UNIVERSITY OF Alberta

Faculty of Science

161 The Professors

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RL Eadie, PhD (Engineering)
Y Feng, PhD (Agriculture, Forestry, and Home Economics)
S Harvey, PhD (Medicine)
EE Knaus, PhD (Pharmacy and Pharmaceutical Sciences)
K Munro, PhD (Arts)

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B Gustafson, PhD (Education)

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E Karpinski, PhD (Physiology)
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C Pate, PGeol (APEGGA)

Undergraduate Students of the Faculty

Graduate Students of the Faculty

162 Faculty Regulations

162.1 Faculty Overview

The Faculty of Science offers degrees in Actuarial Science, Applied Mathematics, Atmospheric Sciences, Biochemistry, Biological Sciences (Cell Biotechology, 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 §162.8(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) **Full-Session Course**
A full-session course means a single course with ★6.

(7) **Half Session**
The instructional periods from September to December and January to April.

(8) **Half-Session Course**
A half-session course means a single course with ★3.

(9) **Intersession**
The instructional periods of May/June (first term) and July/August (second term).

(10) **Junior Courses**
Those courses numbered 199 or lower.

(11) **Normal Course Load**
A normal, full academic course load is ★30 during the Winter Session.

(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) **Session**
Refers to Winter Session or Intersession.

(15) **Winter Session**
The instructional period of September to April.

(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 Cumulative Grade Point Average (CGPA)

The cumulative grade point average is the weighted average over all courses attempted while registered in this Faculty (in all sessions including Intersession) since first admission to this Faculty (or the effective date of these regulations, whichever is later). The only exception is that for students who

have been required to withdraw from the Faculty and who are subsequently readmitted on the basis of work done elsewhere, the CGPA will be computed only on courses taken following readmission.

The calculation of the CGPA is also subject to the following rules:

(1) An alphabetic grade of ABF will be counted as a numeric grade of 1.0 in the computation of the CGPA.

(2) An alphabetic grade of WF will be counted as a grade of 1.0 in the computation of the CGPA.

(3) Grades of Credit, No Credit, and Pass-Fail will not be included in the computation of the CGPA.

(4) The CGPA will be rounded to the nearest decimal place using standard rounding rules–that is, it will be rounded up with a value of 5.0 or greater in the first nonsignificant place and rounded down with a value of 4.0 or less in the first nonsignificant place.

162.6 Sessional Grade Point Average (GPA)

The GPA refers to the sessional average and the following are the rules for its computation:

$$\text{GPA} = \frac{\text{sum of (grade x units of course weight)}}{\text{sum of units of course weight}}$$

(1) The GPA for any session shall be based on the final grades in all courses taken during that session, including half-session courses repeated in the second term and courses extra to the degree program.

(2) An alphabetical grade of ABF will be counted as a numeric grade of 1.0 in the computation of the common GPA.

(3) An alphabetical grade of WF will be counted as a numeric grade of 1.0 in the computation of the common GPA.

(4) Grades of Credit, No Credit, and Pass-Fail will not be included in the computation of the common GPA.

(5) The Winter Session GPA or sessional GPA will be rounded to the nearest decimal place using standard rounding rules–that is, it will be rounded up with a value of 5.0 or greater in the first nonsignificant place and rounded down with a value of 4.0 or less in the first nonsignificant place.

162.7 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

Each student's academic performance is reviewed at the end of each Winter Session. Decisions regarding continuation will be based on courses completed up to and including the current Winter Session only. Any courses completed in the first term of the Intersession, following the period under review, will not be considered part of the decision on academic standing. Continuation in the Faculty of Science requires a CGPA of at least 5.0 on all courses attempted while registered in the Faculty of Science.

162.7.1 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 Winter Session. 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 if they meet the continuation requirements of those programs. 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 an Honors program whose CGPA at the end of Winter Session 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).

162.7.2 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 Winter Session. 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 Winter Session 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).

162.7.3 Continuation in the General Program

(1) **Satisfactory Standing**

To remain in satisfactory standing in the Faculty of Science, students must maintain a CGPA of at least 5.0.

(2) **Marginal Standing—Academic Warning**

Students in the General program whose CGPA at the end of Winter Session is between 4.5 and 4.9 will be deemed to have a Marginal Standing. Subject to the next paragraph, they will be allowed to continue in the BSc General program for one further Winter Session on Academic Warning.

Only one period of attendance on Academic Warning will be allowed while students are registered in the Faculty of Science. Students who have received an Academic Warning in any previous year and whose CGPA at the end of Winter Session 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).

Note: Students under academic warning are only permitted to interrupt their programs with the 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.

(3) **Unsatisfactory Standing—Required to Withdraw**

Students, whether in an Honors, Specialization, or the General program, whose CGPA at the end of Winter Session is below 4.5, will be required to withdraw. Any registration in the second term of Intersession and in the subsequent Winter Session 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).

(4) **Probation**

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

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

Probation students must successfully complete ★24 during their one Probationary Winter Session. To clear Probation, they must achieve a GPA of at least 5.0 on all work attempted during that Winter Session. The CGPA will then be calculated from the beginning of the Probationary Winter Session.

Probationary students who fail to complete successfully at least ★24 with at least a 5.0 GPA on all work attempted during that Winter Session 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. For students who clear Probation, the CGPA is then calculated from the beginning of the successful Probationary Winter Session. Students who clear Probation and whose CGPA again falls below 5.0 are not permitted to continue on Academic Warning, nor are they allowed a second period of Probation. Such students are required to withdraw and are not normally readmitted to the Faculty of Science.

(5) **Scholarship**

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

(6) **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 Winter Session. This is also referred to as the Dean's Honor Roll.

(7) **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 in §162 should be consulted for further details.

162.7.4 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 every course beyond ★120 in which they register. Students in Honors or Specialization programs must also have the written approval of their Departmental Advisor.

162.8 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 Winter Session, 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 first and second 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" (Withdrew 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.

162.9 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 ★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 a Winter Session. Those completing degree requirements during Intersession 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 Winter Sessions if the student was enrolled in a full academic load (★30) during each Winter Session.

(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 ★60 and if the student was enrolled in a full academic load (★30) during each Winter Session 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 §163.22.

162.10 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.

162.11 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 The Degree of 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.

Applicants to the BSc Honors program who have taken non-Arts and non-Science courses before application will have the potential to transfer credit for such courses assessed at the time of admission to the program.

Course Load Requirements

Students in Honors programs must take at least ★30 during the Winter Session 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 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 Winter Sessions is required. For Honors, a GPA of at least 6.5 on ★30 in each Winter Session 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 of the Winter Sessions 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 Winter Sessions. 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, and Psychology.

A five-year (★150) BEd/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.

Note: Any 200-level course without a 100-level (or higher) prerequisite will be counted as a junior course for this purpose.

(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.

Applicants to the BSc Specialization program who have taken non-Arts and non-Science courses before application will have the potential transfer credit for such courses assessed at the time of admission to the program.

Course Load Requirements

Students in Specialization programs should normally take at least ★30 during the Winter Session 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 Winter Sessions. 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 last ★60 if the student was enrolled in a normal course load (★30) during each Winter Session 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 Specialization and Honors programs. Students who intend to transfer to an Honors program must complete ★30 in each Winter Session 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 ★24 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 (§§45.1 to 45.26).

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 (including Art, Art History, and Design); Canadian Studies; Central/East European Studies; Chinese; Classics (including Ancient History, Art, Classical Literature in Translation); Comparative Literature; Drama; East Asian Studies; Economics; English; Film Studies; French; Geography**; German; Greek and Latin; History, Ancient or Medieval History, or 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 127; 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 Winter Session 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 Winter Sessions 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. This must include at least ★30 of the last ★60 applicable to the BSc program.

Time Limits for Program Completion

The Faculty of Science may permit a student to complete the requirements for a General degree over a period longer than four years or meet the requirements in a shorter time by attending Intersession.

163.1.4 BSc General—Minor in Business

Note: For requirements, see §163.1.3. Students admitted to the program lacking one or more prerequisites will be required to make up the deficiency during the first Winter Session in the Business Minor program.

BSc General program students admitted to the Minor in Business quota must complete the following:

(1) ECON 101, 102

(2) ★18 to ★30 in courses offered by the Faculty of Business including ACCTG 311; ORG T 301; two of FIN 301, MGTSC 352, MARK 301, ORG T 311

Notes

(1) Several of the above courses have one or more Arts or Science courses as prerequisites. These prerequisites must be met.

(2) Students completing a minor in Business must still choose a major in Science and must satisfy the requirement that at least ★72 of the ★120 credited to the degree be in Science.

(3) Students minoring in Business must still complete at least ★18 in Arts. ECON 101 and ECON 102 constitute six of those required Arts units.

Once admitted to the minor in Business, students in the BSc General program will be allowed to continue in the Business minor as long as they remain in good standing in the BSc General program. BSc General program students who have been admitted to the minor in Business and who subsequently apply to transfer to a Specialization or Honors program which has a Business component controlled by quota will have to apply and compete for admission to that quota.

163.1.5 Special Certificates

An applicant holding a BSc degree from this Faculty may qualify for a certificate indicating that the requirements for the equivalent of a BSc Honors degree (§162.1.1) or a BSc Specialization Degree (§162.1.2) have been met. To qualify for a Special Certificate, at least ★30 additional must be completed and all admission, program, academic standing, and graduation requirements of the equivalent degree must be met. Admission to a Special Certificate program requires approval of the appropriate Department and the Faculty Office. The specific course requirements are determined at the time of admission by the appropriate Department and the Faculty Office. The Special Certificate is not available to degree holders from other faculties at the University of Alberta or from other universities. For further information, consult the Faculty of Science Student Services Office.

163.1.6 The BSc After an Undergraduate Degree (Other than a BSc from the Faculty of Science at the University of Alberta)

An applicant holding an undergraduate degree may qualify for the BSc General (four-year) degree, a BSc Specialization degree, or a BSc Honors degree by meeting the following requirements:

(1) Satisfactorily complete a minimum of ★60 (normally the last 60) while registered in the Faculty of Science at the University of Alberta

(2) Satisfy all admission requirements (see §15.16), as well as program, academic standing, and graduation requirements of the particular degree program (See §162.1.1 for Honors, §162.1.2 for Specialization, and §162.1.3 for General Program.)

Admission to a Specialization program and an Honors program requires approval of the appropriate Department and the Faculty Office. The specific course requirements for a degree program are determined, at the time of admission, by the appropriate Department (for Specialization and Honors) and the Faculty Office. The BSc after a previous undergraduate degree is available to holders of undergraduate degrees from other faculties at the University of Alberta and from other universities. For further information, consult the Faculty of Science Student Services Office.

Note: A holder of a BSc degree from another university is not eligible for a BSc General After Degree.

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.

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 ★60 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 fulfil specific subject requirements of a degree program in Science but will not fulfil 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 Winter Sessions.

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

Year 1	Year 2
CHEM 101/102 and 161/163 MATH 113 (or 114), and 115 BIOL 107/108 ★6 in a junior Arts option (ENGL 101 recommended)	BIOCH 203/205 CHEM 271/273 PHYS 100 and 101 or equivalent ★6 in an approved Science option ★6 in an Arts option
Year 3	**Year 4**
BIOCH 401 ★6 in Biochemistry (normally selected from BIOCH 410, 420, 430, or 441) CHEM 211/213 ★6 in approved Science options ★6 in Arts options	★6 in Biochemistry (normally selected from BIOCH 410, 420, 430, or 441) ★3 in Biochemistry (selected from BIOCH 450, 455, or 460) CHEM 361 and 363 ★15 in approved Science options

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 in Biochemistry program.

(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.

Year 1	Year 2
CHEM 101/102 and 161/163 MATH 113 (or 114), 115 BIOL 107/108 ★6 junior Arts option (ENGL 101 recommended).	BIOCH 203/205 PHYS 100 and 101, or equivalent ★6 in an approved Mathematical Science or Physical Science option ★6 in an approved Science option ★6 in an Arts option
Year 3	**Year 4**
BIOCH 401 ★6 in Biochemistry (normally selected from BIOCH 410, 420, 430, or 441) CHEM 211/213 ★6 in an approved Science option ★6 in an Arts option	★6 in a senior Biochemistry (normally selected from BIOCH 410, 420, 430, or 441) ★15 in approved Science options ★9 in an option

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 Sciences 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 450, 455, 460; 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) BIOCH 410, 420, 430, 441, 450, 455, and 460 are offered only in alternating years. Check the *Registration Procedures* book for those courses offered in the current year.

163.3 Biological Sciences

The Honors and Specialization programs formerly offered in the Biological Sciences Department were replaced with the programs below, effective Winter Session 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 Biological Science identified in §163.3.4. 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 Science 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 are 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 block 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 Science

Admission to the BSc Honors in Biological Science 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 Winter Session.

Continuation in the Honors Biological Science program requires a minimum GPA of 6.5 in the preceding Winter Session. 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 Winter Session 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 Science

Admission to the BSc Specialization in Biological Science 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 Winter Session.

Continuation in the Specialization program requires a GPA of 5.5 in the preceding Winter Session. 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 Science

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 should 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 should also take CHEM 163 in the first year.

(3) 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.

(4) 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.

163.3.4 Course Sequence for Honors and Specialization in Biological Sciences

See Science Chart 1.

Science Chart 1 Course Sequence for Honors and Specialization in Biological Sciences

Cell Biotechnology	**Year 2**	**Year 3 and 4**
	BIOL 201, 207, 208; BIOCH 203, 205; MICRB 265; GENET 270; ★6 Arts options; ★3 Science option.	GENET 301, 304, 390; MICRB 311, 313, 415, 450; MICRB 343 and 345 or GENET 420; ★6 Arts options; ★24 Approved options.
Environmental Biology	**Year 2**	**Year 3 and 4**
	BIOL 207, 208; BIOCH 220; CHEM 163 or 263; BOT 201 or 210; EAS 102; ZOOL 224; ZOOL 250 or ENT 220; ★3 Arts option; MATH 115 or 120.	STATS 337 or BIOL 430; BIOL 321, 380; ★9 from BIOL 331, BOT 332, FOR 322 or SOILS 330; ZOOL 332, 371; ★6 from BOT 240, 250, 382, ENT 321, GENET 270, 275, MICRB 265, ZOOL 241, 242; ★9 from List 1; ★9 Arts options, ★12 Approved options. **List 1:** Recommended options include, but are not restricted to, BIOL 361, 366, 430, 433, 435; BOT 305, 306, 333, 431, 433, 520; EAS 250; ENT 460; INT D 421; ZOOL 301, 405, 407, 408, 427, 434, 464, 467, 468.

Note: Students in Honors in Biological Science must successfully complete BIOL 499. It is recommended that students in Specialization in Biological Science take BIOL 498 or 499.

Science Chart 1 Course Sequence for Honors and Specialization in Biological Sciences (cont'd)

Invertebrate Biology	Year 2	Year 3 and 4
	BIOL 207, 208; BIOCH 220; CHEM 163 or 263; ENT 220; MICRB 265; ZOOL 202, 250; GENET 275, ★3 Arts option.	ZOOL 370 or 371; ZOOL 351 or 427, 352; ZOOL 355 or 302; BIOL 331 or ZOOL 332; ZOOL 464; CMPUT 101 or 114; ENT 321, 378 or ZOOL 354; ★6 from ENT 207, 280, 392; ★9 Arts options; ★18 Approved options. **Note:** One of MA SC 410, 430 recommended; ZOOL 224 and other senior vertebrate Zoology or senior Botany courses recommended.
Microbiology	**Year 2**	**Year 3 and 4**
	BIOL 201, 207; CHEM 102; BIOCH 203, 205; MICRB 265; GENET 270; ★3 Science option; ★6 Arts options. **Note:** A minimum grade of 6 is required in MICRB 265 in order to stay in Microbiology Honors program.	BIOL 208; MICRB 311, 313; CHEM 211/213; ★6 Arts options; ★12 in MICRB options; ★12 Science options; ★15 Approved options. **Note:** A minimum grade of 6 is required in MICRB 311 in order to stay in Microbiology Honors Program. **List 2:** Recommended options include, but are not restricted to, the following: **Microbiology options:** GENET 390, MICRB 314, 343, 345, 391, 392, 410, 415, 420, 450, 452; INT D 224, 371, 372, 452; NU FS 361, 363, 402, 480; MMI 350, 405, 415, 425, 427, 516, 520. **Science options:** BIOCH 410, 420, 430, 441, 450, 455, 460; BIOL 380, 490; BOT 306, 380, 383, CHEM 271, 273, 303, 361, 363; COMPUT 101 or 114; ENT 378; GENET 275, 301, 302, 304, 390, 408, 471; EAS 201, 203; PHYS 100, 101; ZOOL 352, 452. **Approved options:** NU FS 361, 363, 402, 480, MMI 350, 405, 415, 425, 427; PHARM 484; PHYSL 210; SOILS 210, 430. (Some of these approved options count as Science courses, see §173).
Molecular Genetics	**Year 2**	**Year 3 and 4**
	BIOL 207, 208; CHEM 102; BIOCH 203, 205; GENET 270, 275; MICRB 265; ★6 Arts options.	BIOL 201, 380; GENET 301, 302, 304, 390; ★12 from GENET 364, 408, 412, 418, 420; ★6 Arts options; ★12 Approved options; ★12 from List 3. **List 3:** Recommended options include, but are not restricted to, CELL 300, 301; BIOCH 401, 410, 420, 430, 450; BIOL 315, 321, 420, 445; BOT 250 306, 303, 382; CHEM 271, 273; ENT 220, 321; INT D 224, 371; MICRB 311, 313, 314, 343, 345, 401; PHYSL 210, 401; ZOOL 241, 250, 303, 340, 342.
Physiology an Developmental Biology	**Year 2**	**Year 3 and 4**
	BIOL 201, 207, 208; BIOCH 203, 205; ZOOL 225, 241, 242, 250; ★3 Science option.	ZOOL 302, 303, 344 and one of 402 or 441 or 442; ★12 Arts options; ★12 Approved options; ★24 from List 4. **List 4:** Recommended options include, but are not restricted to, ANAT 415; BIOL 445, BOT 240, 306, 340, 431; CELL 300, 301; ENT 321; GENET 301, 302, 304, 412; INT D 371, 452, 543, 544; MICRB 265, 311, 313; PHYSL 372, 401, 402, 404; PMCOL 371; ZOOL 340, 341, 342, 343, 352, 355, 370, 402, 441, 442, 452.
Plant Biology	**Year 2**	**Year 3 and 4**
	BIOL 207, 208; BIOCH 220; CHEM 102; CHEM 163 or 263; BOT 201, 202, 210; ★3 Science option; ★3 Arts option.	BIOL 201; BOT 240, 250, 309, 320, 332; ★3 GENET; MICRB 265; ★9 Arts options; ★9 Approved options•; ★18 Senior Botany Courses.
Systematics and Evolution	**Year 2**	**Year 3 and 4**
	BIOL 207, 208; BIOL 380; BIOCH 220; ★6 from BOT 201, 210; ZOOL 224, 225, 250; ENT 220; ★3 from BOT 240, ZOOL 241, 242, ENT 321; ★3 Arts option; ★6 Approved option.	BIOL 321, 335, 420, 435; ★3 from BOT 411, PALEO 318, 319; ★3 from BIOL 331, BOT 332, ZOOL 332; ★6 from BOT 302, 305, 306, 320, ZOOL 224, 405, 407, 408 or 427; ENT 280; MICRB 265; ★9 Arts options; ★12 from List #5; ★15 Approved options. **List 5:** Recommended options include, but are not restricted to, BIOL 331, 430, 433, 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:** Marine Science courses on this list are offered at Bamfield Marine Station.
Note: Students in Honors in Biological Science must successfully complete BIOL 499. It is recommended that students in Specialization in Biological Science take BIOL 498 or 499.		

163.3.5 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 parchment 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 12 months, 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 WKEXP 941–943 plus BIOL 400 Industrial Internship Practicum. BIOL 400 must be taken in the first term immediately following WKEXP 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

Year 4	Course	Year 5	Course
Fall	WKEXP 401	Fall	Courses + BIOL 400
Winter	WKEXP 402	Winter	Courses
Summer	WKEXP 943		

163.3.6 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; MICRB; ZOOL; CELL 300, 301; IMMUN 405, 451; INT D 224, 370, 421, 455, 464; LB AN 301; MMID 350; NU FS 363; PHYSL 210, 372, 401, 404, 410; PMCOL 305, 307 332, 335, 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, MICRB 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 Science. 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 Winter Session. Graduation requires a minimum GPA of 6.5 on the last ★60 credited to the degree.

Year 1	Year 2
CHEM 161/163 CHEM 101/102 MATH 113 or 114, and 115 BIOL 107, 108 ★6 in an Arts option (English 101 recommended)	BIOL 201 BIOCH 203/205 PHYS 100, 101 GENET 270 BIOL 207, 208 MICRB 265 ★3 in an Arts option
Year 3	**Year 4**
CELL 300, 301 ★6 from Group A Cell Biology options ★9 from Group B Cell Biology options ★3 in an approved Science option ★6 in Arts options	BIOL 445 CELL 490 ★6 from Group A Cell Biology options ★6 from Group B Cell Biology options ★6 in approved Science options ★3 in an Arts option
Group A: Cell Biology Options	**Group B: Cell Biology Options**
BIOCH 420 BIOCH 430 or GENET 304 ZOOL 202 or BOT 202 STAT 237	BIOCH 410, 441, 455 BIOL 585 BOT 250, 382 CHEM 271 and 273 GENET 275, 301, 364, 390 INT D 224, 371, 372 MICRB 265, 314 PHYSL 401 ZOOL 342, 445, 452

163.4.2 Specialization in Cell Biology

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

Year 1	Year 2
CHEM 161/163 CHEM 101/102 MATH 113 or 114, and 115 BIOL 107, 108 ★6 in an Arts option (English 101 recommended)	BIOL 201 BIOCH 203/205 PHYS 100, 101 GENET 270 BIOL 207, 208 MICRB 265 ★3 in an Arts option
Year 3	**Year 4**
CELL 300, 301 ★6 from Group A Cell Biology options ★9 from Group B Cell Biology options ★3 in an approved Science option ★6 in Arts options	BIOL 445 ★6 from Group A Cell Biology options ★6 from Group B Cell Biology options ★9 in an approved Science options ★3 in an Arts option ★3 in an approved option
Group A Cell Biology Options:	**Group B Cell Biology Options:**
BIOCH 420 BIOCH 430 or GENET 304 ZOOL 202 or BOT 202 STAT 237	BIOCH 410, 441, 455 BIOL 585 BOT 250, 382 CHEM 271 and 273 GENET 275, 301, 364, 390 INT D 224, 371, 372 MICRB 265, 314 PHYSL 401 ZOOL 342, 445, 452

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 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 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 in options in the third and fourth years of the program. These are normally chosen from offerings within the Faculty of Science. All options must be selected in consultation with the Department of Chemistry.

Continuation in the Honors Chemistry program requires a GPA of 6.5 in the preceding Winter Session. Graduation requires a minimum GPA of 6.0 on the last ★30.

Year 1	Year 2	Years 3 and 4
CHEM 101, 102, 161, 163 PHYS 100,102 MATH 113 (or 114), 115 a junior course in English or ★3 in English and ★3 in an Arts option	CHEM 211, 213, 241 CHEM 271, 273 PHYS 230 MATH 214, 215 ★6 in an Arts option	CHEM 341, 361, 363, 381, 383 ★18 in senior chemistry courses ★21 in science options ★6 in Arts options

Group A	Group B
CHEM 313, 437 CHEM 461, 465 CHEM 477, 479 BIOCH 203	CHEM 305, 401, 403, 407 CHEM 413, 415, 417, 419, 421 CHEM 433, 439 CHEM 463, 467 469, CHEM 481, 483, 491, 493 BIOCH 205

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 an 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 credited 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 and Winter terms 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 year-long internship, 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 report and oral presentation may be classified 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

Year 4	Course	Weight	Grade
Fall	WKEXP 401	0	CR/F
Winter	WKEXP 402	0	CR/F
Intersession			
(for 16 month option)	WKEXP 403	0	CR/F
Year 5			
Fall	CHEM 400	3	9-point

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, 331, 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 §163.1.3.

163.5.6 Diploma After a Previous Degree

Students who, after a period of professional employment, wish to update their qualifications may enrol in a special one-year program designed for this purpose. Those who possess at least the three-year general degree or its equivalent, and who complete satisfactorily an approved selection of ★30, may be awarded a diploma attesting to this improvement in their qualification. All courses must be selected in consultation with the Department.

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 Winter Session. Graduation requires a GPA of at least 6.5 on the last ★30 credited to the degree and at least 6.5 on the last ★60 credited 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.

Year 2	Year 3	Year 4
CMPUT 201, 204, 280, 285, 291 MATH 120, 214 (or 217), 215 (or 317) STAT 221 ★3 in Arts options	CMPUT 301, 304, 325, 379, 391 MATH 128 or 223 STAT 222 ★6 in Arts options ★3 in approved options	CMPUT 366, 418 or 419, 474, and at least ★3 in CMPUT at the 300-level or higher ★9 in approved options ★6 in approved Science options ★3 in Arts options

Notes

(1) Honors students should take the Honors version of the Mathematics courses beginning in the first year.

(2) Honors students must take CMPUT 495 (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 Winter Session. Graduation requires a GPA of at least 6.0 on the last ★90 credited 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.

Year 2	Year 3	Year 4
CMPUT 280 ★9 in CMPUT at the 200-level (must include three of CMPUT 201, 204, 285, 291) MATH 120, 214 STAT 221 ★6 in Arts options ★3 in approved options	CMPUT 301, 325, 379 STAT 222 ★3 in Arts options ★12 in approved options ★3 in Science options	CMPUT 340 ★6 in CMPUT at the 300-level or higher ★15 in approved options ★3 in approved Science options ★3 in Arts options

Notes

(1) Students entering Year 2 of the program may register for no more than two Computing Science courses per term.

(2) At least ★9 in approved options must be at the 300-level or higher.

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 Winter Session 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 Programs

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. 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. University of Alberta students are registered as being 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, 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 WKEXP 923.

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

Note: Students planning to enter the IIP stream should register in ORG A 321 in the third year of their program.

Students registered in the IIP are helped to find suitable internship employment. Career and Placement Services (2-100 Students' Union Building) will prepare and search for suitable industrial positions for these students. However, there is no guarantee that all qualified students can be placed. Interested students should see the Industrial Experience programs coordinator in the Department of Computing Science for more information.

Courses Related to the Industrial Internship Programs

	Normal	Industrial Internship Program
Year 2		
Fall	Courses	Courses
Winter	Courses	Courses
Year 3		
Fall	Courses	Courses
Winter	Courses	Courses
Summer	n/a	IIP (probationary)
Year 4		
Fall	Courses	IIP and WKEXP 921
Winter	Courses	IIP and WKEXP 922
Summer	n/a	IIP and WKEXP 923
Year 5		
Fall	n/a	Courses + CMPUT 400
Winter	n/a	Courses

163.6.5 BSc General—Computing Science Minor

The Computing Science minor requires between ★24 and ★36 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 §82.5).

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 §83.3(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 Winter Session. 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.

Year 1	Year 2
EAS 101 and 102 ENGL 101 CHEM 101 and 102 MATH 113 or 114 and 115 PHYS 100 and 102	EAS 220, 221, 270, 271 and 327 MATH 120, 214 and 215 PHYS 244 and 281
Year 3	**Year 4**
EAS 290 or 291, 370 and 371 ★9 Arts options ★12 in approved Science options (see Note below)	EAS 426, 470 and 471 or 472 ★21 in approved Science options (see Note below)

Note: Approved Science options should be chosen from the following list: EAS 208, 320, 324, 325, 326, 352, 427, 428, 451, 453, 454, 455, 457, 471, 472; CHEM 211, 213, 261, 263, 303; ENCS 203, 360; FOR 340, 372; GEOPH 221, 429; MATH 121, 280, 337; PHYS 211, 261, 264, 364, 285, 381, 383; SOILS 210, 330, 440. For students in the Industrial Internship program: EAS 401, WKEXP 411, WKEXP 412, WKEXP 413. Recommended Arts options include EAS 190, 191, 290, 291, 292, 390, 391, 392, 491, 493.

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 Winter Session. To graduate in four years, a student needs to complete ★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.

Year 1	Year 2
EAS 101 and 102 ENGL 101 CHEM 101 and 102 MATH 113 or 114 and 115 PHYS 100 and 102	EAS 220, 221, 270 and 271 MATH 120, 214 and 215 PHYS 244 and 281 ★3 Arts options
Year 3	**Year 4**
EAS 290 or 291, 327, 370, 371 ★6 Arts options ★12 in approved Science options (see Note below)	EAS 470 and 471 or 472 ★24 in approved Science options (see Note below)

Note: Approved Science options should be chosen from EAS 208, 320, 324, 325, 326, 352, 427, 428, 451, 453, 454, 455, 457, 471, 472; CHEM 211, 213, 261, 263, 303; ENCS 203, 360; FOR 340, 372; GEOPH 221, 429; MATH 121, 280, 337; PHYS 211, 261, 264, 364, 285, 381, 383; SOILS 210, 330, 440. For students in the Industrial Internship program: EAS 401, WKEXP 411, WKEXP 412, WKEXP 413. Recommended Arts options include EAS 190, 191, 290, 291, 292, 390, 391, 392, 491, 493.

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 6.5 on at least ★30 in the previous Winter Session.

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.

Year 1	Year 2
EAS 101 and 102 ENGL 101 CHEM 101 and 102 MATH 113 or 114 and 115 PHYS 100 and 101	BIOL 108 EAS 220, 221, 222, 223, 224, 225, 250, 270 or 271 and 290
Year 3	**Year 4**
EAS 320, 324 and 354 GEOPH 223 ★18 Optional Elements (see below)	EAS 426 ★27 Optional Elements (see below)
Optional Elements Students must take additional courses from each of the following six groups: **Groups** (1) At least ★3 (Field and Laboratory Methods) of EAS 233, 327, 423, 424 (2) At least ★3 (Geoprocessing) of EAS 325, 351, 451 (3) At least ★3 (Math, Statistics and Computing) of EAS 326; CMPUT 101, 114; MATH 120, 214, 215, 280, 334 (4) At least ★3 (Geology) of EAS 207, 232, 321, 322, 330, 420, 421, 422, 425 (5) At least ★6 (Surface Processes and Quaternary Geology) of EAS 270, 271, 352, 370, 371, 453, 454, 455, 457; INT D 594 (6) At least ★9 of Arts options. Recommended Arts options include EAS 190, 191, 290, 291, 292, 390, 391, 392, 491, 493	

Note: An additional ★21 of the following approved options: ANTHR 488; BIOL 208, 381, 464; CIV E 250, 355, 381; EAS 427, 428; ECON 101; ENCS 352, 475; INT D 369, 421; PHIL 265, 355, 465; POL S 222, 432; REN R 425; SOILS 210, 420, 430, 450; or from Groups 1–6 listed above. For students in the Industrial Internship program: EAS 401, WKEXP 411, WKEXP 412, WKEXP 413.

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 Winter Session. 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.

Year 1	Year 2
EAS 101 and 102 ENGL 101 CHEM 101 and 102 MATH 113 or 114 and 115 PHYS 100 and 101	BIOL 108 EAS 220, 221, 222, 223, 224, 225, 250 and 270 or 271 and 290
Year 3	**Year 4**
EAS 320, 324 and 354 GEOPH 223 ★21 of Optional Elements (see below)	★30 Optional Elements (see below)
Optional Elements Students must take additional courses from each of the following six groups: **Groups** (1) At least ★3 (Field and Laboratory Methods) of EAS 233, 327, 423, 424 (2) At least ★3 (Geoprocessing) of EAS 325, 351, 451 (3) At least ★3 (Math, Statistics and Computing) of EAS 326; CMPUT 101, 114; MATH 120, 214, 215, 280, 334 (4) At least ★3 (Geology) of EAS 207, 232, 321, 322, 330, 420, 421, 422, 425 (5) At least ★6 (Surface Processes and Quaternary Geology) of EAS 270, 271, 352, 370, 371, 453, 454, 455, 457; INT D 594 (6) At least ★9 of Arts options. Recommended Arts options include EAS 190, 191, 290, 291, 292, 390, 391, 392, 491, 493	

Note: An additional ★24 of the following approved options: ANTHR 488; BIOL 208, 381, 464; CIV E 250, 355, 381; EAS 427, 428; ECON 101; ENCS 352, 475; INT D 369, 421; PHIL 265, 355, 465; POL S 222, 432; REN R 425; SOILS 210, 420, 430, 450; or from Groups 1–6 listed above. For students in the Industrial Internship Program: EAS 401, WKEXP 411, WKEXP 412, WKEXP 413.

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 ★30 in the previous Winter Session.

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

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

Year 1	Year 2
EAS 101 and 103 ENGL 101 CHEM 101 and 102 MATH 113 or 114 and 115 PHYS 100 and 101	EAS 220, 221, 223, 224, 225, 230, 231, 232, 233 and 234
Year 3	**Year 4**
EAS 320, 321, 322, 330, 331, 332 and 333 EAS 290 or 291 GEOPH 221 ★3 Arts option	EAS 426 GEOPH 223 or 224 ★6 EAS Science courses 250 or higher ★12 Science options (including but not restricted to EAS courses 250 or higher) ★6 Arts options

Note: Recommended Arts options include EAS 190, 191, 290, 291, 292, 390, 391, 392, 491, 493; for students in the Industrial Internship program: EAS 401, WKEXP 411, WKEXP 412, WKEXP 413.

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 Winter Session. To graduate in four years, a student needs to complete ★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 consult the Geology program student advisor before registration each year.

Year 1	Year 2
EAS 101 and 103 ENGL 101 CHEM 101 and 102 MATH 113 or 114 and 115 PHYS 100 and 101	EAS 220, 221, 223, 224, 225, 230, 231, 232, 233 and 234
Year 3	**Year 4**
EAS 320, 321, 322, 330, 331, 332 and 333 EAS 290 or 291 GEOPH 221 ★3 Arts option	GEOPH 223 or 224 ★9 EAS Science courses 250 or higher ★12 in approved Science options (including but not restricted to EAS 250 or higher) ★6 Arts options

Note: Recommended Arts options include EAS 190, 191, 290, 291, 292, 390, 391, 392, 491, 493; for students in the Industrial Internship program: EAS 401, WKEXP 411, WKEXP 412, WKEXP 413.

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 (PGeol), 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 work experience is normally undertaken after completion of the third year. The program consists of a four-month probationary appointment from May to August, after which all parties involved decide whether to proceed with the additional 12-month program. Students return to the department for their fourth year. 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, Winter, and Summer Intersession terms of the work experience, the student registers in WKEXP 411, WKEXP 412, and WKEXP 413 and is considered a full-time student at the University of Alberta. 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

	Normal	Industrial Internship Program
Year 2		
Fall	Courses	Courses
Winter	Courses	Courses
Year 3		
Fall	Courses	Courses
Winter	Courses	Courses
Summer	n/a	IIP (Probationary)
Year 4		
Fall	Courses	IIP and WKEXP 411
Winter	Courses	IIP and WKEXP 412
Summer	n/a	IIP and WKEXP 413 (for 16-month IIP)
Year 5		
Fall	n/a	Courses + EAS 401
Winter	n/a	Courses

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 Winter Session. Graduation requires a minimum of GPA of 5.5 on the last ★90 credited to the degree.

Year 1	Year 2
CHEM 101 and 102 MATH 113 or 114 MATH 115 PHYS 100 PHYS 101 or 102 EAS 101 and 102 ★6 in English (ENGL 101 recommended)	BIOL 108 CHEM 261 and 263 MATH 120 PHYS 201 EAS 220 and 221 (See Note 1) or PHYS 261 and 264 ★9 in Arts options or approved Science or other options (See Notes 2 and 3)
Year 3	**Year 4**
CHEM 211 and 213 EAS 220 and 221 (See Note 1) or PHYS 261 and 264, whichever were not previously taken. EAS 223 and 270 PHYS 294 PHYS 364 or approved Science option ★6 in Arts options or approved Science or other options. (See Notes 2 and 3)	CHEM 303 CHEM 305 or EAS 351 EAS 425 PHYS 364 or approved Science option, whichever was not previously taken. ★18 in Arts options or approved Science or other options. (See Notes 2 and 3)

Notes

(1) In lieu of EAS 220, an approved course in computation, computing, or statistics may be taken.

(2) ★6 to ★12 must be taken in Arts option, in addition to the ★6 in 100-level English. These may include EAS 290, 291, 390, 493; ECON 101; PHIL 355.

(3) Approved Science or other options must total ★24 to ★30, such that a total of ★36 of optional courses are taken. These options include, but are not restricted to, CHEM 271, 273, 313, 331, 332, 415, 417; EAS 224, 225, 250, 327, 352, 457; ENCS 203, 352; GEOPH 227, 229; INT D 369; MATH 214, 215, 270; SOILS 210.

163.8.2 Industrial Internship Program

The Environmental Physical Sciences Program in the Faculty of Science offers an Industrial Internship Program which allows students to augment their program of study with 12 or 16 months of paid, discipline-related employment with approved firms or institutions. Only students who have completed three years of the Specialization Program in good 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, the

student, and the IIP Coordinator. If all parties are satisfied, the employment will continue for a further nine or 13 months. During this time 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 and Winter terms, 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 completion of the IIP, the student will register in ENVPS 400 (★3), which is graded on the normal 9-point grading scale and which comprises the academic component of the IIP. The student will submit a report to the IIP Coordinator describing the project(s) undertaken and will make an oral presentation to an Advisory IIP committee. A grade will be assigned in ENVPS 400, based on the employer's assessment, the report and the oral presentation.

A student who has successfully completed WKEXP 421, 422 and ENVSP 400, will receive an Industrial Internship Designation on the degree certificate.

Courses Related to the Industrial Internship Program

		Course	Weight	Grade
Year 4	Fall	WKEXP 421	0	CR/F
Year 4	Winter	WKEXP 422	0	CR/F
Year 5	Fall	ENVPS 400	3	9-point

163.8.3 Honors in Paleontology

See §163.16, Paleontology, for details on the Honors in Paleontology program.

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).

163.9.1 Professional Association

The practice of geophysics in Alberta is regulated by the Association of Professional Engineers, Geologists and Geophysicists of Alberta (APEGGA).

The right to practise geophysics in Alberta and accept professional responsibility for such work as well as the right to use the geophysicist title is limited to those registered with APEGGA.

Members of the Geophysics Student Society are automatically student members of APEGGA. Graduates are encouraged to join APEGGA as Geophysicists-in-training. Two years of acceptable experience following graduation is necessary for registration as a Professional Geophysicist, the APEGGA membership category which confers the right to accept responsibility for geophysical work.

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 during the fall term.

Courses run Monday to Saturday.

A refundable deposit of $100 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 Winter Session. Graduation requires a minimum GPA of 6.5 on ★30 in each Winter Session.

Year 1	Year 2	Years 3 and 4
MATH 117, 118, 127, 128	MATH 217, 227, 317, 336	★30 in Mathematics courses
★3 in a Computing Science option	★6 in an approved Science options	★6 in an approved Science option
★3 in an approved Science option	★6 in an approved Arts options	★6 in an approved Arts option
★6 in approved Arts options	★6 in an approved options	★18 in approved options
★6 in approved options		

The program must include MATH 411, 417, 418, 426, 427, 447, 496; two of MATH 324, 347, 373, 412, 421, 486; 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 alternating years.

Honors in Applied Mathematics

This program is the same as the above except for the courses required in the third and fourth years: MATH 337, 411, 417, 436, 486, 496; one of MATH 373 or 421; ★12 in approved options at the 300-level in the field of application; ★3 in an approved 300- or 400-level Mathematics and/or Mathematical Physics option; ★12 in approved Science options; ★6 in an approved Arts option; ★6 in an approved option.

Minor in Statistics

The degrees Honors in Mathematics and Honors in Applied Mathematics can each be obtained with a minor in Statistics if the student's program included STAT 265, 266, 465, 466, 471, and two of STAT 377, 472, 475, 479, or a 400-level Statistics course.

Minor in Computing Science

The degrees Honors in Mathematics and Honors in Applied Mathematics can each be obtained with a Minor in Computing Science. The student's program must include CMPUT 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. CMPUT 304, 311, 313, and 474 are recommended.

The Department also offers a BA Honors in Mathematics (see §43.15.1).

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 Winter Session with a GPA of at least 5.5, and a GPA of at least 5.5 on all MATH, ECON, and STAT courses taken in that session. Graduation requires a GPA of at least 5.5 on all courses credited towards the degree and a GPA of at least 5.5 on all MATH, FIN, ECON and STAT courses credited towards the degree.

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

Year 1	Year 2
CMPUT 101, 102 or 114, 115	ECON 102
ECON 101	MATH 214, 215
MATH 114, 115	MATH 253
MATH 120, 121	STAT 265, 266
STAT 141 or 151	★3 in Arts
★6 in a junior English	★6 in Science
	★3 option

Year 3	Year 4
ACCTG 311	STAT 453, 466, 471, 479
FIN 301	★9 options to be chosen from FIN 412, 413, 414, 416 and ACCTG 413
MATH 353, 354	★9 options
STAT 312, 378	
★3 in Arts	
★3 options from MATH or STAT	
★3 options to be chosen from MGTSC 352, MARK 301 and ORG A 301	
★3 options	

Notes

(1) Students are strongly encouraged to choose their Business options from the following list of recommended courses: ACCTG 322, 413, 414; FIN 412, 413, 414, 416, 422, 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, 323, 341, 353, 378; CMPUT 201, 204, 272, 280, 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 Winter Session, 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 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 all Mathematics courses credited toward the degree.

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

Year 1	Year 2
MATH 114, 115 MATH 120, 121 ★6 from CMPUT 101, 102 or 114, 115 ★6 in approved options ★6 in a junior English	MATH 214, 215 MATH 223 ★3 in Mathematics ★6 in an approved Science option ★6 in an Arts option ★6 in an approved option
Year 3	**Year 4**
MATH 314/414 ★6 in Mathematics ★6 in an approved Science option ★6 in an Arts option ★6 in an approved option	★12 in a 300- or 400-level Mathematics ★6 in approved Science options ★12 in approved options

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, and MATH 127 can be substituted for MATH 120.

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

Year 1	Year 2	Years 3 and 4
ECON 101, 102 MATH 117, 118, 127, 128 ★6 in a junior English ★6 in a Science option	ECON 281, 282 MATH 217, 317, STAT 265, 266 ★6 in a Science option ★6 in an option	★24 in Economics ★24 in Mathematics or Statistics courses ★6 in a Science option ★6 in an option

The program must contain MATH 227; ECON 481, 482, 407, 408; and four of MATH 336, 373, 411, 417, 421, 426, 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 winter session, 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 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 course, which should be taken in the years indicated:

Year 1	Year 2	Years 3 and 4
ECON 101, 102 MATH 114, 115 MATH 120, 121 ★6 in a junior English ★6 in Science options	ECON 281, 282 MATH 214, 215 STAT 151 and 265 or STAT 265 and 266 ★6 in Science options ★6 in options	★24 in Economics including either ECON 399 or 407, 408 ★18 in Mathematics ★18 in options

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. MGTSC 352, 404, 424, 426, 427 are approved options but are not substitutes for Economics courses. Credit will not normally be given for ECON 386, 387, or 399. 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, and MATH 127 can be substituted for MATH 120.

163.11.5 Specialization in Mathematics and Finance

Continuation in the program normally requires, in the previous Winter Session, 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 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 MATH, STATS, ACCTG, ECON, FIN, and MGTSC courses credited toward the degree.

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

Year 1	Year 2
MATH 114, 115 MATH 120, 121 CMPUT 101, 102 or 114, 115 ECON 101/102 ★6 of junior English	MATH 214/215 MATH 253 STAT 151/265 or 265/266 ACCTG 311 ECON 281 ★9 of options
Year 3	**Year 4**
MATH 254 MATH 314/414 MATH 373 FIN 301 FIN option ★3 of Science option ★9 of Science options	★3 in MATH options ★6 in FIN options ★12 in Science options ★9 in options

Notes
(1) Approved ACCTG, ECON, FIN and MGTSC options include ACCTG 413; ECON 282, 384, 385, 407, 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 471, 472.
(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, and MATH 127 can be substituted for MATH 120.

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

			Weight	Grade
Year 4	Fall	WKEXP 951	0	CR/F
Year 4	Winter	WKEXP 952	0	CR/F
Year 4	Intersession	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 Winter Session. Graduation requires a minimum GPA of 7.0 on ★120 contributing to the degree. Each program of study must be approved by the coordinator in the Division of Neuroscience.

Year 1

CHEM 101, 161
BIOL 107, 108
MATH 113 or 114
MATH 115 or STAT 151
PHYS 100, 101 or PHYS 108, 109
ENGL 101

Year 2

BIOCH 220
CHEM 263
BIOL 207
PHYSL 210
PSYCO 104, 275
★6 in Science options
★3 in an Arts option

Year 3

PMCOL 371
PHYSL 372
PSYCO 377
ZOOL 342
★12 in approved Science options
★6 in Arts options

Year 4

NEURO 450, 451
★12 chosen from ANAT 415, PMCOL 407, 412, 509, 512, PSYCI 511, PSYCO 475, 478, ZOOL 445
★9 in approved Science options (PHYSL 401 and 402 recommended)
★3 in an Arts option

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 Winter Session.

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.

Year 3

ANTHR 390
BIOL 321 and 361
EAS 224 or PALEO 414
EAS 225 and 330
BIOL 335 or BOT 411
★6 approved Arts options
★3 approved option

Year 4

EAS 224 or PALEO 414
PALEO 318 and 319
BIOL 335 or BOT 411
BIOL 499 or EAS 427 and 428
★3 Arts option
★9 approved courses

Note: For information regarding new Biological Sciences and Earth and Atmospheric Sciences courses, please consult your Department advisor.

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 Winter Session 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.

Year 1

CHEM 101, 102
CHEM 161, 163
MATH 113 (or 114)
BIOL 107, 108
★3 in an approved Science option
ENGL 101

Year 2

BIOCH 203, 205
MICRB 265
PHYSL 210
PMCOL 201
★6 in Science options from BIOCH, BIOL, CHEM, GENET, MATH, MICRB, PHYS, PHYSL, PMCOL, or ZOOL
★6 in an approved Arts option

Year 3

PMCOL 305
PMCOL 332
PMCOL 342
STAT 237 or 141 or 151
★9 in Science options from areas as indicated for Year 2.
★6 in approved Arts option

Year 4

PMCOL 335, 336, 392, 403, 407, 409, 412, 415, 498, 499
★3 in Science options from areas indicated for Year 2.

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 Winter Session. 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.

Year 1

CHEM 101, 102
CHEM 161, 163
MATH 113 (or 114)
BIOL 107, 108
ENGL 101
★3 in an approved Science option

Year 2

BIOCH 203/205
MICRB 265
PHYSL 210
PMCOL 201
★6 in Science options from: BIOCH, BIOL, CHEM, GENET, MATH, MICRB, PHYS, PHYSL, PMCOL, or ZOOL
★6 in an approved Arts option

Year 3

PMCOL 305, 332, 342
★6 in Arts options
STAT 237 or 141 or 151
★9 in Science options from areas as indicated for Year 2

Year 4

PMCOL 335, 336, 392, 403; of the remaining ★18, at least ★9 shall be chosen from PMCOL 407, 409, 412, 415, and the remainder shall be Science options from areas as indicated for Year 2

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

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 Winter Session. Graduation requires a GPA of 6.5 on the last ★90 credited 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 Winter Session. Graduation requires a GPA of 5.5 on the last ★90 credited to the degree.

Notes

(1) Students interested in the Engineering-Physics program should consult §82.7 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 Physics and Geophysics courses are offered every year.

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 A: PHYS 362, 395, 413, 415, 472, 481, 484, 485, 491, 499; MA PH 343, 451.

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.

Year 1	Year 2	Years 3 and 4
PHYS 100, 102 MATH 113 (or 114, or 117), 115 (or 118) MATH 120 (or 127) ★9 in Science options (★3 in Computing Science recommended; other suggested options are in Astronomy, Chemistry, or Earth and Atmospheric Sciences) ★6 in Arts options (English recommended) (see Note 1 above)	PHYS 211, 244, 271, 281, 295, 297 MATH 121 (or 227) MATH 214 (or 217), 215 (or 317) ★3 in an Art option	PHYS 311, 351, 372, 381, 397, 472, 481 MATH 311 (or 411), 334 (or 336), 337 ★30 in other courses (See Notes 1, 2, and 3 above). In Year 4, students are also expected to take part in the weekly Physics Colloquium.

163.16.2 Honors in Geophysics

The Honors and Specialization (see §163.16.5) programs are identical except for the GPA requirements (see §163.18) 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, 325, 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.

Year 1	Year 2	Years 3 and 4
PHYS 100, 102 MATH 113 (or 114 or 117), 115 (or 118), 120 (or 127) ★6 from EAS 101, CHEM 101, CHEM 102, ★3 Arts option (see Note 1) ★3 in Computing Science (see Note 3) ★6 in Arts options (English recommended)	PHYS 211, 244, 271, 281, 295 MATH 214 (or 217), 215 (or 317) GEOPH 221 ★6 from: EAS 101, CHEM 101, CHEM 102, a three credit Arts option, whichever were not taken previously (see Note 1)	(see Notes 1, 2, and 3) PHYS 381, 481 MATH 311 (or 411), 334, (or 336, 337) EAS 233 EAS 222 (or 103 or 224) ★15 in approved Geophysics Core courses ★9 in approved Geophysics Pool courses ★12 in approved Science options ★3 in Arts options

163.16.3 Honors in Mathematical Physics

Year 1	Year 2	Years 3 and 4
MATH 117, 118, 127 PHYS 100, 102 ★3 in Computing Science or MATH 128; ★6 in Science options (Chemistry recommended); ★6 in Arts options (English recommended)	MATH 217, 227, 317 PHYS 211, 244, 271, 281, 295 MATH 128 or ★3 in Computing Science, whichever was not take previously ★3 in an Arts option	MATH 311 (or 411), 334 (or 336), 337, 417; MA PH 343, 451 PHYS 311, 351, 372, 381, 472, 481; STAT 235 or 265 ★12 approved Science options ★9 Arts options

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 A: PHYS 362, 395, 413, 415, 472, 481, 484, 485, 491, 499, MA PH 343, 451.

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. Specialization students may take 200-level courses from Science departments other than Physics and Mathematical Sciences. 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	Year 2	Years 3 and 4
PHYS 100, 102 MATH 113 (or 114 or 117), 115 (or 118), 120 (or 127) ★9 in Science options (★3 in Computing Science recommended) ★6 in Arts options (English recommended) (see Note 1 above)	PHYS 211, 244, 271, 281, 295, 297 MATH 121 (or 227), 214 (or 217), 215 (or 317) ★3 in an Arts option (see Note 1 above)	PHYS 311, 351, 372, 381, 397 MATH 311 (or 411), 334 (or 336), 337 ★36 in other courses (see Notes 1, 2 and 3 above)

163.16.5 Specialization in Geophysics

The Honors (see §163.16.2) and Specialization programs are identical except for the GPA requirements (see §163.16) 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, 325, 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.

Year 1	Year 2	Years 3 and 4
PHYS 100, 102 MATH 113 (or 114 or 117), 115 (or 118), 120 (or 127) ★6 from EAS 101, CHEM 101, CHEM 102, ★3 Arts option ★3 in Computing Science (see Note 3) ★6 in Arts options (English recommended)	PHYS 211, 244, 271, 281, 295 MATH 214 (or 217), 215 (or 317) GEOPH 221 ★6 from: EAS 101, CHEM 101, CHEM 102, ★3 Arts option, whichever were not taken previously (see Note 1)	(see Notes 1, 2, and 3) PHYS 381, 481 MATH 311 (or 411), 334 (or 336), 337 EAS 233 EAS 222 (or 103 or 224) ★15 in approved Geophysics Core courses ★9 in approved Geophysics Pool courses ★12 in approved Science options ★3 in an Arts option

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 PHYS 400, 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	WKEXP 421	0	CR/F
Year 4	Winter	WKEXP 422	0	CR/F
Year 4	Intersession	WKEXP 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 294 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 (§§163.1.2 and 163.1.3).

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 Biology. The trend is toward quantitative aspects of Physiology, and students should acquire the best background in Mathematics and in the chemical and physical sciences, consistent with their interests and abilities.

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 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
CHEM 101, 102, 161, 163;
ENGL 101
★6 in approved Science or Arts options (see Note 1)

Year 2

PHYSL 211
BIOL 201, 207
STAT 141, 151 or 237
BIOCH 203, 205
★9 in approved Science or Arts options (see Note 1)

Year 3

PMCOL 371, 332
PHYSL 372, 401, 402, 404
CELL 300, 301
★3 in an approved Science or Arts option (see Note 1)

Year 4

PHYSL 502 or 506
at least ★12 from: PHYSL 410, 501, 527, PMCOL 509
INT D 543, 544, 545
BIOL 445
★12 in approved options (see Note 1)

Notes

(1) The program must consist of a minimum of ★90 in science, a minimum of ★18 in Arts, and up to ★12 in non-Arts/non-Science options.

(2) Approved Science options should be chosen from the following: Junior Courses: PSYCO 104; PHYS 100, 101 or 102*; MATH 113 or 114, 115; CMPUT 114. Advanced Courses: BIOCH 410, 420, 430, 441, 450, 455, 460; BIOL 315, 585; CHEM 211, 213, 419; CMPUT 251, 252; ENT 292; GENET 270, 275, 301, 302, 304, 390, 418, 421, 471; LB AN 301; MATH 214, 215 262; MICRB 265, 370, 371; PH AS 221; PMCOL 305, 407, 412, 415 505, 506, 508; PSYCO 275, 281, 371, 377, 381, 459, 476, 478; STAT 252, 341, 368; ZOOL 202, 225, 226, 241, 242, 311, 340, 341, 342, 343, 412, 422, 445.

(3) Approved non-Science/non-Arts options must be chosen from the following: AN SC 310, 311, 410, 374, 484; ASM 513, 563; IMMUN 370, 451, MMID 224; 350, 520; NU FS 225, 227, 301, 302, 452, 468; OCCTH 106, 107; PEDS 200; PSYCI 511.

(4) Recommended Arts options may be chosen from the following: CHRTC 352; ENGL 310; LING 321, 323, 499; PHIL 101, 250, 265, 412, 415, 417; POL S 212, PSYCO 105, 223, 258, 425; SOC 100, 300, 382, 462, 473, WRITE 298.

(5) Honors students are also encouraged to attend all department seminars.

*Recommended taken in the second year.

163.18 Psychology

163.18.1 Honors in Psychology

The Department offers courses leading to the degrees of BSc and BA with Honors in Psychology. Students wishing to emphasize the physical, biological, and mathematical sciences should enrol in the BSc program; those wishing to emphasize the humanities and social sciences should enrol in the BA program. Either program is appropriate for students considering postgraduate training in psychology or in other fields that require these research skills.

Continuation in and graduation from the Honors Psychology program require a minimum GPA of 7.0 in the preceding Winter Session. Although admission into the Honors Psychology program is permitted only in the second or third year, students are expected to take at least ★30 during the Winter Session of each year of study, including the first and second years. Exceptions to this requirement must be approved by both the Department of Psychology and the Faculty of Science. A minimum of ★48 (but no more than ★60) must be taken in Psychology. A minimum of ★72 in science courses must be taken. A student's program of courses must be approved in advance each year by the Honors Psychology advisor.

Note: The required courses noted in Year 1 and Year 2 below must be taken during the first two years of study.

Year 1

ENGL 100 or 101
PSYCO 104, 105
BIOL 107, 108
★6 from CMPUT 101, 102, 114, 115, MATH 113, 114, 115, 117, 118, 120, 121, STAT 252, 341, or other computing science, mathematics or statistics course approved by the Honors Advisor
★6 in approved Science options

Year 2

STAT 151 and PSYCO 212
★6 (two of) from PSYCO 223, 233, 241, 258
★6 (two of) from PSYCO 267, 275, 281
★6 from approved courses offered by the Departments of Anthropology, Economics, Linguistics, Political Science and/or Sociology
★6 in approved Science options

Year 3

PSYCO 300, 390, 391
★3 (one of) PSYCO 356, 364, 410, 411, 431, 441, 475, 476, 482, 493, or other advanced research methods course approved by the Honors Advisor
★9-★12 in approved Science options
★6-★9 in approved options

Year 4

PSYCO 400, 490
★6 (two of) in a 400-level Psychology course other than 400, 410, 411, 431, 441, 475, 476, 482, 490, 493, 496, 497, 498, except as approved by the Honors Advisor
★9-★15 in approved Science options
★3-★9 in approved options

Notes

(1) In addition to the courses specifically listed above, the program must include, among the student's optional courses, a minimum of ★12 in one or more disciplines relevant to Psychology, e.g., Anthropology, Biology, Chemistry, Computing Science, Economics, Genetics, Linguistics, Mathematics, Neuroscience, Pharmacology, Philosophy, Physics, Physiology, Political Science, Sociology, Statistics, and applied Probability, and Zoology. These courses may not overlap those used to fulfil the Computing/Mathematics/Statistics, Natural Science and Social Science requirements listed above.

(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 conduct and write an empirical thesis (PSYCO 490) during the fourth year. Third-year students present their thesis research proposals, and fourth-year students present the results of their thesis research at the annual Honors Psychology Conference in April.

163.18.2 Specialization in Psychology

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

Year 1

PSYCO 104, 105
BIOL 107/108
★6 in an English course (ENGL 101 is recommended)
★6 from junior courses offered in the departments of Computing Science and Mathematics
★6 from junior courses offered in the departments of Chemistry and Physics

Year 2

STAT 151
★9 from PSYCO 258, 266 or 267, 275, 281
★3 in an approved Arts option
★6 in approved Science options
★9 in approved options

Year 3

★6 in approved Arts options
(a) for students meeting Year 2 requirements by taking PSYCO 258:
★15 in approved Science options
★9 in approved options or
(b) for students meeting Year 2 requirements by taking courses other than PSYCO 258:
★12 in approved Science options
★12 in approved options

Year 4

★21 in approved Science options
★9 in approved options

To fulfil the degree requirements, students must complete a minimum of ★36 in Science Psychology courses, 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 ★48 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

			Weight	Grade
Year 4	Fall	WKEXP 931	0	CR/F
Year 4	Winter	WKEXP 932	0	CR/F
Year 4	Intersession	WKEXP 933	0	CR/F
Year 5	Fall	PSYCO 410	3	9-point

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 Winter Session.

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:

Year 1	Year 2	Years 3 and 4
STAT 151 MATH 114 (or 117), 115 (or 118) MATH 120 (or 127), 121 (or 128) Any two of CMPUT 101, 102, 114, 115 ★6 in an Arts option ★3 in an approved option	STAT 265, 266 MATH 214 (or 217), 215 (or 317) ★6 in an Arts option ★6 in an approved Science option ★6 in an approved option	STAT 368, 378, 466, 471, 472, 475 MATH 311 or 334 or 373 or 380 MATH 314 or 417 MATH 414 or 418 ★3 in a statistics option ★6 in an Arts option ★24 in approved options

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 Winter Session, 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 Statistics and Mathematics 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 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:

Year 1	Year 2	Years 3 and 4
STAT 141 or 151 MATH 114, 115 MATH 120, 121 ★15 in approved options. See Note (1) below.	STAT 252, 265, 266 MATH 214, 215 ★15 in approved options. See Note (1) below.	STAT 312, 368, 378, 466, 471 Two of STAT 332, 361, 377 Two of STAT 453, 472, 476, 479 ★33 in approved options

Notes

(1) The program must include ★6 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, and MATH 127 can be substituted for MATH 120.

(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

			Weight	Grade
Year 4	Fall	WKEXP 951	0	CR/F
Year 4	Winter	WKEXP 952	0	CR/F
Year 4	Intersession	WKEXP 953	0	CR/F
Year 5	Fall	STAT 400	3	9-point

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.

163.20.1 Preprofessional Requirements for Medicine and Dentistry

For admission requirements for the DDS Degree program and the MD Degree program, see §15.4 and §15.9, respectively. Students planning to apply for admission to one of these degree programs may take the required courses while registered in a degree program in Science. See §15.16.8 for Grade 12 requirements for the preprofessional program.

163.20.2 Preprofessional Requirements for Veterinary Medicine

See §§15.16 and 43.2.7. Students may take the required courses while registered in a BSc General program or one of the BSc Specialization or BSc Honors programs. Students should consult the Faculty Office regarding appropriate courses.

163.20.3 Preprofessional Requirements for Rehabilitation Medicine

See §§15.14.3 and 15.16. Students may take the required courses while registered in a BSc General program or one of the BSc Specialization or BSc Honors programs.

163.20.4 Preprofessional Requirements for Optometry

A maximum of seven students from Alberta wishing to enter the School of Optometry at the University of Waterloo may complete the required preprofessional courses at the University of Alberta. Applicants must be Canadian Citizens or be residents of Canada who have held permanent resident (landed immigrant) status for at least 12 months before the registration day of the Fall Term.

Students interested in completing the preprofessional requirements while registered in a BSc program in the Faculty of Science at the University of Alberta should consult the Faculty of Science Student Services Office for a recommended outline of courses.

Information about admission requirements for the Doctor of Optometry program may be obtained from the School of Optometry, University of Waterloo (519) 885-1211 or (519) 888-4567 (automated attendant) or from their web site: http://www.optometry.uwaterloo.ca.

Note: Courses in human anatomy, histology, and embryology, that are comparable to those at the University of Waterloo, are not available in the BSc program at the University of Alberta.

163.20.5 Preprofessional Requirements for Medical Laboratory Science

Admission requirements for the BSc Medical Laboratory Science program are given in §15.9.1. Students planning to apply for admission to Medical Laboratory Science may take the required courses while registered in the Faculty of Science.

164 Details of Courses

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 Oral Health Sciences) (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 Oral Health Sciences) (PMCOL)
Physiology (taught by the Faculty of Medicine and Oral Health Sciences) (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, 332, 342, 336, 392, 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 466.

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.