to the degree of BSc with Honors in Physiology is offered by the Department of Physiology in the Faculty of Medicine.

The Honors program prepares students for advanced study leading to academic and research careers. A choice of courses is available for students with interest in particular branches of the life sciences.

Continuation in the program requires a GPA of 7.0 in the year completed and a grade of at least 7.0 in PHYSL 210 or 211 (equivalent course). Students must consult the program advisor in the Department before registration in each year of the program.

The course requirements in the program are as follows:

| Year 1 | BIOL 107, 108
| Year 1 | CHEM 101, 102, 161, 163;
| Year 1 | ENGL 101
| Year 2 | BIOC 203, 205
| Year 2 | BIOL 201, 207
| Year 2 | PHYS 211
| Year 2 | PHYS 100, 101
| Year 2 | in approved Science or Arts options

Notes
(1) In addition to the courses specifically listed above, the program must include, among the student's optional courses, a minimum of 6 in approved Science or Arts options.
(2) Under the supervision of a faculty member in the Department of Psychology, students undertake a year-long research apprenticeship (PSYCO 390) during the third year and...
163.18.2 Specialization in Psychology

Continuation in the Specialization in Psychology program requires a minimum GPA of 5.5 in the preceding Fall/Winter. Graduation requires a minimum GPA of 5.5 on all courses credited to the degree.

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSYCO 104, 105</td>
<td>STAT 151</td>
</tr>
<tr>
<td>BIOL 107/108</td>
<td>*9 from PSYCO 258, 266 or 267, 275, 281</td>
</tr>
<tr>
<td>*6 in an English course (ENGL 101 is recommended)</td>
<td>*9 in an approved Arts option</td>
</tr>
<tr>
<td>*6 in junior courses offered in the departments of Computing Science and Mathematics</td>
<td>*9 in approved Science options</td>
</tr>
<tr>
<td>*6 in junior courses offered in the departments of Chemistry and Physics</td>
<td>*9 in approved options</td>
</tr>
</tbody>
</table>

To fulfill the degree requirements, students must complete a minimum of 18 in approved Science options, or PSYCO 258 and a minimum of 33 in Science Psychology courses. At least \*12 must be in Science Psychology courses at the 300-level or above. Students may take a maximum of 18 in approved Arts options from PSYCO courses listed in the Arts and Science Course Listing sections.

163.18.3 Industrial Internship Program

The Industrial Internship program provides students who have finished their third year of study in the Department of Psychology an opportunity for extended work experience. The program lasts 12 or 16 months, and, after completing the reporting requirements, students can receive university credit for the experience.

Students must successfully complete WKEXP 931, 932, 933 (WKEXP 933 for the 16-month option), PSYCO 410, and the final year of their academic program to graduate with the Industrial Internship designation.

The Department makes every effort to find suitable employment, but it is not possible to guarantee that all interested students can do an internship. Students should contact the Coordinator, Industrial Internship program in the Department of Psychology for further information.

Courses Related to the Industrial Internship Program

<table>
<thead>
<tr>
<th>Year</th>
<th>Semester</th>
<th>Course</th>
<th>Weight</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 4</td>
<td>Fall</td>
<td>WKEXP 931</td>
<td>0</td>
<td>CR/F</td>
</tr>
<tr>
<td>Year 4</td>
<td>Winter</td>
<td>WKEXP 932</td>
<td>0</td>
<td>CR/F</td>
</tr>
<tr>
<td>Year 4</td>
<td>Spring/Summer</td>
<td>WKEXP 933</td>
<td>0</td>
<td>CR/F</td>
</tr>
<tr>
<td>Year 5</td>
<td>Fall</td>
<td>PSYCO 410</td>
<td>3</td>
<td>9-point</td>
</tr>
</tbody>
</table>

163.19 Statistics and Applied Probability

163.19.1 Honors in Statistics

Continuation in the Honors in Statistics and Applied Probability program requires a GPA of 6.5 in the preceding Fall/Winter. Graduation requires a GPA of 7.0 on all Statistics and Mathematics courses taken and a GPA of 6.0 on the last 30 credited to the degree.

The program must contain the following courses, which should be taken in the years indicated:

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Years 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAT 151</td>
<td>STAT 265, 266</td>
<td>STAT 368, 378, 441, 466, 471, 472</td>
</tr>
<tr>
<td>MATH 114 (or 117), 115 (or 118)</td>
<td>MATH 214 (or 217), 215 (or 317), 225</td>
<td>MATH 311 or 334 or 373 or 380</td>
</tr>
<tr>
<td>MATH 125</td>
<td>*6 in approved Arts options</td>
<td>MATH 314 or 417</td>
</tr>
<tr>
<td>CMPUT 101 (or 114), 102 (or 110)</td>
<td>*6 in approved Science options</td>
<td>MATH 414 or 418</td>
</tr>
<tr>
<td>*6 in approved Arts options</td>
<td>*3 in an approved option</td>
<td>*3 in a Statistics option</td>
</tr>
<tr>
<td>*6 in approved options</td>
<td></td>
<td>*24 in approved options</td>
</tr>
</tbody>
</table>

Note: At least \*9 in approved options in one distinct field of application must be taken at the 300-level or higher. Examples of fields of applications are Biology, Business, Computing Science, Economics, Engineering, Pharmacology, Political Science, Psychology, and Sociology. Students should plan to take the proper prerequisites early in the program.

163.19.2 Specialization in Statistics

The Specialization program in Statistics is for students interested in applying Statistics to a second discipline. Students in this program must choose one distinct field of application. Recommended fields of application are Agriculture, Business, Chemical Engineering, Computing Science, Economics, Education, Genetics, Health Sciences Administration, Pharmacology, Political Science, Psychology, Sociology, and Zoology. Students may, in consultation with the Department of Mathematical Sciences, select a different field of application than those listed above.

Continuation in the program normally requires, in the previous Fall/Winter, successful completion of at least \*24 with a GPA of at least 5.5. Graduation requires a GPA of at least 5.5 on all courses credited toward the degree and a GPA of at least 5.5 on the aggregate of all Statistics and Mathematics courses credited toward the degree.

The program must contain the following courses. It is recommended that these courses be taken in the years indicated:

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Years 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAT 141 or 151</td>
<td>STAT 202, 205, 206</td>
<td>STAT 312, 326, 378, 466, 471</td>
</tr>
<tr>
<td>MATH 114, 115</td>
<td>MATH 214, 215</td>
<td>Two of STAT 322, 361, 377</td>
</tr>
<tr>
<td>MATH 125</td>
<td>MATH 225</td>
<td>Two of STAT 441, 453, 472, 479</td>
</tr>
<tr>
<td>*18 in approved options. See Note (1) below.</td>
<td>*12 in approved options. See Note (1) below.</td>
<td>*33 in approved options</td>
</tr>
</tbody>
</table>

Notes:
(1) The program must include \*9 in English and either CMPUT 101, 102 or 114, 115. These courses should be taken in the first two years of the program.
(2) The program must include at least \*18 in a single field of applications. The student is advised to consult the Department of Mathematical Sciences regarding specific program recommendations for the field of applications.
(3) The program must meet the requirements of the Faculty of Science ($163.1.2$) and include \*18 in Arts courses.
(4) A corresponding Honors Mathematics course can be substituted for any Mathematics course listed. For example, MATH 117 can be substituted for MATH 114.
(5) Each program must be approved by the Department of Mathematical Sciences.

163.19.3 Industrial Internship Program

The Industrial Internship program provides students who have finished their third year in the Department of Mathematical Science an opportunity for extended work experience. The program lasts 16 months, and, after completing the reporting requirements, a student can receive university credit for the experience.

A student must successfully complete WKEXP 951, 952, 953, STAT 400, and the final year of their academic program to graduate with the Industrial Internship designation.

This program should be of particular interest to Mathematics students studying Actuarial Science, Applied Mathematics, Economics, Finance, or Statistics.

Students’ participation in the program is voluntary. Although the Department makes every effort to find suitable employment, it is not possible to guarantee that all interested students can do an internship. Students should contact the Industrial Internship program coordinator in the Department of Mathematical Sciences for further information.

Courses Related to the Industrial Internship Program

<table>
<thead>
<tr>
<th>Year</th>
<th>Semester</th>
<th>Course</th>
<th>Weight</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 4</td>
<td>Fall</td>
<td>WKEXP 951</td>
<td>0</td>
<td>CR/F</td>
</tr>
<tr>
<td>Year 4</td>
<td>Winter</td>
<td>WKEXP 952</td>
<td>0</td>
<td>CR/F</td>
</tr>
<tr>
<td>Year 4</td>
<td>Spring/Summer</td>
<td>WKEXP 953</td>
<td>0</td>
<td>CR/F</td>
</tr>
<tr>
<td>Year 5</td>
<td>Fall</td>
<td>STAT 400</td>
<td>3</td>
<td>9-point</td>
</tr>
</tbody>
</table>

163.20 Preprofessional Programs

Students admitted to a Faculty of Science degree program who plan to transfer later to a professional program in another faculty must satisfy Faculty of Science requirements while they are registered in Science. Students planning to apply to a professional program should consult the relevant Calendar sections to ensure that they are satisfying preprofessional requirements and program requirements in the Faculty of Science.
164.1 Course Listings

Science courses can be found in §201, Course Listings, under the following subject headings:

- Astronomy (ASTRO)
- Biochemistry (taught by the Faculty of Medicine and Dentistry) (BIOCH)
- Biochimie (BIOCM) (Faculté Saint-Jean)
- Biological Science - Biology (BIOL)
- Biological Science - Botany (BOT)
- Biological Science - Entomology (ENT)
- Biological Science - Genetics (GENET)
- Biological Science - Microbiology (MICRB)
- Biological Science - Zoology (ZOOL)
- Biologie (BIOLE) (Faculté Saint-Jean)
- Cell Biology (CELL)
- Chemistry (CHEM)
- Chimie (CHIM) (Faculté Saint-Jean)
- Computing Science (CMPUT)

Earth and Atmospheric Sciences (formerly Geography and Geology (EAS))
- Geophysics (GEOPH)
- Interdisciplinary Studies (INT D)
- Laboratory Animal Management (LB AN)
- Marine Science (MA SC)
- Mathematical Physics (MA PH)
- Mathematics (MATH)
- Mathématiques (MATHQ) (Faculté Saint-Jean)
- Paleontology (PALEO)
- Pharmacology (taught by the Faculty of Medicine and Dentistry) (PMCOL)
- Physiology (taught by the Faculty of Medicine and Dentistry) (PHYSL)
- Physics (PHYS)
- Physique (PHYSQ) (Faculté Saint-Jean)
- Psychology (PSYCO)
- Science (SCI)
- Statistics and Applied Probability (STAT)
- Statistique (STATQ) (Faculté Saint-Jean)

164.2 Prerequisites

Where a prerequisite is stated in a course description, it is understood that equivalent courses may satisfy the requirement. Also, the department offering a course with prerequisite requirements may waive the prerequisite in writing. (Prerequisite waiver forms are available from the Faculty of Science office and the Department offices.)

164.3 Biochemistry Courses

The following courses can be used by students in the Faculty of Science as science courses: BIOCH 203, 205, 220, 401, 410, 420, 430, 441, 450, 455, and 460.

164.4 Computing Science Courses

Introductory

The following courses are considered introductory: CMPUT 101, 102, 114, 115. Specific course details are in Course Listings (§201).

Specialization and Honors

All other courses, except those noted above, are restricted to students registered in various Specialization and Honors programs in the Faculty of Science, in the Computer Engineering program, and Computer Process Control Option in the Chemical Engineering program. Some senior Computing courses are available to students with a Computing Science minor in the BSc General program and to other students, subject to space availability. See Course Listings (§201) for detailed descriptions.

164.5 Food Science Courses

NU FS 363 may be used by students in the Faculty of Science as a science course in Microbiology.

164.6 Immunology Courses

The following courses may be used by students in the Faculty of Science as science courses in Microbiology: INT D 371, 372 and 452.

164.7 Medical Microbiology Courses

The following courses may be used by students in the Faculty of Science as science courses in Microbiology: INT D 224, MMI 350.

164.8 Pharmacology Courses

The following courses may be used by students in the Faculty of Science as science courses: PMCOL 201, 305, 342, 336, 371, 403, 407, 409, 412, and 415.
164.9  Physiology Courses

The following may be used by students in the Faculty of Science as science courses: PHYSL 210, 211, 401, 402, 404, 410, 465 and 486.

164.10  Graduate Courses

Courses numbered 500 and up are restricted to graduate students and normally may not be taken for credit by undergraduate science students.