181 The Professors 307

182 Faculty Regulations 308
182.1 Faculty Overview 308
182.2 Degrees and Certificates 308
182.3 Admission 309
182.4 Definitions 309
182.5 Academic Standing 309
182.6 Courses 310
182.7 Graduation 311
182.8 Appeals and Grievances 311
182.9 Visiting Student Status 311

183 Programs of Study 311
183.1 BSc in the Honors, Specialization, and General Programs 311
183.2 Biochemistry 317
183.3 Biological Sciences 318
183.4 Cell Biology 321
183.5 Chemistry 321
183.6 Computing Science 322
183.7 Earth and Atmospheric Sciences 325
183.8 Environmental Physical Sciences 327
183.9 Geophysics 327
183.10 Immunology and Infection 327
183.11 Marine Science 328
183.12 Mathematics 328
183.13 Neuroscience 330
183.14 Northern Studies 331
183.15 Paleontology 331
183.16 Pharmacology 332
183.17 Physics 332
183.18 Physiology 335
183.19 Psychology 336
183.20 Statistics 337
183.21 Preprofessional Programs 337

184 Details of Courses 338
184.1 Course Listings 338
184.2 Prerequisites 338
184.3 Biochemistry Courses 338
184.4 Computing Science Courses 338
184.5 Food Science Courses 338
184.6 Medical Microbiology Courses 338
184.7 Pharmacology Courses 338
184.8 Physiology Courses 338
184.9 Graduate Courses 338

181 The Professors

Members of the Faculty

Officers of the Faculty
Dean
GJ Taylor, PhD
Vice Dean
DS Szathmáry, PhD
Associate Deans
GA Chambers, PhD (Professor Emeritus)
WM Samuel, PhD (Professor Emeritus)
WJ Page, PhD
Assistant Dean
A Adam, BSc, BEd
Director of Student Services
JM Stanley, BA
Liaison and Recruitment Officer
LL Volery, BA
Director of Biological Sciences Animal Service
DG McKay, PhD
Distinguished University Professor
RE Taylor, PhD
Honorary Professors of Science
JA Jacobs, DSc
RWW Stewart, PhD, FRSC, FRS, FSc

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, Honorary Professors of Science
DLW St Louis,PHD

Professors
SE Bayley, PhD
JB Bell, PhD
MB泄露vich, PhD
SA Boutin, PhD
MS Boyce, PhD
JP Chang, PhD
RS Curnah, PhD
NRT Dale, PhD
AI Deschêres, PhD
PM Fedoruk, PhD
JS Fogg, PhD
LS Frost, PhD
WW Gallin, PhD
JI Goldberg, PhD
AG Good, PhD
SJ Hannam, PhD
BS Heming, PhD
J Hoddinott, PhD
SE Jensen, PhD
WM Kaufman, PhD
MA Lewis, DPhil
J Locke, PhD

Computing Science

Chemistry
Professor and Chair
M Cowie, PhD

Faculty of Science
Faculty Regulations

182.1 Faculty Overview

The Faculty of Science offers degrees in Actuarial Science, Applied Mathematics, Atmospheric Sciences, Biochemistry, Bioinformatics, Biological Sciences (Animal Biology, Cell Biotechnology, Environmental Biology, Evolutionary Biology, Microbiology, Molecular Genetics, Physiology and Developmental Biology, Plant Biology), Chemistry, Cell Biology, Computing Science, Computing Science with a Business Minor, Computing Science with Specialization in Bioinformatics, Computing Science-School of Software Quality Option, Computational Mathematics (Science or Physics), Environmental Earth Sciences, Environmental Physical Sciences, Geology, Geophysics, Immunology and Infection, Mathematical Physics, Mathematics, Mathematics and Economics, Mathematics and Finance, Neuroscience, Paleontology, Pharmacology, Physics, Psychology, and Statistics.

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 8-, 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 §182.21).

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 §183.1, 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 §113 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
Refers to university or univsity transfer courses completed with a final grade and excludes courses from which a student has withdrawn with permission.

(4) Courses Successfully Completed
Refers to university with a final grade of D or higher.

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

(6) Fall/Winter
The instructional period of September to April.

(7) Two-term Course
A two-term course is a single course with ★6.

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

(9) Single-term Course
A single-term course is a single course with ★3.

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

(11) Normal Course Load
A normal, full academic course load is ★30 during Fall/Winter.

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

(13) Science Option
Those courses offered by the Faculty of Science for which the student is eligible. Note: Not all courses offered by the Faculty of Science are available to students registered in the Faculty of Science.
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 §23.4.5 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 §73.4 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 at the Faculty Office by February 1 for Spring Convocation or by September 1 for Fall Convocation.

(2) **Degree Requirements**

All BSc Degrees require a minimum of ★120. Courses with weights of ★0 are offered for credit only, and, although they may be required in specific degree programs, cannot be used to meet the minimum units of course weight requirement in any degree program.

(3) **Convocation**

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

(4) **First-Class Honors**

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

a. 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. It 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 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.

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.
Science

Selection of Courses
See §15.16.4 for admission requirements.

A five-year (Œ150) BEd/BSc (Specialization in Science and Education) Physics, and Psychology.

Specialization programs are available in the Departments of Biochemistry, a professional level and lead to the degree of BSc with Specialization.

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.

Course Load Requirements
Students in Honors 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 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 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 ★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.

183.1.3 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. 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) A student who fails to attain the standard necessary for continuance in General programs in 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.

(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 (★60) 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.
To obtain a BSc General Degree, a student must receive credit in at least 60. At least 72 and not more than 120 must be in Science. At least 18 and not more than 48 must be in Arts.

Each student must complete a major subject or area of concentration. The major subject or area must be in Science. A minimum of 36 and a maximum of 54 are required in the major subject or area of concentration, with no more than 18 at the junior level. Each student must also either complete a second major which also must be a subject or area of concentration in Science. Students who complete a second major in Science will have the Double Majors recorded on their transcripts and diplomas; or complete a minor subject or area of concentration. The minor subject or area of concentration may be in Science, or a student may present a subject of concentration in Agriculture, Forestry, and Home Economics, Arts or Business. For a list of Agriculture, Forestry, and Home Economics Minors, see §183.1.4. For a list of Arts subjects available as a minor, refer to “Minors”. For information about admission to the Business minor, see §15.16.2. Requirements for a Business minor appear in §183.1.5. At least 24 and not more than 36 are required in the minor subject or area of concentration with no more than 12 at the junior level. If the minor subject of concentration is in Arts, additional requirements as specified by the Arts Department may be required. Students are responsible for meeting any additional departmental requirements as specified in the Faculty of Arts.

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

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

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

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

**Earth and Atmospheric Sciences**: EAS courses (see §183.7), Geophysics and Paleontology

A Minor subject of concentration consists of Science courses taken in one of the following subjects: Chemistry, Computing Science, Mathematics, Physics, Science Psychology, Statistics, or in one of the subjects or areas in the Faculty of Arts noted below. For information about the Minor in Computing Science, see §183.6.8. A Minor area of concentration may be chosen from one of the areas noted above, i.e., Biological Sciences, Physical Sciences, Mathematical Sciences, or Earth Sciences. A BSc General—Minor in Business is also available.

It the Minor subject of concentration chosen is from Arts, the above requirements and any further requirements as specified by the Arts Department must be met. (See the Faculty of Arts §§42.1 to 43.32 for specific requirements for minors, by Department.) The following Arts subjects may be offered as a minor subject of concentration: Anthropology; Art and Design (including Art, Art History, and Design); Canadian Studies; Central/ East European Studies; Chinese; Classics (Including Ancient History, Art, Classical Literature in Translation); Comparative Literature; Drama; East Asian Studies; Economics; English; Film Studies; French; Geography; German; Globalization Studies; Greek and Latin; History, Ancient or Medieval History, and Women's History; Italian; Japanese; Latin American Studies; Linguistics; Music; Native Studies; Philosophy; Political Science; Psychology; Religious Studies; Russian; Scandinavian; Science, Technology and Society; Sociology; Spanish; Ukrainian; Women's Studies.

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

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

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

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

- 6 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 (CMPT 101 or 114; CMPT 115; MATH 113 or 114 or 117; MATH 115 or 118; MATH 120 or 125; MATH 153; STAT 141 or 151)
- 6 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)

(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.

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. HELOC 200
3. HELOC 150 or HELOC 170
4. HELOC 320
5. 12 to 18 in HELOC 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

**Note:** 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

**Note:** 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, MGTSC 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 minoring in Business must still complete at least 18 in Arts. ECUN 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 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 selecting 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

**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.

<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: ★45</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Major: ★42</td>
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<tr>
<td>Minor: ★24</td>
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<tr>
<td>100-level: ★36 (Maximum ★42)</td>
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<td></td>
</tr>
<tr>
<td>Graduation Requirements:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GPA of 2.3 on all courses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GPA of 2.7 on Major courses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area “B”</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIOL 315, LHEM 303, LHEM UC 352; HIST 294, 397, 398, 406; INF D 200, PHYS 285, 375, 405, PHYS 286, 264, SLUI 367, 426</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area “C”</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASTRO 320, 322, CHEM 331, 332, PHYS 301, 302, 307, 309, 319</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**

1. Courses 1 through 5 above constitute the Introductory Professional Term and must be taken concurrently.
2. Courses 6 through 8 above constitute the Advanced Professional Term and must be taken concurrently.
### Physical Sciences Major/Mathematical Sciences Minor (150)

<table>
<thead>
<tr>
<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>1. BIOL 107, 108</td>
<td>1. CHEM 261, 263</td>
<td>1. CMPUT 101 or 114</td>
<td>1. EDFX 350</td>
<td>1. EDPS 410</td>
</tr>
<tr>
<td>2. CHEM 101, 102</td>
<td>2. EDFX 200</td>
<td>2. MATH 223</td>
<td>2. EDFX 450</td>
<td>2. EDFX 451</td>
</tr>
<tr>
<td>3. ENGL 101</td>
<td>3. EDFX 200</td>
<td>3. MATH 215 or 241</td>
<td>3. EDPS 310</td>
<td>3. EDPS 310</td>
</tr>
<tr>
<td>4. MATH 113 or 114</td>
<td>4. MATH 120</td>
<td>4. MATH 120</td>
<td>4. EDPY 303</td>
<td>4. EDSE (Major)</td>
</tr>
<tr>
<td>5. MATH 115</td>
<td>5. MATH 214</td>
<td>5. MATH 228</td>
<td>5. EDSE (Minor)</td>
<td>5. EDSE (Major)</td>
</tr>
<tr>
<td>6. PHYS 124 or 144</td>
<td>6. PHYS 224</td>
<td>6. PHYS 224</td>
<td>6. CHEM 261</td>
<td>6. CHEM 261</td>
</tr>
<tr>
<td>7. PHYS 200, 206, 271</td>
<td>7. *6 in Chemistry chosen from CHEM 211 or PHYS 294</td>
<td>7. *6 in Mathematics at the 200-level</td>
<td>7. *6 in Mathematics at the 300- or 400-level</td>
<td>7. *6 in Mathematics at the 200- or 400-level</td>
</tr>
</tbody>
</table>

**Note:** Courses 1 through 5 above constitute the Introductory Professional Term and must be taken concurrently.

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

<table>
<thead>
<tr>
<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>1. BIOL 107, 108</td>
<td>1. EDFX 200</td>
<td>1. EDFX 350</td>
<td>1. EDFX 450</td>
<td>1. EDPS 410</td>
</tr>
<tr>
<td>2. CHEM 101, 102</td>
<td>2. EDFX 200</td>
<td>2. EDFX 450</td>
<td>2. EDPS 310</td>
<td>2. EDPS 310</td>
</tr>
<tr>
<td>3. ENGL 101</td>
<td>3. EDPY 200</td>
<td>3. EDSE (Minor)</td>
<td>3. EDSE (Major)</td>
<td>3. EDSE (Major)</td>
</tr>
<tr>
<td>4. MATH 113 or 114</td>
<td>4. MATH 214</td>
<td>4. MATH 228</td>
<td>4. MATH 228</td>
<td>4. MATH 228</td>
</tr>
<tr>
<td>5. MATH 115</td>
<td>5. MATH 214</td>
<td>5. MATH 228</td>
<td>5. MATH 228</td>
<td>5. MATH 228</td>
</tr>
<tr>
<td>7. *6 in Physics or Chemistry chosen from CHEM 101, 102, PHYS 124 or 144, 126 or 146.</td>
<td>7. *6 in Mathematics at the 200-level</td>
<td>7. *6 in Mathematics at the 300- or 400-level</td>
<td>7. *6 in Mathematics at the 300- or 400-level</td>
<td>7. *6 in Mathematics at the 300- or 400-level</td>
</tr>
</tbody>
</table>

**Note:** Courses 1 through 5 above constitute the Introductory Professional Term and must be taken concurrently.

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

<table>
<thead>
<tr>
<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>1. BIOL 107, 108</td>
<td>1. CHEM 261, 263</td>
<td>1. CMPUT 101 or 114</td>
<td>1. EDFX 350</td>
<td>1. EDPS 410</td>
</tr>
<tr>
<td>2. CHEM 101, 102</td>
<td>2. EDFX 200</td>
<td>2. MATH 223</td>
<td>2. EDFX 450</td>
<td>2. EDFX 451</td>
</tr>
<tr>
<td>3. ENGL 101</td>
<td>3. EDFX 200</td>
<td>3. MATH 215 or 241</td>
<td>3. EDPS 310</td>
<td>3. EDPS 310</td>
</tr>
<tr>
<td>4. MATH 113 or 114</td>
<td>4. MATH 120</td>
<td>4. MATH 120</td>
<td>4. EDPY 303</td>
<td>4. EDSE (Minor)</td>
</tr>
<tr>
<td>5. MATH 115</td>
<td>5. MATH 214</td>
<td>5. MATH 228</td>
<td>5. EDSE (Minor)</td>
<td>5. EDSE (Major)</td>
</tr>
<tr>
<td>7. *6 in Chemistry chosen from CHEM 211 or PHYS 294</td>
<td>7. *6 in Mathematics at the 200-level</td>
<td>7. *6 in Mathematics at the 300- or 400-level</td>
<td>7. *6 in Mathematics at the 300- or 400-level</td>
<td>7. *6 in Mathematics at the 300- or 400-level</td>
</tr>
</tbody>
</table>

**Note:** Courses 1 through 5 above constitute the Introductory Professional Term and must be taken concurrently.

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

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

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

<table>
<thead>
<tr>
<th>Core Program Requirements</th>
<th>Year 1 (150)</th>
<th>Year 2 (150)</th>
<th>Year 3 (150)</th>
<th>Year 4 (150)</th>
<th>Year 5 (150)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education: <em>A</em></td>
<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>Minor: <em>B</em></td>
<td>3. ENGL 101</td>
<td>3. CHEM 102</td>
<td>3. EDFX 301</td>
<td>3. EDSE (Major)</td>
<td>3. English and Theory of Science</td>
</tr>
<tr>
<td>100-level: <em>C</em></td>
<td>4. MATH 113 or 114</td>
<td>4. EDFX 200</td>
<td>4. EDSE (Minor)</td>
<td>4. EDPS (Major)</td>
<td>4. <em>C</em></td>
</tr>
<tr>
<td>GPA of 2.3 on all courses</td>
<td>5. <em>3</em> chosen from MATH 115,120, STAT 151</td>
<td>5. EDFY 200</td>
<td>5. <em>6</em> in Biological Sciences at the 200-level</td>
<td>5. <em>6</em> in Biological Sciences at the 300- or 400-level</td>
<td>5. <em>3</em></td>
</tr>
</tbody>
</table>

**Note:** Courses 1 through 6 above constitute the Introductory Professional Term and must be taken concurrently.

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

<table>
<thead>
<tr>
<th>Core Program Requirements</th>
<th>Year 1 (150)</th>
<th>Year 2 (150)</th>
<th>Year 3 (150)</th>
<th>Year 4 (150)</th>
<th>Year 5 (150)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education: <em>A</em></td>
<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>Minor: <em>B</em></td>
<td>3. ENGL 101</td>
<td>3. CHEM 102</td>
<td>3. EDFX 301</td>
<td>3. EDSE (Major)</td>
<td>3. English and Theory of Science</td>
</tr>
<tr>
<td>100-level: <em>C</em></td>
<td>4. MATH 113 or 114</td>
<td>4. EDFX 200</td>
<td>4. EDSE (Minor)</td>
<td>4. EDPS (Major)</td>
<td>4. <em>C</em></td>
</tr>
<tr>
<td>GPA of 2.3 on all courses</td>
<td>5. <em>3</em> chosen from MATH 115,120, STAT 151</td>
<td>5. EDFY 200</td>
<td>5. <em>6</em> in Biological Sciences at the 200-level</td>
<td>5. <em>6</em> in Biological Sciences at the 300- or 400-level</td>
<td>5. <em>3</em></td>
</tr>
</tbody>
</table>

**Note:** Courses 1 through 6 above constitute the Introductory Professional Term and must be taken concurrently.

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 30 senior units from 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. At least 9 senior units of the major and at least 6 senior units of the minor for the second degree must be completed while registered in the second degree program.

3. A graduate holding a BSc General degree may qualify for a BSc Specialization or BSc Honors degree by completing a minimum of 30 senior units. The specific course requirements for a BSc Specialization or BSc Honors degree as a second degree are determined at the time of registration by the appropriate Department(s) and the Faculty Office. At least 15 senior units of 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 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.

2. Students who present the equivalent of a BSc Honors or Specialization degree from another institution may complete a second BSc Honors or Specialization degree, in a different discipline, from this Faculty.

3. Satisfactorily complete a minimum of an additional 60 senior units while registered at the University of Alberta with at least 30 senior units while registered in the Faculty of Science second degree program.

4. For students completing a BSc General After degree, at least 18 senior units in the student’s major and at least 12 senior units in the student’s chosen minor must be completed while registered in the After Degree program in the Faculty of Science at the University of Alberta.

5. In the BSc Specialization or Honors After Degree, at least 24 senior units of the course requirements in the subject discipline of the degree must be
completed while registered in the After Degree program in the Faculty of Science at the University of Alberta.

(6) Satisfy all admission requirements (see §15.16), as well as program, academic standing, and graduation requirements of the particular degree program (See §183.1.1 for Honors, §183.1.2 for Specialization, and §183.1.3 for General Program.)

(7) Admission to a Specialization program and an Honors program requires approval of the appropriate Department and the Faculty Office. The specific course requirements for a degree program are determined, at the time of admission, by the appropriate Department (for Specialization and Honors) and the Faculty Office. For further information, consult the Faculty of Science Student Services Office.

183.1.9 Industrial Internship Program

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

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

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

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

183.1.10 Transfers Between Programs

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

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

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 90 in each Fall/Winter period credited towards the degree.

Year 1
BIOL 107, 108
CHEM 101, 102 and 161, 263
MATH 113 (or 114), and 115
★ 6 in junior-level ENGL

Year 2
BIOL 200 (Fall), and BIOL 320, 330 (Winter)
CHEM 211, 213
PHYS 124 and 126 or equivalent
★ 6 in an approved Science option
★ 3 in an approved Arts options

Year 3
BIOL 310 (Fall), and BIOL 401
★ 6 in senior-level BIOCHEM courses (normally selected from BIOL 410, 420, 430, or 441)
CHEM 371, 373
★ 3 in approved Science options
★ 6 in an approved Arts options

Year 4
★ 6 in senior-level BIOCHEM courses (normally selected from BIOL 410, 420, 430, or 441)
★ 3 in a senior-level BIOCHEM course selected from BIOL 450, 455, or 460
BIOL 409
CHEM 361 and 383
★ 6 in 400- or 500-level CHEM
★ 6 in approved Science options
★ 3 in an approved Arts option

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; MICR 265; MATH 214 and 215; GENE 270 and 275; PHYS 210 or 211; PMCOL 201; STA1 141 or 151.
(4) Recommended science options for third and fourth year include BIOCHEM 450, 455, and 460; MICR 311 or 415; PHYS 210 or 211; IMIN 200; PMCOL 305; and BIOL 380.
(5) BIOL 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
BIOL 107, 108
CHEM 101, 102 and 161, 263
MATH 113 (or 114), 115
★ 6 junior-level ENGL

Year 2
BIOL 200 (Fall), and BIOCHEM 320, 330 (Winter)
PHYS 124 and 126, or equivalent
CHEM 211, 213
★ 6 in an approved Science option
★ 3 in an approved Arts option

Year 3
BIOL 310 (Fall), BIOCHEM 401
★ 6 in senior-level BIOCHEM courses (normally selected from BIOL 410, 420, 430, or 441)
★ 3 in an approved Arts option

Year 4
★ 6 in senior-level BIOCHEM courses (normally selected from BIOL 410, 420, 430, or 441)
★ 6 in approved Mathematical or Physical Science options
★ 3 in an approved Science option
★ 6 in an approved Arts option

Notes
(1) Students must receive a grade of not less than B- in BIOCHEM 200, 310, 320, and 330 and C in all other BIOCHEM 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; GENET 270 and 275; PHYS 210 or 211; PMCOL 201.

(4) Recommended mathematical or physical science options include MATH 214 and 215; CIST 371 and 373; PHYS 212 and 213; STAT 141 or 151; or approved CMPUT courses.

(5) Recommended science options for third and fourth year include BIOLCH 450, 455, and 460; MICRB 311 or 415; PHYS 210 or 211; IMIN 200; PMCOL 305; and BIOL 383.

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

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. Specific course requirements of Honors students: BIOL 499, a directed research project, is required for Honors students. The research project must be conducted on a topic appropriate to the student’s area of concentration. BIOL 499 is a recommended option for Specialization students.

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

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

183.3.1 Honors in Biological Sciences (including Bioinformatics)

Admission to the BSc Honors in Biological Sciences program directly from high school requires a minimum average of 80% on the following required courses: English 30 or English Language Arts 30-1, Biology 30, Chemistry 30, Pure Mathematics or Mathematics 30, and a subject from group A, B, or C (Physics 30 recommended). Admission on transfer requires a minimum GPA of 3.0 on a minimum of ★24 in the preceding Fall/Winter.

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 ★60 credited 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 directly from high school requires a minimum average of 75% on the following required courses: English 30 or English Language Arts 30-1, Biology 30, Chemistry 30, Pure Mathematics or Mathematics 30, and a subject from group A, B, or C (Physics 30 recommended). Admission on transfer requires a minimum GPA of 2.3 in the preceding Fall/Winter.

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

First Year:
BIOL 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 the following areas of concentration: 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★ 8 Science option.
(2) The rest of the Biological Sciences program core consists of BIOL 207, 208 and BIOCH 200, which should be completed in the second year.
(3) Students intending to complete their degree in Bioinformatics are required to take CHEM 101, 102, 163 or 263 and CMPUT 114 and 115 in their first year, in place of MATH and STAT.
(4) Students in Honors Biological Sciences must successfully complete BIOL 499.

First-Year Core for Bioinformatics: BIOL 107, 108; CHEM 101, 161, 163 or 263; CMPUT 101 (if required); CMPUT 114 and 115;★3 Science option (if not taking CMPUT 101);★6 Arts options (English recommended).

183.3.4 Course Sequence in Biological Sciences

See Science Chart 2.
### Cell Biotechnology

<table>
<thead>
<tr>
<th>Course Options</th>
<th>Year 2</th>
<th>Year 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BIOCH 200; BIOL 201, 207, 208; GENET 270; MICRB 265</strong></td>
<td><strong>BIOJ 391; GENET 390; MICRB 311, 343, 345, 415, 450</strong></td>
<td><strong>9 in Science options</strong></td>
</tr>
<tr>
<td><strong>6 in Science options</strong></td>
<td><strong>30 in approved options from list below</strong></td>
<td><strong>9 in Science options</strong></td>
</tr>
<tr>
<td><strong>6 in Science options</strong></td>
<td><strong>Recommended options include but are not restricted to the following:</strong></td>
<td><strong>9 in Science options</strong></td>
</tr>
<tr>
<td><strong>Note: A minimum grade of B- is required in MICRB 265 and 311 to stay in the Cell Biotechnology Honors program.</strong></td>
<td>List A. Approved options:</td>
<td><strong>9 in Science options</strong></td>
</tr>
<tr>
<td>T must include at least <strong>30 from the approved options from the list below:</strong></td>
<td>BIOCH 310, 320, 330, 401, 410, 420, 430, 441, 450, 455, 460, BIION 301, BIOL 380, 400, 450, 490, 495, 496, 499; BUT 350, 380, 382, 403; CALL 300; CHEM 211, 213, 361, 363; CMUPU 101, 114, 115; GENET 275, 301, 302, 304, 364, 375, 408, 412, 418, 420; IMIN 200, 324, 371, 372, 401, 452; MMI 351, 352, 405, 415, 426, 520; MICRB 316, 406, 410, 491, 492; NU FS 363, 402, 480; PHAHM 493; PHYS 124, 126; PHYSL 210; PSYJQ 104; CHEM 211 and 213 are strongly recommended. (Other options may be approved if suitable)</td>
<td><strong>Recommended options include but are not restricted to the following:</strong></td>
</tr>
<tr>
<td><strong>List B. Approved Senior Biotechnology Lab Options:</strong></td>
<td>BIOIN 301; BIOL 400, 498, 499; CHEM 211, 213, 361, 363; GENET 375, 420, IMIN 372; MMI 352; MICRB 492.</td>
<td><strong>Recommended options include but are not restricted to the following:</strong></td>
</tr>
<tr>
<td><strong>Notes:</strong></td>
<td><strong>(1) Honors students are required to take BIOL 499, CHEM 211 and 213, and reduce the approved options accordingly.</strong></td>
<td>**(2) Specialization students are required to take at least <strong>3 approved senior Biotechnology Lab Options and reduce the approved options accordingly.</strong></td>
</tr>
<tr>
<td><strong>Environmental Biology</strong></td>
<td><strong>Evolutionary Biology</strong></td>
<td><strong>Microbiology</strong></td>
</tr>
</tbody>
</table>

### Environmental Biology

<table>
<thead>
<tr>
<th>Course Options</th>
<th>Year 2</th>
<th>Year 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BIOCH 200; BIOL 207, 208; BUT 205 or 210; CHEM 163 or 263; EAS 102; MAH 115 or 120; ZOOL 224 or 225; ZOOL 250 or ENT 220</strong></td>
<td><strong>BIOJ 430 or STAT 337; BIOL 321</strong></td>
<td><strong>BIOL 321, 335, 391; GENET 390</strong></td>
</tr>
<tr>
<td><strong>6 in Science options</strong></td>
<td><strong>12 from BIOL 331, 332, 340, 380, 470; BUT 332; FOR 322; ZOOL 371.</strong></td>
<td><strong>3 from BIOL 331, 332, BUT 332</strong></td>
</tr>
<tr>
<td><strong>6 in Science options</strong></td>
<td><strong>6 from BOTT 240, 350, 382; ENT 321; GENET 270, 276; MICRB 265; ZOOL 241, 242.</strong></td>
<td><strong>9 in Science options</strong></td>
</tr>
<tr>
<td><strong>3 in an Arts option</strong></td>
<td><strong>9 in Arts options</strong></td>
<td><strong>18 in approved options</strong></td>
</tr>
<tr>
<td><strong>6 in approved options</strong></td>
<td><strong>Recommended options include, but are not restricted to additional courses from the above, and the following:</strong></td>
<td><strong>Recommended options include, but are not restricted to additional courses from the above, and the following:</strong></td>
</tr>
<tr>
<td><strong>(1) Marine Science courses on this list are offered at Bamfield Marine Sciences Centre.</strong></td>
<td><strong>BIOL 331, 400, 430, 433, 480, 495, 498, 500, BUT 306, 322, 431; EAS 250, ENT 427; ZOOL 340, 405, 407, 408, 434, 436; Streams in conservation/wildlife biology and in freshwater biology are available. A field techniques course (e.g., BIOL 432, ZOOL 430, BUT 332) is strongly recommended for students who do not have field experience.</strong></td>
<td><strong>Note: Honors students are required to take BIOL 499 and reduce the approved options accordingly.</strong></td>
</tr>
</tbody>
</table>

### Evolutionary Biology

<table>
<thead>
<tr>
<th>Course Options</th>
<th>Year 2</th>
<th>Year 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BIOCH 200; BIOL 207, 208, 380</strong></td>
<td><strong>BIOJ 321, 335, 391; GENET 390</strong></td>
<td><strong>BIOL 321, 335, 391; GENET 390</strong></td>
</tr>
<tr>
<td><strong>6 from BOT 205, 210; ENT 220; ZOOL 224, 225, 250</strong></td>
<td><strong>3 from BIOL 411, PALEO 318, 319</strong></td>
<td><strong>3 from BIOL 331, 332, BUT 332</strong></td>
</tr>
<tr>
<td><strong>3 in an Arts option</strong></td>
<td><strong>3 in an Arts option</strong></td>
<td><strong>9 in Science options</strong></td>
</tr>
<tr>
<td><strong>6 in approved options</strong></td>
<td><strong>Recommended options include, but are not restricted to additional courses from the above, and the following:</strong></td>
<td><strong>9 in Science options</strong></td>
</tr>
<tr>
<td><strong>(1) Marine Science courses on this list are offered at Bamfield Marine Sciences Centre.</strong></td>
<td><strong>BIOL 331, 400, 430, 433, 480, 495, 498, 500, BUT 306, 322, 431; EAS 250, ENT 427; ZOOL 340, 405, 407, 408, 434, 436; Streams in conservation/wildlife biology and in freshwater biology are available. A field techniques course (e.g., BIOL 432, ZOOL 430, BUT 332) is strongly recommended for students who do not have field experience.</strong></td>
<td><strong>Note: Honors students are required to take BIOL 499 and reduce the approved options accordingly.</strong></td>
</tr>
</tbody>
</table>

### Microbiology

<table>
<thead>
<tr>
<th>Course Options</th>
<th>Year 2</th>
<th>Year 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BIOCH 200; BIOL 207, 208; GENET 270; IMIN 200; MICRB 265</strong></td>
<td><strong>BIOL 201, 391; CHEM 211, 213; GENET 390; MICRB 311</strong></td>
<td><strong>BIOL 201, 391; CHEM 211, 213; GENET 390; MICRB 311</strong></td>
</tr>
<tr>
<td><strong>6 in Science options</strong></td>
<td><strong>12 in Microbiology options (List A)</strong></td>
<td><strong>6 in Science options</strong></td>
</tr>
<tr>
<td><strong>6 in Science options</strong></td>
<td><strong>9 in Science options (List A or B)</strong></td>
<td><strong>Recommended options include, but are not restricted to the following:</strong></td>
</tr>
<tr>
<td><strong>Note:</strong></td>
<td><strong>15 in Approved options (List A, B or C)</strong></td>
<td><strong>Recommended options include, but are not restricted to the following:</strong></td>
</tr>
<tr>
<td>(1) A minimum grade of B- is required in MICRB 265 and 311 to stay in the Microbiology Honors program. (2) BIOL 201 highly recommended in Year 2.</td>
<td><strong>GENET 375; IMIN 324, 371, 372, 452; MICRB 316, 343, 345, 410, 415, 450, 491, 492; NU FS 361, 363, 402, 480; MMI 351, 352, 405, 415, 427, 520.</strong></td>
<td><strong>Recommended options include, but are not restricted to the following:</strong></td>
</tr>
<tr>
<td><strong>List B. Science options:</strong></td>
<td><strong>BIOCH 310, 320, 330, 401, 410, 420, 430, 441, 450, 455, 460; BIION 301, BIOL 400, 490, 495, 498, 499; BUT 306; CHEM 271, 273 or 371, 373; CHEM 303, 361, 363; CMUPU 101 or 114, 115; ENT 378; GENET 275, 301, 302, 304, 364, 375, 408; IMIN 401; PHYS 124, 126; ZOOL 352, 452.</strong></td>
<td><strong>Recommended options include, but are not restricted to the following:</strong></td>
</tr>
<tr>
<td><strong>List C. Approved options:</strong></td>
<td><strong>BIOJ 380; BUT 380, 382; CALL 300, 301; EAS 201; PHYSL 210; PSYJQ 104; SUILS 210, 430.</strong> (Some of these approved options actually count as Science courses, see §184).**</td>
<td><strong>Recommended options include, but are not restricted to the following:</strong></td>
</tr>
<tr>
<td><strong>Note:</strong></td>
<td><strong>(1) Honors students are required to take BIOL 499, MICRB 343 and 345 and reduce the number of Science and Microbiology options accordingly.</strong></td>
<td><strong>Recommended options include, but are not restricted to the following:</strong></td>
</tr>
</tbody>
</table>
Science Chart 2 | Course Sequence in Biological Sciences (cont’d)

Molecular Genetics

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Year 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIUCH 200; BIOL 201 or CELL 201; BIOL 207, 208; GENET 270, 275; MICRB 265</td>
<td></td>
</tr>
<tr>
<td>*6 in Arts options</td>
<td>*3 in a Science option</td>
</tr>
<tr>
<td>Notes:</td>
<td></td>
</tr>
<tr>
<td>(1) BIOL 207 must be taken in the first term.</td>
<td></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></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></td>
</tr>
<tr>
<td>*6 in Science options</td>
<td></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; BIOL 205, 210, 240; CHEM 102, 161 or 263</td>
<td></td>
</tr>
<tr>
<td>*3 in an Arts option</td>
<td></td>
</tr>
</tbody>
</table>

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 for a continuous sequence of at least two work experience (WKEXP) courses 941 and 942, starting in May, September or January. During the program, student are considered full-time students of the University. Work experience courses have no weight and are graded credit/no credit, and recorded on the student's transcript. The 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 BIOL 400. BIOL 400 must be taken in the first term immediately following completion of the WKEXP period. If required by the employer, the student's written report and oral presentation in BIOL 400 may be classified confidential. The employer also assesses the student's performance during the work term. Based on the student's written report and oral presentation, and the report from the employer, students are awarded a grade in BIOL 400.

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

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 BIOL; BOT; CELL 300, 301; ENT; GENET; INT D 224, 371, 372, 421, 452, 455; MA SC; MICRB; MMI 351; NEURO; NU FS 363; PALEO; PHYS 210, 372, 401, 404, 410; PMCOL 201, 305, 335, 360, 342, 371, 392, 403, 409, 412, 415; ZOOL

Courses in Biochemistry (see §184.3) may be used for a concentration in Biological Sciences or Physical Sciences but not for both.

Notes: 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, 163
MA1H 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
★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
BIUCH 430 or GENET 304
BIUCH 450
CELL 402, 415, 498, 499
GENET 375, 420
IMIN 324, 452
MICRB 316
PMLCUL 371 or ZOOL 303, 342 or BIUI 303

Group B Cell Biology Options:

ANAT 200
BIUCH 310, 320, 330, 401, 410, 441, 450, 455
BIOL 208, 315, 321, 401, 430
BUO 303, 382
CHEM 271 and 273
GENET 275, 301, 302, 364, 390, 408, 412
IMIN 205, 371, 372
MICRB 311, 410
PHYS 210, 401
STAT 337
ZOOUL 242, 303, 342

183.4.2 Specialization in Cell Biology

Continuation in the Specialization Cell Biology program normally requires successful completion of at least 24 in the preceding Fall/Winter with a GPA of at least 2.7. Graduation requires a minimum GPA of 2.7 on the last 30.

The Department of Chemistry may approve variations in the above program on application.

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 an experimental course, and ★18 in Arts courses. In addition to the core courses, honors students must complete at least six ★3 in senior courses in Chemistry. Four of these must be from Group A and the other two from either Group A or Group B. Finally, the honors student must include six ★3 in options in the third and fourth years of the program. These are normally chosen from offerings within the Faculty of Science. All options must be selected in consultation with the Department of Chemistry.

Continuation in the Honors Chemistry program requires a GPA of 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
MA1H 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, 343, 282
MA1H 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

Years 3 and 4

CHEM 313, 361, 363, 371, 373, 383
BIUCH 200 or BIOL 107
CHEM 460 or CHEM 401
★18 in senior chemistry courses
★21 in Science options
★6 in Arts options

Group A

CHEM 305, 333, 403, 405, 413, 415, 417, 423, 433, 436, 438, 439, 467, 483, 489, 493

The Department of Chemistry may approve variations in the above program on application.
183.5.2 Specialization in Chemistry

The complete Specialization program consists of 120 and must include CHEM 101, 102, 161 (or 261), 211, 241, 243, 263, 282, 313, 361, 371, 373; MATH 113 (or 114), 215, 214, and either 120 or 125 or 215 or STAT 151; PHYS 144, 146 (if PHYS 124 and 126 are taken in Year 1, then PHYS 220 or 281 is also required); BIOCH 200 or BIOL 107; 6 in junior English or 12 in Arts options, and 6 in an Arts option. 12 in Arts options, and 62 in approved options. These options are normally chosen from the Faculty of Science. All options must be selected in consultation with the Department of Chemistry. The honors curriculum can be used as a guide in planning a specialization program.

Continuation in the Specialization in Chemistry program requires a GPA of 2.3 on all Chemistry courses and a GPA of 2.3 on all courses beyond the first 30. Graduation requires a minimum GPA of 2.3 on the last 30 credited to the degree.

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

183.5.3 Industrial Internship Program

An Industrial Internship Program, similar to a co-op program, is offered to students in the Specialization or Honors programs in Chemistry (see 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 (WKEPX) courses 401 and 402, starting in May, September or January. During the program, students are considered full-time students of the University, Work experience courses have no weight and are graded credit/no credit, and recorded on the student’s transcript. The Industrial Internship Program Advisor maintains contact at approximately three-month intervals with the student and the person designated by the employer to be responsible for the student’s progress. This arrangement ensures satisfactory completion 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 WKEPX 401 and 402 plus CHEM 400. CHEM 400 must be taken in the first term immediately following completion of the WKEPX period. If required by the employer, the student’s written report and oral presentation in CHEM 400 may be classified confidential. The employer also assesses the student’s performance during the work term. Based on the student’s written report and oral presentation, and the report from the employer, students are awarded a grade in CHEM 400.

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

183.5.4 Concentration in Chemistry

Students in the BSc General program with a major in Chemistry should complete CHEM 100, 102, 161 (or 261), 263; MATH 113 (or 114), 115, and 6 of junior physics during the first two years of their programs. CHEM 101, 102, MATH 113 (or 114) and 115 should be taken in Year 1 because these provide maximum flexibility for course selection in Year 2 and subsequent years of the program. To complete a major in Chemistry, students should select from the following senior courses: CHEM 211, 213, 241, 282, 333, 361, 365, 371 and 313. Students majoring in Chemistry should consult the Chemistry Department Advisor before registering in second and later years of the program to plan a course of study and have their programs approved by the Advisor.

Students in the BSc General program with a minor in Chemistry should include CHEM 101, 102, 161 (or 261), and 263 in their program. Other Chemistry courses to complete the minor may be selected from CHEM 211, 213, 292, 303, 313, 353, 361, 363, and 371.

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 enroll 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)
5 in an approved option (see Note 7)

Year 2

CMPUT 201, 204, 229, 281
MATH 125 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
3 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 468. The department may approve variations in the above requirement on application. CMPUT 400 satisfies the project requirement, but cannot be used as Group B in CMPUT at the 300-level or higher 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.

(7) 18 in approved options cannot be MATH/STAT/CMPUT.

183.6.2 Specialization in Computing Science

Continuation in the program requires the successful completion of at least 18 in the previous Fall/Winter with a GPA of 2.3 (a program for less than 18 may be approved by the Department. Students are to contact the Department prior to September 1) and a 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 2.3 on the last 30 credited to the degree and at least 2.3 on all CMPUT, MATH and STAT courses credited to the degree.

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

The program gives students freedom to pursue specialized areas of interest in Computing Science and in other disciplines. Students should use the required Arts and approved option in Year 2 to build a foundation in disciplines related to Computing Science. Course selections in other departments and Faculties may be subject to enrolment management and GPA requirements.
Year 1

CMPUT 114, 115, 272 (see Note 1)

MATH 114, 115

★6 in Science options (excluding MATH/STAT1/CMPUT)

★3 in an approved option (see Note 6)

Year 2

CMPUT 201, 204, 229, 291

MATH 120 (MATH 125 recommended)

STAT 221, 222

★6 in Arts options

★3 in an approved option (see Note 6)

Year 3

CMPUT 301, 325, 379

★6 in CMPUT at the 300-level or higher (see Notes 3 and 4)

★3 in a MATH or STAT option at the 200-level or higher (see Note 5)

★3 in an Arts option

★9 in approved options (see Note 6)

Year 4

★9 in CMPUT at the 300-level or higher (see Notes 3 and 4)

★15 in approved options (see Note 6)

★3 in a Science option

★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) 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.

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 credited 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 enrollment 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 credited to the degree and at least 2.3 on all CMPUT, MATH and STAT courses credited to the degree.

Specialization students with the Software Quality Option must complete a minimum of ★21 in CMPUT courses at the 300- or 400-level offered at the University of Alberta.

Year 1

CMPUT 114, 115, 272 (see Note 1)

MATH 114, 115

★6 junior English

★6 in Science options (excluding MATH/STAT1/CMPUT)

★3 in an approved option

Year 2

CMPUT 201, 204, 229, 291

MATH 120 (MATH 125 recommended)

STAT 221, 222

★6 in Arts options

★3 in an approved option

Year 3

CMPUT 300, 301, 379

★3 in a MATH or STAT option at the 200-level or higher (see Note 6)

★6 in CMPUT at the 300-level or higher (see Notes 4 and 5)

★6 in Business electives (see Note 2 below)

★3 in an Arts option

★3 in a Science option

Year 4

IIP (WKEXP 921, 922, 923) - 16 month Industrial Internship (Note: Students in the program who fail to obtain placement in the IIP must withdraw from the program, but may continue as Specialization or Honors students).

Year 5

CMPUT 325, 400, 401, 402

★3 in CMPUT at the 300-level or higher (see Notes 4 and 5)

★6 in Business electives (see Note 2 below)

★3 in an approved option

★3 in a Science option

★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) Students in the Specialization Program with the Software Quality Option must choose ★12 from the following Business courses: MGISC 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 60 credits to the degree and at least 3.0 on the last 21 credits to the degree and at least 2.3 on all CMPUT, MATH, and STAT courses credited to the degree. Honors students in the Bioinformatics stream must complete a minimum of 21 credits in CMPUT courses at the 300- or 400-level offered at the University of Alberta. In addition, to graduate with the designation of Honors 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

| BIOL 107 |
| CMPUT 114, 115, 272 (see Note 1) |
| MATH 114, 115 (see Note 2) |
| *3 in a Science option |
| *6 junior English |

Year 2

| BIOL 207 |
| CMPUT 201, 204, 229, 291 |
| GENET 270 |
| MATH 125 and *3 in one of MATH 225, 228, 229 |
| STAT 221, 222 |

Year 3

| BIOIN 301 |
| *3 in a BIOL option (see Note 7) |
| CMPUT 301, 325, 379, 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 4

| 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 |
| *9 in an Arts option |

Notes

(1) Students with no previous computing 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 in the Bioinformatics stream are strongly encouraged to take the Honors version of the MATH courses, beginning in the first year.

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

(4) Honors students in 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.

(5) Honors students in 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.

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

(7) 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.

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 experiences (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 both 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, 291, 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.
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 §82.5). 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 §83.3(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, a student pursuing this designation must also complete a minimum of 21 credits 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 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 101 and 102
6 junior ENGL
MATH 113 or 114, 115 and 120
PHYS 144 and 146

Year 2

EAS 220, 221, 270, 294 and 327
MATH 214 and 215
PHYS 244 and 281
STAT 141 or 151

Year 3

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

Year 4

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

Note: Science options include but are not limited to EAS 202, 208, 212, 225, 324, 325, 326, 325, 427, 451, 453, 454, 455, 457; CHEM 101, 102, 211, 213, 261, 263, 303; CMPUT 201, 204, 301, 304, 306, 340; ENGS 360; FOR 340, 372; GEOPH 210, 429; MAH 201, 334, 337, 372; PHYS 211, 261, 264, 361, 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 resources 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.

Year 1

CHEM 101 and 102
EAS 101 and 102
6 junior ENGL
MAH 113 or 114 and 115
PHYS 126 and 126 or PHYS 144 and 146

Year 2

BIOL 108
EAS 220, 221, 222, 224, 225, 250, 270, and 294
3 Optional Element (see below)

Year 3

EAS 320, 323, 324 and 354
GEOPH 223
15 Optional Elements (see below)

Year 4

EAS 426
24 Optional Elements (see below)

Optional Elements

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

Groups
(1) At least 3 (Field and Laboratory Methods) in EAS 233, 237, 424
(2) At least 3 (Geoprocessing) in EAS 325, 351, 451
(3) At least 3 (Math, Statistics and Computing) in CMPUT 101, 114, MATH 120, 214, 215, 334, STAT 141, 151
(4) At least 3 (Geology) of EAS 207, 232, 321, 325, 420, 421, 422, 425
(5) At least 3 (Surface Processes and Quaternary Geology) of EAS 270, 352, 370, 371, 453, 454, 455, 457; INT D 594
(6) 6 of any EAS X9X courses.

Note: An additional 21 of approved options including courses listed in Groups 1-5 above. For students in the Industrial Internship Program: EAS 401, WKEXP 411, WKEXP 412.
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 24 in the previous Fall/Winter. To graduate in four years, a student needs 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 Environmental Earth Sciences Program student advisor before registration.

Year 1
CHEM 101 and 102
EAS 101 and 102
★6 junior ENGL
MA1H 113 or 114 and 115
PHYS 124 and 126 or PHYS 144 and 146

Year 2
BIOL 108
EAS 220, 221, 222, 224, 225, 270 and 294
★3 Optional Elements (see below)

Year 3
EAS 320, 323, 324 and 394
GEOPH 223
★15 Optional Elements (see below)

Year 4
★30 Optional Elements (see below)

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

Groups
(1) At least ★3 (Field and Laboratory Methods) of EAS 233, 327, 424
(2) At least ★3 (Geoprocessing) of EAS 325, 351, 451
(3) At least ★3 (Math, Statistics and Computing) of CMPUT 101, 114; MATH 120, 214, 215, 334; STAT 141, 151
(4) At least ★3 (Geology) of EAS 207, 232, 321, 330, 421, 422, 425
(5) At least ★6 (Surface Processes and Quaternary Geology) of EAS 270, 352, 370, 371, 453, 454, 455, 457; INT D 594
(6) ★6 of any EAS 200 courses.

Note: An additional ★24 of approved options including courses listed in Groups 1-6 above. For students in the Industrial Internship Program: EAS 401, WKEXP 411, WKEXP 412.

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 in the previous Fall/Winter.

Graduation requires a minimum GPA of 3.0 on the last 60 credited to the degree.

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

Year 1
CHEM 101 and 102
EAS 101 and 103
★6 junior ENGL
MATH 113 or 114 and 115
PHYS 124 and 126 or PHYS 144 and 146

Year 2
EAS 220, 221, 222, 225, 230, 232, 233, 234, 235 and 236

Year 3
EAS 294, 320, 321, 330, 331, 332 and 333
GEOPH 210 or 223 or 224
★3 in an Arts option

Year 4
GEOPH 210 or 223 or 224
★9 EAS Science courses 250 or higher
★12 in approved Science options (including but not restricted to EAS 250 or higher)
★6 in Arts options

Note: Recommended Arts options include any EAS 10X courses. For students in the Industrial Internship Program: EAS 401, WKEXP 411, WKEXP 412.

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 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
CHEM 101 and 102
EAS 101 and 103
★6 junior ENGL
MATH 113 or 114 and 115
PHYS 124 and 126 or PHYS 144 and 146

Year 2
EAS 220, 221, 224, 225, 230, 232, 233, 234, 235 and 236

Year 3
EAS 294, 320, 321, 330, 331, 332 and 333
GEOPH 210 or 223 or 224
★3 in an Arts option

Year 4
GEOPH 210 or 223 or 224
★9 EAS Science courses 250 or higher
★12 in approved Science options (including but not restricted to EAS 250 or higher)
★6 in Arts options

Note: Recommended Arts options include any EAS 10X courses. For students in the Industrial Internship Program: EAS 401, WKEXP 411, WKEXP 412.

183.7.7 Professional Association

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

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

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

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

183.7.8 Honors in Paleontology

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

183.7.9 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 are considered full-time students of the University. Work experience courses have no weight and are not included in the calculation of GPA. A grading of pass/no credit/no grade is 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 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 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.

### 183.8 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 GPA of 2.3 on the last 90 credited to the degree.

**Year 1**

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<tr>
<td>EAS 101 and 102</td>
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<tr>
<td>MATH 115</td>
<td>3</td>
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<td>PHYS 124 and 126 or PHYS 144 and 146</td>
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<td><strong>9 in English (ENGL 101 recommended)</strong></td>
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**Year 2**

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<td>CHEM 261 and 263</td>
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<td>MAH 120</td>
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<td>PHYS 224</td>
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<tr>
<td><strong>9 in Arts options or approved Science or other options (See Notes 2 and 3)</strong></td>
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**Year 3**

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<td>EAS 220 and 221 (See Note 1) or PHYS 261 and 264, whichever were not previously taken</td>
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<td></td>
</tr>
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<td>EAS 270 and 323</td>
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<td>PHYS 294</td>
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<td>PHYS 364 or approved Science option (See Note 4 below)</td>
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<td><strong>9 in Arts options or approved Science or other options (See Notes 2 and 3)</strong></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 364 or approved Science option, whichever was not previously taken (See Note 4 below)</td>
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</tr>
<tr>
<td><strong>9 in Arts options or approved Science or other options (See Notes 2 and 3)</strong></td>
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**Notes**

1. In lieu of EAS 220, an approved course in computation, computing, or statistics may be taken.
2. 6 to 12 must be taken in Arts option, in addition to the 6 in 100-level English. These may include EAS 290, 291, 390, 493; ECON 101; PHIL 355.
3. Approved Science or other options must total 24 to 30, such that a total of 36 of optional courses are taken. These options include, but are not restricted to, CHEM 271, 273, 313, 331, 332, 415, 417; EAS 224, 225, 250, 327, 352, 457; ENCS 203, 352; GEPH 223, 224; INI D 368; MATH 214, 215, 270; SOILS 210.
4. PHYS 364 is offered in alternate years only. Students must check the course schedule and take PHYS 364 in either the third or fourth year of their program, depending on which year PHYS 364 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 ENVPS 403 ( ), 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 ENVPS 403, based on the employer’s assessment, the report and the oral presentation.

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

### Courses Related to the Industrial Internship Program

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

#### 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) 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). Graduates are encouraged to join APEGGA as Geophysicists-in-training. Acceptable experience following graduation is necessary for registration as a Professional Geophysicist, the APEGGA membership category which confers the right to accept responsibility for geophysical work. Contact the APEGGA office for more information.

#### 183.10 Immunology and Infection

#### 183.10.1 Honors in Immunology and Infection

Continuation in the Honors in Immunology and Infection requires a minimum GPA of 3.0 in the 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 the preceding Fall/Winter. Graduation requires a GPA of 2.3 in all courses credited to the degree.

<table>
<thead>
<tr>
<th>Course</th>
<th>Weight</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>BIOL 107, 108</td>
<td></td>
</tr>
<tr>
<td>CHEM 101, 102</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHEM 161, 163 or 263</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MATH 113 or 114 or 120</td>
<td></td>
<td></td>
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<tr>
<td>STAT 141 or 151</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>6 in Arts options</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Year 2 | BIOCH 230 |  |
| BIOL 201 |  |
| BIOL 207, 208 |  |
| IMIN 200 |  |
| MICRB 265 |  |
| GENET 270 or BIUCHE 330 |  |
| **6 in Science option** |
| **6 in Arts options** |
Years 3 and 4

ZOOI 241 and 242 or PHYSL 210 or 211
Use of: BIOL 420; GENET 304; MICRB 316
IMIN 324, 371, 452
MM1 351
ZOOI 352
★6 in Arts options
★6 in Science options from the Options List below
★21 in options from the Options List below or options approved by an advisor.

'At least ★3 must be in a course with a laboratory component. Honors students must take at least ★6 in a laboratory research project course (honors thesis). Approved project courses are BIOL 498 and MATH 499. Therefore, Honors students need take only ★15 from third Options List below.

Options List

BIOCH 320, 430, 450
CELL 300
ENT 378
GENET 304
IMIN 372, 401
MICRB 316
MMI 352, 405, 415, 426
ZOOI 354, 452

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, either 228 or 229
★6 in 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, 448, 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-level in the field of application
★3 in an approved 300- or 400-level Mathematics and/or Mathematical Physics option
★12 in approved Science options
★6 in 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, 378, 471, and two of STAT 368, 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 an 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 towards 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, 114
ECON 101, 102
MATH 114, 115
MATH 125
STAT 151
★6 in junior English

Year 2

MATH 214, 215
MATH 225
MATH 253
STAT 265
★6 in Arts options
★6 in options
183.12.3 Specialization in 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 all MATH 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 all MATH 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 CMPUT, MATH and STAT courses taken in that Fall/Winter.

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 Code</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 114, 115</td>
<td></td>
</tr>
<tr>
<td>MATH 125</td>
<td></td>
</tr>
<tr>
<td>CMPUT 101 and 114, or 114 and 115</td>
<td>★6 in a junior English</td>
</tr>
<tr>
<td>★3 in a Science option</td>
<td>★6 in options</td>
</tr>
</tbody>
</table>

Year 2

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 214, 215</td>
<td></td>
</tr>
<tr>
<td>MATH 225</td>
<td></td>
</tr>
<tr>
<td>MATH 228 or 229</td>
<td>★3 in a MATH option</td>
</tr>
<tr>
<td>★3 in a Science option</td>
<td>★6 in Arts options</td>
</tr>
<tr>
<td>★6 in options</td>
<td></td>
</tr>
</tbody>
</table>

Year 3

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 314, 414</td>
<td>★6 in MA/1H options</td>
</tr>
<tr>
<td>★6 in Science options</td>
<td>★6 in Arts options</td>
</tr>
<tr>
<td>★6 in options</td>
<td>★12 in options</td>
</tr>
</tbody>
</table>

Year 4

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>★12 in MA/1H at the 300- or 400-level</td>
<td></td>
</tr>
<tr>
<td>★6 in Science options</td>
<td>★12 in options</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 MA/1H 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 the aggregate of 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 Code</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMPUT 114, 115</td>
<td></td>
</tr>
<tr>
<td>MATH 114 and 115, or 117 and 118</td>
<td>★6 in a junior English</td>
</tr>
<tr>
<td>MATH 125</td>
<td>★6 in options</td>
</tr>
</tbody>
</table>

Year 2

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMPUT 201, 204, 272</td>
<td></td>
</tr>
<tr>
<td>MATH 214 and 215, or 217 and 317</td>
<td></td>
</tr>
<tr>
<td>MATH 222, 225</td>
<td></td>
</tr>
<tr>
<td>STAT 221</td>
<td>★6 in Arts</td>
</tr>
</tbody>
</table>

Year 3

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMPUT 229, 291</td>
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</tr>
<tr>
<td>MATH 228, 381</td>
<td></td>
</tr>
<tr>
<td>STAT 222</td>
<td>★3 in MATH or STAT</td>
</tr>
<tr>
<td>★3 in Arts</td>
<td>★9 in options</td>
</tr>
</tbody>
</table>

Year 4

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>★6 in CMPUT at 300-level or higher</td>
<td></td>
</tr>
<tr>
<td>★3 in MATH or STAT at 300-level or higher</td>
<td></td>
</tr>
<tr>
<td>★3 in an option at 300-level or higher</td>
<td></td>
</tr>
<tr>
<td>★3 in Arts</td>
<td>★12 in options</td>
</tr>
</tbody>
</table>

Notes

(1) The program must contain at least ★72 in Science and ★18 in Arts.
(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 Mathematics 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

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECON 101, 102</td>
<td></td>
</tr>
<tr>
<td>MATH 117, 118, 125, 228</td>
<td>★6 in a junior English</td>
</tr>
<tr>
<td>★6 in approved Science options</td>
<td></td>
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</tbody>
</table>

Year 2

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECON 281, 282</td>
<td></td>
</tr>
<tr>
<td>MATH 217, 317</td>
<td></td>
</tr>
<tr>
<td>STAT 265, 366</td>
<td>★6 in approved Science options</td>
</tr>
<tr>
<td>★6 in approved options</td>
<td></td>
</tr>
</tbody>
</table>

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 481, 482, 407, 408; STAT 366; and four of MATH 334, 373, 381, 411, 417, 421, 422, 481. Credit is not given for ECON 386, 387, or 390.
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 ECON, 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, 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, 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, 225
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 Mathematics and Statistical Sciences and must include
a. at least ★63 in Science
b. at least ★45 in MATH and STAT with at least ★12 of these at the 300-level or higher
c. CMPUT 101 and 114, or 114 and 115
d. at least ★36 in ECON, including ★12 chosen from ECON 384, 385, 399, or courses at the 400-level or higher.
(2) Credit will not normally be given for ECON 299, 386, or 387.
(3) Students who are considering graduate work in Economics should take ECON 407 and 408.
(4) A Student must take at least ★6 in ECON, MATH, or STAT in each Fall/Winter of the program.
(5) A corresponding Honors MATH course can be substituted for any MATH course listed. For example, MATH 117 can be substituted for MATH 114.
(6) 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 ACCGT, ECON, FIN, MATH, MGTS, 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 ACCGT, ECON, FIN, MATH, MGTS, 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 ACCGT, ECON, FIN, MATH, MGTS, 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
CMPTU 101 and 114, or 114 and 115
ECON 101, 102
MATH 114, 115, 125
STAT 151
★6 in junior English

Year 2
ACCGT 311
ECON 281
MATH 214, 215
MATH 225, 253
MGTS 352
STAT 265
★6 in options

Year 3
ECON 399 or STAT 378
FIN 301
MATH 314, 414
MATH 353
MATH 373
STAT 365
★3 in a FIN option
★6 in options

Year 4
★3 in a MATH option
★6 in FIN options
★12 in Science options
★9 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, including ★36 in MATH with at least ★12 of these at the 300-level or higher
(2) ★12 in ACCGT, ECON, FIN, MATH, or MGTS, including ★9 in 400-level HN
(3) Students should choose some of their MATH and Science options from the following courses: MATH 304, 305, 304, 305, 404, 405, 491, 482, FIN 412, 412, 413, 414, 416, 422, 434, 442; MGTS 404, 405.
(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 CMPTU courses as options in subsequent years should note that CMPTU 115 is a prerequisite for all non-junior CMPTU 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 Mathematical and Statistical Sciences. Contact the Industrial Internship Program Advisor for more information.

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, students are considered full-time students of the University. Work experience courses have no weight and are graded credit/no credit, and recorded on the student’s transcript. The Industrial Internship Program Advisor maintains contact at approximately three-month intervals with the student and the person designated by the employer to be responsible for the student’s progress. This arrangement ensures satisfaction on all sides. If the review shows the situation is not satisfactory, the internship may be terminated and the student would then return to classes at the next available opportunity. The graduation requirements for the Industrial Internship program designation include successful completion of at least WKEXP 951 and 952 plus MATH or STAT 400. MATH or STAT 400 must be taken in the first term immediately following completion of the WKEXP period. If required by the employer, the student’s written report and oral presentation in MATH or STAT 400 may be classified confidential. The employer also assesses the student’s performance during the work term. Based on the student’s written report and oral presentation, and the report from the employer, students are awarded a grade in MATH or STAT 400.

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

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.

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 the 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 STAB 141 or 151
- PHYS 12A, 12B

**Year 2**

- BIUCH 203 or 220
- BIOL 207
- CHEM 163
- PHYS 210 or ZOOL 241 and 242
- PSYCO 104 and 279
- ★6 in Science options
- ★3 in an Arts option

**Year 3**

- PMOC 371
- PHYS 372
- PSYCU 377
- 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 (see above) chosen from CELL 415; NEURO 443, 472; PMOC 407, 412, 509, 512; PHYS 444, 527; PSYCI 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: BIUCH 410, 430; BIUL 315, 380, 420; CELL 300, 301, 401, 402, 445; CHEM 211, 271, 273, 331, 332; CMPT 114, 115, 201, 204, 229, 329, 366; EAS 101, 103, 201, 207, 230; ENI 321 (ENI): 270, 275, 301, 302, 394, 390; GELPH 221; IMM 224, 371, 452; MATH 214; PMICR 265, 311; PMOC 201, 305, 342, 409, 415; PHYS 208, 211, 212, 213, 234, 281; PHYS 401, 402, 403, 404; PSYCO 267, 281, 354, 364, 371, 372, 381, 385, 458, 482; STAT 221, 222, 225, 337; ZOOL 343, 344, 370, 442.

5. Suggested Arts options include the following: ANTHR 230, 332; CLASS 110, 212; CI LIT 422; HIST 301, 302, 397, 398; PHIL 205, 217, 295, 317, 366, 375, 386; PSYCO 105, 212, 233, 258, 301, 232, 339, 350, 357; WRITE 298.

6. Approved non-Science/non-Arts options must be chosen from the following: ANAT 200, 301, 407; BIUL 107; REHAB 454.

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.

**183.14 Northern Studies**

Students interested in Canada’s North and especially those planning a career in northern Canada should include 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 101 and 103
- ★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
- BUT 411 or approved option
- EAS 233, 234 and 235
- PALEO 414 or approved option
- ★6 approved Arts options

**Year 4**

- BUT 411 or approved option
- BIOL 499 or EAS 426
- EAS 330
- PALEO 318 and 319
- PALEO 414 or approved option
- ★3 approved Arts option
- ★6 approved Science options

**Notes:** 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; ENI 220; ZOOL 405, 407, 408, 427. Approved Arts options: ANTHR 391, CHRTC 350, 451, PHIL 265, 317. For information regarding additional approved options, please consult your Department advisor.

**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 the previous Fall/Winter. To graduate in four years, a student needs to complete ★30 per year. Students who extend their programs beyond the two 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 161 or 102
- EAS 101 and 103
- ★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
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 in the preceding Fall/Winter and a minimum GPA of 3.3 in all science courses taken, and a grade of B+ in all courses taken during the Department of Pharmacology.

Year 1

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<tr>
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<tr>
<td>BIOCH 200</td>
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<td>BIOL 107, 108</td>
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<tr>
<td>CHEM 101, 102, 161, 163</td>
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<td>★6 in Arts options ENGL recommended</td>
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<td>STAT 141 or 151</td>
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Year 2

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<tr>
<td>★6 in Arts options</td>
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<td>★6 in Science options as indicated in Year 2</td>
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<tr>
<td>★6 in approved options</td>
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Note: Students must consult the Chair of the Department or designee for approval of options.

Recommended Science options: BIOCH, BIOL, CHEM, GENET, MATH, MICROB, PHYS, PHYSL, PMCOL, STAT or ZOOL

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 taken in the Department of Pharmacology.

Year 1

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Year 2

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<tr>
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<td>★3 in approved options</td>
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Year 4

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<tbody>
<tr>
<td>PMCOL 337</td>
<td>★15 from PMCOL 407, 412, 415, 416, 424, 425, 442</td>
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<tr>
<td>★6 in Science options as indicated in Year 2</td>
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<tr>
<td>★6 in approved options</td>
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Note: Students must consult the Chair of the Department or designee for approval of options.

Recommended Science options: BIOCH, BIOL, CHEM, GENET, MATH, MICROB, PHYS, PHYSL, PMCOL, STAT or ZOOL

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 courses 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 40 units of Physics, including a minimum of 24 units of Physics in the preceding Fall/Winter. Graduation requires a GPA of 3.0 on the last 30 units of Physics.

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 2.7 in the preceding Fall/Winter. Graduation requires a GPA of 2.7 on the last 30 units of Geophysics.

Notes:
1. Students interested in the Engineering-Physics program should consult §182.7 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 362, 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

MAIM 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 183.17)
★6 in Science options (suggested options are in Astronomy, Chemistry, or Earth and Atmospheric Sciences)
★6 in Arts options (English recommended) (see Note 1 above)

Year 2

MAIM 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

MAIM 311 (or 411), 334, 337
PHYS 311, 351, 372, 381, 397, 472, 481
★12 in Pool A options (see Notes 2 and 3)
★9 in Pool A or B options (see Note 2)
★9 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 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
MAIM 113 (or 114 or 117), 115 (or 118), 120 (or 125), 225
PHYS 144, 146 (see Note 4 above; see also Note 3 in 183.17)
★6 in Arts options

Year 2

MAIM 214, 215
PHYS 211, 234, 244, 271, 281, 295, 297
★3 in an Arts option

Year 3

MAIM 311, 334, 337
PHYS 311, 362, 372, 381, 395, 397
★3 in an Arts option

Year 4 - Concentration in Photonics and Condensed Matter Physics

PHYS 415, 461, 472, 481, 499
★9 in AP Pool options (see Note 2)
★6 in Arts options

Year 4 - Concentration in Plasma Science

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

Year 4 - Concentration in Medical Physics

PHYS 420, 472, 481, 499
One of ONCOL 580 or 562
★9 from MedPhys pool options (see Note 3)
★6 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 362, 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.

Year 1

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

Year 3

ASTRO 322
MAIM 311, 334, 337
MA PH 343
PHYS 311, 351, 372, 381
★3 Arts option

Year 4

ASTRO 430 and 465
PHYS 472, 481
★9 in AS Pool options
★9 in Arts options

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 CMPU 201 corequisite of CMPU 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 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

CMPU 114, 115
MAIM 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

CMPU 201
MAIM 214 (or 217), 215 (or 317)
PHYS 211, 234, 244, 271, 281
★6 in Arts option
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 MA1H 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 in 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, 332, 431, 437, 440; PET E 365; PHYS 372, 499. 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 200
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 232
GEOPH 325, 326
MATH 311 (or 411), 334, 337
PHYS 381
9 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
9 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 MA1H 113 (or 114 or equivalent) and MA1H 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
MA1H 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
MA1H 334
PHYS 211, 244, 271, 281, 295
3 in an Arts option

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: 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. 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 9 from Pool A.
(4) The courses listed below comprise a minimum program. Students may, in consultation with the Department, select more advanced courses in place of those listed. A suitably enriched program can be used for admission to graduate work in Physics if satisfactory standing is obtained.
(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 MA1H 115 in the second term. A student who successfully completes PHYS 124 and 126, or PHYS 124 and 146, and who also completes MA1H 113 (or 114 or equivalent) and MA1H 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
MA1H 113 (or 114 or 117), 115 (or 118), 120 (or 125 for more theoretically inclined students)
PHYS 211, 234, 244, 271, 281, 295, 297
3 in an Arts option (see Note 1 above)

Year 2
MA1H 214 (or 217), 215 (or 317),
PHYS 211, 234, 244, 271, 281, 295, 297
3 in an Arts option (see Note 1 above)

Year 3
PHYS 311, 351, 372, 381, 397
MA1H 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) AS Pool: MA PH 343; PHYS 362, 395, 397; 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 MA1H 113 in the first term, and then take PHYS 146 and MA1H 115 in the second term. A student who successfully completes PHYS 124 and 126, or PHYS 124 and 146, and who also completes MA1H 113 (or 114 or equivalent) and MA1H 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
MA1H 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
MA1H 214 (or 217), 215 (or 317)
PHYS 211, 234, 244, 271, 281, 295, 297

Year 3
ASTRO 322
MA1H 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) CP/MPUT options: CP/MPUT 204, 272, 291, 301, and 306.
(3) The CP/MPUT 306 prerequisites of STAT 221/222 may be waived in lieu of PHYS 234 and 295.
(4) The CP/MPUT 201 corequisite of CP/MPUT 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 CP/MPUT 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
CP/MPUT 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
CP/MPUT 201
MATH 214 (or 217), 215 (or 317)
PHYS 211, 214, 244, 271, 281
★ 6 in Arts option

Year 3
★ 3 in a CP/MPUT option (see Notes 2 and 3)
MATH 381 (or CP/MPUT 340)
MATH 311, 354, 337
PHYS 295, 311, 372, 381
★ 3 in an Arts option

Year 4
CP/MPUT 229
PHYS 420
★ 3 in a CP/MPUT option (see Notes 2, 3 and 4)
★ 6 in CP Pool options (see Note 1)
★ 3 in a CP/MPUT 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 ★ 6 from Geophysics Specialization Pool courses,★ 12 in approved Science options, and ★ 12 in Arts options.
(3) Specialization Pool: ASTIRU 429; CP/MPUT 340; GEOPH 210, 332, 421, 431, 440; MA PH 467; PET E 365; PHYS 372, 499. 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; 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)

183.17.11 Industrial Internship Program

An Industrial Internship Program, similar to a co-op program, is offered to students in the Honors or Specialization programs in Physics (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 421 and 422, starting in May, September or January. During the program, students are considered full-time students of the University. Work experience courses have no weight and are graded credit/no credit, and recorded on the student’s transcript. The Industrial Internship Program Advisor maintains contact at approximately three-month intervals with the student and the person designated by the employer to be responsible for the student’s progress. This arrangement ensures satisfaction on all sides. If the review shows the situation is not satisfactory, the internship may be terminated and the student 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 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, PHYS 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 (§183.1.3 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 PHYS 211 in order to continue in the program. Students who are eligible to enter the program in their third year and have credit in PHYSYL 210 require a grade of at least B+ in PHYSYL 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)
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 *90 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.

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

Year 1

<table>
<thead>
<tr>
<th>BIOL 107, 109</th>
<th>On of ENGL 111, 112, 113, 114</th>
<th>PSYCO 104, 105</th>
</tr>
</thead>
<tbody>
<tr>
<td>*6 from CMPUT 101, 114, 115, MA TH 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.)</td>
<td>*6 in approved Science options</td>
<td></td>
</tr>
</tbody>
</table>

Year 2

<table>
<thead>
<tr>
<th>STAT 151 and PSYCO 212</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>*6 (two of) from PSYCO 223, 233, 241, 258</td>
<td>*6 in approved Science options</td>
</tr>
<tr>
<td>*6 (two of) from PSYCO 267, 275, 281</td>
<td></td>
</tr>
<tr>
<td>*6 from approved courses offered by the Departments of Anthropology, Economics, Linguistics, Political Science and/or Sociology</td>
<td></td>
</tr>
<tr>
<td>*6 in approved Science options</td>
<td></td>
</tr>
</tbody>
</table>

Notes:

(1) The program must consist of a minimum of *90 in Science, a minimum of *18 in Arts, and no more than *12 in non-Arts/non-Science options or *42 at the junior level.

(2) Science options must be chosen from the following: Junior Courses: CMPUT 114; MA TH 113 or 114, 115, 120 or 125; PSYCO 104. Advanced Courses: BIOL 420, 430, 441, 450, 455, 460; BIOL 315; CELL 301; CHEM 211, 213, 361; GENET 270, 275, 301, 302, 304, 375, 390, 418; IMIN 200, 324, 371, 481; MATH 214, 215; MICH 265; MIMI 351, 350; PSYCO 305, 306, 307, 401, 415, 505, 506; PSYCO 275, 281, 371, 377, 381, 499, 478; STAT 252, 268; 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, 484; BME 513; NUTR 301, 302; UCCUT 206; PEDS 412.

(4) Suggested Arts options include the following: CHRT 352; CLASS 294; ENGL 310; LINGU 321, 323, 499; PHIL 101, 230, 265, 415, 417; POL S 101; PSYCO 105, 223, 238; SOC 100, 241, 300, 382, 462, 473; WRITE 298.

(5) Other options may be acceptable with written permission of an advisor.

(6) MA TH 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 PHYS 211.

183.19.2 Specialization in Psychology

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

Year 1

<table>
<thead>
<tr>
<th>BIOL 107/108</th>
<th>PSYCO 104, 105</th>
</tr>
</thead>
<tbody>
<tr>
<td>*6 in an English course (ENGL 101 is recommended)</td>
<td>*6 from junior courses offered in the departments of Computing Science and Mathematics</td>
</tr>
<tr>
<td>*6 from junior courses offered in the departments of Chemistry and Physics</td>
<td></td>
</tr>
</tbody>
</table>

Year 2

<table>
<thead>
<tr>
<th>STAT 151</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>*9 from PSYCO 258, 266 or 275, 281</td>
<td>*3 in an approved Arts option</td>
</tr>
<tr>
<td>*6 in approved Science options</td>
<td>*9 in approved options</td>
</tr>
</tbody>
</table>

Year 3

<table>
<thead>
<tr>
<th>*6 in approved Arts options</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) for students meeting Year 2 requirements by taking PSYCO 258:</td>
<td>*15 in approved Science options</td>
</tr>
<tr>
<td>*9 in approved options or</td>
<td></td>
</tr>
<tr>
<td>(b) for students meeting Year 2 requirements by taking courses other than PSYCO 258:</td>
<td>*12 in approved Science options</td>
</tr>
<tr>
<td>*12 in approved options</td>
<td></td>
</tr>
</tbody>
</table>

Year 4

<table>
<thead>
<tr>
<th>*21 in approved Science options</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>*9 in approved options</td>
<td>To fulfill the degree requirements, students must complete a minimum of *36 in Science Psychology courses, or PSYCO 258 and a minimum of *33 in Science Psychology courses. At least *12 must be in Science Psychology courses at the 300-level or above. Students may take a maximum of *48 from PSYCO courses listed in the Arts and Science Course Listing sections.</td>
</tr>
</tbody>
</table>
Work Experience Program. 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 931 and 932 plus PSYCO 410. PSYCO 410 must be taken in the first term immediately following completion of the WKEXP period. If required by the employer, and the student's written report and oral presentation, and the report from the employer, students are awarded a grade in PSYCO 410.

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

### 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 22 credits in the preceding Fall/Winter.

Graduation requires a GPA of 3.3 on all Statistics and Mathematics courses taken and a GPA of 2.7 on the last 30 credits 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 (2)
- **MA1H 125**
- **MA1H 114** (or 117), 115 (or 118)
- **STAT 151**
  - 6 in approved Arts options
  - 6 in approved options

**Year 2**

- **MA1H 214** (or 217), 215 (or 317), 225 (2)
- **STAT 265**
  - 6 in approved Arts options
  - 9 in approved Science options
  - 3 in an approved option

**Years 3 and 4**

- **MA1H 314 or 417**
- **MA1H 414 or 418**
- **STAT 312, 366, 368, 471**
- Two of **STAT 335, 361, 368, 377**
- Three of **STAT 433, 441, 453, 454, 472, 479**
  - 6 in approved Arts options
  - 21 in approved Science options

**Notes**

1. At least 9 in approved options in one distinct field of application must be taken at the 300-level or higher. Examples of fields of applications are Biology, 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 program in Statistics is for students interested in applying Statistics to a second discipline. Students in this program must choose one distinct field of application. Recommended fields of application are Agriculture, Chemical Engineering, Computing Science, Economics, Education, Genetics, Health Sciences Administration, Pharmacology, Political Science, Psychology, Sociology, and Zoology. Students may, in consultation with the Department of Mathematical 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 credits 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 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**

- **MA1H 114, 115, 125**
- **STAT 151**
- **18 in options (see Note 2 below)**

**Year 2**

- **MA1H 214, 215, 225**
- **STAT 265, 266, 368, 378**
- **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 18 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 Sciences regarding specific program recommendations for the field of applications.
4. The program must meet the requirements of the Faculty of Science (§183.1.2) and include 18 in Arts courses.
5. A corresponding Honors MATH course can be substituted for any MATH course listed. For example, MA1H 117 can be substituted for MATH 114.
6. 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.

#### 183.20.3 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.

**Courses Related to the Industrial Internship Program**

<table>
<thead>
<tr>
<th>Year</th>
<th>Course</th>
<th>Weight</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Fall</td>
<td>WKEXP 951</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>Winter</td>
<td>WKEXP 952</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>Spring</td>
<td>WKEXP 953</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>Fall</td>
<td>STAT 400</td>
<td>3</td>
</tr>
</tbody>
</table>

### 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 (BIOCM) (Faculté Saint-Jean)
- Biological Science - Biology (BIOL)
- Biological Science - Botany (BOT)
- Biological Science - Entomology (ENT)
- Biological Science - Genetics (GENET)
- Biological Science - Microbiology (MICRB)
- Biological Science - Zoology (ZOOIL)
- 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 (GEOPH)
- Interdisciplinary Studies (INT D)
- Laboratory Animal Management (LB AN)
- Marine Science (MA SC)
- Mathematical Physics (MA PH)
- Mathematics (MATH)
- Mathématiques (MATHQ) (Faculté Saint-Jean)
- Paleontologie (PALEO)
- Pharmacology (taught by the Faculty of Medicine and Dentistry) (PMCOL)
- Physiology (taught by the Faculty of Medicine and Dentistry) (PHYSL)
- Physics (PHYS)
- Physique (PHYSQ) (Faculté Saint-Jean)
- Psychology (PSYCO)
- Science (SCI)
- 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 480.

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, 305, 337, 343, 344, 371, 400, 401, 402, 403, 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.