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185 The Professors

Members of the Faculty

Officers of the Faculty
Dean
GJ Taylor, PhD

Vice Dean
DS Szathmary, PhD

Associate Deans
MA Armour, PhD (Professor Emeritus)
R Elio, PhD
BK Leskow, PhD
WJ Page, PhD

Assistant Dean
A Adam, BSc

Director of Student Services
JM Stanley, BA

Administrative Professional Officer
A Thompson, BCom

Liaison and Recruitment Officer
LL Voloney, BA

Research Administration Officer
Jae Mac Lean, BA, BSc

Director of Biological Sciences Animal Service
DG McKay, PhD

Distinguished University Professor
RE Taylor, PhD

Honorary Professors of Science
JA Jacobs, DSc

Research Faculty
LR Stewart, PhD, FRSC, FRS, DSc

Biological Sciences
Professor and Chair
LS Frost, PhD

Professors and Associate Chairs
HE McDermid, PhD
FE Nargang, PhD
CA Paszkowski, PhD

Killam Memorial Chair of Science
DW Schindler, DPhil, DSc, DrSc, FRSC

Professors
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M Belosevic, PhD
SA Boutin, PhD
RS Boyce, PhD
JP Chang, PhD
RS Cumah, PhD
PJT Curne, PhD
MW Dule, PhD
AE Drecherche, PhD
PM Fedorak, PhD
JMG Fughi, PhD
LS Frost, PhD
WJ Gallin, PhD
AG Good, PhD
GG Goss, PhD
SJ Hannon, PhD
DS Hua, PhD
J Hoddinott, PhD
SE Jensen, PhD
WR Kaufman, PhD
MA Lewis, DPhil
J Locke, PhD
HE McDermid, PhD
FE Nargang, PhD
WJ Page, PhD
AR Palmer, PhD
CA Paszkowski, PhD
RE Peter, PhD, FRSC
DB Pilgrim, PhD
LJ Reha-Krantz, PhD
J Roland, PhD
DW Schindler, DPhil, DSc, DrSc, FRSC
FW Spellberg, PhD
NE Stacey, PhD
RA Stockey, PhD
GJ Taylor, PhD
WM Tonn, PhD
MVW Wilson, PhD
DS Wishart, PhD

Associate Professors
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JF Cahill, PhD
SD Campbell, PhD
DW Collman, PhD
KL Dvoka, PhD
BA Keddie, PhD
BK Leskow, PhD
BG Magor, PhD
KE Magor, PhD
EH Merrill, PhD
GWO Overton, PhD
HC Proctor, PhD
CC St Clair, PhD
VL St Louis, PhD
RD Vinebrooke, PhD
PW Wong, PhD

Assistant Professors
MB Adams, PhD
DWA At, PhD
E Bayne, PhD
JE Cooke, PhD
JJ Denesi, PhD
MK Dryhoslos, PhD
ML Evenden, PhD
MF Feldman, PhD
SP Ley, PhD
TL Raino, PhD
E Scarpeia, PhD
AJ Waskiewicz, PhD

Faculty Service Officers
ME Haag, MSc

Faculty Service Officer IV
AW Shoostak, PhD, MSc, BSc

Administrative Professional Officer and Assistant Chair (Administration)
DG Howatt, MBA, MA, BSc

Administrative Professional Officer
G Law, BSc

Chemistry
Professor and Chair
M Cowie, PhD

Professors and Associate Chairs
GR Loppnow, PhD
J Takats, PhD

Faculty Service Officer II and Assistant Chair
CA McDermott, PhD

University Professor
JC Vederas, PhD, FRSC

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LM Browne, PhD
A Dittr, PhD

Faculty Service Officers
NE Green, PhD
RM Whittal, PhD

Administrative Professional Officer and Assistant Chair (Administration)
TW Brisbane, BSc

Computing Science
Professor and Chair
J Schaffer, PhD

Professors and Associate Chairs
JN Amaral, PhD
RC Holte, PhD
HA Hoover, PhD

Professors
JN Amaral, PhD
A Rosu, PhD
182 Faculty Regulations

182.1 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 an 18-, 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 §183.21).

182.2 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 degrees 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 §183, followed by descriptions of each degree program under the subject headings (§183.1 to §183.21).

182.3 Admission

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

182.4 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 §182.6(1).

(2) Arts Option
Those courses offered by the Faculty of Arts for which the student is eligible and Christian Theology courses listed in §221, Course Listings. Note: Students registered in the Faculty of Science may not take SOC 210, 315 for degree credit.

(3) Courses Attempted
The instruction periods of May/June (Spring Term) and July/August (Summer Term).

(4) Courses Successfully Completed
A two-term course is a single course with ★6.

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

(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
the work completed during the Fall/Winter under review) and whose GPA at the end of Fall/Winter is between 1.3 and 1.6 will be permitted to continue at the University of Alberta in the Fresh Start program. Students who have previously been on Academic Warning or Probation at this University or in any other postsecondary program are not eligible for the Fresh Start program. In referring students to the Fresh Start program, the Faculty may specify course requirements that must be fulfilled before the student will be considered for readmission to the Faculty of Science. If successful in the Fresh Start program and if all specified course requirements have been fulfilled, such students may apply for readmission to the Faculty of Science as transfer students as described in §15.16.9.  

(2) Students who have completed ★60 or more applicable to a BSc degree  
Students, whether in an Honors, Specialization or the General program, who have completed ★60 or more applicable to a BSc degree (including the work completed during the Fall/Winter under review) and whose GPA at the end of Fall/Winter is below 1.7 will be required to withdraw.  

182.5.5 Probation and Academic Warning  

(1) 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.  
Probationary students who fail to complete successfully ★24 with at least a 2.0 GPA on all work attempted during that Fall/Winter or who fail to fulfill all specified conditions of Probation will fail Probation and will 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 2.0 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.  

(2) Marginal Standing—Academic Warning  
Students, whether in an Honors, Specialization, or the General program, whose GPA at the end of Fall/Winter is between 1.7 and 1.9 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 1.7 and 1.9 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 §914.2.1(5) and 15.16.9.  
Note: Students under Academic Warning are only permitted to interrupt their programs with the prior written approval of the Associate Dean. Marginal students who want permission to interrupt their programs must make that request in writing by August 15 immediately following the ruling that placed them on Academic Warning. If students on Academic Warning interrupt their programs for more than 12 months without prior approval, readmission will normally not be granted unless the student meets the current readmission criteria. (This provision regarding permission to interrupt their program does not apply to Marginal students who attend another postsecondary institution in the interim. Such students must reapply as transfer applicants, see §15.16.9).  

182.5.6 Continuation in the BSc (Specialization in Science and Education) and BEd (Secondary) Combined Degrees Program  
Continuation in the BSc Specialization in Science and Education/BEd (Secondary) combined degrees program requires a Grade Point Average (GPA) of at least 2.3 in the Fall/Winter. (See §23.4(6) 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 §72.4 for academic standing regulations for admission to the BEd program and to §183.1.3 for academic standing regulations for admission to the BSc General program.  

182.5.7 Scholarship, First-Class Standing  

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

(2) First-Class Standing  
First-class standing in a given Fall/Winter is awarded to any student who obtains a GPA of not less than 3.5 while enrolled in ★24 or more during that Fall/Winter. This is also referred to as the Dean’s Honor Roll.  

182.5.8 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.  

182.5.9 Reexamination  
Reexaminations are not normally permitted in the Faculty of Science. Students wishing to be considered for a reexamination in a course in the Faculty of Science must, in addition to meeting the requirements set out in §23.5.5, also meet the following conditions:  

(1) Students must provide evidence of a medical condition or similarly compelling circumstance existing at the time of the writing of the final examination; and  

(2) provide evidence that the student’s performance in the final examination was so affected by circumstances as shown in (a) that there was a substantial difference between the final examination results and the term work; and  

(3) excluding the final exam, must have completed at least one-half of the term work.  
Note: Registrants in BSc degree programs in the Faculty of Science who fail to meet the graduation GPA may be granted a reexamination in one passed or failed Science course taken in the final Fall/Winter or Spring/Summer (last ★30 or less) provided the maximum number of reexaminations (★12) has not been previously taken. Such courses must qualify for reexamination, according to §23.5.5.  

182.6 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 normally restrict their registration to junior courses. First year students contemplating taking senior level courses should be careful to ensure that they have completed any prerequisites.  

(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 D 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 D 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 D 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.

182.7 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 on Bear Tracks (https://www.beartracks.ualberta.ca) 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.

(6) First-Class Honors

First-class Honors Degrees are awarded to any student in an Honors program who obtained:

a. A GPA of at least 3.5 in each of the last two Fall/Winters of the program; and
b. A GPA of at least 3.5 on the last ★60 of the program. If determination of the last ★60 requires consideration of one or more courses from a given Fall/Winter or Session, then all courses from that Fall/Winter or Session will be used in calculating whether the student has achieved a 3.5 average for the purposes of qualifying for First-class Honors.

(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 3.5 over the last ★60 and if the student successfully completed ★24 or more in each of the last two Fall/Winters. If determination of the last ★60 requires consideration of one or more courses from a given Fall/Winter or Session, then all courses from that Fall/Winter or Session will be used in calculating whether the student has achieved a 3.5 average for the purposes of qualifying for With Distinction.

Further regulations regarding academic standing, promotion, and graduation vary from program to program within the Faculty of Science, and are therefore given in §183 below. Regulations for Honors, Specialization, and General programs are found in §183.1, regulations for preprofessional patterns in §183.21.

182.8 Appeals and Grievances

A copy of Faculty of Science regulations regarding appeals on grades and academic standing 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.

182.9 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 cannot attend two postsecondary institutions at the same time and 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. Transfer credits will not be awarded if a student attends another postsecondary institution without first obtaining a current Letter of Permission from the Faculty of Science.

183 Programs of Study

183.1 BSc in the Honors, Specialization, and General Programs

183.1.1 Honors Programs

A minimum of ★120 normally taken in no more than five consecutive academic years is required to complete the Honors program for the degree of BSc with Honors. Some departments require that an Honors program be completed in four years, others permit five. See individual departments for details. 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 and Statistical Sciences, Neuroscience, Pharmacology, Physics, Physiology, and Psychology. Honors is the preferred program for students who plan graduate study.

Admission

See §15.16.3 for admission requirements.

Selection of Courses

The following regulations govern Honors programs:

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

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

(3) A student normally must take at least ★18 in Arts courses as part of the requirements for the Honors degree.

(4) Normally, no more than ★42 in junior (100-level) courses are permitted in Honors programs.

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

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

Students in Honor programs must complete 24 or more during the Fall/Winter of each year of the program. In some Departments, Honors students are required to complete 30 each Fall/Winter. See individual Departments for details. Exceptions to course load requirements must be approved in advance each year 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 3.0 on a course load of 24 or more in the preceding Fall/Winter periods. See description of Honors programs of individual departments for additional requirements relating to continuation in the Honors program. Students must be in good standing in the Honors program in order to graduate.

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 programs 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 3.5 on the last 60 of the program. If determination of the last 60 requires consideration of one or more courses from a given Fall/Winter or Session, then all courses from that Fall/Winter or Session will be used in calculating whether the student has achieved a 3.5 average for the purposes of qualifying for First Class Honors.

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

Some Departments require that Honors programs be completed in four consecutive Fall/Winter periods. Others permit five consecutive Fall/Winters. See individual Departments for details. An Honors program may be interrupted only by special permission of the Department and the Dean.

183.1.2 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 and Statistical 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 §15.16.6 and 75.6).

Admission

See §15.16.4 for admission requirements.

Selection of Courses

The following regulations govern Specialization programs:

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

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

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

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

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

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

Course Load Requirements

To graduate in four years normally requires that BSc Specialization students take the usual full course load of 30 in each Fall/Winter of the program. Students who wish to extend their programs are still expected to complete at least 24 in each Fall/Winter of the program. Exceptions to course load requirements must be approved in advance each year by the Department and the Faculty Office. (See Time Limits for Completion of Program below.)

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 2.3 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. Students must be in good standing in the Specialization program in order to graduate.

2. A student who fails to attain the standard necessary for continuation in the Specialization program will be required to withdraw from the program. In so doing, the student may 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 2.0.

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

4. For graduation, a program of at least 120 credited to the degree.

5. BSc Specialization degrees with Distinction are awarded when students achieve a GPA of at least 3.5 on the last 60 if the student was enrolled in a normal course load 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 (normally the last 60) while registered in the Faculty of Science.

Time Limits for Completion of Program

The BSc Specialization program is a four-year program, but students who wish to extend their programs to a fifth year may do so (see course load requirements above). Students who wish to extend their programs beyond five years must first obtain the written approval of the Faculty of Science and the Department.

183.1.3 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 §15.16.1 for admission requirements for the BSc (General) programs.

Selection of Courses

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. In the major, at least 12 must be in 300-level or higher courses offered by the Faculty of Science. If the minor is a science subject or area, at least 6 must be in 300-level or higher courses offered by the Faculty of Science.

3. Each student must complete a major subject or area of concentration. The major subject or area must be in Science. A minimum of 36 and a
The General program features a first-year core of courses which must include the following:

- 8 from among junior courses offered by the Department of English (normally to be chosen from ENGL 111, 112, 113, 114)
- 6 from among junior courses offered by the Departments of Computing Science, and Mathematical and Statistical Sciences (CMPUT 101 or 114; CMPUT 115; MATH 113 or 114 or 117; MATH 115 or 118; MATH 120 or 125; MATH 153; STAT 141 or 151)
- 8 from among junior courses in the Departments of Chemistry or Physics (ASTRO 120, 122; CHEM 101, 102, 161; PHYS 124, 126, 144, 146)
- 6 from among junior Science courses titled Biology, Earth and Atmospheric Sciences, or Science Psychology (BIOL 107, 108; EAS 101, 102, 103; PSYCO 104)
- 6 from among 100-level courses in Arts or Science (Students interested in the Business Minor must take ECON 101 and 102)

(5) Normally, at least 30 at the junior level must be successfully completed before a student may register in senior-level courses.
(6) Not more than 42 of all courses taken can be at the junior level.
(7) Each student must successfully complete a minimum of 12 at the 300-level (or higher) in the major subject or area of concentration and, in addition, at least 6 at the 300-level (or higher) in the minor subject or area of concentration.
(8) Subject to receiving written approval from the Faculty of Science Office before registration, a maximum of 12 may be taken from Faculties other than Arts or Science. For applicants to the BSc General who have already taken courses from Faculties other than Arts or Science, potential transfer credit for such courses will be assessed at the time of admission to the program.

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

Note: In Women’s Studies minor subject of concentration, courses not in Arts or Science but in the list of “cross-listed courses” may count toward the minor subject of concentration in Women’s Studies (see §43.31).

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

Academic Standings and Graduation
The following regulations govern General Programs:
(1) To obtain a BSc General degree, a GPA of at least 2.0 must be attained on the last 60 credited to the degree. Moreover, a GPA of at least 2.3 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 3.5 or higher over the last 60 if the students have satisfactorily completed at least a normal academic load of 30 during the Fall/Winter periods of the last two years at the University of Alberta.

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

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.

183.1.4 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 §183.1.3 apply.

Minor in Agriculture
The minor in Agriculture consists of at least 24 and no more than 30 in Agriculture courses as follows:
(1) AN SC 200
(2) AREC 200 (requires prerequisite of ECON 101 and 102)
(3) PL SC 221
(4) SOILS 210
(5) 12 to 18 in additional courses at the 300-level or higher to be chosen from AN SC, AREC, 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.

### 183.1.5 BSc General—Minor in Business

**Notes**

For requirements, see §183.1.3. 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 ACCTG 311; ORG A 301; two of FIN 301, MARK 301, MGTS 352, ORG A 321

**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 minorin 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.

### 183.1.6 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 §15.16.6)

### 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. A student is not permitted to repeat a course in which a grade of D or more has been received 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 D 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.
### 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>
<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: Major: 45</td>
<td>1. BIOL 107, 108</td>
<td>2. CHEM 101, 102</td>
<td>3. MATH 114</td>
<td>4. EDPS 310</td>
<td>1. EDFX 450</td>
</tr>
<tr>
<td>Minor: 27</td>
<td>3. MATH 115</td>
<td>4. CHEM 261, 263</td>
<td>5. MATH 214</td>
<td>6. EDPS 301</td>
<td>2. EDSE 460</td>
</tr>
<tr>
<td>100-level: 30 (Maximum 32)</td>
<td>5. MATH 215</td>
<td>6. MATH 219 or 214</td>
<td>7. STAT 151</td>
<td>8. EDSE 437</td>
<td>3. EDSE 438</td>
</tr>
<tr>
<td>Graduation Requirements: GPA of 2.3 on all courses</td>
<td>6. MATH 228</td>
<td>7. MATH 241</td>
<td>8. 3 Arts options</td>
<td>9. EDSE 438</td>
<td>4. EDSE 438</td>
</tr>
</tbody>
</table>

**Area “A”**
BIOL 200, CHEM 212, 213, PHYS 208, 209, 211, 213, 261, 264, STS 200, SOC 462, WST 350

**Area “C”**
ASTRO 320, 322, any 300-level CHEM or PHYS.

**Notes:** It is the student’s responsibility to ensure all prerequisites for 300-level courses are met.

#### Mathematical Sciences Major/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: Major: 45</td>
<td>1. BIOL 107, 108</td>
<td>2. CHEM 101, 102</td>
<td>3. MATH 114</td>
<td>4. EDPS 310</td>
<td>1. EDFX 450</td>
</tr>
<tr>
<td>Minor: 27</td>
<td>3. MATH 115</td>
<td>4. CHEM 261, 263</td>
<td>5. MATH 214</td>
<td>6. EDPS 301</td>
<td>2. EDSE 460</td>
</tr>
<tr>
<td>100-level: 30 (Maximum 32)</td>
<td>5. MATH 215</td>
<td>6. MATH 219 or 214</td>
<td>7. STAT 151</td>
<td>8. EDSE 437</td>
<td>3. EDSE 438</td>
</tr>
<tr>
<td>Graduation Requirements: GPA of 2.3 on all courses</td>
<td>6. MATH 228</td>
<td>7. MATH 241</td>
<td>8. 3 Arts options</td>
<td>9. EDSE 438</td>
<td>4. EDSE 438</td>
</tr>
</tbody>
</table>

**Area “A”**
BIOL 200, CHEM 212, 213, PHYS 208, 209, 211, 213, 261, 264, STS 200, SOC 462, WST 350

**Area “C”**
ASTRO 320, 322, any 300-level CHEM or PHYS.

**Notes:** It is the student’s responsibility to ensure all prerequisites for 300-level courses are met.

#### Mathematical Sciences Major/Biological 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: Major: 45</td>
<td>1. BIOL 107, 108</td>
<td>2. CHEM 101, 102</td>
<td>3. MATH 114</td>
<td>4. EDPS 310</td>
<td>1. EDFX 450</td>
</tr>
<tr>
<td>Minor: 24</td>
<td>3. MATH 115</td>
<td>4. CHEM 261, 263</td>
<td>5. MATH 214</td>
<td>6. EDPS 301</td>
<td>2. EDSE 460</td>
</tr>
<tr>
<td>100-level: 33 (Maximum 32)</td>
<td>5. MATH 215</td>
<td>6. MATH 219 or 214</td>
<td>7. STAT 151</td>
<td>8. EDSE 437</td>
<td>3. EDSE 438</td>
</tr>
<tr>
<td>Graduation Requirements: GPA of 2.3 on all courses</td>
<td>6. MATH 228</td>
<td>7. MATH 241</td>
<td>8. 3 Arts options</td>
<td>9. EDSE 438</td>
<td>4. EDSE 438</td>
</tr>
</tbody>
</table>

**Area “B”**
BIOL 200, CHEM 212, 213, PHYS 208, 209, 211, 213, 261, 264, STS 200, SOC 462, WST 350

**Area “C”**
ASTRO 320, 322, any 300-level CHEM or PHYS.

**Notes:** It is the student’s responsibility to ensure all prerequisites for 300-level courses are met.
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 Majors/Mathematical Sciences Minor (150)

<table>
<thead>
<tr>
<th>Year 1 (1*30)</th>
<th>Year 2 (1*30)</th>
<th>Year 3 (1*30)</th>
<th>Year 4 (1*30)</th>
<th>Year 5 (1*30)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. BIOL 107, 108</td>
<td>1. BIOL 207, 208</td>
<td>1. EDFX 350</td>
<td>1. EDFX 450</td>
<td>1. EDPS 410</td>
</tr>
<tr>
<td>2. CHEM 101, CHEM 161</td>
<td>2. BIOCH 200</td>
<td>2. EDPS 310</td>
<td>2. EDPS 451</td>
<td>2. EDPS 412</td>
</tr>
<tr>
<td>3. 6 junior English</td>
<td>3. 3 chosen from CMPT 101 or 114</td>
<td>3. EDFY 301</td>
<td>3. EDSE 452</td>
<td>3. EDSE 433</td>
</tr>
<tr>
<td>4. MATH 113 or 114</td>
<td>4. EDU 250</td>
<td>4. EDPS 303</td>
<td>4. EDSE 337</td>
<td>4. <em>B</em> Arts options</td>
</tr>
<tr>
<td>5. 3 chosen from MATH 115, 120, STAT 151</td>
<td>5. EDFY 200</td>
<td>5. <em>B</em> in Biological Sciences at the 200-level</td>
<td>5. <em>B</em> in Biological Sciences at the 200-level</td>
<td>5. <em>C</em> Area “B”</td>
</tr>
</tbody>
</table>

### Biological Sciences Majors/Physical Sciences Minor (150)

<table>
<thead>
<tr>
<th>Year 1 (1*30)</th>
<th>Year 2 (1*30)</th>
<th>Year 3 (1*30)</th>
<th>Year 4 (1*30)</th>
<th>Year 5 (1*30)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. BIOL 107, 108</td>
<td>1. BIOL 207, 208</td>
<td>1. EDFX 350</td>
<td>1. EDFX 450</td>
<td>1. EDPS 410</td>
</tr>
<tr>
<td>2. CHEM 101, CHEM 161</td>
<td>2. BIOCH 200</td>
<td>2. EDPS 310</td>
<td>2. EDPS 451</td>
<td>2. EDPS 412</td>
</tr>
<tr>
<td>3. 6 junior English</td>
<td>3. 3 chosen from CMPT 101 or 114</td>
<td>3. EDFY 301</td>
<td>3. EDPS 303</td>
<td>3. <em>B</em> Arts options</td>
</tr>
<tr>
<td>4. MATH 113 or 114</td>
<td>4. EDU 250</td>
<td>4. EDPS 303</td>
<td>4. EDSE 337</td>
<td>4. <em>B</em> Area options</td>
</tr>
<tr>
<td>5. 3 chosen from MATH 115, 120, STAT 151</td>
<td>5. EDFY 200</td>
<td>5. <em>B</em> in Biological Sciences at the 200-level</td>
<td>5. <em>B</em> in Biological Sciences at the 200-level</td>
<td>5. <em>C</em> Area “B”</td>
</tr>
</tbody>
</table>

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### 183.1.7 The BSc After a BSc from the Faculty of Science at the University of Alberta

An applicant holding a BSc degree from this Faculty may qualify for a second degree by completing a minimum of an additional *150* subject to the following provisions.

1. All admission, program, academic standing and graduation requirements of the second degree program must be met. Admission to a BSc Honors or Specialization program as a second degree requires the approval of the appropriate Department(s) and the Faculty Office.

2. A graduate holding a BSc General degree from this Faculty may qualify for a second BSc General degree provided the major in the second degree is not the same as either the major or minor in the first degree. The only exception is that students who wish to upgrade their previous minor to be the major in their second degree may do so. However, their original minor must have been in Science and the new minor cannot overlap either the major or minor of their previous degree.

3. A graduate holding a BSc General degree may qualify for a BSc Specialization or BSc Honors degree by completing a minimum of *180*. The specific course requirements for a BSc Specialization or BSc Honors degree as a second degree are determined at the time of admission by the appropriate Department(s) and the Faculty Office. At least 15 senior units in the subject discipline of the degree must be completed while registered in the second degree program.

4. A graduate holding a BSc Specialization or BSc Honors degree from this Faculty may qualify for a second BSc Specialization or Honors degree provided the second degree is in a different subject or area.

5. Students in a second degree program must maintain satisfactory standing in each Fall/Winter. Such students in a second degree program who do not maintain satisfactory standing will be required to withdraw and will not be eligible for Academic Warning or Probation.

### 183.1.8 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 from another Faculty at the University of Alberta or from another university may qualify for the BSc General degree, a BSc Specialization degree, or a BSc Honors degree by meeting the following requirements.

1. Students who present the equivalent of a BSc General or other undergraduate degree from another institution may complete a BSc General degree, as a second degree, from this Faculty provided the major in the second degree is not the same as either the major or minor in the first degree. The only exception is that students who wish to upgrade their previous minor to be the major in their second degree may do so. However, their original minor must have been in Science and the new minor cannot overlap either the major or minor of their previous degree.
183.1.11 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 while registered in the Faculty of Science at the University. Courses completed in the Faculty of Science before transfer may count toward the minimum 60 that must be completed while registered in the Faculty of Science. Science or Arts courses taken while in another Faculty, which are clearly noted as “extra-to-degree” on the transcript, may fulfill specific subject requirements of a degree program in Science but will not fulfill the minimum residence requirement of the program.

183.2 Biochemistry

183.2.1 Honors in Biochemistry

Continuation, or graduation, in the Honors program in Biochemistry requires a minimum GPA of 3.3 on at least 30 in each Fall/Winter period credited towards the degree.

Year 1

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 107, 108</td>
<td>7</td>
</tr>
<tr>
<td>CHEM 101, 102 and 161, 263</td>
<td>7</td>
</tr>
<tr>
<td>MATH 113 (or 114), and 115</td>
<td>6</td>
</tr>
<tr>
<td>*6 in junior-level ENGL</td>
<td></td>
</tr>
</tbody>
</table>

Year 2

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOCH 310 (Fall), and BIOCH 401 (Winter)</td>
<td>8</td>
</tr>
<tr>
<td>CHEM 211, 213</td>
<td>8</td>
</tr>
<tr>
<td>PHYS 124 and 126 or equivalent</td>
<td>8</td>
</tr>
<tr>
<td>*6 in an approved Science option</td>
<td></td>
</tr>
<tr>
<td>*3 in an approved Arts options</td>
<td></td>
</tr>
</tbody>
</table>

Year 3

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOCH 410, 420, 430, or 441</td>
<td>6</td>
</tr>
<tr>
<td>CHEM 371, 373</td>
<td>6</td>
</tr>
<tr>
<td>*3 in approved Science options</td>
<td></td>
</tr>
<tr>
<td>*6 in an approved Arts options</td>
<td></td>
</tr>
</tbody>
</table>

Year 4

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>*6 in senior-level BIOCH courses (normally selected from BIOCH 410, 420, 430, or 441)</td>
<td>6</td>
</tr>
<tr>
<td>*3 in a senior-level BIOCH course selected from BIOCH 450, 455, or 460</td>
<td>3</td>
</tr>
<tr>
<td>BIOCH 409</td>
<td>6</td>
</tr>
<tr>
<td>*6 in 300- or 400-level CHEM</td>
<td></td>
</tr>
<tr>
<td>*6 in approved Science options</td>
<td></td>
</tr>
<tr>
<td>*3 in an approved Arts option</td>
<td></td>
</tr>
</tbody>
</table>

Notes

(1) Students must receive a grade of not less than B– in all Biochemistry courses credited toward the minimum number required for the degree.

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

(3) Recommended science options for second year include BIOL 207; MICRB 265; MATH 214 and 215; GENET 270 and 275; PHYSYL 210 or 211; PMCOL 201; STAT 141 or 151.

(4) Recommended science options for third and fourth year include BIOCH 450, 455, and 460; MICRB 311 or 415; PHYSYL 210 or 211; IMIN 200; PMCOL 305; and BIOL 380.

(5) BIOCH 410, 420, 430, 441, 450, 455, and 460 are offered only in alternating years. Check the Registration and Courses menu at www.registrar.ualberta.ca for courses offered in the current year.

183.2.2 Specialization in Biochemistry

Continuation, or graduation, in the Specialization program in Biochemistry requires a minimum GPA of 2.7 in each Fall/Winter period credited towards the degree.

Year 1

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 107, 108</td>
<td>7</td>
</tr>
<tr>
<td>CHEM 101, 102 and 161, 263</td>
<td>7</td>
</tr>
<tr>
<td>MATH 113 (or 114), 115</td>
<td>6</td>
</tr>
<tr>
<td>*6 junior-level ENGL</td>
<td></td>
</tr>
</tbody>
</table>
183.3 Biological Sciences

All students in Honors and Specialization programs in Biological Science take a common core of four BIOL courses in the first and second years. Thereafter, they follow the course sequence of one of the areas of concentration in either Honors or Specialization in Biological Sciences identified in 183.3.4. Students must declare an area of concentration and follow the appropriate course sequence. The title of the area of concentration will appear on their degree. Additional course requirements for Honors students include BIOL 499 and program specific courses. BIOL 499, a directed 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.

183.3.1 Honors in Biological Sciences (including Bioinformatics)

Admission to the BSc Honors in Biological Sciences program see Admission Chart 5, §15.16.

Continuation in the Honors Biological Sciences program requires a minimum GPA of 3.0 in the preceding Fall/Winter. Graduation requires a minimum GPA of 3.0 on the last 24 credits to the degree. Students in Honors programs must take at least 24 during the Fall/Winter of each year of the program. Exceptions to this requirement must be approved by the Department and the Faculty Office.

183.3.2 Specialization in Biological Sciences

Admission to the BSc Specialization in Biological Sciences program see Admission Chart 5, §15.16.

Continuation in the Specialization program requires a GPA of 2.3 in the preceding Fall/Winter. Graduation requires a minimum GPA of 2.3 on all courses credited to the degree.

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

BIOI 107, 108; CHEM 101,161; MATH 113 or 114 or 120; STAT 151; 6 Arts option (English recommended); 6 Science option.

Notes:
(1) Students intending to complete their degree in Cell Biotechnology, Microbiology, or Molecular Genetics must also take both CHEM 102 and 263, normally in the second term of their first year, as the 6 Science option.
(2) Students intending to complete their degree in Bioinformatics are required to take: BIOI 107, 108; CHEM 101, 102, 261; CMPUT 101 (if necessary, or else a 3 Science option); CMPUT 114 and 115; 6 Arts options (English recommended) in their first year.
(3) Students intending to complete their degree in Environmental Biology are recommended to take EAS 100 as a Science option in their first year.

183.3.4 Course Sequence in Biological Sciences

See Science Chart 2.

183.3.5 Industrial Internship Program

An Industrial Internship Program, similar to a co-op program, is offered to students in the Specialization or Honors programs in Biological Sciences (see §183.1.9 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 either Credit (C) or No Credit (NC), 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 941 and 942 plus BIOI 400. BIOI 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 BIOI 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 BIOI 400.

Interested students should see the Industrial Internship Advisor in the Department of Biological Sciences for more information.
### Science Chart 2 Course Sequence in Biological Sciences (cont’d)

#### Bioinformatics Specialization

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Year 3 and 4</th>
</tr>
</thead>
</table>
| BIOCH 200; BIOL 207, 208; CHEM 263, CMPUT 201, 203, GENET 270; MATH 120 or 125, STAT 151 | One of BIOCH 310, 320, 330  
| Note: GENET 270 may be taken in Year 3                                 | BIOIN 301, 401; CMPUT 204, 272, 301                                                           |
| ★6 in Science options                                                 | ★6 in GENET 275, 301, 302, 304 or 390                                                          |
| ★6 in Arts options                                                    | ★12 in Arts options                                                                           |
| ★3 CMPUT from recommended options below                              | ★21 in Science options                                                                        |

Recommended options include, but are not restricted to additional courses from above and the following:

- BIOCH 310, 320, 330, 420
- BIOL 321, 380, 391, 400, 405, 495, 498, 499, 520
- CMPUT 229, 304, 325, 340, 366, 379, 391, 466, 474, 495
- GENET 275, 301, 302, 304, 390
- IMIN 200; MICRB 265, 316; STAT 221, 222, 337

Note: Honors students are required to take BIO 499 and reduce the approved options accordingly.

#### Cell Biotechnology

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Year 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOCH 200; BIOL 201, 207, 208; GENET 270; MICRB 265</td>
<td>BIOL 391; GENET 390; MICRB 311, 343, 345, 415, 450</td>
</tr>
<tr>
<td>★6 in Science options</td>
<td>★9 in Arts options</td>
</tr>
<tr>
<td>★6 in Arts options</td>
<td>Recommended options include but are not restricted to the following:</td>
</tr>
<tr>
<td>Note: A minimum grade of B- is required in MICRB 265 and 311 to stay in the Cell Biotechnology Honors program.</td>
<td>List A. Approved options:</td>
</tr>
</tbody>
</table>

- BIOCH 310, 320, 330, 401, 410, 420, 430, 441, 450, 455, 460
- BIOIN 301; BIOL 380, 400, 450, 490, 495, 498, 499
- BOT 350, 380, 382, 403, CELL 300; CHEM 211, 213, 381, 383; CMPUT 101, 114, 115; ENT 378
- GENET 275, 301, 302, 304, 364, 375, 458, 462, 469, 472
- IMIN 200, 324, 371, 401, 452; MMI 351, 352, 405, 415, 426, 520; MICRB 316, 411, 420
- NU FS 363, 402, 480; PHARM 493; PHYS 124, 126; PSYCO 104

- (Other options may be approved if suitable)

List B. Approved Senior Biotechnology Lab Options:

- BIOIN 301; BIOL 400, 498, 499; CHEM 211, 213, 361, 363; GENET 375, 420; IMIN 372; MMI 352; MICRB 492.

Notes:

1. Honors students are required to take BIOL 499, CHEM 211 and 213, and reduce the approved options accordingly.
2. Specialization students are required to take at least ★3 approved senior Biotechnology Lab Options and reduce the approved options accordingly.

#### Environmental Biology

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Year 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOCH 200; BIOL 207, 208; BOT 205; MICRB 265; ZOOL 224 or 225; ZOOL 250 or ENT 220</td>
<td>BIOL 321, 330</td>
</tr>
<tr>
<td>★6 in Science options</td>
<td>★12 from BIOL 331, 332, 340; BOT 332; FOR 322; ZOOL 371</td>
</tr>
<tr>
<td>★3 from BIOL 380; BOT 240, 303, ENT 302, 321; GENET 270, 276; IMIN 200, MICRB 311; ZOOL 241, 242</td>
<td>★3 from BIOL 330, 331, 332, 340; BOT 332; FOR 322; ZOOL 371</td>
</tr>
<tr>
<td>★3 from BOT 306, 310, 314, 321, 322, 330; ENT 427; ZOOL 351, 352, 405, 407, 408</td>
<td>★3 from BIOL 330, 331, 332, 340; BOT 332; FOR 322; ZOOL 371</td>
</tr>
<tr>
<td>★9 from BOT 333, 361, 364, 366, 367, 381, 430, 433, 450, 464, 468, 470, 488, 499, BOT 384, 431, MICRB 491</td>
<td>★3 from BIOL 330, 331, 332, 340; BOT 332; FOR 322; ZOOL 371</td>
</tr>
<tr>
<td>★3 in Arts options</td>
<td>★10 in approved options</td>
</tr>
<tr>
<td>★9 in an Arts option</td>
<td>★3 from BIOL 365, 432, MA SC 4XX (at BMS), ZOOL 434</td>
</tr>
</tbody>
</table>

Note:

- Streams in conservation/wildlife biology and in freshwater biology are available.

- Honors students are required to take BIOL 430 and 499 and reduce the approved options accordingly.

#### Evolutionary Biology

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Year 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOCH 200; BIOL 207, 208, 380</td>
<td>BIOL 321, 335, 391</td>
</tr>
<tr>
<td>★6 from BOT 205, 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 BIOL 331, 332, BOT 332</td>
</tr>
<tr>
<td>★3 in an Arts option</td>
<td>★6 from GENET 270, 275, 390</td>
</tr>
<tr>
<td>★6 in approved options</td>
<td>★6 from BOT 306, 321, ENT 380, 427; MICRB 265, ZOOL 405, 407, 408</td>
</tr>
<tr>
<td>Note: A minimum grade of B- is required in MICRB 265 and 311 to stay in the Cell Biotechnology Honors program.</td>
<td>★9 in Arts options</td>
</tr>
<tr>
<td>Note: A minimum grade of B- is required in MICRB 265 and 311 to stay in the Cell Biotechnology Honors program.</td>
<td>★15 from list below</td>
</tr>
<tr>
<td>Note: A minimum grade of B- is required in MICRB 265 and 311 to stay in the Cell Biotechnology Honors program.</td>
<td>★12 in approved options</td>
</tr>
</tbody>
</table>

Recommended options include, but are not restricted to additional courses from the above, and the following:

- BIO 331, 400, 430, 433, 490, 495, 498, 499, 520
- BOT 303, 308, 330, 350, 409, 431, 506, 511
- ENT 302, 321, 376; EAS 100, 230; GENET 270; MA SC 410, 412, 420, 430, 440, 445; PALEO 520; PHYS 124, 126; ZOOL 303, 340, 351, 352, 354, 434, 472

Notes:

1. Marine Science courses on this list are offered at Bamfield Marine Sciences Centre.
2. Honors students are required to take BIOL 499 and reduce the approved options by ★6.
Science Chart 2 Course Sequence in Biological Sciences (cont’d)

**Microbiology**

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Year 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOCH 200; BIOL 207, 208; GENET 270; IMIN 200; MICRB 265</td>
<td>BIO 201, 391; CHEM 211, 213; GENET 380; MICRB 311</td>
</tr>
<tr>
<td>*6 in Science options</td>
<td>*9 in Science options</td>
</tr>
<tr>
<td>*6 in Art options</td>
<td>*12 in Microbiology options (List A)</td>
</tr>
<tr>
<td>Notes: *15 in approved options (List A, B or C)</td>
<td>Notes: Recommended options include, but are not restricted to the following:</td>
</tr>
<tr>
<td>(1) A minimum grade of B- is required in MICRB 265 and 311 to stay in Microbiology Honors program.</td>
<td>List A: Microbiology options:</td>
</tr>
<tr>
<td>(2) BIOL 201 highly recommended in Year 2.</td>
<td>IMIN 324, 371, 372, 425; MICRB 316, 343, 345, 410, 415, 450, 491, 492; NU FS 361, 363, 402, 480; MMI 351, 352, 405, 415, 520.</td>
</tr>
</tbody>
</table>

**Molecular Genetics**

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Year 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOCH 200; BIOL 201 or CELL 201; BIOL 207, 208; GENET 270, 275; MICRB 265</td>
<td>*12 in approved options</td>
</tr>
<tr>
<td>*6 in Arts options</td>
<td>*9 from List A</td>
</tr>
<tr>
<td>*3 in a Science option</td>
<td>*3 from List B</td>
</tr>
<tr>
<td>Notes: *12 from List C</td>
<td>*12 from List C</td>
</tr>
<tr>
<td>(1) BIOL 207 must be taken in the first term.</td>
<td>*9 in Options</td>
</tr>
<tr>
<td>(2) GENET 270 and 275 must be taken during the second year to permit completion of the program in four years.</td>
<td>Notes:</td>
</tr>
</tbody>
</table>

**Physiology and Developmental Biology**

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Year 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOCH 200; BIOL 201 or CELL 201; BIOL 207, 208; ZOOL 225, 241, 242, 250</td>
<td>ZOOL 303, 344</td>
</tr>
<tr>
<td>*6 in Science options</td>
<td>*9 from ZOOL 402, 441, 442 or BIOL 545</td>
</tr>
<tr>
<td>Notes: *12 in Arts options</td>
<td>*12 in approved options</td>
</tr>
<tr>
<td>*3 from indicated course</td>
<td>*27 from list below</td>
</tr>
</tbody>
</table>

**Plant Biology**

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Year 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOCH 200; BIOL 201, 207, 208; BOT 205, 210, 240; CHEM 102, 263</td>
<td>BIO 321; BOT 308, 321, 332, 350; MICRB 265</td>
</tr>
<tr>
<td>*3 in a Genetics option</td>
<td>*9 in Arts options</td>
</tr>
<tr>
<td>*3 in an Arts option</td>
<td>*30 from the lists below (*15 must be Botany courses)</td>
</tr>
<tr>
<td>Notes: *15 approved options include, but are not restricted to the following:</td>
<td>Approved options include, but are not restricted to the following:</td>
</tr>
<tr>
<td>List A: Organismal Plant Biology options:</td>
<td>List A: Organismal Plant Biology options:</td>
</tr>
<tr>
<td>List B: Cellular, Molecular and Physiological Plant Biology options:</td>
<td>List B: Cellular, Molecular and Physiological Plant Biology options:</td>
</tr>
<tr>
<td>BIOL 400, 498, 499; BOT 303, 308, 392, 403, 409, 431; GENET 364; PL SC 465; REN R 421, 468.</td>
<td>BIOL 400, 498, 499; BOT 303, 308, 392, 403, 409, 431; GENET 364; PL SC 465; REN R 421, 468.</td>
</tr>
</tbody>
</table>

### 183.3.6 General Program in Biological Sciences

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

Courses which may be used toward a Biological Sciences major or minor include BIOCH; BOT; CELL 300, 301; ENT; GENET; INT D 224, 371, 372, 421, 452, 455; MA SC; MICRB; MIM 351; NEURO; NU FS 363; PALEO; PHYS 210, 372, 401, 404, 410; PMCOL 201, 305, 335, 336, 342, 371, 392, 403, 409, 412, 415; ZOOL.

Courses in Biochemistry (see §184) may be used for a concentration in Biological Sciences or Physical Sciences but not for both.

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

The following previously offered courses may not be used for a concentration in Biological Sciences: BIOCH 110, BOT 201, GENET 165, and PMCOL 101.

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

183.4 Cell Biology

183.4.1 Honors in Cell Biology

Continuation in the Honors Cell Biology program requires a minimum GPA of 3.0 on at least 24 in the preceding Fall/Winter. Graduation requires a minimum GPA of 3.0 on the last 60 credited to the degree.

Year 1

- BIOL 107, 108
- CHEM 101, 102
- CHEM 161, 263
- MATH 113 or 114, and 115
- ★6 in an Arts option (Junior English recommended)

Year 2

- BIOCH 200
- BIOL 207
- CELL 201 or BIOL 201
- GENET 270
- MICRB 265
- PHYS 124, 126
- STAT 141 or 151
- ★3 in an Arts option
- ★3 from Group B Cell Biology options

Year 3

- CELL 300, 301
- CHEM 371
- ★3 from BIOCH 310, 320 or 330
- ★6 from Group A Cell Biology options
- ★6 from Group B Cell Biology options
- ★6 in Arts options

Year 4

- CELL 445
- ★9 from Group A Cell Biology options
- ★15 from Group B Cell Biology options
- ★3 in an Arts option

Group A Cell Biology Options:

- BIOCH 420
- BIOCH 430 or GENET 304
- BIOCH 450
- CHEM 371
- GENET 375, 420
- IMIN 200, 324, 452
- MICRB 316
- ONCOL 320
- PMCOL 371 or ZOOL 342
- ZOOL 303 or BOT 303

Group B Cell Biology Options:

- ANAT 200
- BIOCH 310, 320, 330, 401, 410, 441, 450, 455
- BIOL 208, 315, 321, 430
- BOT 363, 382
- CHEM 282, 373
- GENET 275, 301, 302, 364, 390, 408, 412
- IMIN 371, 372, 401
- MICRB 311, 410
- PHYSL 210, 401
- STAT 337
- ZOOL 242

183.5 Chemistry

183.5.1 Honors in Chemistry

Honors students in Chemistry must take a core of Chemistry and auxiliary courses. The core consists of ★45 in Chemistry courses, ★12 in Mathematics courses, ★6 in Physics courses, ★3 in Biology or Biochemistry courses, ★3 in either CHEM 400 or 401, ★6 in a junior English or ★3 in English and ★3 in Arts option, and ★12 in Arts options. In addition to the core courses, honors students must complete at least ★18 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 ★15 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 3.0 on at least 24 in the preceding Fall/Winter. Graduation requires a minimum GPA of 2.7 on the last 30.

The Honors Chemistry degree is accredited by the Canadian Society for Chemistry.

Year 1

- CHEM 101, 102, 161, 263
- MATH 113 (or 114), 115
- PHYS 144, 146
- a junior course in English or ★3 in English and ★3 in an Arts option

Year 2

- CHEM 211, 241, 243, 282, 298
- MATH 214 and either 120 or 125 or 215 or STAT 151 (if PHYS 124 and 126 are taken in Year 1, then PHYS 230 or 281 is also required)
- ★6 in Arts options
- ★3 in Science options
183.5.5 Certificate of Specialization After a BSc Degree

All outstanding requirements of the Specialization Degree must be completed with an average of 2.3 or higher in all chemistry courses taken after the general degree. See §183.1.3.

183.5.6 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.

183.6 Computing Science

For admission requirements, see §15.16. Senior Computing Science courses (400-level) are restricted to third- and fourth-year Science Honors and Specialization students, and students participating in degree programs requiring these courses.

183.6.1 Honors in Computing Science

Continuation in the Honors program requires successful completion of at least 24 in the previous Fall/Winter with a GPA of at least 3.0 and an overall GPA of at least 2.3 on all CMPUT, MATH and STAT courses taken in that Fall/Winter.

Graduation requires a GPA of at least 3.0 on the last 30 credited to the degree and at least 3.0 on the last 60 credited to the degree, and at least 2.3 on all CMPUT, MATH and STAT courses credited to the degree.

Honors students must complete a minimum of 21 in CMPUT courses at the 300- or 400-level offered at the University of Alberta.

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.

Year 1

CMPUT 114, 115, 272 (see Note 1)
MATH 114, 115 (see Note 2)
★6 in junior English
★6 in Science options (excluding MATH/STAT/CMPUT)
★3 in an approved option (see Note 7)

Year 2

CMPUT 201, 204, 229, 291
MATH 129 and ★3 in a MATH or STAT option at the 200-level or higher (see Note 6)
STAT 221, 222
★3 in an Arts option
★3 in an approved option (see Note 7)

Year 3

CMPUT 301, 325, 379, 391, and ★3 in CMPUT at the 300-level or higher (see Notes 4 and 5)
MATH 225 or 228 or 229
★3 in a MATH or STAT option at the 200-level or higher (see Note 6)
★6 in Arts options
★6 in an approved option (see Note 7)

Year 4

CMPUT 366, and at least ★9 in CMPUT at the 300-level or higher (see Notes 4 and 5)
★9 in approved options (see Note 7)
★6 in Science options
★3 in an Arts option

Notes

(1) Students with no previous computing science experience should enrol in CMPUT 101, followed by CMPUT 114 and 115. Students are strongly encouraged to take CMPUT 272 in Year 1.

(2) Honors students are strongly encouraged to take the Honors version of the MATH courses, beginning in the first year.

(3) Honors students must take CMPUT 495 (Honors Seminar) in Year 3.

(4) Honors students must take ★9 in Group A courses which include CMPUT 304, 340 and 474. A complete list of Group A courses to be offered in a given year is available from the department.

(5) Honors students must take ★3 in Group B project courses which include CMPUT 400, 401, 410, 412, 414, 415, 422, and 466. The department may approve variations in the above requirement on application. CMPUT 400 satisfies the project requirement, but cannot be used as ★3 in CMPUT at the 300-level or higher or as a Science option.
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 GPA of at least 2.3 on the last 90 credits to the degree and at least 2.3 on all CMPUT, MATH and STAT courses credited to the degree and must achieve a minimum GPA of 2.3 on all Business courses contributing to the minor. This calculation does not include the two economics courses.

183.6.4 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. 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 STAT 221 will be admitted.

Continuation in the Specialization Stream in Software Quality has the same requirements as Computing Science Specialization. Graduation requires a GPA of at least 2.3 on the last 90 credits to the degree and at least 2.3 on all CMPUT, MATH and STAT courses credited to the degree.

Students who withdraw from the Specialization Computing Science program lose their status as "pursuing a Business Minor Within Specialization Computing Science." Students who retire from the Specialization Computing Science program in the first two years of the Specialization Program in Computing Science may continue as Specialization or Honors students.

Students must complete a minimum of 21 in CMPUT courses at the 300- or 400-level offered at the University of Alberta.

Notes

(1) Students with no previous computing science experience should enrol in CMPUT 101, followed by CMPUT 114 and 115. Students are strongly encouraged to take CMPUT 272 in Year 1.
(2) At least 9 in approved options must be at the 300-level or higher.
(3) Specialization students must take 3 in Group A courses which include CMPUT 304, 340 and 474. A complete list of Group A courses to be offered in a given year is available from the department.
(4) Specialization students must take 3 in Group B project courses which include CMPUT 400, 401, 410, 412, 414, 415, 422, and 466. The department may approve variations in the above requirement on application. CMPUT 400 satisfies the project requirement, but cannot be used as 3 in CMPUT at the 300-level or higher or as a science option.
(5) Some higher level CMPUT courses may require specific MATH courses as prerequisites. These prerequisites should be taken for the MATH or STAT option.
(6) 6 of the total 30 in approved options cannot be MATH/STAT/CMPUT.

183.6.3 Specialization in Computing Science—Minor in Business

Continuation in the Computing Science Specialization program (Business Minor) has the same requirements as Computing Science Specialization. Students who meet these continuation requirements may continue with the designation "pursuing a Business Minor within Specialization Computing Science."

Specialization with Business Minor students must complete a minimum of 21 in CMPUT courses at the 300- or 400-level offered at the University of Alberta.

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.

Notes

(1) Students with no previous computing science experience should enrol in CMPUT 101, followed by CMPUT 114 and 115. Students are strongly encouraged to take CMPUT 272 in Year 1.
(2) Students in the Specialization Program with the Software Quality Option must choose 12 from the following Business courses: MGTSC 352, 422, 461, 465; MIS 412, 414.
(3) Because the BSc Specialization in Computing Science - Software Quality Option includes the Industrial Internship Program component, students are eligible to apply for ISP (Information Systems Professional) certification upon completing 6 months of work experience in the software industry after graduation. The ISP is a registered designation under the Professional and Occupational Associations Registration Act in Alberta. The ISP designation was registered in February 1997, and is administered by the Registrar of CIPS Alberta.

(4) Specialization students must take \(3\) in Group A courses which include CMPUT 304, 340 and 474. A complete list of Group A courses to be offered in a given year is available from the department.

(5) Specialization students must take \(3\) in Group B project courses which include CMPUT 400, 401, 410, 412, 414, 415, 422, and 466. The department may approve variations in the above requirement on application. CMPUT 400 satisfies the project requirement, but cannot be used as \(3\) in CMPUT at the 300-level or higher or as a Science option.

(6) Some higher level CMPUT courses may require specific MATH courses as prerequisites. These prerequisites should be taken for the MATH or STAT option.

183.6.5 Computing Science Honors Stream in Bioinformatics

The discipline of bioinformatics has developed out of the need for recording and analyzing very large sets from genome and DNA sequencing projects. The goal of the Bioinformatics Stream within the Computing Science program is to train students to understand, develop and use computational tools and large sets of sequence data to answer questions in biology and medicine.

The graduate will be able to understand problems embraced in bioinformatics and collaborate effectively with biologists in the construction and use of new bioinformatics tools. Interested students should select their first year science options according to the recommendations given below.

Continuation in the Honors Stream in Bioinformatics has the same requirements as Computing Science Honors. Graduation requires a GPA of at least 3.0 on the last \(10\) credited to the degree and at least 3.0 on the last \(6\) credited to the degree and at least 2.3 on all CMPUT, MATH, and STAT courses credited to the degree. Specialization students in the Bioinformatics stream must achieve a minimum of 2.3 on BIOIN 301 and 401, BIOL 207, GENET 270, two of GENET 275, 301, 302, 304, or 390 and one of BIOL 321, 380 or BIOCH 220.

Year 1

1. BIOIN 107
   • \(3\) in a BIOL or CHEM option
   • CMPUT 114, 115, 227 (see Note 1)
   • MATH 114, 115 (see Note 2)
   • \(3\) in a Science option
   • \(3\) in junior English

2. BIOIN 207
   • CMPUT 201, 204, 229, 291
   • BIOL 207
   • MATH 125 and \(3\) in one of MATH 225, 228, 229
   • STAT 221, 222

Year 2

1. BIOIN 301
   • \(3\) in a BIOL option (see Note 7)
   • CMPUT 304, 325, 399, 391, and \(3\) in CMPUT at the 300-level or higher (see Notes 4 and 5)
   • \(3\) in a GENET Option (see Note 7)
   • \(3\) in a MATH or STAT option at the 200-level or higher (see Note 6)
   • \(3\) in an Arts option

Year 3

1. BIOIN 401
   • CMPUT 366, and at least \(9\) in CMPUT at the 300-level or higher (see Notes 4 and 5)
   • \(3\) in a GENET Option (see Note 7)
   • \(3\) in a MATH or STAT option at the 200-level or higher
   • \(3\) in an Arts option

Notes
(1) Students with no previous computing experience should enrol in CMPUT 101, followed by CMPUT 114 and 115.
(2) Some higher level CMPUT courses may require specific MATH courses as prerequisites. These prerequisites should be taken for the MATH or STAT option.
(3) Specialization students with the Bioinformatics stream must take \(3\) in Group A courses which include CMPUT 304, 340 and 474. A complete list of Group A courses to be offered in a given year is available from the department.
(4) Specialization students with the Bioinformatics stream must take \(3\) in Group B project courses which include CMPUT 400, 401, 410, 412, 414, 415, 422, and 466. The department may approve variations in the above requirement on application. CMPUT 400 satisfies the project requirement, but cannot be used as \(3\) in CMPUT at the 300-level or higher or as a Science option.
(5) The \(6\) in GENET options must be chosen from GENET 275, 301, 302, 304 or 390. The \(3\) in a BIOL option must be chosen from BIOL 321, 380 or BIOCH 220. Notes: students interested in GENET 390 and BIOCH 220 are advised to take CHEM 101 and 161 in year 1.

183.6.6 Computing Science Specialization Stream in Bioinformatics

Continuation in the Specialization Stream in Bioinformatics has the same requirements as Computing Science Specialization. Graduation requires a GPA of at least 2.3 on the last \(10\) credited to the degree and a 2.3 on all CMPUT, MATH, and STAT courses credited to the degree. Specialization students in the Bioinformatics stream must complete a minimum of \(21\) in CMPUT courses at the 300- or 400-level offered at the University of Alberta. In addition, to graduate with the designation of Specialization Stream in Bioinformatics, students must achieve a minimum of 2.3 on BIOIN 301 and 401, BIOL 207, GENET 270, two of GENET 275, 301, 302, 304, or 390 and one of BIOL 321, 380 or BIOCH 220.

Year 1 (Recommended Course Sequence)

1. BIOIN 107
   • CMPUT 101 and 114, or 114 (see Note 1)
   • CMPUT 115, 227
   • \(3\) in junior English
   • MATH 114, 115
   • \(3\) in an approved Science option (if not taking CMPUT 101)
   • \(3\) in a BIOL or CHEM option

Year 2

1. BIOL 207
   • CMPUT 201, 204, 229, 291
   • GENET 270
   • MATH 120 (MATH 125 recommended)
   • STAT 221, 222
   • \(3\) in an Arts option

Year 3

1. BIOIN 301
   • CMPUT 301, 325, 379
   • \(3\) in CMPUT at the 300-level or higher (see Note 3 and 4)
   • \(3\) in a GENET Option (see Note 5)
   • \(3\) in a MATH or STAT option at the 200-level or higher (see Note 6)
   • \(3\) in an Arts option

Year 4

1. BIOIN 401
   • \(3\) in a GENET Option (see Note 5)
   • \(3\) in a CMPUT option at the 300-level or higher (see Notes 3 and 4)
   • \(3\) in Arts options
   • \(3\) in approved options

Notes
(1) Students with no previous computing experience should enrol in CMPUT 101, followed by CMPUT 114 and 115.
(2) Some higher level CMPUT courses may require specific MATH courses as prerequisites. These prerequisites should be taken for the MATH or STAT option.
(3) Specialization students with the Bioinformatics stream must take \(3\) in Group A courses which include CMPUT 304, 340 and 474. A complete list of Group A courses to be offered in a given year is available from the department.
(4) Specialization students with the Bioinformatics stream must take \(3\) in Group B project courses which include CMPUT 400, 401, 410, 412, 414, 415, 422, and 466. The department may approve variations in the above requirement on application. CMPUT 400 satisfies the project requirement, but cannot be used as \(3\) in CMPUT at the 300-level or higher or as a Science option.
(5) The \(6\) in GENET options must be chosen from GENET 275, 301, 302, 304 or 390. The \(3\) in a BIOL option must be chosen from BIOL 321, 380 or BIOCH 220. Notes: students interested in GENET 390 and BIOCH 220 are advised to take CHEM 101 and 161 in year 1.

183.6.7 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 183.6.19 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, 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 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.

183.6.8 **BSc General—Computing Science Minor**

The Computing Science minor requires the following courses: CMPUT 114, 115, 201, 204, 229, 272, 273, 379; MATH 114, 115, 120; STAT 265; one of CMPUT 306, 313, 325, 340 or 366. Further credits at the 300- and 400-level are typically not permitted.

**Note:** Students with no previous computing experience should enroll in CMPUT 101 first and then take CMPUT 114 and 115.

183.6.9 **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 §182.5).

For administrative purposes, students in the program will be registered in the Faculty of Engineering. See admission requirements in §15.7. Promotion and Graduation regulations are found in 183.3(2).

183.6.10 **BSc in Computing Science After an Undergraduate Degree (other than a BSc from the Faculty of Science at the University of Alberta)**

In addition to the requirements set out in §183.1.8, a student pursuing this designation must also complete a minimum of 21 in CMPUT courses at the 300- or 400-level offered at the University of Alberta as part of their 60.

183.7 **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.

183.7.1 **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 3.0 on at least 24 in the previous Fall/Winter. Graduation requires a GPA of at least 3.0 on the last 60 credited to the degree.

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

**Year 1**

CMPUT 101 or 114
EAS 100
6 junior ENGL
MATH 113 or 114, 115 and 120
PHYS 1A and 148
STAT 141 or 151

**Year 2**

EAS 212, 221, 270 and 294
MATH 214 and 215
PHYS 244 and 281
3 in Science option
3 in Arts option

**Year 3**

EAS 327, 370, 371, 372 and 373
PHYS 234
6 in Arts options
6 in Science options (see Note below)

**Year 4**

EAS 426
EAS 470, 471 and 475
18 in Science options (see Note below)

**Note:** Science options include but are not limited to EAS 105, 202, 208, 225, 250, 324, 325, 326, 352, 427, 451, 453, 454, 455, 457, CHEM 101, 102, 211, 213, 261, 263, 303; CMPUT 201, 204, 301, 304, 306, 340; ENCS 360; FOR 340, 372; GEOPH 210, 429; MATH 201, 336, 337, 372; PHYS 211, 291, 294, 364, 381, 481; SOILS 210, 440. For students in the Industrial Internship Program: EAS 401, WKEXP 411, WKEXP 412. Recommended Arts options include any EAS X9X courses.

183.7.2 **Specialization in Atmospheric Sciences**

Continuation in the Specialization in Atmospheric Sciences program requires a GPA of at least 2.3 on at least 24 in the previous Fall/Winter. To graduate in four years, a student needs to complete 30 per year. Students who extend their programs beyond five years must first obtain the written approval of the Faculty of Science and the Department of Earth and Atmospheric Sciences.

Graduation requires a GPA of at least 2.3 on the last 60 credited to the degree.

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

**Year 1**

CMPUT 100
EAS 101 and 102
6 junior ENGL
MATH 113 or 114, 115 and 120
PHYS 144 and 151
STAT 141 or 151

**Year 2**

EAS 212, 221, 270 and 294
MATH 214 and 215
PHYS 244 and 281
3 in an Arts option
3 in a Science option

**Year 3**

EAS 327, 370, 371, 372 and 373
PHYS 234
6 in Arts options
6 in Science options (see Note below)

**Year 4**

EAS 470, 471 and 475
21 in Science options

**Note:** Science options include but are not limited to EAS 105, 202, 208, 225, 250, 324, 325, 326, 352, 427, 451, 453, 454, 455, 457, CHEM 101, 102, 211, 213, 261, 263, 303; CMPUT 201, 204, 301, 304, 306, 340; ENCS 360; FOR 340, 372; GEOPH 210, 429; MATH 201, 336, 337, 372; PHYS 211, 291, 294, 364, 381, 481; SOILS 210, 440. For students in the Industrial Internship Program: EAS 401, WKEXP 411, WKEXP 412. Recommended Arts options include any EAS X9X courses.

183.7.3 **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 3.0 on at least 24 in the previous Fall/Winter.

Graduation requires a GPA of at least 3.0 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.
183.7.4 Specialization in Environmental Earth Sciences

Continuation in the Specialization in Environmental Earth Sciences program requires a GPA of at least 2.3 on at least 12 credits in the previous Fall/Winter. To graduate in four years, a student needs 30 credits per year. Students who extend their programs beyond five years must first obtain the written approval of the Faculty of Science and the Department of Earth and Atmospheric Sciences.

Graduation requires a GPA of at least 2.3 on the last 60 credits to the degree.

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

Year 1

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Credits</th>
</tr>
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<tbody>
<tr>
<td>CHEM 101 and 102</td>
<td>3</td>
</tr>
<tr>
<td>EAS 100 and 105</td>
<td>6</td>
</tr>
<tr>
<td>MATH 113 or 114 and 115</td>
<td>12</td>
</tr>
<tr>
<td>PHYS 124 and 126 or PHYS 144 and 146</td>
<td>12</td>
</tr>
</tbody>
</table>

Year 2

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>BIOL 108</td>
<td>4</td>
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<tr>
<td>EAS 212, 221, 222, 224, 225, 250, 270, and 294</td>
<td>15</td>
</tr>
<tr>
<td>STAT 141 or 151</td>
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Year 3

<table>
<thead>
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</tr>
<tr>
<td>EAS 320, 323, 324 and 324</td>
<td>12</td>
</tr>
<tr>
<td>GEOPH 223</td>
<td>3</td>
</tr>
<tr>
<td>EAS 426</td>
<td>3</td>
</tr>
<tr>
<td>EAS 420 or 425</td>
<td>6</td>
</tr>
</tbody>
</table>

183.7.5 Honors in Geology

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

Continuation in the Honors in Geology program requires a GPA of 3.0 on at least 24 credits in the previous Fall/Winter.

Year 1

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<thead>
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<th>Course Code</th>
<th>Credits</th>
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<td>EAS 100 and 105</td>
<td>6</td>
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<tr>
<td>MATH 113 or 114 and 115</td>
<td>12</td>
</tr>
<tr>
<td>PHYS 124 and 126 or PHYS 144 and 146</td>
<td>12</td>
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Year 2

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 108</td>
<td>4</td>
</tr>
<tr>
<td>EAS 212, 221, 222, 224, 225, 250, 270, and 294</td>
<td>15</td>
</tr>
<tr>
<td>STAT 141 or 151</td>
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Year 3

<table>
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<tr>
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<th>Credits</th>
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<tr>
<td>BIOL 208</td>
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</tr>
<tr>
<td>EAS 320, 323, 324 and 324</td>
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<tr>
<td>GEOPH 223</td>
<td>3</td>
</tr>
<tr>
<td>EAS 426</td>
<td>3</td>
</tr>
<tr>
<td>EAS 420 or 425</td>
<td>6</td>
</tr>
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</table>

183.7.6 Specialization in Geology

Continuation in the Specialization in Geology program requires a GPA of at least 2.3 on at least 24 credits in the previous Fall/Winter. To graduate in four years, a student needs 30 credits per year. Students who extend their programs beyond five years must first obtain the written approval of the Faculty of Science and the Department of Earth and Atmospheric Sciences.

Graduation requires a GPA of at least 2.3 on the last 60 credits to the degree.

A student enrolling in the Specialization program should consult the Geology program student advisor before registration.

Year 1

<table>
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<tr>
<th>Course Code</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CHEM 101 and 102</td>
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<tr>
<td>EAS 100 and 105</td>
<td>6</td>
</tr>
<tr>
<td>MATH 113 or 114 and 115</td>
<td>12</td>
</tr>
<tr>
<td>PHYS 124 and 126 or PHYS 144 and 146</td>
<td>12</td>
</tr>
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</table>

Year 2

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>BIOL 108</td>
<td>4</td>
</tr>
<tr>
<td>EAS 212, 221, 222, 224, 225, 250, 270, and 294</td>
<td>15</td>
</tr>
<tr>
<td>STAT 141 or 151</td>
<td>3</td>
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Year 3

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 208</td>
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</tr>
<tr>
<td>EAS 320, 323, 324 and 324</td>
<td>12</td>
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<tr>
<td>GEOPH 223</td>
<td>3</td>
</tr>
<tr>
<td>EAS 426</td>
<td>3</td>
</tr>
<tr>
<td>EAS 420 or 425</td>
<td>6</td>
</tr>
</tbody>
</table>

183.7.7 Honors in Paleontology

See §183.15, Paleontology, for details on the Honors in Paleontology program.

183.7.8 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 (see §183.1.9 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, student is 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 401. EAS 401 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 401 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 401.

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

### 183.7.9 Professional Registration

Graduates of EAS programs may qualify for registration as professional geologists (P. Geol.). The practice of geology in Alberta is governed by provincial law in the interest of public protection against unskilled practice. The right to practice independently (meaning that you are legally able to accept responsibility for your work and sign for it), and the right to use the title of professional geologist (P. Geol.), are restricted to individuals registered by the Association of Professional Engineers, Geologists and Geophysicists of Alberta (APEGGA). Members of the PS Warren student society are automatically student members of APEGGA and as such are introduced to the professional association.

Individuals who are planning to meet the knowledge requirements for P. Geol., while also completing their degree at the University of Alberta should plan their program course selection carefully. Attention is drawn in particular to the science subject requirements, additional to calculus, physics and chemistry. APEGGA verifies that specific knowledge requirements are met, by reviewing academic credentials course-by-course. Holders of degrees that do not cover the APEGGA syllabus may be assessed examinations in missing subjects by the APEGGA Board of Examiners before being accepted for registration. Current syllabus and registration information is available at the Departmental Office or from APEGGA. Full information is available at [http://www.apegga.com](http://www.apegga.com).

Specific questions about programs of study or individual courses applicable to professional registration can also be directed to the Departmental APEGGA Liaison.

### 183.8 Environmental Physical Sciences

#### 183.8.1 Specialization in Environmental Physical Sciences

Continuation in the Specialization in the Environmental Physical Sciences program requires a minimum GPA of 2.3 in the preceding Fall/Winter. Graduation requires a minimum of GPA of 2.3 on the last 90 credited to the degree.

**Year 1**

<table>
<thead>
<tr>
<th>Course</th>
<th>Weight</th>
<th>Grade</th>
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<tbody>
<tr>
<td>CHEM 101 and 102</td>
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</tr>
<tr>
<td>EAS 101 and 102</td>
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<td></td>
</tr>
<tr>
<td>MATH 113 or 114</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MATH 115</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHYS 124 and 126 or PHYS 144 and 146</td>
<td></td>
<td></td>
</tr>
<tr>
<td>★6 in English (ENGL 101 recommended)</td>
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**Year 2**

<table>
<thead>
<tr>
<th>Course</th>
<th>Weight</th>
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<tbody>
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<td>BIOL 108</td>
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</tr>
<tr>
<td>CHEM 261 and 263</td>
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<td></td>
</tr>
<tr>
<td>EAS 220 and 221 (See Note 1) or PHYS 261 and 264</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MATH 120</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHYS 224</td>
<td>★9 in Arts options or approved Science or other options (See Notes 2 and 3)</td>
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**Year 3**

<table>
<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>CHEM 211 and 213</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EAS 220 and 221 (See Note 1) or PHYS 261 and 264, whichever were not previously taken</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EAS 270 and 323</td>
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<td></td>
</tr>
<tr>
<td>PHYS 29a</td>
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<tr>
<td>PHYS 36A or approved Science option (See Note 4 below)</td>
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<td></td>
</tr>
<tr>
<td>★6 in Arts options or approved Science or other options (See Notes 2 and 3)</td>
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**Year 4**

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<td>CHEM 305 or EAS 351</td>
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<td>EAS 425</td>
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<tr>
<td>PHYS 36A or approved Science option, whichever was not previously taken (See Note 4 below)</td>
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<tr>
<td>★18 in Arts options or approved Science or other options (See Notes 2 and 3)</td>
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</tr>
</tbody>
</table>

**Notes**

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

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

(3) Approved Science or other options must total ★24 to ★30, such that a total of ★36 of optional courses are taken. These options include, but are not restricted to, CHEM 241, 313, 333, 371, 373, 415, 417; EAS 224, 225, 250, 327, 352, 457; ENCS 203, 352; GEOPH 223, 224; INT D 369; MATH 214, 215, 270; SOILS 210.

(4) PHYS 36A is offered in alternate years only. Students must check the course schedule and take PHYS 36A in either the third or fourth year of their program, depending on which year PHYS 36A is offered.

#### 183.8.2 Industrial Internship Program

The Environmental Physical Sciences Program in the Faculty of Science offers an Industrial Internship Program which allows students to augment their program of study with 12 or 16 months of paid, discipline-related employment with approved firms or institutions. Only students who have completed three years of the Specialization Program in good standing and who are Canadian citizens or permanent residents are eligible to compete for places in the IIP.

Employment will begin in May after completion of Year 3. After three months of employment, the Internship will be reviewed by the employer, the student, and the IIP Coordinator. If all parties are satisfied, the employment will continue for a further nine or 13 months. During this time the IIP Coordinator will maintain contact periodically with the student and the person designated by the employer to supervise the student to ensure satisfaction on all sides for the remainder of the work term. If the review shows the situation is not satisfactory, the Internship is terminated and the student may return to classes in September to complete Year 4. In this way, the completion of the student's academic program is not delayed.

During the Fall/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 ENVS 463 (★3), which is graded on the University of Alberta four-point letter grading system 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 ENVS 403, based on the employer's assessment, the report and the oral presentation.

A student who has successfully completed WKEXP 421, 422 and ENVS 403, will receive an Industrial Internship Designation on the degree certificate.

#### Courses Related to the Industrial Internship Program

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

#### 183.9 Geophysics

The Department of Physics offers two programs dealing with solid earth physics and space physics. The Honors in Geophysics program (see 183.17.5) 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 §183.17 (Physics).

#### 183.9.1 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. Acceptable experience following graduation is necessary for registration as a Professional Geophysicist. Membership in APEGGA is necessary for registration as a Professional Geophysicist, the APEGGA membership category which confers the right to accept responsibility for geophysical work. Contact the APEGGA office for more information.

#### 183.10 Immunology and Infection

Continuation in the Honors in Immunology and Infection requires a minimum GPA of 3.0 in each preceding Fall/Winter. Graduation requires a minimum GPA of
3.0 on the last ★60 credited to the degree. Students in the Honors program must take at least ★24 in the Fall/Winter of each year. Exceptions to this requirement must be approved by the Department of Biological Sciences and the Faculty of Science office.

183.10.2 Specialization in Immunology and Infection

Continuation in the Specialization in Immunology and Infection requires a minimum GPA of 2.3 in each course credited to the degree. Students in Specialization programs must take at least ★24 during the Fall/Winter of each year of the program. Exceptions to this requirement must be approved by the Department and the Faculty Office.

Year 1

BIOL 107, 108
CHEM 101, 102
CHEM 161, 163 or 263
MATH 113 or 114 or 120
STAT 141 or 151
★6 in Arts options

Year 2

BIOL 200
BIOL 207, 208
IMIN 201
MICRB 265
GENET 270 or BIOCH 330
★3 in a Science option
★6 in Arts options

Years 3 and 4

ZOOL 241 and 242 or PHYS 210 or 211
One of: BIOCH 430; GENET 304; MICRB 316
IMIN 324, 371, 452
MMI 361
ZOOL 352
★6 in Arts options
★9 in Science options from the Options List below
★21 in options from the Options List below or options approved by an advisor.

Note: Normally only ★12 are allowed outside the Faculties of Science and Arts in the entire program. See §184 for courses outside the Faculty of Science that will be considered as Science options.

183.11 Marine Science

Excellent opportunities for the study of marine biology and related subjects exist at Bamfield Marine Sciences Centre (BMSC) 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 $1,000 must be paid on arrival at BMSC to cover the cost of field trips, lab supplies and course materials.

There is a mandatory room and board charge of $1,840 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 Sciences Centre, to whom application should be made.

See §221 Course Listings for descriptions of available Marine Science courses.

183.12 Mathematics

183.12.1 Honors in Mathematics

Continuation in the Honors in Mathematics program requires a minimum GPA of 3.0 in the preceding Fall/Winter. Graduation requires a minimum GPA of 3.0 on ★24 in each Fall/Winter.

Year 1

MATH 117, 118, 125, 228
★6 in an approved Science option
★6 in approved Arts options
★6 in approved options

Year 2

MATH 217, 225, 317, either 229 or 334
★6 in approved Science options
★6 in approved Arts options
★6 in approved options

Years 3 and 4

★30 in MATH courses
★6 in approved Science options
★6 in approved Arts options
★18 in approved options

The program must include MATH 229, 325 or 329, 334, 411, 417, 418, 446 or 448, 447, 496 and ★3 in a Computing Science or Statistics option.

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

Honors in Applied Mathematics

Continuation in the Honors in Applied Mathematics program requires a minimum GPA of 3.0 in the preceding Fall/Winter. Graduation requires a minimum GPA of 3.0 on ★24 in each Fall/Winter.

Year 1

MATH 117, 118, 125, either 228 or 229
★6 in approved Science options
★6 in approved Arts options
★6 in approved options

Year 2

MATH 217, 225, 317, 334
★6 in approved Science options
★6 in approved Arts options
★6 in approved options

Years 3 and 4

★21 in Mathematics courses
★6 in approved options at the 300- or 400-level
★3 in an approved 300- or 400-level Mathematics and/or Mathematical Physics option
★12 in approved Science options
★6 in approved Arts options
★12 in approved options

The program must include in the third and fourth years: MATH 337, 381, 411, 417, 436, 496; one of MATH 373 or 421 and ★3 in a Computing Science or Statistics option. The Honors Seminar, MATH 496, should normally be taken in the fourth year. Note that several of the required courses, including MATH 496, are only given in alternate years.

Minor in Statistics

The degrees Honors in Mathematics and Honors in Applied Mathematics can each be obtained with a minor in Statistics if the student’s program includes STAT 265, 366, 471, and two of STAT 365, 441, 472, 479.

Minor in Computing Science

The degrees Honors in Mathematics and Honors in Applied Mathematics can each be obtained with a Minor in Computing Science. The student’s program must include CMPUT 114, 115, 201, 204, 229, 272, 291, 304 and at least one additional ★3 in Computing Science at the 300- or 400-level.

The Department also offers a BA Honors in Mathematics (see §43.17.1).

Honors in Mathematical Physics

See §183.17.6 for details.

Honors in Statistics

See §183.20.1 for details.
183.12.2 Specialization in Actuarial Science—Business Minor

Continuation in the program normally requires successful completion of at least 24 in the previous Fall/Winter with a GPA of at least 2.3, and a GPA of at least 2.3 on the aggregate of all ECON, FIN, MATH and STAT courses taken in that Fall/Winter.

In the last Fall/Winter of the program, a GPA of at least 2.3 and a GPA of at least 2.3 on the aggregate of all ECON, FIN, MATH and STAT courses taken in that Fall/Winter is required.

Graduation requires a GPA of at least 2.3 on all courses credited toward the degree and a GPA of at least 2.3 on the aggregate of all ECON, FIN, MATH and STAT courses credited toward the degree.

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

Year 1

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMPUT 101, 114</td>
<td>1</td>
</tr>
<tr>
<td>ECON 101, 102</td>
<td>1</td>
</tr>
<tr>
<td>MATH 114, 115</td>
<td>2</td>
</tr>
<tr>
<td>MATH 125</td>
<td>1</td>
</tr>
<tr>
<td>STAT 151</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total Credits:</strong></td>
<td><strong>11</strong></td>
</tr>
</tbody>
</table>

**Notes**

(1) Each student’s program must have the approval of the Department of Mathematics and Statistical Sciences.

(2) A student must take at least 6 in MATH in each Fall/Winter of the program.

(3) A corresponding Honors MATH course can be substituted for any MATH course listed. For example, MATH 117 can be substituted for MATH 114.

(4) Students interested in taking non-junior CMPUT courses as options in subsequent years should note that CMPUT 115 is a prerequisite for all non-junior CMPUT courses.

183.12.4 Specialization in Computational Science (Mathematics)

Continuation in the program normally requires successful completion of at least 24 in the previous Fall/Winter with a GPA of at least 2.3, and a GPA of at least 2.3 on the aggregate of all CMPUT, MATH and STAT courses taken in that Fall/Winter.

In the last Fall/Winter of the program, a GPA of at least 2.3 and a GPA of at least 2.3 on the aggregate of all CMPUT, MATH and STAT courses taken in that Fall/Winter is required.

Graduation requires a GPA of at least 2.3 on all courses credited toward the degree and a GPA of at least 2.3 on all CMPUT, MATH and STAT courses credited toward the degree.

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

Year 1

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMPUT 101 and 114, or 114 and 115</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total Credits:</strong></td>
<td><strong>4</strong></td>
</tr>
</tbody>
</table>

**Notes**

(1) Each student’s program must have the approval of the Department of Mathematics and Statistical Sciences.

(2) Recommended MATH options include MATH 314, 322, 324, 325, 334, 337, 373, 414, 421, 422, 481.

(3) Recommended CMPUT options include CMPUT 301, 304, 313, 325, 379, 391, 401, 411.
(4) Recommended STAT options include STAT 368, 378, 466, 471, 479.
(5) STAT 265/366 can be substituted for STAT 221, 222.
(6) Each student’s program must have the approval of the Department of Mathematical and Statistical Sciences.

183.12.5 Mathematics and Economics

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

Honors in Mathematics and Economics

Continuation in the Honors in Mathematics and Economics program requires a minimum GPA of 3.0 in the previous Fall/Winter. Graduation requires a minimum GPA of 3.0 on ★24 in each Fall/Winter.

Year 1

ECON 101, 102
MATH 117, 118, 125, 228
★6 in a junior English
★6 in approved Science options

Year 2

ECON 281, 282
MATH 217, 317
STAT 265, 368
★6 in approved Science options
★6 in approved options

Years 3 and 4

★24 in Economics
★27 in MATH or STAT courses
★6 in approved Science options
★6 in approved options

The program must contain MATH 225; ECON 384, 385, 481, 482, 407, 408; STAT 366; and four of MATH 334, 337, 354, 381, 432, 481; STAT 368, 483, 383, 384, 382, 482. Credit is not given for ECON 386, 387, or 399.

Specialization in Mathematics and Economics

Continuation in the program normally requires successful completion of at least ★24 in the previous Fall/Winter with a GPA of at least 2.3, and a GPA of at least 2.3 on the aggregate of all ACCTG, ECON, FIN, MATH, MGSC, and STAT courses taken in that Fall/Winter.

In the last Fall/Winter of the program a GPA of at least 2.3 and a GPA of at least 2.3 on the aggregate of all ACCTG, ECON, FIN, MGSC and STAT courses taken in that Fall/Winter is required.

Graduation requires a GPA of at least 2.3 on all courses credited toward the degree and a GPA of at least 2.3 on the aggregate of all ECON, MATH, and STAT courses credited toward the degree.

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

Year 1

ECON 101, 102
MATH 114, 115, 125
STAT 151
★6 in junior English
★3 in a Science option
★3 in an option

Year 2

ECON 281, 282
MATH 214, 215, 228
STAT 265
★9 in Science options
★3 in an option

Years 3 and 4

STAT 366
★24 in ECON including either ECON 399 or both ECON 407 and 408
★18 in MATH or STAT options
★15 in options

Notes

(1) Each student’s program must have the approval of the Department of Mathematical and Statistical Sciences and must include
a. ★18 in Arts courses
b. ★63 in Science courses
c. ★33 in ACCTG, ECON, FIN, or MGSC, including ★9 in 400-level FIN
(2) Approved ACCTG, ECON, FIN and MGSC options include ACCTG 302, 412, 432, 443, ECON 282, 384, 385, 407, 408, 481, 482, FIN 412, 413, 414, 416, 422, 434, 442, MGSC 404, 405.
(3) Recommended Science options include: MATH 334, 337, 354, 381, 432, 481; STAT 366, 471, 472, 479.
(4) A corresponding Honors MATH course can be substituted for any MATH course listed. For example, MATH 117 can be substituted for MATH 114.
(5) Students interested in taking non-junior CMPUT courses as options in subsequent years should note that CMPUT 115 is a prerequisite for all non-junior CMPUT courses.

183.12.6 Specialization in Mathematics and Finance

Continuation in the program normally requires successful completion of at least ★24 in the previous Fall/Winter with a GPA of at least 2.3, and a GPA of at least 2.3 on the aggregate of all ACCTG, ECON, FIN, MATH, MGSC, and STAT courses taken in that Fall/Winter.

In the last Fall/Winter of the program a GPA of at least 2.3 and a GPA of at least 2.3 on the aggregate of all ACCTG, ECON, FIN, MGSC and STAT courses taken in that Fall/Winter is required.

Graduation requires a GPA of at least 2.3 on all courses credited toward the degree and a GPA of at least 2.3 on the aggregate of all ACCTG, ECON, FIN, MATH, MGSC, and STAT courses credited toward the degree.

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

Year 1

CMPUT 101 and 114, or 114 and 115
ECON 101, 102
MATH 114, 115, 125
STAT 151
★6 in junior English

Year 2

ACCTG 311
ECON 281
MATH 214, 215
MATH 225, 253
MGSC 352
STAT 265
★6 in options

Year 3

FIN 301
STAT 353
MATH 356, 357
STAT 366
★3 in a FIN option
★12 in options

Year 4

MATH 314, 414
MATH 373
ECON 399 or STAT 378
★6 in FIN options
★12 in options

Notes

(1) Each student’s program must have the approval of the Department of Mathematical and Statistical Sciences and must include
a. ★18 in Arts courses
b. ★63 in Science courses
c. ★33 in ACCTG, ECON, FIN, or MGSC, including ★9 in 400-level FIN
(2) Approved ACCTG, ECON, FIN and MGSC options include ACCTG 322, 412, 432, 443, ECON 282, 384, 385, 407, 408, 481, 482, FIN 412, 413, 414, 416, 422, 434, 442, MGSC 404, 405.
(3) Recommended Science options include: MATH 334, 337, 354, 381, 432, 481; STAT 366, 471, 472, 479.
(4) A corresponding Honors MATH course can be substituted for any MATH course listed. For example, MATH 117 can be substituted for MATH 114.
(5) Students interested in taking non-junior CMPUT courses as options in subsequent years should note that CMPUT 115 is a prerequisite for all non-junior CMPUT courses.

183.12.7 Industrial Internship Program

An Industrial Internship Program, similar to a co-op program, is offered to students in the Specialization or Honors programs in Mathematics and Statistical Sciences (see 183.1.9 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
The University of Alberta

183.13 Neuroscience

183.13.1 Honors in Neuroscience

The Honors program in Neuroscience is an interdisciplinary program coordinated by the Centre for Neuroscience and administered by the Faculty of Science. This program is for students planning a career in Neuroscience. Entry into the Honors program from High School requires a minimum matriculation average of 80% with completed credits in Biology 30, Chemistry 30 and Physics 30 as prerequisites for admission.

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 3.3 in each preceding Fall/Winter. Graduation requires a minimum GPA of 3.3 on #60 in Years 3 and 4 of the program. Each program of study must be approved by the program coordinator in the Centre for Neuroscience.

All full course load of #30 per academic year must be maintained throughout each year of the Honors program. Courses cannot be deferred to the Spring/Summer Terms without prior permission of the program coordinator.

Year 1

BIOL 107, 108
CHEM 101, 161
One of ENGL 111, 112, 113, 114 or ENGL 104 and 105
MATH 113 or 114
MATH 115 or STAT 141 or 151
PHYS 124, 126

Year 2

BIOL 200
BIOL 207
CHEM 263
PHYS 210 or ZOOL 241 and 242
PSYCO 104 and 275
★6 in Science options
★3 in an Arts option

Year 3

PMCOL 371
PHYS 372
One of PSYCO 377, PSYCO 371, GENET 270, GENET 390, ZOOL 344
ZOOL 342
★12 in approved Science options
★6 in Arts options

Year 4

NEURO 450
NEURO 451 or 452 and ★12 chosen from following list or NEURO 451 and 452 and ★9 chosen from following list: ★9 or 12 (see above) chosen from CELL 115; NEURO 443, 472; PMCOL 407, 412, 508, 512; PHYS 444, 527; PSYCO 511; PSYCO 475, 478
★9 in approved Science options (PHYS 401 and 402 recommended)
★3 in an Arts option

Notes

1) Each student's program must include:
   a. a minimum of ★18 in Arts courses;
   b. a minimum of ★90 in Science courses;
   c. no more than ★12 in non-Science, non-Arts courses
   d. no more than ★42 at the junior level

2) Courses in Faculties outside of the Faculties of Arts and Science require prior approval by the Centre for Neuroscience and these courses cannot be credited as Arts or Science options.

3) Each student's program must have the approval of the Centre for Neuroscience.

4) Approved Science options may be chosen only from the following: BIOCH 410, 430; BIOL 315, 380, 420; CELL 300, 301, 401, 402, 445; CHEM 211, 271, 273, 331, 332; CMPUT 114, 115, 201, 204, 229, 329, 366; EAS 101, 103, 201, 207, 230; ENT 321; GENET 270, 275, 301, 302, 304, 380; GEOPH 221; IMIN 224, 371, 452; MATH 214; MICRB 265, 311; PMCOL 201, 305, 342, 404, 415; PHYS 208, 211, 212, 213, 236, 281; PHYSL 401, 402, 403, 404; PSYCO 267, 281, 354, 364, 371, 372, 381, 385, 458, 482; STAT 221, 222, 252, 337, ZOOL 343, 344, 370, 442.

5) Suggested Arts options include the following: ANTHR 230, 332; CLASS 110, 252; C LIT 342; HIST 391, 396, 397, 399; PHIL 205, 217, 265, 317, 368, 375, 386; PSYCO 105, 212, 233, 261, 301, 322, 339, 350, 357, WRITE 298.

6) Approved non-Science/non-Arts options must be chosen from the following: ANAT 200, 301, 401; INT D 208; REHAB 45A.

7) In the fourth year, all students must successfully complete an individual study program with members of the Centre for Neuroscience. This program consists of a reading course, NEURO 450, and a laboratory course, NEURO 451/452. Students must consult the Centre for Neuroscience before the beginning of their fourth year to arrange an individual study program.

183.14 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 448; BIOL 368; CANST 302 and 408; EAS 453 and 455; ENCS 201; INT D 443; POL S 432. These courses may be taken within the framework of existing General, Specialization, or Honors programs in the Faculty of Science. Students interested in Northern Studies should mention this to their faculty advisor.

183.15 Paleontology

Paleontology is a basic science concerned with the evolutionary history of life. Students are required to have a broad knowledge base of biological and geological knowledge. Areas of detailed knowledge will include vertebrate and invertebrate paleobiology, paleobotany, evolutionary biology, systematics, functional morphology, sedimentology, stratigraphy, and plate tectonics. Paleontologists usually hold advanced research degrees and work as research scientists and teachers in universities, museums, and industrial laboratories.

183.15.1 Honors in Paleontology

The Honors program is administered by the Departments of Earth and Atmospheric Sciences and Biological Sciences. The curriculum is drawn from both departments enabling students to develop a broad knowledge base that will prepare them for later entry into more specialized postgraduate studies in their selected paleontological discipline. Interested students should consult with an Honors program advisor to prepare their programs.

The Honors Paleontology program follows the Faculty of Science rules and regulations governing standards of admission, continuation and graduation (see §183.1.1).

Year 1

BIOL 107 and 108
CHEM 101 and 161 or 102
EAS 100 and 105
★6 junior English
MATH 113 or 114 or 120
STAT 151

Year 2

BIOL 207, 208 and 335
BOT 210
EAS 225 and 230
ZOOL 224, 225 and 256
★3 approved Science option

Year 3

ANTHR 390
BIOL 321
BOT 411 or approved option
EAS 233, 234, 235 and 236
PALEO 414 or approved option
★6 approved Arts options
183.15.2 Specialization in Paleontology

Continuation in the Specialization in Paleontology program requires a GPA of at least 2.3 on at least 24 in each preceding Fall/Winter. To graduate in four years, a student needs to complete 30 per year. Students who extend their programs beyond five years must first obtain the written approval of the Faculty of Science and the Department of Earth and Atmospheric Sciences. Graduation requires a GPA of at least 2.3 on the last 60 credited to the degree. A student enrolling in the Specialization program should consult the Paleontology program student advisor before registration each year.

Year 1

Biol 107 and 108
Chem 101 and 102
Eas 100 and 105
3 junior English
Math 113 or 114 or 120
Stat 151

Year 2

Biol 207, 208 and 335
Biol 210
Eas 225 and 230
Zool 224, 225 and 250
3 approved Science options

Year 3

Anth 390
Biol 321
Biol 411 or approved option
Eas 233, 234, 235 and 236
Paleo 414 or approved option
6 approved Science options

Year 4

Biol 411 or approved option
Eas 330
Paleo 318 and 319
Paleo 414 or approved option
3 approved Arts option
12 approved Science options

Note: Paleo 414 is offered in alternate years but must be taken in Year 3 or 4. Eas 110 may be taken as an approved Science option in the first or second year. Approved Science options: Biol 315, 361, 364; Eas 207, 250; Ent 220; Zool 405, 407, 408, 427. Approved Arts options: Anth 391; Chrtc 350, 451; Phil 265, 317. For information regarding additional approved options, please consult your Department advisor.

183.16 Pharmacology

183.16.1 Honors in Pharmacology

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

Continuation and graduation from the Honors Pharmacology program requires a minimum GPA of 3.3 on at least 30, and a minimum GPA of 3.3 in all science courses taken, and a grade of B+ in each course taken in the Department of Pharmacology during the preceding Fall/Winter.

Year 1

Bioch 200
Biol 107, 108
Chem 101, 102, 161, 283
6 in Arts options ENGL recommended
Stat 141 or 151

Year 2

Bioch 320, 330
Chem 211, 213
Physsl 210 or 211
Pmcol 201
6 in Arts options
3 in a Science option from Bioch, Biol, Chem, Genet, Math, Micrb, Phys, Physsl, Pmcol, Stat or Zool

Year 3

Pmcol 303, 305, 343, 344
6 in Science options as indicated in Year 2
6 in Arts options
6 in approved options

Year 4

Pmcol 337, 498
3 in an approved option
3 in a Science option as indicated in Year 2
15 from the following: Pmcol 407, 412, 415, 416, 424, 425, 442
Note: Students must consult the Chair of the Department or designee for approval of the selection of options. Students will not be permitted to take 400-level pharmacology courses unless all prerequisites have been met.


183.16.2 Specialization in Pharmacology

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

Continuation and graduation from the Specialization program in Pharmacology require a minimum GPA of 2.7 in the preceding Fall/Winter. In addition, a GPA of at least 2.7 is required in all Science courses taken and a minimum GPA of 2.7 is required in all courses in the Department of Pharmacology.

Year 1

Bioch 200
Biol 107, 108
Chem 101, 102, 161, 263
6 in Arts options ENGL recommended
Stat 141 or 151

Year 2

Bioch 320, 330
Chem 211, 213
Physsl 210 or 211
Pmcol 201
6 in Arts options
3 in a Science option from Bioch, Biol, Chem, Genet, Math, Micrb, Phys, Physsl, Pmcol, Stat or Zool

Year 3

Pmcol 303, 305, 343, 344
6 in Science options as indicated in Year 2
6 in Arts options
6 in approved options

Year 4

Pmcol 337, 498
3 in an approved option
3 in a Science option as indicated in Year 2
15 from the following: Pmcol 407, 412, 415, 416, 424, 425, 442
Note: Students must consult the Chair of the Department or designee for approval of options.


183.16.3 Industrial Internship Program

An Industrial Internship Program, similar to a co-op program, is offered to students in the Specialization or Honors programs in Pharmacology (see §183.1.9 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 990, 991 and 992, 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 regular
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 a review shows the situation is not satisfactory, the internship may
be terminated and the student will then return to classes at the next available
opportunity.

The graduation requirements for the Industrial Internship program
designation include successful completion of at least two of WKEXP 990, 991 and
992 plus PMCOL 400. PMCOL 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 PMCOL 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 PMCOL 400.

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

183.17 Physics

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

Continuation in the Honors Physics, including the Applied Physics,
Astrophysics, Computational Science (Physics), Geophysics and Mathematical
Physics, programs requires a GPA of 3.0 on at least 2.5 in the preceding Fall/Winter. Graduation requires a GPA of 3.0 on the last 40 credited to the
degree.

The Specialization programs provide greater flexibility for students who
want a four-year degree in Physics or Geophysics without the full comprehensive
training of the Honors Programs. Continuation in the Specialization program
in Astrophysics, Computational Science (Physics) and Geophysics requires a GPA
of at least 2.3 in the preceding Fall/Winter. Graduation requires a GPA of 2.3 on
the last 30 credited to the degree.

Notes

(1) Students interested in the Engineering-Physics program should consult §82.7 of
the Faculty of Engineering section.

(2) Honors and Specialization Physics students must consult an advisor in the
Department of Physics regarding their programs. Note to second-, third- and
fourth-year students: Not all 200-, 300- and 400-level Physics and Geophysics
courses are offered every year.

(3) Students who wish to enter a Department of Physics program, but do not have
Mathematics 31, are advised to register in PHYS 124 and MATH 113 in the
first term, and then take PHYS 146 and MATH 115 in the second term. They
may then apply to transfer into year two of one of the Department programs
outlined below, and proceed to the 200-level PHYS courses. Students who have
taken PHYS 124 and 126, and MATH 113 (or 114) and 115, may also apply to
transfer into year two of one of the Department programs, and proceed to the
200-level PHYS courses.

183.17.1 Honors in Physics

Notes

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

(2) Students must take 21 from Pools A and B, in addition to the specific PHYS
courses listed as requirements.

Pool A: PHYS 382, 395; MA PH 343; all 400-level ASTRO, PHYS and MA PH
courses.

Pool B: BME 513, 564; all 300- and 400-level ASTRO, PHYS, MA PH, and GEOPH
courses, unless otherwise indicated in the course descriptions, plus all 400-
level MATH courses. With consent of the Department, other courses may be
taken for credit.

(3) Students wishing to qualify for an Honors degree must take a minimum of 12 from Pool A, in addition to the specific courses listed as requirements.

(4) Students who wish to enter a Department of Physics program, but do not have
Mathematics 31, are advised to register in PHYS 124 and MATH 113 in the
first term, and then take PHYS 146 and MATH 115 in the second term. A student
who successfully completes PHYS 124 and 126, or PHYS 124 and 146, and who
also completes MATH 113 (or 114 or equivalent) and MATH 115, may apply to
transfer to an Honors or Specialization program in the Department of Physics,
provided the GPA and course load requirements have also been met.

Year 1

MATH 113 (or 114, or 117), 115 (or 118)
MATH 120 (or 125 for more theoretically inclined students), MATH 225
PHYS 144, 146 (see Note 4 above; see also Note 3 in 5183.17)
3 in Science options (suggested options are in Astronomy, Chemistry, or Earth
and Atmospheric Sciences)
5 in Arts options (English recommended) (see Note 1 above)

Year 2

MATH 214 (or 217), 215 (or 317)
PHYS 211, 234, 244, 271, 281, 295, 297
3 in an Art option (see Note 1 above)

Years 3 and 4

MATH 311 (or 411), 334, 337
PHYS 311, 351, 372, 381, 397, 472, 481
12 in Pool A options (see Notes 2 and 3)
3 in Pool A or B options (see Note 2)
3 in Arts options (see Note 1)

In Year 4, students are also expected to take part in the weekly Physics Colloquium.

183.17.2 Honors in Applied Physics

Notes

(1) In this program, there are three possible concentrations in the selection of courses
for Year 4, after completion of Years 1, 2 and 3. Students must choose one of
these concentrations. The three concentrations are in the following areas:

a. Concentration in Photonics and Condensed Matter Physics

b. Concentration in Plasma Science

c. Concentration in Medical Physics

(2) AP Pool options: BME 513, 564; E E 474, 573; GEOPH 426; PHYS 351; all 300-
and 400-level ASTRO and MA PH courses; all 400-level PHYS courses

(3) MedPhys Pool options: BME 513, 564; ONCOL 550, 552, 562, 564, 568; PHYS
415, 461, 484

(4) Students who wish to enter a Department of Physics program, but do not have
Mathematics 31, are advised to register in PHYS 124 and MATH 113 in the first
term, and then take PHYS 146 and MATH 115 in the second term. A student
who successfully completes PHYS 124 and 126, or PHYS 124 and 146, and who
also completes MATH 113 (or 114 or equivalent) and MATH 115, may apply to
transfer to an Honors or Specialization program in the Department of Physics,
provided the GPA and course load requirements have also been met.

Year 1

CHEM 101, 102
MATH 113 (or 114 or 117), 115 (or 118), 120 (or 125), 225
PHYS 144, 146 (see Note 4 above; see also Note 3 in 5183.17)
5 in Arts options

Year 2

MATH 214, 215
PHYS 211, 234, 244, 271, 281, 295, 297
3 in an Art option

Year 3

MATH 311, 334, 337
PHYS 311, 382, 397, 381, 395, 397
3 in an Art option

Year 4 - Concentration in Photonics and Condensed Matter Physics

PHYS 415, 461, 472, 481, 499
3 in AP Pool options (see Note 2)
5 in Arts options

Year 4 - Concentration in Plasma Science

E E 474
ASTRO 429
PHYS 420, 472, 481, 499
5 in Arts options

Year 4 - Concentration in Medical Physics

PHYS 420, 472, 481, 499
One of ONCOL 550 or 562
5 in Arts options

183.17.3 Honors in Astrophysics

Notes

(1) Students must take a total of 18 in Arts options.

(2) AS Pool: MA PH 343; PHYS 382, 395, 397; all 400-level ASTRO, PHYS, MA PH,
and GEOPH courses.

(3) Students who wish to enter a Department of Physics program, but do not have
Mathematics 31, are advised to register in PHYS 124 and MATH 113 in the first
term, and then take PHYS 146 and MATH 115 in the second term. A student
who successfully completes PHYS 124 and 126, or PHYS 124 and 146, and who
also completes MATH 113 (or 114 or equivalent) and MATH 115, may apply to
transfer to an Honors or Specialization program in the Department of Physics,
provided the GPA and course load requirements have also been met.
183.17.4 Honors in Computational Science (Physics)

Notes

(1) CP Pool: PHYS 297; all 300- and 400-level ASTRO, GEOPH, MA PH and PHYS courses.
(2) The CMPUT 201 corequisite of CMPUT 272 would be waived for this program.
(3) Students who wish to enter a Department of Physics program, but do not have Mathematics 31, are advised to register in PHYS 124 and MATH 115 in the first term, and then take PHYS 146 and MATH 115 in the second term. A student who successfully completes PHYS 124 and 126, or PHYS 124 and 146, and who also completes MATH 113 (or 114 or equivalent) and MATH 115, may apply to transfer to an Honors or Specialization program in the Department of Physics, provided the GPA and course load requirements have also been met.

Year 1

CMPUT 114, 115
MATH 113 (or 114 or 117), 115 (or 118), 120 (or 125), 225
PHYS 144, 146 (see Note 3 above; see also Note 3 in 183.17)

★ 6 in Arts options

Year 2

CMPUT 201
MATH 214 (or 217), 215 (or 317)
PHYS 211, 234, 244, 271, 281

★ 6 in Arts option

Year 3

CMPUT 272
MATH 281 (or CMPUT 340)
MATH 311, 334, 337
PHYS 295, 311, 372, 381

★ 3 in an Arts option

Year 4

CMPUT 204
CMPUT 229
PHYS 420, 472, 481

★ 6 in CP Pool options (see Note 1)

★ 6 in approved Science options

★ 3 in Arts options

183.17.5 Honors in Geophysics

Notes

(1) Students who wish to enter a Department of Physics program, but do not have Mathematics 31, are advised to register in PHYS 124 and MATH 113 in the first term, and then take PHYS 146 and MATH 115 in the second term. A student who successfully completes PHYS 124 and 126, or PHYS 124 and 146, and who also completes MATH 113 (or 114 or equivalent) and MATH 115, may apply to transfer to an Honors or Specialization program in the Department of Physics, provided the GPA and course load requirements have also been met.

(2) In addition to the specific courses required in the program, students must take a minimum of ★ 3 from Geophysics Honors Pool courses, ★ 12 in approved Science options, and ★ 12 in Arts options.

(3) Honors Pool: ASTRO 429, CMPUT 340; EAS 321; GEOPH 210, 320, 431, 437, 440; PET E 365; PHYS 372, 489. 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.

Year 1

CHEM 101
EAS 101
GEOPH 110
MATH 113 (or 114 or 117), 115 (or 118), 120 (or 125 for more theoretically inclined students)
PHYS 144, 146 (see Note 1 above; see also Note 3 in 183.17)

★ 6 in Arts options (English recommended)

Year 2

CHEM 102
EAS 233
MATH 214 (or 217), 215 (or 317)
PHYS 234, 244, 271, 281, 295

★ 3 in an Arts option (see Note 2 above)

Year 3

EAS 222
GEOPH 325, 326
MATH 311 (or 411), 334, 337
PHYS 381

★ 3 in approved Science options or Honors Pool courses (see Notes 2 and 3 above; GEOPH 210 recommended)

Year 4

GEOPH 421, 424, 426, 438
MA PH 467
PHYS 211 (or 224), 481

★ 6 in approved Science options or Honors Pool courses (GEOPH 440 recommended, see Notes 2 and 3 above)

★ 3 in an Arts option (See Note 2 above)

183.17.6 Honors in Mathematical Physics

Note: Students who wish to enter a Department of Physics program, but do not have Mathematics 31, are advised to register in PHYS 124 and MATH 113 in the first term, and then take PHYS 146 and MATH 115 in the second term. A student who successfully completes PHYS 124 and 126, or PHYS 124 and 146, and who also completes MATH 113 (or 114 or equivalent) and MATH 115, may apply to transfer to an Honors or Specialization program in the Department of Physics, provided the GPA and course load requirements have also been met.

Year 1

MATH 117, 118, 125, 229
PHYS 144, 146 (see Note above; see also Note 3 in 183.17)

★ 6 in Science options (★ 3 in Computing Science recommended)

★ 6 in Arts options (English recommended)

Year 2

MATH 217, 225, 317
MATH 334
PHYS 211, 234, 244, 271, 281, 295

Year 3 and 4

MATH 311 (or 411), 337, 417
MA PH 343, 451
PHYS 311, 351, 372, 381, 472, 481

★ 3 in 400-level ASTRO, GEOPH, MATH, MA PH, or PHYS course

★ 12 approved Science options

★ 12 Arts options

183.17.7 Specialization in Physics

Notes

(1) By the end of their programs, students must have taken ★ 18 of Arts options.
(2) Students must take ★ 27 from Pools A and B in addition to the specific PHYS courses listed as requirements.

Pool A: PHYS 362, 395; MA PH 343; all 400-level ASTRO, PHYS and MA PH courses.

Pool B: BIOL 513, 564; all 300- and 400-level ASTRO, PHYS, MA PH, and GEOPH courses, unless otherwise indicated in the course descriptions, plus all 400-level MATH courses. Specialization students may take 200-level courses from Science departments other than Physics and Mathematical and Statistical Sciences. With consent of the Department, other courses may be taken for credit.
(3) Students wishing to qualify for a Specialization degree must take a minimum of ★ 3 from Pool A.
(4) The courses listed below comprise a minimum program. Students may, in consultation with the Department, select more advanced courses in place of those listed. A suitably enriched program can be used for admission to graduate work in Physics if satisfactory standing is obtained.
(5) Students who wish to enter a Department of Physics program, but do not have Mathematics 31, are advised to register in PHYS 124 and MATH 113 in the first term, and then take PHYS 146 and MATH 115 in the second term. A student who successfully completes PHYS 124 and 126, or PHYS 124 and 146, and who also completes MATH 113 (or 114 or equivalent) and MATH 115, may apply to
transfer to an Honors or Specialization program in the Department of Physics, provided the GPA and course load requirements have also been met.

Year 1

MATH 113 (or 114 or 117), 115 (or 118), 120 (or 125), 225
PHYS 144, 146 (see Note 5 above; see also Note 3 in §183.17)
★6 in Science options
★6 in Arts options (English recommended) (see Note 1 above)

Year 2

MATH 214 (or 217), 215 (or 317), PHYS 211, 234, 244, 271, 281, 295, 297
★3 in an Arts option (see Note 1 above)

Years 3 and 4

PHYS 311, 351, 372, 381, 397
MATH 311 (or 411), 334, 337
★9 in Pool A options (see Notes 2 and 3)
★18 in Pool A or B options (see Note 2)
★9 in Arts options (see Note 1)

183.17.8 Specialization in Astrophysics

Notes

(1) Students must take a total of ★18 in Arts options.
(2) CP Pool: MA PH 343, PHYS 362, 365, 367, all 400-level ASTRO, PHYS, MA PH, and GEOPH courses. Other options may be discussed with the Department advisor.
(3) Students who wish to enter a Department of Physics program, but do not have Mathematics 31, are advised to register in PHYS 124 and MATH 113 in the first term, and then take PHYS 146 and MATH 115 in the second term. A student who successfully completes PHYS 124 and 126, or PHYS 124 and 146, and who also completes MATH 113 (or 114 or equivalent) and MATH 115, may apply to transfer to an Honors or Specialization program in the Department of Physics, provided the GPA and course load requirements have also been met.

Year 1

MATH 113 (or 114 or 117), 115 (or 118), 120 (or 125), 225
PHYS 144, 146 (see Note 3 above; see also Note 3 in §183.17)
★6 in Science options (suggested options are in ASTRO or CHEM)
★6 in Arts options

Year 2

ASTRO 320
MATH 214 (or 217), 215 (or 317)
PHYS 211, 234, 244, 271, 281, 295, 297

Year 3

ASTRO 322
MATH 311, 334, 337
PHYS 311, 351, 372, 381
★6 Arts option

Year 4

ASTRO 430 and 465
★18 in AS Pool options
★6 in Arts options

183.17.9 Specialization in Computational Science (Physics)

Notes

(1) CP Pool: PHYS 297, all 300- and 400-level ASTRO, GEOPH, MA PH and PHYS courses.
(2) CMPUT options: CMPUT 204, 272, 291, 301, and 306.
(3) The CMPUT 306 prerequisites of STAT 221/222 may be waived in lieu of PHYS 225 and 295.
(4) The CMPUT 201 corequisite of CMPUT 272 would be waived for this program.
(5) Students should be aware that there may be extra prerequisites for some of the Computing Science option courses, so the specified list of CMPUT options (Note 2) may be more restricted.
(6) Students who wish to enter a Department of Physics program, but do not have Mathematics 31, are advised to register in PHYS 124 and MATH 113 in the first term, and then take PHYS 146 and MATH 115 in the second term. A student who successfully completes PHYS 124 and 126, or PHYS 124 and 146, and who also completes MATH 113 (or 114 or equivalent) and MATH 115, may apply to transfer to an Honors or Specialization program in the Department of Physics, provided the GPA and course load requirements have also been met.

Year 1

CMPUT 114, 115
MATH 113 (or 114 or 117), 115 (or 118), 120 (or 125), 225
PHYS 144, 146 (see Note 6 above; see also Note 3 in §183.17)
★6 in Arts options

Year 2

CMPUT 201
MATH 214 (or 217), 215 (or 317)
PHYS 211, 234, 244, 271, 281
★6 in Arts option

Year 3

★3 in a CMPUT option (see Notes 2 and 3)
MATH 381 (or CMPUT 340)
MATH 311, 334, 337
PHYS 295, 311, 372, 381
★3 in an Arts option

Year 4

CMPUT 229
PHYS 420
★3 in a CMPUT option (see Notes 2, 3 and 4)
★6 in CP Pool options (see Note 1)
★3 in a CMPUT option or CP Pool option (see Notes 1, 2, 3 and 4)
★9 in approved Science options
★3 in an Arts option

183.17.10 Specialization in Geophysics

Notes:

(1) Students who wish to enter a Department of Physics program, but do not have Mathematics 31, are advised to register in PHYS 124 and MATH 113 in the first term, and then take PHYS 146 and MATH 115 in the second term. A student who successfully completes PHYS 124 and 126, or PHYS 124 and 146, and who also completes MATH 113 (or 114 or equivalent) and MATH 115, may apply to transfer to an Honors or Specialization program in the Department of Physics, provided the GPA and course load requirements have also been met.
(2) In addition to the specific courses listed in the program, students must take a minimum of ★3 from Geophysics Specialization Pool courses, ★12 in approved Science options, and ★12 in Arts options.
(3) Specialization Pool: ASTRO 429; CMPUT 340; GEOPH 210, 332, 421, 431, 440; MA PH 467; PET E 365; PHYS 372, 489. 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.

Year 1

CHEM 101
EAS 101
GEOPH 110
MATH 113 (or 114 or 117), 115 (or 118), 120 (or 125 for more theoretically inclined students)
PHYS 146, 146 (see Note 1; see also Note 3 in §183.17)
★6 in Arts options (English recommended)

Year 2

CHEM 102
EAS 233
MATH 214 (or 217), 215 (or 317)
PHYS 234, 244, 271, 281, 295
★3 in an Arts option (see Note 2 above)

Year 3

EAS 222 and 321
GEOPH 325, 326
MATH 311 (or 411), 334, (or 336), 337 (or 300)
PHYS 381
★6 in approved Science options or Specialization Pool courses (see Notes 2 and 3 above; GEOPH 210 recommended)

Year 4

GEOPH 424, 426, 437, 438
PHYS 211 (or 224)
★12 in approved Science options or Specialization Pool courses (see Notes 2 and 3 above)
★3 in Arts option (see Note 2 above)

183.17.11 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 §183.19 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, 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 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.

183.17.12 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 208 and 224 as early as possible in their program. To complete a major in Physics, PHYSICS 294 is strongly recommended. Students majoring in Physics should normally select from PHYS 301, 308, 319, and 364. They should also consult the Physics Department about course offerings, as not all 200- and 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 Faculty of Science advisor (M183.1.3 and 183.1.5).

183.18 Physiology

183.18.1 Honors in Physiology

Honors in Physiology is offered by the Department of Physiology in the Faculty of Medicine and Dentistry.

The Honors program is designed primarily to prepare 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.

Entry into the Honors Program from high school requires a minimum matriculation average of 80% with Biology 30, Chemistry 30, Physics 30, as prerequisites. Continuation in the program requires a GPA of 3.3 on at least ★30 in the previous Fall/Winter term. In addition, students in the second year of the program must obtain a grade of at least B in PHYSL 211 in order to continue in the program. Students who are eligible to enter the program in their third year and have credit in PHYSL 210 require a grade of at least B+ in PHYSL 210. Graduation requires a GPA of 3.3 in the final year. Students must consult their advisor in the Department prior to registration in each year of the program.

The course requirements for the program are as follows:

- **Year 1**
  - BIOL 107, 108
  - CHEM 101, 102, 161, 263;
  - ★6 junior English
  - ★6 in approved Science or Arts options (see Note 1)
- **Year 2**
  - BIOCH 200 and one of 310, 320 or 330
  - BIOL 201, 207
  - PHYS 124, 126
  - PHYSL 211
  - ★6 in approved Science or Arts options (see Note 1)
- **Year 3**
  - CELL 300
  - PMCOL 343 and 344, 371
  - PHYSL 372, 401, 403
  - STAT 141 or 151
  - ★6 in approved Science or Arts options (see Note 1)
- **Year 4**
  - PHYSL 402, 404, 465, 466
  - ★12 from CELL 445; NEURO 443; PHYSL 444, 501, 512, 513, 527, 544, 545; PMCOL 415, 515 or another 400- or 500-level Science course with Department approval.
  - ★6 in approved options (see Note 1)

**Notes**:
1. The program must consist of a minimum of ★90 in Science, a minimum of ★18 in Arts, and no more than ★12 in non-Arts/non-Science options or ★42 at the junior level.
2. Science options must be chosen from the following: Junior Courses: CMPUT 114; MATH 113 or 114, 115, 120 or 125; PSYCO 104. Advanced Courses: BIOCH 420, 430, 441, 450, 455, 460; BIOL 315; CELL 301; CHEM 213, 213, 361; GENET 270, 275, 301, 302, 304, 375, 390, 416; IMIN 205, 324, 371, 422; MATH 214, 215, MIRC 265; MMT 351, 520; PMCOL 305, 403, 407, 412, 415, 505, 508; PSYCO 275, 281, 371, 377, 381, 459, 478; STAT 252, 253, 258; ZOOL 225, 303, 340, 342, 343, 402.
3. Non-Science/non-Arts options must be chosen from the following: ANAT 200; AN SC 310, 311, 410, 488; BME 513; NUTR 301, 302; OCCTH 206; PEDS 412.
4. Suggested Arts options include the following: CRHCR 352; CLASS 298; ENGL 310; LING 321, 323, 499; PHIL 101, 250, 265, 415, 417; POL S 101; PSYCO 105, 223, 258; SOC 100, 241, 300, 382, 462, 473; WRITE 298.
5. Other options may be acceptable with written permission of an advisor.
6. MATH 113 or 114 is a recommended option.
7. Honors students are also encouraged to attend all department seminars.
8. Honors students in the second year of the program are required to take PHYSL 211.

183.19 Psychology

183.19.1 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 3.3 in the preceding Fall/Winter. Students are expected to take at least ★30 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 ★48 (but no more than ★60) must be taken in Psychology. A minimum of ★72 in science courses must be taken. A student's program of courses must be approved in advance each year by the Honors Psychology advisor.

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

**Year 1**
- BIOL 107, 108
- On of ENGL 111, 112, 113, 114
- PSYCO 104, 105
- ★6 from CMPUT 101, 114, 115, MATH 113, 114, 115, 117, 118, 120, 125, STAT 252 or other Computing Science, Mathematics or Statistics course approved by the Honors Advisor. (Note: STAT 151, a requirement in Year 2, is a prerequisite to STAT 252. ★6 in approved Science options

**Year 2**
- STAT 151 and PSYCO 212
- ★6 (two of) from PSYCO 223, 233, 241, 258
- ★6 (two of) from PSYCO 267, 275, 281
- ★6 from approved courses offered by the Departments of Anthropology, Economics, Linguistics, Political Science and/or Sociology
- ★6 in approved Science options

**Year 3**
- PSYCO 309, 390 and PSYCO 303 or 304
- ★3 (one of) PSYCO 386, 410, 411, 413, 431, 475, 476, 482, or other advanced research methods course approved by the Honors Advisor
- ★9-12 in approved Science options
- ★6-9 in approved options

**Year 4**
- PSYCO 409, 499
- ★6 (two of) in a 400-level Psychology course other than 409, 410, 411, 413, 431, 475, 476, 482, 499, 496, 497, 498, except as approved by the Honors Advisor
- ★9-15 in approved Science options
- ★6-9 in approved options

**Notes**:
1. In addition to the courses specifically listed above, the program must include, among the student’s optional courses, a minimum of ★12 in one or more disciplines relevant to Psychology, e.g., ANTHR, BIOL, CHEM, CMPUT, ECON, GENET, LING, MATH, NEURO, PHARM, PHIL, PHYS, PHYSL, POL S, SOC, STAT, ZOOL.
2. These courses may not overlap those used to fulfill the Computing/Mathematics/Statistics, Natural Science and Social Science requirements listed above.
3. 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 498) 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.
183.20 Statistics

183.20.1 Honors in Statistics

Continuation in the Honors in Statistics program requires a GPA of 3.0 on at least 24 in the preceding Fall/Winter.

Graduation requires a GPA of 3.0 on all Statistics and Mathematics courses taken and a GPA of 2.7 on the last 30 credited to the degree.

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

**Year 1**
- CMPUT 101 and 114, or 114 and 115
- MATH 125
- MATH 114 (or 117), 115 (or 118)
- STAT 151
  - 6 in approved Arts options
  - 6 in approved options

**Year 2**
- MATH 214 (or 217), 215 (or 317), 225
- STAT 205
  - 6 in approved Arts options
  - 9 in approved Science options
  - 3 in an approved option

**Years 3 and 4**
- MATH 314 or 417
- MATH 414 or 418
  - STAT 312, 366, 378, 471
  - Two of STAT 335, 361, 368, 377
  - Three of STAT 432, 441, 453, 454, 472, 479
  - 6 in approved Arts options
  - 21 in approved Science options

**Notes**
1. 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 application are Biology, Computing Science, Economics, Engineering, Pharmacology, Political Science, Psychology, and Sociology. Students should plan to take the proper prerequisites early in the program.
2. Students interested in taking non-junior CMPUT courses as options in subsequent years should note that CMPUT 115 is a prerequisite for all non-junior CMPUT courses.

**Honors in Mathematics**
See §183.12.1 for details.

183.20.2 Specialization in Statistics

The Specialization 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, Chemical Engineering, Computing Science, Economics, Education, Genetics, Health Sciences Administration, Pharmacology, Political Sciences, Psychology, Sociology, and Zoology. Students may, in consultation with the Department of Mathematical and Statistical Sciences, select a different field of application than those listed above.

Continuation in the program normally requires, successful completion of at least 24 in the previous Fall/Winter, and a GPA of at least 2.3, and a GPA of at least 2.3 on the aggregate of all MATH and STAT courses taken in that Fall/Winter.

In the last Fall/Winter of the Program a GPA of at least 2.3 and a GPA of at least 2.3 on the aggregate of all MATH and STAT courses taken in that Fall/Winter is required.

Graduation requires a GPA of at least 2.3 on all courses credited toward the degree and a GPA of at least 2.3 on the aggregate of all MATH and STAT courses credited toward the degree.

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

**Year 1**
- MATH 114, 115, 125
- STAT 151
  - 18 in options (see Note 2 below)

**Year 2**
- MATH 214, 215, 225
- STAT 252, 265
  - 15 in options (see Note 2 below)

**Years 3 and 4**
- STAT 361, 366, 368, 378
  - 12 in STAT options at 300- and 400-level
  - 36 in options

**Notes**
1. Each student’s program must have the approval of the Department of Mathematical and Statistical Sciences.
2. The program must include 6 in English and either CMPUT 101 and 114, or CMPUT 114 and 115. These courses should be taken in the first two years of the program.
3. The program must include at least 18 in a single field of applications. The student is advised to consult the Department of Mathematical and Statistical
183.20.3 Industrial Internship Program

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

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

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

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

183.21 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.

183.21.1 Preprofessional Requirements for Medicine and Dentistry

For admission requirements for the DDS Degree program and the MD Degree program, see §§15.9.7 and 15.9.9, respectively. Students planning to apply for admission to one of these degree programs may take the required courses while registered in a degree program in Science. See §15.16.8 for Grade 12 requirements for the preprofessional program.

183.21.2 Preprofessional Requirements for Veterinary Medicine

See §§15.16 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.

183.21.3 Preprofessional Requirements for Rehabilitation Medicine

See §§15.14 and 15.16. Students may take the required courses while registered in a BSc General program or one of the BSc Specialization or BSc Honors programs.

183.21.4 Preprofessional Requirements for Optometry

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

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

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

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

183.21.5 Preprofessional Requirements for Medical Laboratory Science

Admission requirements for the BSc Medical Laboratory Science program are given in §15.9.2. Students planning to apply for admission to Medical Laboratory Science may take the required courses while registered in the Faculty of Science.

184 Details of Courses

184.1 Course Listings

Science courses can be found in §221, Course Listings, under the following subject headings:

- Astronomy (ASTRO)
- Biochemistry (taught by the Faculty of Medicine and Dentistry) (BIOCH)
- Biochimie (BIOCIM) (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 (ZOO)
- Biologie (BIOLE) (Faculté Saint-Jean)
- Cell Biology (CELL)
- Chemistry (CHEM)
- Chimie (CHIM) (Faculté Saint-Jean)
- Computing Science (CMPUT)
- Earth and Atmospheric Sciences (formerly Geography and Geology (EAS))
- Environmental Physical Sciences (ENVPS)
- Geophysics (GEO)
- 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)
- Psychologie (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)

184.2 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.)

184.3 Biochemistry Courses

The following courses can be used by students in the Faculty of Science as science courses: BIOCH 200, 310, 320, 330, 401, 420, 430, 441, 450, 455, and 460.
184.4 Computing Science Courses

Introductory
The following courses are considered introductory: CMPUT 101, 114, 115. Specific course details are in Course Listings (§221).

Specialization and Honors
All other courses, except those noted above, are restricted to students registered in various Specialization and Honors programs in the Faculty of Science, in the Computer Engineering program, and Computer Process Control Option in the Chemical Engineering program. Some senior Computing courses are available to students with a Computing Science minor in the BSc General program and to other students, subject to space availability. See Course Listings (§221) for detailed descriptions.

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

184.6 Medical Microbiology Courses
The following courses may be used by students in the Faculty of Science as science courses in Microbiology: MMI 351, 352.

184.7 Pharmacology Courses
The following courses may be used by students in the Faculty of Science as science courses: PMCOL 201, 303, 305, 337, 343, 344, 371, 400, 401, 402, 407, 412, 415, 416, 424, 425, 442 and 498.

184.8 Physiology Courses
The following may be used by students in the Faculty of Science as science courses: PHYSL 210, 211, 372, 401, 402, 403, 404, 444, 465 and 466. Senior undergraduate students may use certain 500-level courses with the permission of the department advisor.

184.9 Graduate Courses
Courses numbered 500 and up are restricted to graduate students and normally may not be taken for credit by undergraduate science students.
2006-2007 University of Alberta Calendar Errata

This page shows the corrected version of errors in the print version of the Calendar. The corrected segments are highlighted in color.

March 8, 2006.

183.7.2 Specialization in Atmospheric Sciences

Continuation in the Specialization in Atmospheric Sciences program requires a GPA of at least 2.3 on at least 24 in the previous Fall/Winter. To graduate in four years, a student needs to complete 30 per year. Students who extend their programs beyond five years must first obtain the written approval of the Faculty of Science and the Department of Earth and Atmospheric Sciences.

Graduation requires a GPA of at least 2.3 on the last 60 credited to the degree.

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

Year 1

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<th>CMPUT 101 or 114</th>
<th>EAS 100</th>
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<tbody>
<tr>
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<tr>
<td>MATH 113 or 114, 115 and 120</td>
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<tr>
<td>PHYS 144 and 146</td>
<td></td>
</tr>
<tr>
<td>STAT 141 or 151</td>
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</table>

183.7.6 Specialization in Geology

Continuation in the Specialization in Geology program requires a GPA of at least 2.3 on at least 24 in the previous Fall/Winter. To graduate in four years, a student needs to complete 30 per year. Students who extend their programs beyond five years must first obtain the written approval of the Faculty of Science and the Department of Earth and Atmospheric Sciences.

Graduation requires a GPA of at least 2.3 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

<table>
<thead>
<tr>
<th>CHEM 101 and 102</th>
<th>EAS 100 and 105</th>
</tr>
</thead>
<tbody>
<tr>
<td>★6 junior ENGL</td>
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</tr>
<tr>
<td>MATH 113 or 114 and 115</td>
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<tr>
<td>PHYS 124 and 126 or PHYS 144 and 146</td>
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