# Faculty of Science

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J Nelson, PhD

Assistant Dean
A Adam, BSc

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Director of Biological Sciences Animal Service
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DW Schindler, DPhil, DSc, FRS

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VL Rodhig, PhD

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P Kitching, PhD
WJ McDonald, PhD
DN Page, PhD (CAIR Fellow)

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DR Schmitt, PhD
HS Sherrid, PhD
TJ Spanos, PhD
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JA Jung, PhD
F Marsigli, PhD
RW Rankin, PhD
RF Ryder, PhD

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Registrar of the University
BJ Sizer, MEd

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Science

School of Biological Sciences

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J Drummond, PhD (Nursing)
A Friedman, PhD (Arts)
Z Koles, PhD (Medicine)
W Pedrycz, PhD (Computer Engineering)
AE Peterson, PhD (Engineering)

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Professors
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WF Bischof, PhD
DS Grant, PhD
CD Heath, PhD
ML Spetch, PhD
DR Tier, PhD

Assistant Professors
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RL Cabeza, PhD (AHFMR Scholar)
MB Parent, PhD
DR Wong-Wylie, PhD

Faculty Service Officer III
TE Johnson, PhD

Additional Members of Faculty Council

162 Faculty Regulations

162.1 Faculty Overview


A Business Minor, an Arts Minor and an Agriculture, Forestry, and Home Economics 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 Faculty also offers a Bachelor of Science with Specialization in Science Education which is part of a five year BSc/ BEd combined degree program.

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 §15.15.

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 §162.6(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).

(6) Fall/Winter

The instructional period of September to April.

(7) Two-term Course

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

(8) Term

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

(9) Single-term Course

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

(10) Junior Courses

Those courses numbered 199 or lower.

(11) Normal Course Load

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

(12) Option

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

(13) Science Option

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

(14) Term

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

(15) Spring/Summer

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

(16) Year of Program

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

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

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

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

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

162.5 Academic Standing

In all programs in the Faculty of Science, academic standing is assessed on the basis of Grade Point Average. An assessment of academic standing is conducted for each student at the end of the student’s registration in the Fall/Winter regardless of the number of credits attempted and regardless of
whether the student registered in one or both terms. Decisions regarding academic standing will be based on courses attempted during the previous Fall/Winter only. See §23.4(7) and 23.9.2 for information on the calculation of GPA’s and the academic record.

162.5.1 Continuation in an Honors Program

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

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

162.5.2 Continuation in a Specialization Program

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

Those Specialization students who do not meet the continuation requirements of their program may apply to transfer to the General program if they meet the minimum continuation requirements of the General program. Students whose GPA 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 GPA at the end of Fall/Winter is below 4.5 will be required to withdraw. Such students can only apply for readmission after attending another postsecondary institution, at which time they can apply for admission as a transfer student under the conditions described in §14.2.1(5).

162.5.3 Continuation in the General Program

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

(1) Unsatisfactory Standing—Required to Withdraw

Students, whether in an Honors, Specialization, or the General program, whose GPA at the end of Fall/Winter is below 4.5, will be required to withdraw. Any registration in Summer Term and in the subsequent Fall/Winter will be cancelled. Such students can only apply for readmission after attending another postsecondary institution, at which time they can apply for admission as a transfer student under the conditions described in §14.2.1(5) and 15.15.9.

(2) Probation

Students who have been required to withdraw and who have successfully appealed that decision will be placed on Probation in the BSc General program. (See also §23.6.2.) Probationary students are given one Fall/Winter in which to clear probation and are not eligible for any extension of Probation beyond one Fall/Winter.

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

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

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

(3) Scholarship

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

(4) First-Class Standing

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

(5) Continuation in Programs

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

(6) Marginal Standing—Academic Warning

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

Only one period of attendance on Academic Warning will be allowed while registered in the Faculty of Science. Students who have received an Academic Warning in any previous Fall/Winter and whose current Fall/Winter GPA is between 4.5 and 4.9 will be required to withdraw from the Faculty. Such students can only apply for readmission after attending another postsecondary institution at which time they can apply for admission as a transfer student under the conditions described in §14.2.1(5) and 15.15.9.

Note. Students under Academic Warning are only permitted to interrupt their programs with the prior written approval of the Associate Dean. If students on Academic Warning interrupt their programs for more than 12 months without prior approval, readmission will normally not be granted unless the student meets the current readmission criteria. (This provision regarding permission to interrupt their program does not apply to Marginal students who attend another postsecondary institution in the interim. Such students must reapply as transfer applicants, see §15.15.9.)

162.5.4 Continuation in the BSc (Specialization in Science and Education) and BEd (Secondary) Combined Degree Program

Continuation in the BSc Specialization in Science and Education/BEd (Secondary) combined degrees program requires a Grade Point Average (GPA) of at least 5.5 in the Fall/Winter. (See §23.4(7) regarding the rules for calculating Grade Point Average).

A student who does not meet the requirement to continue in the combined degrees program must withdraw from the program and may apply for admission to either a BSc General program or a BEd program, if eligible. Refer to §163.4 for academic standing regulations for admission to the BEd program and to §163.1.3 for academic standing regulations for admission to the BSc General program.

162.5.5 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.

162.6 Courses

(1) Selection of Courses

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

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

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

(3) **Withdrawal from Courses**

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

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.

### 162.7 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 Fall/Winter. Those completing degree requirements during Spring/Summer will graduate at the Fall Convocation.

(4) **First-Class Honors**

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

(5) **With Distinction**

The notation “With Distinction” is inscribed on the parchment of a candidate for a General or Specialization degree if the candidate has obtained a GPA of not less than 7.5 over the last 60 and if the student was enrolled in a full academic load (at least 30) during each Fall/Winter of the last two years.

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

### 162.8 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.

### 162.9 Visiting Student Status

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

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

### 163 Programs of Study

#### 163.1 BSc in the Honors, Specialization, and General Programs

**163.1.1 Honors Programs**

A minimum of 120 normally taken in four consecutive academic years is required to complete the Honors program for the degree of BSc with Honors. These programs provide specialization in the chosen subject or subjects as well as the higher standard implied by the term “Honors.”

Honors programs are available in the Departments of Biochemistry, Biological Sciences, Cell Biology, Chemistry, Computing Science, Earth and Atmospheric Sciences, Mathematical Sciences, Neuroscience, Pharmacology, Physics, Physiology, and Psychology. Honors is the preferred program for students who plan graduate study.

**Admission**

See §15.15.3 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.
Applications 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 130 during the Fall/Winter of each year of the program. Exceptions to this requirement must be approved by the Department and the Faculty Office.

Academic Standings and Graduation
The following regulations govern Honors programs:

(1) Continuation in an Honors program is by recommendation of the department concerned and requires a GPA of at least 6.5 in each of the preceding Fall/Winter sessions. See description of Honors programs of individual departments for additional requirements relating to continuation in the Honors program.

(2) A student who fails to attain the standard necessary for continuance in Honors must withdraw from the Honors program. In so doing, the student may transfer to a Specialization program with the appropriate department’s approval or to the General program in the Faculty of Science. Students applying to transfer from an Honors program to Specialization or General must meet the continuation standards for the program concerned.

(3) A student who fails to complete the requirements for a degree with Honors in the fourth year may be granted the Specialization degree or the General degree on application if the courses taken and the standing attained are satisfactory. Such students must apply to transfer to a Specialization or General program.

(4) Degrees with Honors are awarded in two classes: First-Class Honors and Honors. For First-Class Honors, a GPA of at least 7.5 on the *160 for the last two Fall/Winter sessions is required. For Honors, a GPA of at least 6.5 on *130 in each Fall/Winter is required.

(5) Students transferring to Honors from Specialization or General programs or from other faculties or universities with less than 130 are allowed to make up the deficiency or deficiencies, i.e., *3 to *27, during or after taking the full program of courses in each Fall/Winter after entering the Honors program.

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

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

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

Specialization programs are available in the Departments of Biochemistry, Biological Sciences, Cell Biology, 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 §15.15.4 for admission requirements.

Selection of Courses
The following regulations govern Specialization programs:

(1) In each year, a Specialization student’s program must be approved by a Specialization advisor in the appropriate Department and by the Faculty Office.

(2) A minimum of *72 in Science is required in most Specialization programs. Certain Departments may require more than *72.

(3) A student must take at least *18 in Arts courses as part of the requirements for most Specialization degrees.

(4) Normally, no more than *42 in junior courses are permitted in Specialization programs.

(5) Certain non-Arts and non-Science courses appropriate to the program may be permitted in Specialization programs with the prior written approval of the Department directing the student’s program.

Students applying to transfer from a Specialization program to Honors must withdraw from the Specialization 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 GPA of 5.0.

Academic Standings and Graduation
The following regulations govern Specialization programs:

(1) Continuation in a Specialization program is by recommendation of the Department concerned and requires a GPA of at least 5.5 in each of the preceding Fall/Winter periods. See description of Specialization programs of individual departments for additional requirements relating to promotion in the Specialization program.

(2) A student who fails to attain the standard necessary for continuation in the Specialization program will be required to withdraw from that program. In so doing, the student may apply to transfer to the General program in the Faculty. Students applying to transfer from a Specialization to the General program must meet the continuation GPA 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.

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 Fall/Winter of the last two years.

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

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

163.1.3 General Programs
The BSc General program provides students with a diverse education in more than one branch of study and includes a major and minor subject or area of concentration. Students must major in a Science subject or area of concentration. Students may elect to minor in a Science subject or area of concentration an Arts subject of concentration an Agriculture, Forestry and Home Economics minor, or a Business minor. 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 Fall/Winter preceding admission to the Honors program. Students enrolled in the General program who intend to transfer to another program should consult the appropriate admission requirements for the particular program of interest in §15.16 and carefully select their first-year core courses in accordance with the requirements of the specific program.

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

Admission
See §15.15.1 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.
Each student must complete a major subject or area of concentration. The major subject or area must be in Science. A minimum of \( \geq 36 \) and a maximum of \( \leq 48 \) are required in the major subject or area of concentration, with no more than \( \leq 18 \) 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 Agriculture, Forestry, and Home Economics, Arts or Business. For a list of Agriculture, Forestry, and Home Economics Minors, see §163.1.4. For a list of Arts subjects available as a minor, refer to "Minors". For information about admission to the Business minor, see §15.15.2. Requirements for a Business minor appear in §163.1.5. At least \( \geq 24 \) and not more than \( \leq 36 \) are required in the minor subject or area of concentration with no more than \( \leq 12 \) 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.

**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.

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


**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, and Women’s History; Italian; Japanese; Latin American Studies; Linguistics; Music; Native Studies; Philosophy; Political Science; Psychology;** Religious Studies; Russian; Scandinavian; Spanish; Ukrainian; Women’s Studies.

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

**Earth Sciences/Arts Geography**

**Science Psychology/Arts Psychology**

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

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

- \( \geq 6 \) from among junior courses offered by the Department of English (normally ENGL 101)
- \( \geq 6 \) 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; CMPT 101 or 114; CMPT 102 or 115; STAT 141 or 151)
- \( \geq 6 \) 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)
- \( \geq 6 \) 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)
- \( \geq 6 \) from among 100-level courses in Arts or Science (Students interested in the Business Minor must take ECON 101 and 102)

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

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

(7) Each student must successfully complete a minimum of \( \geq 12 \) at the 300-level (or higher) in the major subject or area of concentration and, in addition, at least \( \geq 6 \) 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 \( \geq 12 \) 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 \( \geq 18 \) in Arts, nor toward the minimum requirement of \( \geq 72 \) 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 \( \geq 30 \) during the Fall/Winter of each year of the program.

**Academic Standings and Graduation**

The following regulations govern General Programs:

(1) To obtain a BSc General degree, a GPA of at least 5.0 must be attained on the last \( \geq 60 \) 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 \( \geq 60 \) if the students have satisfactorily completed at least a normal academic load of \( \geq 30 \) during the Fall/Winter periods of the last two years at the University of Alberta.

**Residence Requirement**

A student transferring to the Faculty of Science with advanced standing must complete at least \( \geq 60 \) applicable to the BSc program while registered at the University of Alberta. Normally, at least \( \geq 30 \) of the last \( \geq 60 \) must be completed while registered in the Faculty of Science.

**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 Spring/Summer.

**163.1.4 BSc General—Minor in Agriculture, Forestry, and Home Economics**

Students may choose a minor in Agriculture, Human Ecology or Nutrition. All other restrictions and requirements of the BSc General program, as outlined in §163.1.3 apply.

**Minor in Agriculture**

The minor in Agriculture consists of at least \( \geq 24 \) and no more than \( \leq 30 \) in Agriculture courses as follows:

(1) AG EC 200

(2) AN SC 200
(3) PL SC 221
(4) SOILS 210
(5) ★12 to ★18 in additional courses at the 300-level or higher to be chosen from AG EC, AN SC, ENCS, PL SC or SOILS.

**Minor in Human Ecology**

The minor in Human Ecology consists of at least ★24 and no more than ★30 in Human Ecology as follows:

(1) HECOL 100
(2) HECOL 200
(3) HECOL 150 or HECOL 170
(4) HECOL 320
(5) ★12 to ★18 in HECOL courses, with at least ★9 at the 300-level.

**Minor in Nutrition**

The minor in Nutrition consists of at least ★24 and no more than ★33 in Nutrition, with no more than ★12 at the 100-level, as follows:

(1) NUTR 100 or NU FS 101
(2) NU FS 372 or 373
(3) NUTR 301
(4) NUTR 302
(5) NU FS 363
(6) ★9 in advanced Nutrition courses

**Notes**: If biochemistry has been taken prior to NUTR 100 or NU FS 100, select an additional ★3 from advanced Nutrition courses.

### 163.1.5 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 Fall/Winter 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 ACCGT 311; ORG A 301; two of FIN 301, MGTSC 352, MARK 301, ORG A 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.

### 163.1.6 BSc (Specialization in Science and Education)/BEd (Secondary) Combined Degrees Program

The Faculties of Science and Education offer a combined degrees program that is more highly structured than the BSc followed by a BEd After-Degree (a six year route). It provides less flexibility in course choice and scheduling than taking the degrees sequentially, because it is designed to meet the minimum requirements of both degrees in five years. In addition, it must meet teacher certification requirements within this time frame.

To accommodate the variety in subject studies needed in secondary school teaching, students in the combined degrees program will select both a major/minor from the following areas:

- **Biological Sciences**: Biochemistry, Biology, Botany, Entomology, Genetics, Microbiology, Pharmacology, Physiology, Zoology.
- **Physical Sciences**: Astronomy, Biochemistry, Chemistry, Geophysics, Mathematical Physics, Physics.

Students apply to the Faculty of Science for admission to the Combined Degrees Program and spend the first two years of the five-year program registered in the Faculty of Science. (See §151.16.6)

**Academic Standing and Graduation**

(1) A student in the combined program is not granted the privilege of repeating a failed course more than once during the program except with the permission of both the Dean of Education and the Dean of Science.
(2) Courses with prerequisites may only be used for credit if the prerequisite requirements have been met. A grade of 4.0 is the minimum grade acceptable in a course to be used as a prerequisite.
(3) Normally, no more than ★42 at the 100-level are permitted in the combined program.
(4) A full-time student in the combined program should normally register in ★30 during Fall/Winter of each year of the program.
(5) A student may be permitted to complete the requirements for the combined program over a longer period than five years on approval by both the Dean of Education and the Dean of Science.

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### Science Chart 1 BSc (Specialization in Science and Education)/BEd

**Note**: Year 1 and Year 2 are completed in the Faculty of Science. Years 3, 4 and 5 are completed in the Faculty of Education.
### Science Chart 1  BSc (Specialization in Science and Education)/BEd (cont'd)

**Note:** Year 1 and Year 2 are completed in the Faculty of Science. Years 3, 4 and 5 are completed in the Faculty of Education.

#### Physical Sciences Major/Mathematical Sciences Minor (150)

<table>
<thead>
<tr>
<th>Core Program Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education: 145</td>
</tr>
<tr>
<td>Major: 45</td>
</tr>
<tr>
<td>Minor: 27</td>
</tr>
</tbody>
</table>

**Graduation Requirements:**
- GPA of 5.5 on all courses
- GPA of 6.0 on Major courses

**Area "A"**
- BIOL 207, BIOL 108
- CHEM 101, CHEM 102
- ENGL 101
- MATH 114
- MATH 115
- MATH 120
- STAT 151

**Area "B"**
- BIOL 207, BIOL 108
- CHEM 101, CHEM 102
- ENGL 101
- MATH 114
- MATH 115
- MATH 120
- STAT 151

**Area "C"**
- BIOL 207, BIOL 108
- CHEM 101, CHEM 102
- ENGL 101
- MATH 114
- MATH 115
- MATH 120
- STAT 151

**Notes:**
- Courses 1 through 5 above constitute the Introductory Professional Term and must be taken concurrently.
- Courses 6 through 9 above constitute the Advanced Professional Term and must be taken concurrently.

#### Mathematical Sciences Major/Physical Sciences Minor (150)

<table>
<thead>
<tr>
<th>Core Program Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education: 145</td>
</tr>
<tr>
<td>Major: 45</td>
</tr>
<tr>
<td>Minor: 27</td>
</tr>
</tbody>
</table>

**Graduation Requirements:**
- GPA of 5.5 on all courses
- GPA of 6.0 on Major courses

**Area "A"**
- BIOL 207, BIOL 108
- CHEM 101, CHEM 102
- ENGL 101
- MATH 114
- MATH 115
- MATH 120
- STAT 151

**Area "B"**
- BIOL 207, BIOL 108
- CHEM 101, CHEM 102
- ENGL 101
- MATH 114
- MATH 115
- MATH 120
- STAT 151

**Area "C"**
- BIOL 207, BIOL 108
- CHEM 101, CHEM 102
- ENGL 101
- MATH 114
- MATH 115
- MATH 120
- STAT 151

**Notes:**
- Courses 1 through 5 above constitute the Introductory Professional Term and must be taken concurrently.
- Courses 6 through 9 above constitute the Advanced Professional Term and must be taken concurrently.

#### Mathematical Sciences Major/Biological Sciences Minor (150)

<table>
<thead>
<tr>
<th>Core Program Requirements</th>
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<tr>
<td>Education: 145</td>
</tr>
<tr>
<td>Major: 45</td>
</tr>
<tr>
<td>Minor: 24</td>
</tr>
</tbody>
</table>

**Graduation Requirements:**
- GPA of 5.5 on all courses
- GPA of 6.0 on major courses

**Area "A"**
- BIOL 207, BIOL 108
- CHEM 101, CHEM 102
- ENGL 101
- MATH 114
- MATH 115
- MATH 120
- STAT 151

**Area "B"**
- BIOL 207, BIOL 108
- CHEM 101, CHEM 102
- ENGL 101
- MATH 114
- MATH 115
- MATH 120
- STAT 151

**Notes:**
- Courses 1 through 5 above constitute the Introductory Professional Term and must be taken concurrently.
- Courses 6 through 9 above constitute the Advanced Professional Term and must be taken concurrently.
### Science Chart 1 BSc (Specialization in Science and Education)/BEd (cont’d)

**Note:** Year 1 and Year 2 are completed in the Faculty of Science. Years 3, 4 and 5 are completed in the Faculty of Education.

#### Biological Sciences/Mathematical Sciences Minor (*$150$)

<table>
<thead>
<tr>
<th>Core Program Requirements</th>
<th>Year 1 (*$30$)</th>
<th>Year 2 (*$30$)</th>
<th>Year 3 (*$30$)</th>
<th>Year 4 (*$30$)</th>
<th>Year 5 (*$30$)</th>
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<tbody>
<tr>
<td>Education</td>
<td>Major: $36$</td>
<td>Minor: $27$</td>
<td>100-level: $33$ (Maximum $42$)</td>
<td>1. BIOL 107, BIOL 108</td>
<td>1. BIOL 207, BIOL 208</td>
</tr>
<tr>
<td>Graduation Requirements</td>
<td>GPA of 6.0 on all courses</td>
<td>GPA of 6.0 on major courses</td>
<td>2. CHEM 101, CHEM 161</td>
<td>2. CHEM 102</td>
<td>2. EDPS 310</td>
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<tr>
<td></td>
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<td></td>
<td>3. ENGL 101</td>
<td>3. EDYF 200</td>
<td>3. EDYF 303</td>
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<td></td>
<td></td>
<td>4. MATH 113 or 114</td>
<td>4. EDYF 200</td>
<td>4. EDSE (Minor)</td>
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<td></td>
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<td></td>
<td>5. *$6$ chosen from MATH 115, 120; STAT 151</td>
<td>6. *$6$ chosen from MATH 115, 120; STAT 151</td>
<td>7. *$6$ in Biological Sciences at the 200-level</td>
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<td></td>
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<td></td>
<td>6. *$6$ Arts Options</td>
<td>7. *$6$ in Biological Sciences at the 200-level</td>
<td>8. *$6$ in Mathematical Sciences at the 200-level</td>
</tr>
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<td></td>
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<td>*$6$ AREA “C”</td>
<td>Note: Courses 1 through 5 above constitute the Introductory Professional Term and must be taken concurrently.</td>
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<tr>
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<td></td>
<td>1. EDFX 450</td>
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<td>2. EDPS 410</td>
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<td>3. EDSE (Major)</td>
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<td></td>
<td>4. EDSE (Major)</td>
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<td></td>
<td>5. *$6$ in Biological Sciences at the 200-, 300- or 400-level</td>
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<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
<td>6. *$3$ in Mathematics at the 300- or 400-level</td>
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<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>7. *$6$ Education Options</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*$6$ Area “A”</td>
</tr>
<tr>
<td></td>
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<td></td>
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<td></td>
<td>Note: Courses 1 through 4 above constitute the Advanced Professional Term and must be taken concurrently.</td>
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</tbody>
</table>

#### Biological Sciences/Physical Sciences Minor (*$150$)

<table>
<thead>
<tr>
<th>Core Program Requirements</th>
<th>Year 1 (*$30$)</th>
<th>Year 2 (*$30$)</th>
<th>Year 3 (*$30$)</th>
<th>Year 4 (*$30$)</th>
<th>Year 5 (*$30$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>Major: $36$</td>
<td>Minor: $27$</td>
<td>100-level: $33$ (Maximum $42$)</td>
<td>1. BIOL 107, BIOL 108</td>
<td>1. BIOL 207, BIOL 208</td>
</tr>
<tr>
<td>Graduation Requirements</td>
<td>GPA of 6.0 on all courses</td>
<td>GPA of 6.0 on major courses</td>
<td>2. CHEM 101, CHEM 161</td>
<td>2. CHEM 102</td>
<td>2. EDPS 310</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3. ENGL 101</td>
<td>3. EDYF 200</td>
<td>3. EDYF 303</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4. MATH 113 or 114</td>
<td>4. EDYF 200</td>
<td>4. EDSE (Minor)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5. *$6$ chosen from MATH 115, 120; STAT 151</td>
<td>6. *$6$ chosen from MATH 115, 120; STAT 151</td>
<td>7. *$6$ in Biological Sciences at the 200-level</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6. *$6$ Arts Options</td>
<td>7. *$6$ in Biological Sciences at the 200-level</td>
<td>8. *$6$ in Mathematical Sciences at the 200-level</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*$6$ AREA “C”</td>
<td>Note: Courses 1 through 5 above constitute the Introductory Professional Term and must be taken concurrently.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1. EDFX 450</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td>2. EDPS 410</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td>3. EDSE (Major)</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>4. EDSE (Major)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5. *$6$ in Biological Sciences at the 200-, 300- or 400-level</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6. *$3$ in Mathematics at the 300- or 400-level</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td>7. *$6$ Education Options</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*$6$ Area “A”</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Note: Courses 1 through 4 above constitute the Advanced Professional Term and must be taken concurrently.</td>
</tr>
</tbody>
</table>

### 163.1.7 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 ($163.1.1$) or a BSc Specialization Degree ($163.1.2$) 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.

### 163.1.8 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 $15.15$), as well as program, academic standing, and graduation requirements of the particular degree program (see $163.1.1$ for Honors, $163.1.2$ for Specialization, and $163.1.3$ for General Program.)

Admission to a Specialization program and an Honors program requires approval of the appropriate Department and the Faculty Office. Note: The discipline in the BSc Specialization or Honors degree may not be the same as that of the first degree. 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. Note: The major selected in the After Degree program may not be in the same discipline as the major in the first degree. For further information, consult the Faculty of Science Student Services Office.

### 163.1.9 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 a minimum of 75, and not more than 105, units of course weight of an Honors or Specialization degree program. Students who have maintained good academic standing in an Honors or Specialization program and are Canadian citizens or permanent residents are eligible for the program. Department IIP Advisors provide approved position descriptions from companies wishing to employ IIP students. Companies are responsible for interviewing and selecting students for the positions. The internship may begin in May, September or January and must be of at least 8 months duration, but may extend to up to 16 months; a 16-month internship normally includes a four-month probationary period. Work during the internship period is full time, for which
the student is paid by the employer at competitive rates. The student, employer and the department must agree to terms of the internship. Following completion of the work experience, students return to the university to complete their degree program of studies. It is not possible to guarantee that all students wishing to obtain an internship will be able to do so.

During the period of the internship, the student registers in work experience (WKEXP) courses and is considered a full-time student at the University of Alberta. Work experience courses are assigned no units of course weight and are graded credit/no credit. All students must register in two WKEXP courses that have associated fees. These fees are used to cover Department costs of job recruitment, supervision and site visits during the internship period, and program administration costs.

During the first term following completion of the internship and return to the university, students must complete the academic requirements of the Industrial Internship. This normally takes the form of a report to the appropriate Advisor and/or Committee as well as to other students as part of a graded seminar course.

Detailed information about the Industrial Internship is available from the IIP Advisor in each Department in the Faculty of Science.

### 163.1.10 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 312. Also, transfers to Honors and Specialization programs require approval of the Department responsible for the new program.

Note that transfer from BSc/BEd program to any of the BSc programs must take place no later than Year 2 to avoid loss of credit.

### 163.1.11 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 credits 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 credits that must be completed while registered in the Faculty of Science. Science or Arts courses taken while in another faculty, which are clearly noted as “extra-to-degree” on the transcript, may fulfill specific subject requirements of a degree program in Science but will not fulfill the minimum residence requirement of the program.

### 163.2 Biochemistry

#### 163.2.1 Honors in Biochemistry

Continuation in the Honors program in Biochemistry requires a GPA of at least 7.0 in each of the preceding Fall/Winter periods. Graduation requires a minimum GPA of 7.0 on the last 60 credits to the degree.

- **Year 1**
  - CHEM 101/102 and 161/163
  - MATH 113 (or 114), and 115
  - BIOL 107/108
  - *6 in a junior Arts option (ENGL 101 recommended)

- **Year 2**
  - BIOCH 203/205
  - CHEM 271/273
  - PHYS 100 and 101 or equivalent
  - *6 in an approved Science option
  - *6 in Arts options

- **Year 3**
  - 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

- **Year 4**
  - BIOCH 499
  - CHEM 361 and 363
  - *9 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 BIOCH 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, 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. If 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, and 460 are offered only in alternating years.
8. Check the Registration Procedures book for courses offered in the current year.
9. BIOCH 401
10. *6 in Biochemistry (normally selected from BIOCH 410, 420, 430, or 441)
11. *6 in an approved Science option
12. *6 in an Arts option
13. *18 in Arts options
14. *441
15. *15 in approved Science options
16. *9 in an option

#### 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 credits to the degree.

- **Year 1**
  - CHEM 101/102 and 161/163
  - MATH 113 (or 114), 115
  - BIOL 107/108
  - *6 junior Arts option (ENGL 101 recommended).

- **Year 2**
  - 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**
  - 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

- **Year 4**
  - *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 BIO 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, and 460 are offered only in alternating years.
9. Check the Registration Procedures book for courses offered in the current year.

### 163.3 Biological Sciences

All students in Honors and Specialization programs in Biological Science take a common core of courses in the first and second years. Thereafter, they follow the course sequence of one of eight areas of concentration in either Honors or Specialization in Biological Sciences identified in 9163.3.4 and 163.3.5. Students must declare an area of concentration and follow the appropriate course sequence. The title of the area of concentration will appear on their degree. Specific course requirements of Honors students: BIOL 499, a directed research project, is required for Honors students. The research project must be conducted on a topic appropriate to the student’s area of concentration. BIOL 499 is a recommended option for Specialization students.

The Department of Biological Sciences offered programs in Honors and Specialization in Invertebrate Biology and Systematics and Evolution until 1998/99. Effective September 1999, these programs were replaced with Animal Biology and Evolutionary Biology, respectively. Students who began the old programs before 1999 may complete the programs if there has been no break in attendance. These students should consult the 1998/99 edition of the Calendar for program details. Students entering the Biological Sciences programs in September 1999 and thereafter will be 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 Sciences

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

Continuation in the Honors Biological Sciences program requires a minimum GPA of 6.5 in the preceding Fall/Winter. Graduation requires a minimum GPA of 5.5 in the preceding Fall/Winter of each year of the program. Exceptions to this requirement must be approved by the Department and the Faculty Office.

163.3.2 Specialization in Biological Sciences

Admission to the BSc Specialization in Biological Sciences program directly from high school requires a minimum average of 75% on the following required courses: English 30, 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 5.5 in the preceding Fall/Winter.

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

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

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

Notes
(1) Students intending to complete their degree in the areas of Cell Biotechnology, Microbiology, or Molecular Genetics must take both CHEM 102 and 163, normally in the second term of their first year, as the Science Option.
(2) Students intending to complete their degree in Physiology and Developmental Biology, or those who wish to incorporate BIOCH 203/205 in place of BIOCH 220 in their Animal Biology program, are required to take CHEM 163 in the first year.
(3) The rest of the Biological Sciences program core consists of BIOL 207, 208, and BIOCH 203 or 220, which would be completed in the second year.
(4) Students intending to complete their degree in the areas of Cell Biotechnology, Microbiology, Molecular Genetics, or Physiology and Developmental Biology require BIOCH 203/205, not BIOCH 220.
(5) Students in Honors Biological Sciences must successfully complete BIOL 499.

163.3.4 Course Sequence for Honors in Biological Sciences

See Science Chart 1.

163.3.5 Course Sequence for Specialization in Biological Sciences

See Science Chart 2.

Science Chart 2 Course Sequence for Honors in Biological Sciences

**Animal Biology**

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Year 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOCH 220; BIOL 201, 207, 208; ZOOL 224, 225; ZOOL 250 or ENT 220; ZOOL 241 or 242</td>
<td>BIOL 321, 499; BIOL 331 or ZOOL 332; ENT 220 or ZOOL 250; GENET 275; ZOOL 302 or 303; ZOOL 352; ZOOL 370 or 371</td>
</tr>
<tr>
<td>3 Approved Science options</td>
<td>9 Arts options</td>
</tr>
<tr>
<td>3 Arts option</td>
<td>12 from List A</td>
</tr>
<tr>
<td>List A: Recommended options include but are not restricted to the following:</td>
<td>3 from List B</td>
</tr>
<tr>
<td>BIOL 335, 380, 420, 430, 435; EAS 230; ENT 280, 321, 392; MA SC 410, 412, 430, 440; PALEO 318, 319; ZOOL 340, 341, 342, 351, 405, 407, 408, 427, 465.</td>
<td>9 Approved options</td>
</tr>
<tr>
<td>List B: BIOL 445, 468; ZOOL 402, 441, 442, 472; or a 500-level graduate seminar.</td>
<td>Note: MA SC courses on this list are offered at Bamfield Marine Station.</td>
</tr>
</tbody>
</table>

**Cell Biotechnology**

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Year 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOCH 203, 205; BIOL 201, 207; GENET 270; MICRB 265;</td>
<td>BIOL 208, 499; CHEM 361, 363; GENET 301, 304, 396; GENET 420 or MICRB 343 and 345; MICRB 311, 313, 406, 415, 450</td>
</tr>
<tr>
<td>6 Approved Science options</td>
<td>6 Approved options from list below</td>
</tr>
<tr>
<td>6 Arts options</td>
<td>6 Arts options</td>
</tr>
<tr>
<td>Note: A minimum grade of 6 is required in MICRB 265 to stay in the Cell Biotechnology Honors program.</td>
<td>Note: A minimum grade of 6 is required in MICRB 311 to stay in Cell Biotechnology Honors program.</td>
</tr>
<tr>
<td>Recommended options include but are not restricted to the following:</td>
<td>Recommended options include but are not restricted to the following:</td>
</tr>
<tr>
<td>BIOCH 410, 420, 430, 450; BIOL 490, 498; BOT 250, 380, 382; CHEM 211, 213, 361, 363; GENET 302, 364, 375; INT D 224, 371; MIMI 351, 352, 405, 415, 425, 520; MICRB 295, 316, 391, 410; NU FS 363, 402. [Other options may be approved if suitable]</td>
<td></td>
</tr>
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</table>

**Environmental Biology**

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Year 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOCH 220; BIOL 207, 208; BOT 201 or 210; CHEM 163 or 263; EAS 102; MATH 115 or 120; ZOOL 224; ZOOL 250 or ENT 220</td>
<td>BIOL 321, 380, 499; BIOL 430 or STATS 337</td>
</tr>
<tr>
<td>9 from BIOL 331, BOT 322, FOR 222 or SOILS 330; ZOOL 332, 371</td>
<td>9 from list below</td>
</tr>
<tr>
<td>9 Arts options</td>
<td>9 Arts options</td>
</tr>
<tr>
<td>12 Approved Options</td>
<td>12 Approved Options</td>
</tr>
<tr>
<td>Recommended options include, but are not restricted to the following:</td>
<td>Recommended options include, but are not restricted to the following:</td>
</tr>
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## Evolutionary Biology

### Year 2

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>BIOCH 220; BIOL 207, 208, 208</td>
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</tr>
<tr>
<td>* 6 from BOT 201, 210; ENT 220; ZOOL 224, 225, 250.</td>
<td></td>
</tr>
<tr>
<td>* 3 from BOT 240; ZOOL 241, 242; ENT 321.</td>
<td></td>
</tr>
<tr>
<td>* 3 Arts options</td>
<td></td>
</tr>
<tr>
<td>* 6 Approved options</td>
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### Year 3 and 4

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 321, 335, 420, 435, 499</td>
<td></td>
</tr>
<tr>
<td>* 3 from BOT 411; PALEO 318, 319.</td>
<td></td>
</tr>
<tr>
<td>* 3 from BIOL 331; BOT 332; ZOOL 332.</td>
<td></td>
</tr>
<tr>
<td>* 6 from BOT 302, 305, 306, 320; ZOOL 224, 405, 407, 408, 427; ENT 280; MICRB 265.</td>
<td></td>
</tr>
<tr>
<td>* 9 Arts options</td>
<td></td>
</tr>
<tr>
<td>* 12 from list below</td>
<td></td>
</tr>
<tr>
<td>* 9 Approved options</td>
<td></td>
</tr>
</tbody>
</table>

Recommended options include, but are not restricted to the following:
- BIOL 331, 430, 433, 520; BOT 250, 303, 309, 409, 431, 504, 565, 566, 511; ENT 321, 378; EAS 101, 230; MA SC 410, 412, 420, 430, 440, 445; PALEO 520; ZOOL 302, 303, 340, 302, 354, 355, 434, 472; PHYS 100 or 108.

Note: Marine Science courses on this list are offered at Bamfield Marine Station.

## Microbiology

### Year 2

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOCH 203, 205; BIOL 201, 207; GENET 270; MICRB 265</td>
<td></td>
</tr>
<tr>
<td>* 6 Science options (List A or B)</td>
<td></td>
</tr>
<tr>
<td>* 6 Arts options</td>
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</table>

### Year 3 and 4

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 208, 489; MICRB 311, 313, 343, 345; CHEM 211, 213</td>
<td></td>
</tr>
<tr>
<td>* 6 Arts options</td>
<td></td>
</tr>
<tr>
<td>* 12 in MICRB options (List A)</td>
<td></td>
</tr>
<tr>
<td>* 6 Science options (List A or B)</td>
<td></td>
</tr>
<tr>
<td>* 9 Approved options</td>
<td></td>
</tr>
</tbody>
</table>

Recommended options include, but are not restricted to the following:
- A. Microbiology options:
- B. Science options:
  - BIOCH 410, 420, 430, 441, 450, 455, 460; BIOL 490, 498; BOT 306; CHEM 271, 273, 303, 361, 363; CMPIUT 101 or 114; ENT 378; GENET 275, 301, 302, 304, 408; PHYS 100, 101; ZOOL 352, 452.
- C. Approved options:
  - BIOL 380; BOT 380, 382, 383; CELL 300, 301; EAS 201; PHYS 210; PSYCO 104; SOILS 210, 430.

(Some of these approved options actually count as science courses, see §164).

## Molecular Genetics

### Year 2

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOCH 203, 205; BIOL 207, 208; GENET 270, 275; MICRB 265</td>
<td></td>
</tr>
<tr>
<td>* 6 Arts Options</td>
<td></td>
</tr>
<tr>
<td>* 3 Science Option</td>
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</tbody>
</table>

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

### Year 3 and 4

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 201, 380, 499; GENET 301, 302, 304, 390</td>
<td></td>
</tr>
<tr>
<td>* 12 from GENET 364, 408, 412, 416, 420</td>
<td></td>
</tr>
<tr>
<td>* 6 Arts options</td>
<td></td>
</tr>
<tr>
<td>* 12 Approved options</td>
<td></td>
</tr>
</tbody>
</table>

Recommended options include, but are not restricted to the following:
- A. Microbiology options:
  - GENET 301, 302, 304, 390
- B. Science options:
  - GENET 364, 408, 412, 416, 420
- C. Approved options:
  - BIOL 380; BOT 380, 382, 383; CELL 300, 301; EAS 201; PHYS 210; PSYCO 104; SOILS 210, 430.

(Some of these approved options actually count as science courses, see §164).

## Physiology and Developmental Biology

### Year 2

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOCH 203, 205</td>
<td></td>
</tr>
<tr>
<td>BIOL 201, 207, 208</td>
<td></td>
</tr>
<tr>
<td>ZOOL 225, 241, 242, 250</td>
<td></td>
</tr>
<tr>
<td>* 3 Science option</td>
<td></td>
</tr>
</tbody>
</table>

### Year 3 and 4

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 499; ZOOL 302, 303, 344</td>
<td></td>
</tr>
<tr>
<td>* 3 of ZOOL 402 or 441 or 442</td>
<td></td>
</tr>
<tr>
<td>* 21 from list below</td>
<td></td>
</tr>
<tr>
<td>* 12 Arts options</td>
<td></td>
</tr>
<tr>
<td>* 9 Approved options</td>
<td></td>
</tr>
</tbody>
</table>

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

## Plant Biology

### Year 2

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOCH 220; BIOL 207, 208; CHEM 102; CHEM 163 or 263; BOT 201, 210, 240</td>
<td></td>
</tr>
<tr>
<td>* 3 Arts option</td>
<td></td>
</tr>
<tr>
<td>* 3 Science option</td>
<td></td>
</tr>
</tbody>
</table>

### Year 3 and 4

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 201, 499; BOT 250, 309, 303, 320, 332; MICRB 265</td>
<td></td>
</tr>
<tr>
<td>* 3 GENET</td>
<td></td>
</tr>
<tr>
<td>* 3 Arts options</td>
<td></td>
</tr>
<tr>
<td>* 3 Approved option</td>
<td></td>
</tr>
<tr>
<td>* 18 Senior Botany Courses</td>
<td></td>
</tr>
</tbody>
</table>
**Science Chart 3** Course Sequence for Specialization in Biological Sciences

### Animal Biology

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Year 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOCH 220; BIOL 201, 207, 208; ZOOL 224, 225; ZOOL 250 or ENT 220; ZOOL 241 or 242</td>
<td>BIO 321; BIOL 331 or ZOOL 332; ENT 220 or ZOOL 250; GENET 275; ZOOL 302 or 303; ZOOL 352; ZOOL 370 or 371</td>
</tr>
<tr>
<td>★3 Approved option</td>
<td>★9 Arts options</td>
</tr>
<tr>
<td>★3 Arts option</td>
<td>★12 from List A</td>
</tr>
<tr>
<td>★6 Approved Science options</td>
<td>★3 from List B</td>
</tr>
<tr>
<td>★6 Arts options</td>
<td>★15 Approved options</td>
</tr>
</tbody>
</table>

**List A:** Recommended options include but are not restricted to the following: BIO 335, 380, 420, 430, 435, 459, 499; EAS 230; ENT 280, 321, 392; MA SC 410, 412, 430, 440; PALEO 318, 319; ZOOL 340, 341, 342, 351, 405, 407, 408, 427, 465.

**List B:** BIO 445, 468; ZOOL 402, 441, 442, 472.

**Note:** MA SC courses on this list are offered at Bamfield Marine Station.

### Cell Biotechnology

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Year 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOCH 203, 205; BIOL 201, 207; GENET 270; MICRB 265</td>
<td>BIO 208; GENET 301, 304, 390; GENET 420 or MICRB 343 and 345; MICRB 311, 313, 415, 450</td>
</tr>
<tr>
<td>★6 Approved Science options</td>
<td>★1 Approved options from list below</td>
</tr>
<tr>
<td>★6 Arts options</td>
<td>★9 Arts options</td>
</tr>
<tr>
<td>★6 from BOT 201, 210; ENT 220; ZOOL 224, 225, 250</td>
<td>★18 Approved options</td>
</tr>
</tbody>
</table>

**Recommended options include, but are not restricted to the following:** BIO 410, 420, 450; BIO 490, 498, 499; BOT 250, 380, 382; CHEM 211, 213, 361, 363; GENET 302, 364, 375; INT D 224, 371; MMI 351, 352, 405, 415, 425, 520; MICRB 295, 316, 391, 410; NU FS 363, 402.

**[Other options may be approved if suitable.]**

### Environmental Biology

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Year 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOCH 220; BIOL 207, 208; BOT 201 or 210; CHEM 163 or 263; EAS 102; MATH 115 or 120; ZOOL 224; ZOOL 293 or ENT 220</td>
<td>BIO 430 or STATS 337; BIO 321, 380</td>
</tr>
<tr>
<td>★3 Arts option</td>
<td>★9 from BIO 331; BOT 332; FOR 322; or SOILS 330; ZOOL 332, 371.</td>
</tr>
<tr>
<td>★3 from BOT 240; ENT 321; ZOOL 241, 242</td>
<td>★9 from list below</td>
</tr>
<tr>
<td>★6 Approved options</td>
<td>★9 Arts options</td>
</tr>
</tbody>
</table>

**Recommended options include, but are not restricted to the following:** BIO 311, 340, 343, 345, 361, 466, 468, 498, 499; BOT 305, 306, 333, 431, 433; EAS 250; INT D 421; ZOOL 301, 405, 407, 408, 427, 434, 465.

### Evolutionary Biology

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Year 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOCH 220; BIOL 207, 208; ZOOL 224, 225, 250</td>
<td>BIO 321, 335, 420, 435</td>
</tr>
<tr>
<td>★6 from BOT 201, 210; ENT 220; ZOOL 224, 225, 250</td>
<td>★3 from BOT 411, PALEO 318, 319</td>
</tr>
<tr>
<td>★3 from BOT 240; ENT 321; ZOOL 241, 242</td>
<td>★3 from BIO 331, BOT 332, ZOOL 332</td>
</tr>
<tr>
<td>★6 Approved options</td>
<td>★6 from BOT 302, 305, 306, 320; ZOOL 224, 245, 407, 408, 427; ENT 280; MICRB 265</td>
</tr>
<tr>
<td>★9 Arts options</td>
<td>★9 from list below</td>
</tr>
<tr>
<td>★15 Approved options</td>
<td>★15 Approved options</td>
</tr>
</tbody>
</table>

**Recommended options include, but are not restricted to the following:** BIO 331, 430, 433, 488, 499, 520; BOT 250, 303, 309, 409, 431, 504, 505, 506, 511; ENT 321, 378; EAS 101, 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.

### Microbiology

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Year 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOCH 203, 205; BIOL 201, 207; GENET 270; MICRB 265</td>
<td>BIO 208; CHEM 211, 213; MICRB 311, 313</td>
</tr>
<tr>
<td>★6 Arts options</td>
<td>★12 MICROB options (List A)</td>
</tr>
<tr>
<td>★6 Science options (List A or B)</td>
<td>★12 Science options (List A or B)</td>
</tr>
<tr>
<td>★6 Arts options</td>
<td>★15 Approved options (List A, B or C)</td>
</tr>
</tbody>
</table>

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

**A. Microbiology options:** GENET 390; INT D 224, 371, 372, 452; MICRB 295, 316, 343, 345, 391, 392, 401, 410, 415, 420, 450; NU FS 381, 383, 402, 480; MMI 351, 352, 405, 415, 425, 427, 516, 520.

**B. Science options:** BIOCH 410, 420, 430, 441, 459, 495, 499; BOT 300; CHEM 271, 273, 303, 381, 383; CMPUT 101 or 114; ENT 376; GENET 275, 301, 302, 304, 408; PHYS 100, 101; ZOOL 352, 452.

**C. Approved options:** BIO 380; BOT 380, 382, 383; CELL 300, 301; EAS 201, 203; PHYS 210; PSYCO 104; SOILS 210, 430. (Some of these approved options actually count as science courses, see §164).
163.3.6 Industrial Internship Program

An Industrial Internship Program, similar to a co-op program, is offered to students in the Specialization or Honors programs in Biological Sciences (see §163.1.9 for guidelines to the program). The Industrial Internship designation will appear on the degree parchments of students who have participated in the program.

Students approved to enter this stream register for a continuous sequence of at least two work experience (WKEXP) courses 941 and 942, starting in May, September or January. During the program, student are considered full-time students of the University. Work experience courses have no weight and are graded credit/no credit, and recorded on the student’s transcript. The graduation requirements for the Industrial Internship program designation include successful completion of at least WKEXP 941 and 942 plus BIOL 400. BIOL 400 must be taken in the first term immediately following completion of the WKEXP period. If required by the employer, the student’s written report and oral presentation in BIOL 400 may be classified confidential. The employer is responsible for the student’s progress. This arrangement ensures satisfaction on all sides. If the review shows the situation is not satisfactory, the internship may be terminated and the student would then return to classes at the next available opportunity. The graduation requirements for the Industrial Internship program designation include successful completion of at least WKEXP 941 and 942 plus BIOL 400. BIOL 400 must be taken in the first term immediately following completion of the WKEXP period. If required by the employer, the student’s written report and oral presentation in BIOL 400 may be classified confidential. The employer also assesses the student’s performance during the work term. Based on the student’s written report and oral presentation, and the report from the employer, students are awarded a grade in BIOL 400.

Interested students should see the Industrial Internship Advisor in the Department of Biological Sciences for more information.

163.3.7 General Program in Biological Sciences

A major or a minor area of concentration in the Biological Sciences is available in the BSc General program.

Courses which may be used toward a Biological Sciences major or minor include BIOL; BOT; ENT; GENET; MA SC; MICRB; PALEO; ZOOL; CELL 300, 301; INT D 224, 371, 372, 421, 452, 543, 544; GENET 301, 302, 304, 412; MICRB 265, 311, 313; PHYSL 210, 401, 402, 404; PMCOL 371; ZOOL 340, 341, 342, 352, 355, 370, 402, 441, 442, 452.

The following previously offered courses may not be used for a concentration in Biological Sciences or Physical Sciences but not for both:

Courses which may be used for a concentration in Biological Sciences: BIOL 110, BOT 130, GENET 165, 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 major or minor in one of the specific subject disciplines in the Biological Sciences. For example, students may not select a major in the Biological Sciences and a minor in Microbiology. Students who choose Biological Sciences as a subject of concentration should consult the Department of Biological Sciences or the Faculty of Science Student Services Office.

163.4 Cell Biology

163.4.1 Honors in Cell Biology

Continuation in the Honors Cell Biology program requires a minimum GPA of 6.5 in the preceding Fall/Winter. Graduation requires a minimum GPA of 6.5 on the last 60 credits to the degree.
Honors in Chemistry must take a core of Chemistry and auxiliary courses. The core consists of ★2 in Chemistry courses, ★12 in Mathematics courses, ★1 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 Fall/Winter. Graduation requires a minimum GPA of 6.0 on the last ★30.

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, 163, 263, 271, 273, 341, 361, 381, 383, 383L, PHYS 100, 102, 230, MATH 113 (or 114), 116, 214, 216, ★26 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

An Industrial Internship Program, similar to a co-op program, is offered to students in the Specialization or Honors programs in Chemistry (see §163.1.9 for guidelines to the program). The Industrial Internship designation will appear on the degree parchments of students who have participated in the program.

Students approved to enter this stream register for a continuous sequence of at least two work experience (WKEXP) courses 401 and 402, starting in May, September or January. During the program, student are considered full-time students of the University. Work experience courses have no weight and are graded credit/no credit, and recorded on the student’s transcript. The Industrial Internship 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. If the review shows the situation is not satisfactory, the internship may be terminated and the student would then return to classes at the next available opportunity. The graduation requirements for the Industrial Internship program designation include successful completion of at least WKEXP 401 and 402 plus CHEM 400. CHEM 400 must be taken in the first term immediately following completion of the WKEXP period. If required by the employer, the student’s written report and oral presentation in CHEM 400 may be classified confidential. The employer also assesses the student’s performance during the work term. Based on the student’s written report and oral presentation, and the report from the employer, students are awarded a grade in CHEM 400.

Interested students should see the Industrial Internship Advisor in the Department of Chemistry for more information.
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 513. 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 §15.15. The Computing Science program has a limit on enrolment in the second year.

Senior Computing Science courses (300- and 400-level) are restricted to third- and fourth-year Science Honors and Specialization students.

163.6.1 Honors in Computing Science
Continuation in the Honors program requires a GPA of at least 6.5 in the preceding Fall/Winter. Graduation requires a GPA of at least 6.5 on the last ★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, applied mathematics are available from the Department.

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMPUT 201, 204, 229, 291</td>
<td>CMPUT 301, 304, 325, 379, 391</td>
<td>CMPUT 340</td>
</tr>
<tr>
<td>MATH 120, 214 (or 217), 215 (or 317)</td>
<td>MATH 129 or 222</td>
<td>★6 in CMPUT at the 300-level or higher</td>
</tr>
<tr>
<td>STAT 221</td>
<td>STAT 222</td>
<td>★9 in approved options</td>
</tr>
<tr>
<td>★3 in an Arts option</td>
<td>★6 in approved options</td>
<td>★9 in approved Science options</td>
</tr>
<tr>
<td>★3 in an approved option</td>
<td>★3 in Science option</td>
<td>★3 in Arts option</td>
</tr>
</tbody>
</table>

Notes
(1) Honors students should take the Honors version of the Mathematics courses beginning in the first year.
(2) Honors students must take CMPUT 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 5.5 in the preceding Fall/Winter. Graduation requires a GPA of at least 5.5 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.

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Same as for regular Specialization</td>
<td>Same as for regular Specialization</td>
<td>Same as for regular Specialization</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CMPUT 300, 301, 325, 379</td>
<td>★3 in CMPUT at the 300-level or higher</td>
<td></td>
</tr>
<tr>
<td></td>
<td>STAT 222</td>
<td>★6 in Business electives (see Note 1 below)</td>
</tr>
<tr>
<td></td>
<td>★3 in arts option</td>
<td>★3 in Science option</td>
</tr>
</tbody>
</table>

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 5.5 in the preceding Fall/Winter in the Specialization Computing Science program may continue with the designation “pursuing a Business Minor within Specialization Computing Science.” Students who withdraw from the Specialization Computing Science program lose their status as “pursuing a Business Minor Within Specialization Computing Science.” Should such students be admitted to the BSc General program and wish to pursue a Business minor within the BSc General program, they must reapply to the Business-Science Quota Committee for admission to the Business minor.

The Business minor in Computing Science consists of the following:
(1) ECON 101, 102
(2) ACCTG 311
(3) ORG A 301
(4) Two of FIN 301, MARK 301, MGTSC 352, and ORG A 321
(5) A minimum of ★6 in courses offered by the Faculty of Business and approved by the student’s advisor

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

163.6.4 Specialization in Computing Science—Software Quality Option
The Software Quality Option program gives students the ability to focus on topics in Computing Science that are most relevant to software professionals while pursuing relatively broad interests in Computing Science and in other disciplines. It is recommended that students use the required Arts and approved options to build a foundation in disciplines related to, or influenced by, Computing Science. Suggested program of study include Arts, Business, Electrical Engineering, and Applied Mathematics. Coherent programs in these and other application areas are to be developed by the student with the assistance of the departmental advisor. Course selections in other departments and Faculties may be subject to enrolment management policies and GPA requirements.

Students will be accepted in the Software Quality Option after completing the first two years of the Specialization Program in Computing Science. Enrolment in this program is limited. Screening will take place after year 2; the students with the highest GPA in CMPUT 201, 204, 229 and 291; MATH 120 and 214; and STAT 221 will be admitted.

Continuation in the Specialization program with the Software Quality Option requires a GPA of at least 5.5 in the preceding Fall/Winter. Graduation requires a GPA of at least 5.5 on the last ★90 credited to the degree.
163.6.5 Industrial Internship Program

An Industrial Internship Program, similar to a co-op program, is offered to students in the Specialization or Honors programs in Computing Science (see §163.1.9 for guidelines to the program). The Industrial Internship designation will appear on the degree parchments of students who have participated in the program.

Students approved to enter this stream register for a continuous sequence of at least two work experience (WKEXP) courses 921 and 922, starting in May, September or January. During the program, students are considered full-time students of the University. Work experience courses have no weight and are graded credit/no credit, and recorded on the student’s transcript. The Industrial Internship 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. If the review shows the situation is not satisfactory, the internship may be terminated and the student would then return to classes at the next available opportunity. The graduation requirements for the Industrial Internship program designation include successful completion of at least WKEXP 921 and 922 plus CMPUT 400. CMPUT 400 must be taken in the first term immediately following completion of the WKEXP period. If required by the employer, the student’s written report and oral presentation in CMPUT 400 may be classified confidential. The employer also assesses the student’s performance during the work term. Based on the student’s written report and oral presentation, and the report from the employer, students are awarded a grade in CMPUT 400.

Interested students should see the Industrial Internship Advisor in the Department of Computing Sciences for more information.

163.6.6 BSc General—Computing Science Minor

The Computing Science minor requires between 24 and 36 in Computing Science, with a maximum of 48 credits 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; MATH 100 and 102
- 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 (101/113); students with previous experience are encouraged to complete 114/115.

163.6.7 BSc Program in Computer Engineering

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

See admission requirements in §15.6. Promotion and Graduation regulations are found in §73.3(2).

163.7 Earth and Atmospheric Sciences

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

163.7.1 Honors in Atmospheric Sciences

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

Continuation in the Honors in Atmospheric Sciences program requires a GPA of at least 5.5 on at least 30 in the previous Fall/Winter. Graduation requires a GPA of at least 6.5 on the last 60 credited to the degree.

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

163.7.2 Specialization in Atmospheric Sciences

Continuation in the Specialization in Atmospheric Sciences program requires a GPA of at least 5.5 on at least 21 approved Science courses.

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 advisor before registration each year.

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 Fall/Winter.

Graduation requires a GPA of at least 6.5 on the last 60 credited to the degree.
A student enrolling in the Honors program should confer with the Environmental Earth Sciences Program student advisor before registration each year.

### Year 1

- CHEM 101 and 102
- EAS 101 and 102
- ENGL 101
- MATH 113 or 114 and 115
- PHYS 100 or 101
- GEOPH 223

**Optional Elements**

Students must take additional courses from each of the following six groups:

1. At least 3 (Field and Laboratory Methods) of EAS 253, 327, 424
2. At least 3 (Geoprocessing) of EAS 235, 351, 451
3. At least 3 (Math, Statistics and Computing) of CMPUT 101, 114; MATH 120, 214, 215, 280, 334; STAT 141, 151
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 any EAS X9X courses.

**Note:** An additional 21 of approved options including courses listed in Groups 1-6 above. For students in the Industrial Internship Program: EAS 401, WKEXP 411, WKEXP 412.

### Year 2

- CHEM 101 and 102
- EAS 101 and 103
- ENGL 101
- MATH 113 or 114 and 115
- PHYS 100 and 101
- GEOPH 223

**Optional Elements**

Students must take additional courses from each of the following six groups:

1. At least 3 (Field and Laboratory Methods) of EAS 253, 327, 424
2. At least 3 (Geoprocessing) of EAS 235, 351, 451
3. At least 3 (Math, Statistics and Computing) of CMPUT 101, 114; MATH 120, 214, 215, 280, 334; STAT 141, 151
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 any EAS X9X courses.

**Note:** Recommended Arts options include any EAS X9X courses. For students in the Industrial Internship Program: EAS 401, WKEXP 411, WKEXP 412.

### Specialization in Environmental Earth Sciences

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

- EAS 232, 234 and 354
- GEOPH 223

- **Optional Elements**

  Students must take additional courses from each of the following six groups:

  1. At least 3 (Field and Laboratory Methods) of EAS 253, 327, 424
  2. At least 3 (Geoprocessing) of EAS 235, 351, 451
  3. At least 3 (Math, Statistics and Computing) of CMPUT 101, 114; MATH 120, 214, 215, 280, 334; STAT 141, 151
  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 any EAS X9X courses.

**Note:** An additional 21 of approved options including courses listed in Groups 1-6 above. For students in the Industrial Internship Program: EAS 401, WKEXP 411, WKEXP 412.

### Year 2

- EAS 290 or 291
- EAS 320, 321, 330, 331, 332 and 333
- GEOPH 221 or 223 or 224

- **3 Arts option**

**Note:** Recommended Arts options include any EAS X9X courses. For students in the Industrial Internship Program: EAS 401, WKEXP 411, WKEXP 412.

### 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 (APEGA). 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 APEGA.

Members of the PS Warren Society, the geology student society, are automatically student members of APEGA 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 APEGA as satisfying the academic requirements if courses are chosen to cover the APEGA syllabus. Holders of degrees that do not cover the APEGA syllabus. Holders of degrees that do not cover the APEGA syllabus may be required, through the APEGA 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 APEGA.

### Honors in Paleontology

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

### Industrial Internship Program

An Industrial Internship Program, similar to a co-op program, is offered to students in the Specialization or Honors programs in Earth and Atmospheric Sciences.

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**Notes:**

- **#** indicates required courses.
- **@** indicates a course that may be repeated.
- **E** indicates that the course is offered in the Fall/Winter term.
- **S** indicates that the course is offered in the Summer term.
- **F** indicates that the course is offered in the Fall term.
- **W** indicates that the course is offered in the Winter term.
Sciences (see §163.1.9 for guidelines to the program). The Industrial Internship designation will appear on the degree parchments of students who have participated in the program.

Students approved to enter this stream register for a continuous sequence of at least two work experience (WKEXP) courses 411 and 412, starting in May, September or January. During the program, students are considered full-time students of the University. Work experience courses have no weight and are graded credit/no credit, and recorded on the student’s transcript. The Industrial Internship 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. If the review shows the situation is not satisfactory, the internship may be terminated and the student would then return to classes at the next available opportunity. The graduation requirements for the Industrial Internship program designation include successful completion of at least WKEXP 411 and 412 plus EAS 400. EAS 400 must be taken in the first term immediately following completion of the WKEXP period. If required by the employer, the student’s written report and oral presentation in EAS 400 may be classified confidential. The employer also assesses the student’s performance during the work term. Based on the student’s written report and oral presentation, and the report from the employer, students are awarded a grade in EAS 400.

Interested students should see the Industrial Internship Advisor in the Department of Earth and Atmospheric Sciences for more information.

### 163.8 Environmental Physical Sciences
#### 163.8.1 Specialization in Environmental Physical Sciences
Continuation in the Specialization in the Environmental Physical Sciences program requires a minimum GPA of 5.5 in the preceding Fall/Winter. Graduation requires a minimum of GPA of 5.5 on the last 15 credits to the degree.

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 101 and 102</td>
<td>BIOL 108</td>
</tr>
<tr>
<td>MATH 113 or 114</td>
<td>CHEM 261 and 263</td>
</tr>
<tr>
<td>MATH 115</td>
<td>MATH 120</td>
</tr>
<tr>
<td>PHYS 144, 146</td>
<td>PHYS 201</td>
</tr>
<tr>
<td>EAS 101 and 102</td>
<td>EAS 220 and 221 (See Note 1) or PHYS 261 and 264</td>
</tr>
<tr>
<td>*6 in English (ENGL 101 recommended)</td>
<td>*6 in Arts options or approved Science or other options (See Notes 1 and 2)</td>
</tr>
</tbody>
</table>

**Year 3**

| CHEM 211 and 213 | CHEM 303 |
| EAS 220 and 221 (See Note 1) or PHYS 261 and 264, whichever were not previously taken. | EAS 305 or EAS 351 |
| EAS 223 and 270 | EAS 425 |
| PHYS 294 | PHYS 364 or approved Science option, whichever was not previously taken. |
| PHYS 364 or approved Science option | *18 in Arts options or approved Science or other options. (See Notes 2 and 3) |

**Year 4**

| CHEM 305 | CHEM 329 or EAS 353 |
| EAS 425 | 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 305.
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, 392, 415, 417, EAS 224, 225, 250, 327, 392, 427; ENCS 203, 392; GEOPH 223, 224; 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 degree. 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/Winter, a student in the IIP will register in work experience courses, WKEXP 421 and 422 and will be considered to be a full-time off-campus student of the University of Alberta. The WKEXP courses are graded credit or no credit. In the Fall term immediately following successful completion of the IIP, the student will register in ENVPS 403, 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 403, based on the employer’s assessment, the report and the oral presentation. A student who has successfully completed WKEXP 421, 422 and ENVPS 403, will receive an Industrial Internship Designation on the degree certificate.

#### Courses Related to the Industrial Internship Program

<table>
<thead>
<tr>
<th>Course</th>
<th>Weight</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 4</td>
<td>Falls</td>
<td>WKEXP 421</td>
</tr>
<tr>
<td>Year 4</td>
<td>Winter</td>
<td>WKEXP 422</td>
</tr>
<tr>
<td>Year 5</td>
<td>Fall</td>
<td>ENVPS 403</td>
</tr>
</tbody>
</table>

### 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 Fall/Winter. Graduation requires a minimum GPA of 6.5 on 30 credits in each Fall/Winter.
The program normally requires, in the previous Fall/Winter, successful completion of at least 24 with a GPA of at least 5.5, and a GPA of at least 5.5 on all Mathematics courses taken in that Fall/Winter. Graduation requires a GPA of at least 5.5 on all courses credited toward the degree and a GPA of at least 5.5 on all Mathematics courses credited toward the degree.

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

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Years 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 117, 118, 125, either 228 or 229</td>
<td>MATH 217, 225, 317, 334</td>
<td>★21 in Mathematics courses ★6 in approved Arts options ★6 in 300-level Mathematics and/or Mathematical Physics options ★12 in approved Science options ★6 in approved Arts options ★6 in approved options</td>
</tr>
</tbody>
</table>

Notes
(1) Students are strongly encouraged to choose their Business options from the following list of recommended courses: ACCCTG 101, 102, 114, 115, 228, 229; ECON 221, 222, 231, 232, 241, 242; MGMT 320, 404, 405, 462; MARK 301, 401, 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, 292, 331, 332, 333, 337, 378; CMPUT 201, 202, 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. ★89 in Science courses, of which ★60 must be MATH and STAT
   d. ★24 MATH and STAT courses at the 300-level or higher

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

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

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 114, 115</td>
<td>MATH 125</td>
<td>ACCCTG 311</td>
<td>STAT 453, 466, 471, 479</td>
</tr>
<tr>
<td>★6 from CMPUT 101, 102 or 114, 115</td>
<td>★6 in approved options</td>
<td>★9 options to be chosen from FIN 412, 413, 414, 416 and ACCCTG 413</td>
<td>★9 options</td>
</tr>
<tr>
<td>★6 in a junior English</td>
<td>★3 in approved Science options</td>
<td>★6 in approved Science options</td>
<td>★6 in approved options</td>
</tr>
<tr>
<td>★3 in Science</td>
<td>★6 in approved options</td>
<td>★6 in approved options</td>
<td>★6 in approved options</td>
</tr>
</tbody>
</table>

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

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

Honors in Mathematics and Economics

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECON 101, 102</td>
<td>ECON 281, 282</td>
<td>ECON 281, 282</td>
<td>★24 in Economics ★24 in Mathematics or Statistics courses</td>
</tr>
<tr>
<td>MATH 117, 118, 125, 228</td>
<td>MATH 217, 218</td>
<td>MATH 217, 218</td>
<td>★6 in approved Science options ★6 in approved Science options</td>
</tr>
<tr>
<td>★6 in a junior English</td>
<td>★3 in approved Science options</td>
<td>★6 in approved options</td>
<td>★6 in approved options</td>
</tr>
<tr>
<td>★6 in approved Science options</td>
<td>★6 in approved options</td>
<td>★6 in approved options</td>
<td>★6 in approved options</td>
</tr>
<tr>
<td>★3 in Science</td>
<td>★3 in Science</td>
<td>★3 in Science</td>
<td>★3 option</td>
</tr>
</tbody>
</table>

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

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

The program must contain MATH 225; ECON 481, 482, 407, 408; and four of MATH 336, 373, 411, 471, 421, 422, 486. Credit is not given for ECON 386, 387, or 399.
Graduation requires a GPA of at least 5.5 on all courses credited toward the degree and a GPA of at least 5.5 on the aggregate of all Mathematics and Economics courses credited toward the degree.

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

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Years 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECON 101, 102</td>
<td>ECON 281, 282</td>
<td>8.24 in Economics including either ECON 399 or ECON 407, 408</td>
</tr>
<tr>
<td>MATH 114, 115</td>
<td>MATH 214, 215</td>
<td>6.18 in Mathematics</td>
</tr>
<tr>
<td>MATH 125</td>
<td>MATH 225</td>
<td>6.18 in Mathematics</td>
</tr>
<tr>
<td>STAT 151/265</td>
<td>STAT 265/266</td>
<td>6.18 in Mathematics</td>
</tr>
<tr>
<td>STAT 151</td>
<td>STAT 265</td>
<td>6.18 in Mathematics</td>
</tr>
</tbody>
</table>

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

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

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

163.11.5 Specialization in Mathematics and Finance

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

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

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

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 114, 115</td>
<td>MATH 214/215, 225</td>
<td>MATH 303</td>
</tr>
<tr>
<td>MATH 125</td>
<td>MATH 225</td>
<td>MATH 337</td>
</tr>
<tr>
<td>CMPT 101, 102, 114, 115</td>
<td>MATH 253</td>
<td>FIN 301</td>
</tr>
<tr>
<td>ECON 101/102</td>
<td>STAT 151/265 or 265/266</td>
<td>ECON 399 or STAT 378</td>
</tr>
<tr>
<td>6 in a junior English</td>
<td>6 in options</td>
<td>6 in options</td>
</tr>
<tr>
<td>3 in option</td>
<td>6 in options</td>
<td>6 in options</td>
</tr>
</tbody>
</table>

Notes
(1) Approved ACCTG, ECON, FIN and MGTS course include ACCTG 413; ECON 282, 384, 385, 407, 408, 481, 482, FIN 412, 413, 414, 416, 422, 432, 442; MGTS 302, 404, 405, 428, 456.
(2) Students should choose some of their MATH and Science options from the following recommended courses: MATH 334, 337, 432, 470; MATH 280, 380; MATH 354; STAT 466, 471, 472, 479.
(3) Each program must have the approval of the Department of Mathematical Sciences and must include:
   a. 12 in Arts Courses;
   b. 6 in Science courses, including 3 of MATH with at least 12 of these at the 300-level or higher;
   c. 6 in ECON, ACCTG, FIN, or MGTS, including 9 of 400-level FIN.
(4) A corresponding Honors Mathematics course can be substituted for any Mathematics course listed. For example, MATH 117 can be substituted for MATH 114.

163.11.6 Industrial Internship Program

An Industrial Internship Program, similar to a co-op program, is offered to students in the Specialization or Honors programs in Mathematical Sciences (see 163.1.9 for guidelines to the program), The Industrial Internship designation will appear on the degree parchments of students who have participated in the program.

Students approved to enter this stream register for a continuous sequence of at least two work experience (WKEXP) courses 951 and 952, starting in May, September or January. During the program, student are considered full-time students of the University. Work experience courses have no weight and are graded credit/no credit, and recorded on the student’s transcript. The Industrial Internship 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. If the review shows the situation is not satisfactory, the internship may be terminated and the student would then return to classes at the next available opportunity. The graduation requirements for the Industrial Internship program designation include successful completion of at least WKEXP 951 and 952 plus MATH or STAT 400. MATH or STAT 400 must be taken in the first term immediately following completion of the WKEXP period. If required by the employer, the student’s written report and oral presentation in MATH or STAT 400 may be classified confidential. The employer also assesses the student’s performance during the work term. Based on the student’s written report and oral presentation, and the report from the employer, students are awarded a grade in MATH or STAT 400.

Interested students should see the Industrial Internship Advisor in the Department of Mathematical Sciences for more information.

163.12 Neuroscience

163.12.1 Honors in Neuroscience

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

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

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

Continuation in the honors program requires a minimum GPA of 7.0 in the preceding Fall/Winter. Graduation requires a minimum GPA of 7.0 in Years 3 and 4 of the program. Each program of study must be approved by the coordinator in the Division of Neuroscience.

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 101, 161</td>
<td>BIOI 107, 108</td>
</tr>
<tr>
<td>BIOI 113</td>
<td>BIOI 114</td>
</tr>
<tr>
<td>MATH 113</td>
<td>STAT 191</td>
</tr>
<tr>
<td>STAT 208</td>
<td>PHYS 108, 109</td>
</tr>
<tr>
<td>PHYS 208</td>
<td>ENGL 101</td>
</tr>
<tr>
<td>PMCOL 371</td>
<td>PSYCO 407, 408</td>
</tr>
<tr>
<td>PMCOL 412</td>
<td>PSYCO 412</td>
</tr>
</tbody>
</table>

Notes
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; BIOI 302 and 408; EAS 453 and 455; ENCS 201; INT D 443; POL S 432. These courses may be taken within the framework of existing General, Specialization, or Honors programs in the Faculty of Science. Students interested in Northern Studies should mention this to their faculty advisor.

163.14 Paleontology

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

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

Honors in Paleontology

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

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

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

Honors in Pharmacology

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

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

163.16 Physics

The Honors Programs offered by the Department of Physics provide a comprehensive education for students planning advanced degrees and a research or academic career. The Specialization programs provide greater flexibility for students who want a four-year degree in Physics or Geophysics without the full comprehensive training of the Honors Programs. Continuation in the Specialization program normally requires a GPA of at least 5.5 in the preceding Fall/Winter. Graduation requires a GPA of 5.5 on the last 90 credited to the degree.

Notes
1. Students interested in the Engineering-Physics program should consult §72.7 of the Faculty of Engineering section.
2. Honors and Specialization Physics students must consult an advisor in the Department of Physics regarding their programs. Note to third- and fourth-year students: Not all 300-level and 400-level Physics and Geophysics courses are offered every year.
3. For information regarding new Biological Sciences and Earth and Atmospheric Sciences courses, please consult your Department advisor.
### 163.16.2 Honors in Geophysics

The Honors and Specialization (see §163.16.5) programs are identical except for the GPA requirements (see §162.6.2) and residency requirements (see §163.1).

**Notes**

1. Students must complete EAS 101 and CHEM 101 and 102 by the end of the second year.
2. Students must take 18 from Geophysics Core courses and a minimum of 9 from Geophysics Pool courses.
3. 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.
4. By the end of their programs, students must have taken 15 in Science options (at least 3 of which must be in Computing Science) and 12 in Arts options.

### 163.16.3 Honors in Mathematical Physics

**Notes**

1. By the end of their programs, students must have taken 18 of Arts options.
2. Students must take at least 27 from Courses A and B.

### 163.16.4 Specialization in Physics

**Notes**

1. 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.

### 163.16.5 Specialization in Geophysics

The Honors (see §163.16.2) and Specialization programs are identical except for the GPA requirements (see §162.6.2) and residency requirements (see §163.1).

**Notes**

1. Students must complete EAS 101 and CHEM 101 and 102 by the end of the second year.
2. Students must take at least 18 from Geophysics Core courses and a minimum of 9 from Geophysics Pool courses.
3. 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.
4. By the end of their programs, students must have taken 15 in Science options (at least 3 of which must be in Computing Science) and 12 in Arts options.

### 163.16.6 Industrial Internship Program

An Industrial Internship Program, similar to a co-op program, is offered to students in the Specialization or Honors programs in Physics (see §163.1.9 for guidelines to the program). The Industrial Internship designation will appear on the degree parchments of students who have participated in the program.

Students approved to enter this stream register for a continuous sequence of at least two work experience (WKEXP) courses 421 and 422, starting in May, September or January. During the program, students are considered full-time students of the University. Work experience courses have no weight and are graded credit/no credit, and recorded on the student’s transcript. The Industrial Internship 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. If the review shows the situation is not satisfactory, the internship may be terminated and the student would then return to classes at the next available opportunity. The graduation requirements for the Industrial Internship program designation include successful completion of at least WKEXP 421 and 422 plus PHYS 400. PHYS 400 must be taken in the first term immediately following completion of the WKEXP period. If required by the employer, the student’s written report and oral presentation in PHYS 400 may be classified confidential. The employer also assesses the student’s performance during the work term. Based on the student’s written report and oral presentation, and the report from the employer, students are awarded a grade in PHYS 400. Interested students should see the Industrial Internship Advisor in the Department of Physics for more information.
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 124/126 or 144/146, and 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 (§163.1.3 and 163.1.4).

163.17 Physiology

163.17.1 Honors in Physiology

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

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

Continuation in the program requires a GPA of 7.0 in the year completed and a grade of at least 7.0 in PHYSL 210 or 211 (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:

<table>
<thead>
<tr>
<th>Year</th>
<th>Required Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>BIOL 107, 108, CHEM 101, 102, 161, 163; ENGL 101; 6 in approved Science or Arts options (see Note 1)</td>
</tr>
<tr>
<td>Year 2</td>
<td>BIOCH 203, 205, PHYS 201, 207, PHYSL 211, PHYS 100, 101; 6 in approved Science or Arts options (see Note 1)</td>
</tr>
<tr>
<td>Year 3</td>
<td>PHYSL 402, 465, 466; 12 from PHYSL 501, 512, 513, 527, 545; BIOL 445; INT D 543, 544; PMCOL 509, 515; or another approved senior-level science course with Department approval; 9 in approved options (see Note 1)</td>
</tr>
</tbody>
</table>

Notes:
(1) The program must consist of a minimum of 90 in Science, a minimum of 18 in Arts, and no more than 12 in Non-Science options.
(2) Approved Science options may be chosen only from the following: Junior Courses: PHYS 104; PHYS 106, 107, 112, 113, 114, 115; CMRUT 114, Advanced Courses: BIOMOL 301, 303, 355, 400, 443, 450, 455, 460; BIOL 301, 315, 359, 370; CHEM 211, 213, 419; CMRUT 291, 292; GENET 270, 275, 301, 302, 303, 304, 380, 418, 421, 471; INT D 371, 372; MATH 214, 215; MODISP 265, PH A321; PMCOL 305, 407, 412, 415, 505, 506, 508; PSYCO 275, 281, 371, 377, 381, 459, 476, 478; STAT 252, 341, 368; ZOOL 225, 226, 241, 242, 311, 340, 341, 342, 293, 412, 422, 445.
(3) Approved non-Science/Non-Science options must be chosen from the following: AN SC 310, 311, 374, 410, 484; JSM 313, 563; IMMUN 370, 451; INT D 224; MATH 311, 320; JSU FS 225, 227, 301, 302, 452, 468; OCOTCH 106, 107, PEDS 290; PHYS 391.
(4) Recommended Arts options may be chosen from the following: CHRTIC 252; ENGL 310, LING 321, 323, 489; PHIL 101, 250, 265, 412, 415, 417; POL S 212; PSYCO 105, 223, 256, 405; SOC 100, 300, 382, 462, 473; WRITE 298.
(5) Other options may be acceptable with permission of an advisor.
(6) MATH 113 or 114 is a recommended option.
(7) Honors students are also encouraged to attend all department seminars.

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.

Admission into the Honors program is permitted only at the end of the second year (after completion of 60). Final acceptance into the Honors program is dependent upon obtaining approval from a potential research supervisor prior to August 7.

Continuation in and graduation from the Honors Psychology program require a minimum GPA of 7.0 in the preceding Fall/Winter. Students are expected to take at least 30 credits during the Fall/Winter 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 88 (but no more than 100) 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.

<table>
<thead>
<tr>
<th>Year</th>
<th>Course Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>ENGL 100 or 101; PSYCO 104, 105; BIOL 107, 108; PHYSL 291; 6 from CMRUT 101, 102, 114, 115, 119, 124; STAT 114, 117, 115, 117, 118, 120, 129, STAT 252, 341, or other computing science, mathematics or statistics course approved by the Honors Advisor; 9 in approved Science options</td>
</tr>
<tr>
<td>Year 2</td>
<td>STAT 151 and PSYCO 212; 6 (two of) from PSYCO 223, 233, 241, 258; PHYSL 107, 108; 6 from approved courses offered by the Departments of Anthropology, Economics, Linguistics, Political Science and/or Sociology; 6 in approved Science options</td>
</tr>
</tbody>
</table>

Year 3

<table>
<thead>
<tr>
<th>Course Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSYCO 300, 390, 391; 9 (one of) from PSYCO 356, 364, 410, 411, 431, 441, 475, 476, 482, 493, or other approved senior-level science course with Department approval; 9 in approved options</td>
</tr>
</tbody>
</table>

Year 4

<table>
<thead>
<tr>
<th>Course Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSYCO 400, 490; 9 (two of) in a 400-level Psychology course other than 400, 410, 411, 431, 441, 475, 476, 482, 493, 498, except as approved by the Honors Advisor; 9 in approved Science options; 3 in approved options</td>
</tr>
</tbody>
</table>

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 fulfill 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 Fall/Winter. Graduation requires a minimum GPA of 5.5 on all courses credited to the degree.

<table>
<thead>
<tr>
<th>Year</th>
<th>Course Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>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</td>
</tr>
<tr>
<td>Year 2</td>
<td>STAT 151; 9 from PSYCO 258, 266 or 267, 275, 281; 9 in an approved Arts option; 9 in approved Science options</td>
</tr>
<tr>
<td>Year 3</td>
<td>9 in approved Science options</td>
</tr>
<tr>
<td>Year 4</td>
<td>21 in approved Science options</td>
</tr>
</tbody>
</table>

To fulfill the degree requirements, students must complete a minimum of 36 in Science Psychology courses, or PSYCO 258 and a minimum of 3 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

An Industrial Internship Program, similar to a co-op program, is offered to students in the Specialization or Honors programs in Psychology (see
The Industrial Internship Program designation includes requirements for the Industrial Internship program and guarantees that all interested students can do an internship. Students should contact the Industrial Internship Program Advisor to ensure satisfaction on all sides. If the review shows the situation is not satisfactory, the internship may be terminated and the student would then return to classes at the next available opportunity. The graduation requirements for the Industrial Internship program designation include successful completion of at least WKEEXP 951 and 952 plus PSYCO 400. PSYCO 400 must be taken in the first term immediately following completion of the WKEEXP period. If required by the employer, the student’s written report and oral presentation in PSYCO 400 may be classified confidential. The employer also assesses the student’s performance during the work term. Based on the student’s written report and oral presentation, and the report from the employer, students are awarded a grade in PSYCO 400.

Interested students should see the Industrial Internship Advisor in the Department of Psychology for more information.

163.19 Statistics and Applied Probability

163.19.1 Honors in Statistics

Continuation in the Honors in Statistics and Applied Probability program requires a GPA of 6.5 in the preceding Fall/Winter.

Graduation requires a GPA of 7.0 on all Statistics and Mathematics courses taken and a GPA of 6.0 on the last 30 credits.

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

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Years 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAT 151</td>
<td>STAT 285, 266</td>
<td>STAT 368, 378, 441, 466</td>
</tr>
<tr>
<td>MATH 114 (or 117), 115 (or 118)</td>
<td>MATH 214 (or 217), 215 (or 317), 225</td>
<td>MATH 311 or 313 or 373 or 380</td>
</tr>
<tr>
<td>MATH 125</td>
<td>MATH 216</td>
<td>MATH 314 or 417</td>
</tr>
<tr>
<td>CMPUT 101 (or 114), 102 (or 115)</td>
<td>MATH 217</td>
<td>MATH 414 or 418</td>
</tr>
<tr>
<td>★6 in approved Arts options</td>
<td>★6 in approved Science options</td>
<td>★3 in a Statistics option</td>
</tr>
<tr>
<td>★6 in approved Arts options</td>
<td>★3 in an approved option</td>
<td>★6 in an Arts option</td>
</tr>
</tbody>
</table>

Note: At least ★3 in approved options in one distinct field of application must be taken at the 300-level or higher. Examples of fields of applications are Biology, Business, Computing Science, Economics, Engineering, Pharmacology, Political Science, Psychology, and Sociology. Students should plan to take the proper prerequisites early in the program.

163.19.2 Specialization in Statistics

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

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

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

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Years 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAT 141 or 151</td>
<td>STAT 252, 285, 266</td>
<td>STAT 312, 368, 378, 466, 471</td>
</tr>
<tr>
<td>MATH 114, 115</td>
<td>MATH 214, 215</td>
<td>Four of STAT 311, 317, 432, 441, 453, 472, 478</td>
</tr>
<tr>
<td>MATH 125</td>
<td>MATH 225</td>
<td>★33 in approved options</td>
</tr>
<tr>
<td>★18 in approved options. See Note (1) below.</td>
<td>★12 in approved options. See Note (1) below.</td>
<td></td>
</tr>
</tbody>
</table>

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.

(5) Each program must be approved by the Department of Mathematical Sciences.

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 §15.8.3 and §15.8.4, 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 §15.15.8 for Grade 12 requirements for the preprofessional program.

163.20.2 Preprofessional Requirements for Veterinary Medicine

See §15.15 and 34.4.7. 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 §15.13.3 and 15.15. 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
163.20.5 Preprofessional Requirements for Medical Laboratory Science

Admission requirements for the BSc Medical Laboratory Science program are given in §15.8.1. 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 Dentistry) (BIOCH)
- Biochimie (BIOCM) (Faculté Saint-Jean)
- Biological Science - Biology (BIOL)
- Biological Science - Botany (BOT)
- Biological Science - Entomology (ENT)
- Biological Science - Genetics (GENET)
- Biological Science - Microbiology (MICRB)
- Biological Science - Zoology (ZOOL)
- Biologie (BIOLE) (Faculté Saint-Jean)
- Cell Biology (CELL)
- Chemistry (CHEM)
- Chimie (CHIM) (Faculté Saint-Jean)
- Computer Engineering (CMPE)
- Computing Science (CMPUT)
- Earth and Atmospheric Sciences (formerly Geography and Geology (EAS))
- Engineering Physics (EN PH)
- Engineering, Computer (ENCAMP)
- Environmental and Conservation Sciences (ENCS)
- Environmental Physical Sciences (ENVPS)
- Geophysics (GEOPH)
- Interdisciplinary Studies (INT D)
- Laboratory Animal Management (LB AN)
- Marine Science (MA SC)
- Mathematical Physics (MA PH)
- Mathematics (MATH)
- Mathématiques (MATHQ) (Faculté Saint-Jean)
- Paleontology (PALEO)
- Pharmacology (taught by the Faculty of Medicine and Dentistry) (PMCOL)
- Physiology (taught by the Faculty of Medicine and Dentistry) (PHYSL)
- Physics (PHYS)
- Physics/Biomedical Engineering (PH B)
- Physique (PHYSQ) (Faculté Saint-Jean)
- Psychology (PSYCO)
- Science (SCI)
- Sciences de la Terre et de l'atmosphère (SCTA) (Faculté Saint-Jean)
- 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.)