

Faculty of Science

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161 The Professors

Members of the Faculty

Officers of the Faculty

Dean

RE Peter, PhD, FRSC

Associate Deans

GA Chambers, PhD
WAG Graham, PhD, FRSC
JS Nelson, PhD

Assistant Dean

A Adam, BSc

Student Services Officer

JM Stanley, BA

Director of Biological Sciences Animal Service

DG McKay, PhD

Distinguished University Professor

RE Taylor, PhD

Honorary Professors of Science

JA Jacobs, DSc
RW Stewart, PhD, FRSC, FRS, DSc

Biological Sciences

Professor and Chair

SE Jensen, PhD

Professors and Associate Chairs

JJ Goldberg, PhD
BK Mitchell, PhD
GJ Taylor, PhD

Killam Memorial Professor of Science

DW Schindler, DPhil, DSc, FRSC

Professors

JF Addicott, PhD
SE Bayley, PhD
JB Bell, PhD
M Belosevic, PhD
SA Boutin, PhD
MS Boyce, PhD (Alberta Conservation Association Chair in Fisheries & Wildlife)
DD Cass, PhD
JP Chang, PhD
RS Currah, PhD
MRT Dale, PhD
PM Fedorak, PhD
LS Frost, PhD
WJ Gallin, PhD
DJ Gifford, PhD
RH Gooding, ScD
SJ Hannon, PhD
BS Heming, PhD
M Hickman, PhD
J Hoddinott, PhD
RB Hodgetts, PhD
WR Kaufman, PhD
HE McDermid, PhD
FE Nargang, PhD
WJ Page, PhD
AR Palmer, PhD
MA Pickard, PhD
EE Prepas, PhD
LJ Reha-Krantz, PhD (AHFMR Scientist)
J Roland, PhD
KLJ Roy, PhD

MA Russell, PhD
WM Samuel, PhD
JR Spence, PhD
AN Spencer, PhD
NE Stacey, PhD
GW Stemke, PhD
RA Stockey, PhD
C Strobeck, PhD
WM Tonn, PhD
DH Vitt, PhD
LCH Wang, PhD, FRSC
MVH Wilson, PhD

Associate Professors

AG Good, PhD
DS Hik, PhD
BA Keddie, PhD
BK Leskiw, PhD
J Locke, PhD
EH Merrill, PhD
CA Paszkowski, PhD
DB Pilgrim, PhD
FAH Sperling, PhD

Assistant Professors

JF Cahill, PhD
SD Campbell, PhD
CP Constabel, PhD
KJ Devito, PhD
JM Foght, PhD
G Goss, PhD
SW Graham, PhD
BG Magor, PhD
KE Magor, PhD
GW Owttrim, PhD
CC St Clair, PhD
VL St Louis, PhD
PW Wong, PhD

Faculty Service Officer III

ME Haag, MSc

Administrative Professional Officers

G Law, BASc
LN Strafford, BSc, MPM

Chemistry

Professor and Chair

G Horlick, PhD, FRSC

Faculty Service Officer IV and Assistant Chair

MA Armour, PhD

Professors

DR Bundle, PhD, FRSC (Strathcouna County -RU Lemieux Chair in Carbohydrate Chemistry)
FF Cantwell, PhD
RG Cavell, PhD
DLJ Clive, PhD
M Cowie, PhD
NJ Dovichi, PhD
DJ Harrison, PhD
O Hinds Gaul, PhD
RB Jordan, PhD
G Kotovych, PhD
L Li, PhD
CA Lucy, PhD
MM Palcic, PhD
J Takats, PhD
JC Vederas, PhD, FRSC (University Professor)
Associate Professors
SH Bergens, PhD
MA Klobukowski, PhD

GR Loppnow, PhD
JA Plambeck, PhD
J Stryker, PhD

Assistant Professors

NR Branda, PhD
DG Hall, PhD
WJ Jaeger, PhD
JS Klassen, PhD
A Mar, PhD
MT McDermott, PhD
P-N Roy, PhD
L Sun, PhD
RR Tykwinski, PhD

Faculty Service Officers IV

LM Browne, PhD
TT Nakashima, PhD

Faculty Service Officers III

N Gee, PhD
A Otter, PhD

Faculty Service Officers II

R McDonald, PhD
RM Whittal, PhD

Administrative Professional Officers

TW Brisbane, BSc
RJ Gardner

Computing Science

Professor and Chair

RG Goebel, PhD

Professors and Associate Chairs

R Elio, PhD
PG van Beek, PhD

Professors

VW Armstrong, PhD
A Basu, PhD
JC Culberson, PhD
P Gburzynski, PhD
MW Green, PhD
R Greiner, PhD
X Li, PhD
TA Marsland, PhD
J Schaeffer, PhD
PG Sorenson, PhD
DA Szaflon, PhD
J-H You, PhD
L-Y Yuan, PhD
Associate Professors
ES Elmallah, PhD
JJ Harms, PhD
RB Hayward, PhD
HJ Hoover, PhD
MH MacGregor, PhD
P Rudnicki, PhD
LK Stewart, PhD
H Zhang, PhD

Assistant Professors

MA Nascimento, PhD
I Nikolaidis, PhD
E Stroulia, PhD
BA Watson, PhD
K Wong, PhD
OR Zaiane, PhD

Faculty Service Officers III

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C Smith, MSc
SF Sutphen, MSc

Administrative Professional Officer

JM MacLellan, BA, BSc

Earth and Atmospheric Sciences

Professor and Chair

B Jones, PhD

Professor and Associate Chair

MJ Sharp, PhD

Associate Professor and Associate Chair

RW Luth, PhD

Professors

BDE Chatterton, PhD
LA Creaser, PhD
DM Cruden, PhD
JH England, PhD
P Erdmer, PhD
LM Heaman, PhD
LM Meaman, PhD
MJ Hodgson, PhD
EL Jackson, PhD
EP Lozowski, PhD
H-G Machel, PhD
K Muehlenbachs, PhD
SG Pemberton, PhD
GW Reuter, PhD
J Shaw, PhD
DGV Smith, PhD
JD Wilson, PhD

Associate Professors

O Catuneanu, PhD
T Chacko, PhD
GP Kershaw, PhD
CA Mendoza, PhD
RB Rains, PhD
JP Richards, PhD
B Rivard, PhD

Assistant Professors

ABG Bush, PhD
MW Caldwell, PhD
TD Garvin, PhD
BJ Rostron, PhD
GA Sanchez-Azofeifa, PhD
KE Smoyer, PhD
AB Woodland, PhD

Administrative Professional Officer

M-J Turnell, BSc, MSc, MPM

Mathematical Sciences

Professor and Chair

AH Rhemtulla, PhD

Professor and Associate Chairs

GH Cliff, PhD
SS Shen, PhD

Associate Professor and Associate Chair

I Baggs, PhD

Professors

W Allegretto, PhD
BN Allison, PhD
KF Andersen, PhD
PL Antonelli, PhD
HH Brungs, PhD
JF Carriere, PhD
Z Ditzian, PhD
RJ Elliott, PhD
PM Hooper, PhD
R-Q Jia, PhD
WZ Krawcewicz, PhD
HP Kunzle, PhD
AT-M Lau, PhD

JD Lewis, PhD
ACF Liu, PhD
G Ludwig, PhD
JW Macki, PhD
TB Moodie, PhD, FIMA
RV Moody, PhD, FRSC
JS Muldowney, PhD
A Pianzola, PhD
RA Poliquin, PhD
SK Sehgal, PhD
M Shirvani, PhD
JW-H So, PhD
GE Swaters, PhD
JG Timourian, PhD
N Tomczak-Jaegermann, PhD, FRSC
AR Weiss, PhD, FRSC
DP Wiens, PhD
YS Wong, PhD

Associate Professors

JC Bowman, PhD
KC Carriere, PhD (AHFMR Scholar)
TJ Gannon, PhD
E Gombay, PhD
RJ Karunamuni, PhD
D Kelker, PhD
MA Kouritzin, PhD
M Kovalyov, PhD
M Légaré, PhD
SR Lele, PhD
JE Lewis, PhD
Y Lin, PhD
LW Marcoux, PhD
PD Mineev, PhD
G Peschke, PhD
NGN Prasad, PhD
BA Schmuland, PhD
Z Shen, PhD
HJ Van Roessel, PhD
W-S Young, PhD

Assistant Professors

A Cadenillas, PhD
G de Vries, PhD
X Guo, PhD
V Runde, PhD
BR Sutherland, PhD

Physics

Professor and Chair

JC Samson, PhD

Professor and Associate Chair

NL Rodning, PhD

Killam Memorial Professor of Science

V Frolov, PhD

Professors

JR Beamish, PhD
BA Campbell, PhD
RF Egerton, PhD
MR Freeman, PhD
ZW Gortel, PhD
LG Greeniaus, PhD
FW Jones, PhD
FC Khanna, PhD
P Kitching, PhD
WJ McDonald, PhD
DN Page, PhD (CIAR Fellow)
JL Pinfold, PhD
W Rozmus, PhD
DR Schmitt, PhD
HS Sherif, PhD
TJT Spanos, PhD
JA Tuszynski, PhD

Associate Professors

DM Gingrich, PhD
JA Jung, PhD
F Marsiglio, PhD
RW Rankin, PhD
RD Sydora, PhD

Assistant Professors

FA Hegmann, PhD
M Heimpel, PhD
A Meldrum, PhD
S Morsink, PhD
MD Sacchi, PhD
MG Vincter, PhD

Faculty Service Officer IV

DJ Austen, PhD

Faculty Service Officer II

J Couch, MSc

Administrative Professional Officer

MA Henderson, BSc

Psychology

Professor and Chair

TM Caelli, PhD

Professors

CHM Beck, PhD
WF Bischof, PhD
DS Grant, PhD
CD Heth, PhD
ML Spetch, PhD
DR Treit, PhD

Assistant Professors

L Buchanan, PhD (AHFMR Scholar)
REL Cabeza, PhD (AHFMR Scholar)
MB Parent, PhD
DR Wong-Wylie, PhD

Faculty Service Officer III

TE Johnson, PhD

Additional Members of Faculty Council

President and Vice-Chancellor

R Fraser, PhD

Registrar of the University

BJ Silzer, MEd

Professors

T Daniel, PhD (Business)
J Drummond, PhD (Nursing)
A Friedman, PhD (Arts)
ZJ Koles, PhD (Medicine)
W Pedrycz, PhD (Computer Engineering)
AE Peterson, PhD (Engineering)

Associate Professors

G Bell, PhD (Physical Education and Recreation)
D Blades, PhD (Education)
JA Boeglin, PhD (Faculté Saint-Jean)
Y Feng, PhD (Agriculture, Forestry, and Home Economics)
E Karpinski, PhD (Physiology)

Assistant Professor

JM Diakur, PhD (Pharmacy and Pharmaceutical Sciences)

Faculty Service Officers

EG Hunter, PhD (Pharmacology)
WT Wolodko, PhD (Biochemistry)

Representatives

B Innes, BSc (Alumni Affairs)
SR Moran, PGeol (APECGA)

Undergraduate Students of the Faculty

Graduate Students of the Faculty

162 Faculty Regulations

162.1 Faculty Overview

The Faculty of Science offers degrees in Actuarial Science, Applied Mathematics, Atmospheric Sciences, Biochemistry, Biological Sciences (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, Environmental Earth Sciences, Environmental Physical Sciences, Geology, Geophysics, Mathematical Physics, Mathematics, Mathematics and Economics, Mathematics and Finance, Neuroscience, Paleontology, Pharmacology, Physics, Physiology, Psychology, and Statistics.

A Business Minor, an Arts Minor and an Agriculture, Forestry, and Home Economics minor are available in the BSc General programs.

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

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

162.2 Degrees and Certificates

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

The Faculty also offers a Bachelor of Science with Specialization in Science Education which is part of a five year BSc/BEd combined 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 §163.1, followed by descriptions of each degree program under the subject headings (§163.1 to §163.19).

Special Certificates are offered for students who already hold a BSc degree from this university.

162.3 Admission

General admission requirements for the University are set out in §§13 and 14. Specific admission information for the Faculty of Science is detailed in §15.15.

162.4 Definitions

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

(1) **Approved Option**

In the Faculty of Science section, the term "approved option" appears only within the description of Honors and Specialization programs. For

students registered in an Honors or Specialization BSc program, an "approved option" is a course (from Arts, Science, or another Faculty) approved in writing by the department directing the student's program.

General program students interested in taking courses from Faculties other than Arts or Science should see §162.6(1).

(2) **Arts Option**

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

(3) **Courses Attempted**

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

(4) **Courses Successfully Completed**

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

(5) **Course Weight**

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

(6) **Fall/Winter**

The instructional period of September to April.

(7) **Two-term Course**

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

(8) **Term**

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

(9) **Single-term Course**

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

(10) **Junior Courses**

Those courses numbered 199 or lower.

(11) **Normal Course Load**

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

(12) **Option**

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

(13) **Science Option**

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

(14) **Term**

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

(15) **Spring/Summer**

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

(16) **Year of Program**

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

- Year 1 if they have successfully completed up to ★29 of their degree program;
- Year 2 if they have successfully completed between ★30 and ★59 of their degree program;
- Year 3 if they have successfully completed between ★60 and ★89 of their degree program;
- Year 4 if they have successfully completed at least ★90 of their degree program.

162.5 Academic Standing

In all programs in the Faculty of Science, academic standing is assessed on the basis of Grade Point Average. An assessment of academic standing is conducted for each student at the end of the student's registration in the Fall/Winter regardless of the number of credits attempted and regardless of

whether the student registered in one or both terms. Decisions regarding academic standing will be based on courses attempted during the previous Fall/Winter only. See §§23.4(7) and 23.9.2 for information on the calculation of GPA's and the academic record.

162.5.1 Continuation in an Honors Program

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

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

162.5.2 Continuation in a Specialization Program

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

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

Students in a Specialization program whose GPA at the end of Fall/Winter is below 4.5 will be required to withdraw. Such students can only apply for readmission after attending another postsecondary institution, at which time they can apply for admission as a transfer student under the conditions described in §14.2.1(5).

162.5.3 Continuation in the General Program

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

(1) Unsatisfactory Standing—Required to Withdraw

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

Such students can only apply for readmission after attending another postsecondary institution, at which time they can apply for admission as a transfer student under the conditions described in §§14.2.1(5) and 15.15.9.

(2) Probation

Students who have been required to withdraw and who have successfully appealed that decision will be placed on Probation in the BSc General program. (See also §23.6.2.)

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

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

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

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

(3) Scholarship

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

(4) First-Class Standing

First-class standing in a given year is awarded to any student who obtains a GPA of not less than 7.5 while enrolled in a full, normal

academic load (★30) during the Fall/Winter. This is also referred to as the Dean's Honor Roll.

(5) Continuation in Programs

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

(6) Marginal Standing—Academic Warning

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

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

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

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

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

A student who does not meet the requirement to continue in the combined degrees program must withdraw from the program and may apply for admission to either a BSc General program or a BEd program, if eligible. Refer to §63.4 for academic standing regulations for admission to the BEd program and to §163.1.3 for academic standing regulations for admission to the BSc General program.

162.5.5 Graduation Year

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

162.6 Courses

(1) Selection of Courses

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

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

(2) Selection of First-Year Courses

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

(3) Withdrawal from Courses

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

Deadlines for withdrawing from courses are listed in §11.

(4) Prerequisites

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

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

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

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

(5) Repeating Courses

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

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

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

- When a higher grade is necessary for a course that is required in one of the degree programs
- When a student in the last year of a degree program repeats a course(s) to raise the GPA to the level required by the degree program

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

(6) Reexamination

See §23.5.5.

162.7 Graduation

(1) Application for Graduation

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

(2) Degree Requirements

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

(3) Convocation

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

(4) First-Class Honors

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

(5) With Distinction

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

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

162.8 Appeals and Grievances

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

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

162.9 Visiting Student Status

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

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

163 Programs of Study

163.1 BSc in the Honors, Specialization, and General Programs

163.1.1 Honors Programs

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

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

Admission

See §15.15.3 for admission requirements.

Selection of Courses

The following regulations govern Honors programs:

- 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.
- A minimum of ★72 in Science is required in most Honors programs. Certain departments may require more than ★72 in Science courses.
- A student normally must take at least ★18 in Arts courses as part of the requirements for the Honors degree.
- Normally, no more than ★42 in junior (100-level) courses are permitted in Honors programs.
- Certain non-Arts and non-Science courses appropriate to the program may be permitted in Honors programs with the written approval of the Department directing the student's program.

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

Course Load Requirements

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

Academic Standings and Graduation

The following regulations govern Honors programs:

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

Residence Requirement

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

Time Limits for Program Completion

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

163.1.2 Specialization Programs

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

Specialization programs are available in the Departments of Biochemistry, Biological Sciences, Cell Biology, Chemistry, Computing Science, Earth and Atmospheric Sciences, Mathematical Sciences, Pharmacology, Physics, and Psychology.

A five-year (★150) BEd/BSc (Specialization in Science and Education) program with majors and minors in Biological, Mathematical, and Physical Sciences is also available (see §§15.5.2 and 65.5).

Admission

See §15.15.4 for admission requirements.

Selection of Courses

The following regulations govern Specialization programs:

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

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

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

Course Load Requirements

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

Academic Standings and Graduation

The following regulations govern Specialization programs:

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

Residence Requirement

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

Time Limits for Completion of Program

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

163.1.3 General Programs

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

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

Admission

See §15.15.1 for admission requirements for the BSc (General) programs. The following regulations govern the General program:

- (1) In each year, a student's program must be approved by an advisor in the student's major subject or area of concentration and by the Faculty Office.
- (2) To obtain a BSc General Degree, a student must receive credit in ★120. At least ★72 and not more than ★102 must be in Science. At least ★18 and not more than ★48 must be in Arts.

- (3) Each student must complete a major subject or area of concentration. The major subject or area must be in Science. A minimum of ★36 and a maximum of ★48 are required in the major subject or area of concentration, with no more than ★18 at the junior level. Each student must also either
- 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 §163.1.4. For a list of Arts subjects available as a minor, refer to “Minors”. For information about admission to the Business minor, see §15.15.2. Requirements for a Business minor appear in §163.1.5. At least ★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.

Majors

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

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

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

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

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

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

Minors

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

If the Minor subject of concentration chosen is from Arts, the above requirements and any further requirements as specified by the Arts Department must be met. (See the Faculty of Arts §§54.1 to 54.26 for specific requirements for minors, by Department.) The following Arts subjects may be offered as a minor subject of concentration: Anthropology; Art and Design (including Art, Art History, and Design); Canadian Studies; Central/East European Studies; Chinese; Classics (including Ancient History, Art, Classical Literature in Translation); Comparative Literature; Drama; East Asian Studies; Economics; English; Film Studies; French; Geography**; German; Greek and Latin; History, Ancient or Medieval History, and Women’s History; Italian; Japanese; Latin American Studies; Linguistics; Music; Native Studies; Philosophy; Political Science; Psychology**; Religious Studies; Russian; Scandinavian; Spanish; Ukrainian; Women’s Studies.

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

Earth Sciences/Arts Geography

Science Psychology/Arts Psychology

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

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

- ★6 from among junior courses offered by the Department of English (normally ENGL 101)
- ★6 from among junior courses offered by the Departments of Computing Science, Mathematical Sciences (MATH 113 or 114 or 117; MATH 115 or 118; MATH 120 or 127; MATH 121 or 128; MATH 153; CMPUT 101 or 114; CMPUT 102 or 115; STAT 141 or 151)
- ★6 from among junior courses in the Departments of Chemistry or Physics (CHEM 101; CHEM 102; CHEM 161; CHEM 163; PHYS 100 or 109; PHYS 101 or 102 or 108; ASTRO 120; ASTRO 122)
- ★6 from among junior Science courses titled Biology, Earth and Atmospheric Sciences, or Science Psychology (BIOL 107; BIOL 108; EAS 101; EAS 102; EAS 103; PSYCO 104)
- ★6 from among 100-level courses in Arts or Science (Students interested in the Business Minor must take ECON 101 and 102)

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

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

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

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

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

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

Course Load Requirements

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

Academic Standings and Graduation

The following regulations govern General Programs:

- To obtain a BSc General degree, a GPA of at least 5.0 must be attained on the last ★60 credited to the degree. Moreover, a GPA of at least 5.5 must be attained in all courses in the major Subject or Area of Concentration.
- BSc General degrees with Distinction are awarded when students achieve a GPA of 7.5 or higher over the last ★60 if the students have satisfactorily completed at least a normal academic load of ★30 during the Fall/Winter periods of the last two years at the University of Alberta.

Residence Requirement

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

Time Limits for Program Completion

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

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

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

Minor in Agriculture

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

- AG EC 200
- AN SC 200

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

Minor in Human Ecology

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

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

Minor in Nutrition

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

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

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

163.1.5 BSc General—Minor in Business

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

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

- (1) ECON 101, 102
 (2) ★18 to ★30 in courses offered by the Faculty of Business including ACCTG 311; ORG A 301; two of FIN 301, MGTSC 352, MARK 301, ORG A 311

Notes

- (1) Several of the above courses have one or more Arts or Science courses as prerequisites. These prerequisites must be met.
 (2) Students completing a minor in Business must still choose a major in Science and must satisfy the requirement that at least ★72 of the ★120 credited to the degree be in Science.
 (3) Students minoring in Business must still complete at least ★18 in Arts. ECON 101 and ECON 102 constitute six of those required Arts units.

Once admitted to the minor in Business, students in the BSc General program will be allowed to continue in the Business minor as long as they remain in good standing in the BSc General program. BSc General program

students who have been admitted to the minor in Business and who subsequently apply to transfer to a Specialization or Honors program which has a Business component controlled by quota will have to apply and compete for admission to that quota.

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

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

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

Biological Sciences: Biochemistry, Biology, Botany, Entomology, Genetics, Microbiology, Pharmacology, Physiology, Zoology.

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

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

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 4.0 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 4.0 is the minimum grade acceptable in a course to be used as a prerequisite.
 (3) Normally, no more than ★42 at the 100-level are permitted in the combined program.
 (4) A full-time student in the combined program should normally register in ★30 during Fall/Winter of each year of the program.
 (5) A student may be permitted to complete the requirements for the combined program over a longer period than five years on approval by both the Dean of Education and the Dean of Science.

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.

Physical Sciences Major/ Biological Sciences Minor (★150)

Core Program Requirements	Year 1 (★30)	Year 2 (★30)	Year 3 (★30)	Year 4 (★30)	Year 5 (★30)
Education: ★45 Major: ★42 Minor: ★24 100-level: ★36 (Maximum ★42) Graduation Requirements: • GPA of 5.5 on all courses • GPA of 6.0 on Major courses Area "B" BIOL 260, 315, CHEM 303, CHRTC 352, HIST 294, 397, 398, 496, INT D 200 PHIL 265, 375, 465, PHYS 261, 264, SOC 367, 426 Area "C" ASTRO 310, CHEM 331, 332, PHYS 301, 302, 307, 309, 319	1. BIOL 107, BIOL 108 2. CHEM 101, CHEM 102 3. ENGL 101 4. MATH 113 or 114 5. MATH 115 6. PHYS 100 7. PHYS 101 or 102	1. BIOL 207, BIOL 208 2. CHEM 261, CHEM 263 3. EDFX 200 4. EDPY 200 5. PHYS 201 6. ★3 chosen from PHYS 200, 208, 271 7. ★3 chosen from CHEM 211 or PHYS 294 8. ★3 Arts Options	1. ★3 chosen from CHEM 211 or PHYS 294 not already taken 2. CMPUT 101 or 114 3. ★6 in Biological Sciences at the 200-level 4. ★6 Arts Options 5. ★6 Area "B" 6. ★6 Area "C"	1. EDFX 350 2. EDPS 310 3. EDPY 301 4. EDPY 303 5. EDSE (Minor) 6. EDFX 450 7. EDFX 451 8. EDSE (Major) 9. EDSE (Major) Notes: (1) Courses 1 through 5 above constitute the Introductory Professional Term and must be taken concurrently. (2) Courses 6 through 9 above constitute the Advanced Professional Term and must be taken concurrently.	1. EDPS 410 2. ★6 in Biological Sciences at the 300- or 400- level 3. ★3 Arts Options 4. ★6 Education Options 5. ★3 Non-Education Options 6. ★3 Science Options 7. ★6 Area "C"

Science Chart 1 BSc (Specialization in Science and Education)/BEd (cont'd)

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

Physical Sciences Major/Mathematical Sciences Minor (★150)					
Core Program Requirements	Year 1 (★30)	Year 2 (★30)	Year 3 (★30)	Year 4 (★30)	Year 5 (★30)
Education: ★45 Major: ★42 Minor: ★27 100-level: ★36 (Maximum ★42) Graduation Requirements: • GPA of 5.5 on all courses • GPA of 6.0 on Major courses Area "B" BIOL 260, 315, CHEM 303, CHRTC 352, HIST 294, 397, 398, 496, INT D 200 PHIL 265, 375, 465, PHYS 261, 264, SOC 367, 426 Area "C" ASTRO 310, CHEM 331, 332, PHYS 301, 302, 307, 309, 319	1. BIOL 107, BIOL 108 2. CHEM 101, CHEM 102 3. ENGL 101 4. MATH 113 or 114 5. MATH 115 6. PHYS 100 7. PHYS 101 or 102	1. CHEM 261, CHEM 263 2. EDFX 200 3. EDPY 200 4. MATH 120 5. MATH 214 6. PHYS 201 7. ★3 chosen from PHYS 200, 208, 271 8. ★3 chosen from CHEM 211 or PHYS 294 9. ★3 Arts Options	1. CMPUT 101 or 114 2. MATH 223 3. MATH 215 or 241 4. ★3 chosen from CHEM 211 or PHYS 294 5. ★6 Arts Options 6. ★6 Area "B" 7. ★6 Area "C"	1. EDFX 350 2. EDPS 310 3. EDPY 301 4. EDPY 303 5. EDSE (Minor) 6. EDFX 450 7. EDFX 451 8. EDSE (Major) 9. EDSE (Major)	1. EDPS 410 2. ★6 in Mathematics at the 300 or 400-level 3. ★3 Arts Options 4. ★6 Education Options 5. ★3 Non-Education Options 6. ★3 Science Options 7. ★6 Area "C"

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

Mathematical Sciences Major/Physical Sciences Minor (★150)					
Core Program Requirements	Year 1 (★30)	Year 2 (★30)	Year 3 (★30)	Year 4 (★30)	Year 5 (★30)
Education: ★45 Major: ★45 Minor: ★27 100-level: ★39 (Maximum ★42) Graduation Requirements: • GPA of 5.5 on all courses • GPA of 6.0 on Major courses Area "A" BIOCH 205, CHEM 211, 263, PHYS 200, 208, 271 Area "B" BIOL 260, 315, CHEM 303, CHRTC 352, HIST 294, 397, 398, 496, INT D 200 PHIL 265, 375, 465, PHYS 261, 264, SOC 367, 426 Area "C" ASTRO 310, CHEM 331, 332, PHYS 301, 302, 307, 309, 319	1. BIOL 107, BIOL 108 2. ENGL 101 3. MATH 114 4. MATH 115 5. MATH 120 6. STAT 151 7. ★6 in Physics or Chemistry chosen from CHEM 101,102, PHYS 100, 101 or 102 (or PHYS 108, 109 for those without PHYS 30)	1. EDFX 200 2. EDPY 200 3. MATH 214 4. MATH 215 5. MATH 228 6. MATH 241 7. ★6 in Physics or Chemistry chosen from CHEM 101, 102, PHYS 100, 101 or 102 (or PHYS 108, 109 for those without Physics 30) 8. ★6 Arts Options	1. EDFX 350 2. EDPS 310 3. EDPY 301 4. EDPY 303 5. EDSE (Minor) 6. CHEM 261 7. CMPUT 101 or 114 8. PHYS 201 9. ★3 in Mathematics at the 200-level 10. ★3 Area "B" Note: Courses 1 through 5 above constitute the Introductory Professional Term and must be taken concurrently.	1. EDFX 450 2. EDFX 451 3. EDSE (Major) 4. EDSE (Major) 5. ★3 in Mathematics at the 200-, 300- or 400-level 6. ★3 in Mathematics at the 300- or 400-level 7. ★3 Arts Option 8. ★3 Area "A" 9. ★3 Area "B" Note: Courses 1 through 4 above constitute the Advanced Professional Term and must be taken concurrently.	1. EDPS 410 2. ★9 in Mathematics at the 300 or 400-level 3. ★6 Education Options 4. ★3 Non-Education Options 5. ★3 Science Options 6. ★6 Area "C"

Mathematical Sciences Major/Biological Sciences Minor (★150)					
Core Program Requirements	Year 1 (★30)	Year 2 (★30)	Year 3 (★30)	Year 4 (★30)	Year 5 (★30)
Education: ★45 Major: ★45 Minor: ★24 100-level: ★33 (Maximum ★42) Graduation Requirements: • GPA of 5.5 on all courses • GPA of 6.0 on major courses Area "B" BIOL 260, 315, CHEM 303, CHRTC 352, HIST 294, 397, 398, 496, INT D 200 PHIL 265, 375, 465, PHYS 261, 264, SOC 367, 426	1. BIOL 107, BIOL 108 2. ENGL 101 3. MATH 114 4. MATH 115 5. MATH 120 6. STAT 151 7. ★6 in Physical Sciences at the 100-level	1. BIOL 207, BIOL 208 2. EDFX 200 3. EDPY 200 4. MATH 214 5. MATH 215 6. MATH 228 7. MATH 241 8. ★6 Arts Options	1. EDFX 350 2. EDPS 310 3. EDPY 301 4. EDPY 303 5. EDSE (Minor) 6. ★3 CMPUT 101 or 114 7. ★3 in Biological Sciences at the 200-level 8. ★3 in Mathematics at the 200-level 9. ★3 Arts Options 10. ★3 Area "B" Note: Courses 1 through 5 above constitute the Introductory Professional Term and must be taken concurrently.	1. EDFX 450 2. EDFX 451 3. EDSE (Major) 4. EDSE (Major) 5. ★3 in Biological Sciences at the 200-, 300- or 400-level 6. ★3 in Mathematics at the 200-, 300- or 400-level 7. ★3 in Mathematics at the 300- or 400-level 8. ★3 Arts Options 9. ★3 Area "B" Note: Courses 1 through 4 above constitute the Advanced Professional Term and must be taken concurrently.	1. EDPS 410 2. ★6 in Biological Sciences at the 300- or 400-level 3. ★9 in Mathematics at the 300- or 400-level 4. ★6 Education Options 5. ★3 Non-Education Options 6. ★3 Science Options

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)					
Core Program Requirements	Year 1 (★30)	Year 2 (★30)	Year 3 (★30)	Year 4 (★30)	Year 5 (★30)
Education: ★45 Major: ★42 Minor: ★27 100-level: ★33 (Maximum ★42) Graduation Requirements: • GPA of 5.5 on all courses • GPA of 6.0 on major courses Area "B" History and Theory of Science ★6 to be chosen from BIOL 260, 315, CHEM 303, CHRTC 352, HIST 294, 397, 398, 496, INT D 200, PHIL 265, 375, PHYS 261, 264, SOC 367, 426	1. BIOL 107, BIOL 108 2. CHEM 101, CHEM 161 3. ENGL 101 4. MATH 113 or 114 5. ★3 chosen from MATH 115,120; STAT 151 6. ★6 Arts Options	1. BIOL 207, BIOL 208 2. BIOCH 220 3. CMPT 101 or 114 4. EDPY 200 5. EDPY 200 6. ★3 chosen from MATH 115, 120; STAT 151 7. ★3 in Biological Sciences at the 200-level 8. ★6 in Mathematical Sciences at the 200-level	1. EDPY 350 2. EDPS 310 3. EDPY 301 4. EDPY 303 5. EDSE (Minor) 6. ★3 chosen from MATH 115,120; STAT 151 7. ★6 in Biological Sciences at the 200-level 8. ★6 AREA "B" Note: Courses 1 through 5 above constitute the Introductory Professional Term and must be taken concurrently.	1. EDPY 450 2. EDPY 451 3. EDSE (Major) 4. EDSE (Major) 5. ★6 in Biological Sciences at the 200-, 300- or 400-level 6. ★3 in Mathematics at the 300- or 400-level 7. ★6 Education Options Note: Courses 1 through 4 above constitute the Advanced Professional Term and must be taken concurrently.	1. EDPS 410 2. ★12 in Biological Sciences at the 300- or 400-level 3. ★3 in Mathematics at the 300- or 400-level 4. ★6 Arts Options 5. ★3 Science Options 6. ★3 Non-Education Options
Biological Sciences Major/Physical Sciences Minor (★150)					
Core Program Requirements	Year 1 (★30)	Year 2 (★30)	Year 3 (★30)	Year 4 (★30)	Year 5 (★30)
Education: ★45 Major: ★42 Minor: ★27 100-level: ★36 (Maximum ★42) Graduation Requirements: • GPA of 5.5 on all courses • GPA of 6.0 on major courses Area "A" BIOCH 205, CHEM 211, 263, PHYS 200, 208, 271 Area "B" BIOL 260, 315, CANST 403, CHEM 303, CHRTC 352, HIST 294, 397, 398, 496, INT D 200, PHIL 265, 375, PHYS 261, 264, SOC 367, 426 Area "C" ASTRO 310, CHEM 331, 332, PHYS 301, 302, 307, 309, 319	1. BIOL 107, BIOL 108 2. CHEM 101, CHEM 161 3. ENGL 101 4. MATH 113 or 114 5. ★3 chosen from MATH 115, 120; STAT 151 6. PHYS 100, PHYS 101	1. BIOL 207, BIOL 208 2. BIOCH 220 3. CHEM 102 4. EDPY 200 5. EDPY 200 6. PHYS 201 7. ★3 in Biological Sciences at the 200-level 8. ★6 Arts Options	1. EDPY 350 2. EDPS 310 3. EDPY 301 4. EDPY 303 5. EDSE (Minor) 6. CMPT 101 or 114 7. ★6 in Biological Sciences at the 200-level 8. ★3 Area "A" 9. ★3 Area "B" Note: Courses 1 through 5 above constitute the Introductory Professional Term and must be taken concurrently.	1. EDPY 450 2. EDPY 451 3. EDSE (Major) 4. EDSE (Major) 5. ★6 Education Options 6. ★6 in Biological Sciences at the 200-, 300- or 400-level 7. ★3 Area "C" Note: Courses 1 through 4 above constitute the Advanced Professional Term and must be taken concurrently.	1. EDPS 410 2. ★12 in Biological Sciences at the 300- or 400-level 3. ★6 Arts Options 4. ★3 Non-Education Options 5. ★3 Area "B" 6. ★3 Area "C"

163.1.7 Special Certificates

An applicant holding a BSc degree from this Faculty may qualify for a certificate indicating that the requirements for the equivalent of a BSc Honors degree (§163.1.1) or a BSc Specialization Degree (§163.1.2) have been met. To qualify for a Special Certificate, at least ★30 additional must be completed and all admission, program, academic standing, and graduation requirements of the equivalent degree must be met. Admission to a Special Certificate program requires approval of the appropriate Department and the Faculty Office. The specific course requirements are determined at the time of admission by the appropriate Department and the Faculty Office. The Special Certificate is not available to degree holders from other faculties at the University of Alberta or from other universities. For further information, consult the Faculty of Science Student Services Office.

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

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

- (1) Satisfactorily complete a minimum of ★60 (normally the last 60) while registered in the Faculty of Science at the University of Alberta.
- (2) Satisfy all admission requirements (see §15.15), as well as program, academic standing, and graduation requirements of the particular degree program (See §163.1.1 for Honors, §163.1.2 for Specialization, and §163.1.3 for General Program.)

Admission to a Specialization program and an Honors program requires approval of the appropriate Department and the Faculty Office. Note: The discipline in the BSc Specialization or Honors degree may not be the same as that of the first degree. The specific course requirements for a degree program are determined, at the time of admission, by the appropriate Department (for Specialization and Honors) and the Faculty Office. The BSc after a previous undergraduate degree is available to holders of undergraduate degrees from other faculties at the University of Alberta and from other universities. Note: The major selected in the After Degree program may not be in the same discipline as the major in the first degree. For further information, consult the Faculty of Science Student Services Office.

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

163 Programs of Study

163.1.9 Industrial Internship Program

The Industrial Internship program (IIP) offers undergraduate students extended work experience in industry in addition to their academic courses. The work experience is normally undertaken after completion of a minimum of 75, and not more than 105, units of course weight of an Honors or Specialization degree program. Students who have maintained good academic standing in an Honors or Specialization program and are Canadian citizens or permanent residents are eligible for the program. Department IIP Advisors 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.

163.1.10 Transfers Between Programs

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

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

163.1.11 Completion of a BSc Degree After Transfer to Another Faculty

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

163.2 Biochemistry

163.2.1 Honors in Biochemistry

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

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

Year 1 CHEM 101/102 and 161/163 MATH 113 (or 114), and 115 BIOL 107/108 ★6 in a junior Arts option (ENGL 101 recommended)	Year 2 BIOCH 203/205 CHEM 271/273 PHYS 100 and 101 or equivalent ★6 in an approved Science option ★6 in Arts options
Year 3 BIOCH 401 ★6 in Biochemistry (normally selected from BIOCH 410, 420, 430, or 441) CHEM 211/213 ★6 in approved Science options ★6 in Arts options	Year 4 ★6 in Biochemistry (normally selected from BIOCH 410, 420, 430, or 441) ★3 in Biochemistry (selected from BIOCH 450, 455, or 460) BIOCH 499 CHEM 361 and 363 ★9 in approved Science options

Notes

- (1) For information about new Biological Sciences courses, consult your Department advisor.
- (2) Recommended Science options for second year include BIOL 207; MICRB 265; MATH 214 and 215; GENET 270 and 275 or other approved Sciences courses.

- (3) Recommended Science options for third and fourth year include BIOCH 450, 455, and 460; PHYS 201; MICRB 311 or 415; PHYSL 210.
- (4) Students should consult the Department of Biochemistry regarding selecting options throughout the course of the program.
- (5) Students must receive a grade of not less than 6.0 in all Biochemistry courses credited toward the minimal number required for the degree.
- (6) ★6 in a junior English is required as one of the ★18 in Arts options within the Honors in Biochemistry program.
- (7) BIOCH 410, 420, 430, 441, 450, 455, and 460 are offered only in alternating years. Check the *Registration Procedures* book for courses offered in the current year.

163.2.2 Specialization in Biochemistry

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

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

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

Notes

- (1) For information about new Biological Sciences courses, consult your Department advisor.
- (2) Recommended Science options for second year include BIOL 207; MICRB 265; GENET 270 and 275 or other approved Sciences courses.
- (3) Recommended Mathematical or Physical Science options include MATH 214 and 215; CHEM 271 and 273; PHYS 201; or other approved Mathematical or Physical Science courses.
- (4) Other recommended Science options for third and fourth year include BIOCH 450, 455, 460; PHYS 201; MICRB 311 or 415; PHYSL 210 or other approved Science courses.
- (5) Students should consult the Department of Biochemistry regarding selecting options throughout the course of the program.
- (6) Students must receive a grade of not less than 6.0 in BIOCH 203 and 205 and 5.0 in all other Biochemistry courses credited toward the minimal number required for the degree.
- (7) ★6 in a junior English is required as one of the ★18 in Arts options within the Specialization in Biochemistry program.
- (8) BIOCH 410, 420, 430, 441, 450, 455, and 460 are offered only in alternating years. Check the *Registration Procedures* book for those courses offered in the current year.

163.3 Biological Sciences

All students in Honors and Specialization programs in Biological Science take a common core of courses in the first and second years. Thereafter, they follow the course sequence of one of eight areas of concentration in either Honors or Specialization in Biological Sciences identified in §§163.3.4 and 163.3.5. Students must declare an area of concentration and follow the appropriate course sequence. The title of the area of concentration will appear on their degree. Specific course requirements of Honors students: BIOL 499, a directed research project, is required for Honors students. The research project must be conducted on a topic appropriate to the student's area of concentration. BIOL 499 is a recommended option for Specialization students.

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

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

163.3.1 Honors in Biological Sciences

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

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

163.3.2 Specialization in Biological Sciences

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

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

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

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

Notes

- (1) Students intending to complete their degree in the areas of Cell Biotechnology, Microbiology, or Molecular Genetics must also take both CHEM 102 and 163, normally in the second term of their first year, as the ★6 Science Option.
- (2) Students intending to complete their degree in Physiology and Developmental Biology, or those who wish to incorporate BIOCH 203/205 in place of BIOCH 220 in their Animal Biology program, are required to take CHEM 163 in the first year.
- (3) The rest of the Biological Sciences program core consists of BIOL 207, 208, and BIOCH 203 or 220, which would be completed in the second year.
- (4) Students intending to complete their degree in the areas of Cell Biotechnology, Microbiology, Molecular Genetics, or Physiology and Developmental Biology require BIOCH 203/205, **not** BIOCH 220.
- (5) Students in Honors Biological Sciences must successfully complete BIOL 499.

163.3.4 Course Sequence for Honors in Biological Sciences

See Science Chart 1.

163.3.5 Course Sequence for Specialization in Biological Sciences

See Science Chart 2.

Science Chart 2 Course Sequence for Honors in Biological Sciences

Animal Biology

Year 2

BIOCH 220; BIOL 201, 207, 208; ZOOL 224, 225; ZOOL 250 or ENT 220; ZOOL 241 or 242
★3 Approved option
★3 Arts option

Year 3 and 4

BIOL 321, 499; BIOL 331 or ZOOL 332; ENT 220 or ZOOL 250; GENET 275; ZOOL 302 or 303; ZOOL 352; ZOOL 370 or 371
★9 Arts options
★12 from List A
★3 from List B
★9 Approved options
List A: Recommended options include but are not restricted to the following:
BIOL 335, 380, 420, 430, 435; EAS 230; ENT 280, 321, 392; MA SC 410, 412, 430, 440; PALEO 318, 319; ZOOL 340, 341, 342, 351, 405, 407, 408, 427, 465.
List B: BIOL 445, 468; ZOOL 402, 441, 442, 472; or a 500-level graduate seminar.
Note: MA SC courses on this list are offered at Bamfield Marine Station.

Cell Biotechnology

Year 2

BIOCH 203, 205; BIOL 201, 207; GENET 270; MICRB 265;
★6 Approved Science options
★6 Arts options

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

Year 3 and 4

BIOL 208, 499; CHEM 361, 363; GENET 301, 304, 390; GENET 420 or MICRB 343 and 345; MICRB 311, 313, 406, 415, 450
★6 Approved options from list below
★6 Arts options
Note: A minimum grade of 6 is required in MICRB 311 to stay in Cell Biotechnology Honors program.
Recommended options include but are not restricted to the following:
BIOCH 410, 420, 430, 450; BIOL 490, 498; BOT 250, 380, 382; CHEM 211, 213, 361, 363; GENET 302, 364, 375; INT D 224, 371; MMI 351, 352, 405, 415, 425, 520; MICRB 295, 316, 391, 410; NU FS 363, 402. [Other options may be approved if suitable]

Environmental Biology

Year 2

BIOCH 220; BIOL 207, 208; BOT 201 or 210; CHEM 163 or 263; EAS 102; MATH 115 or 120; ZOOL 224; ZOOL 250 or ENT 220
★3 Arts option

Year 3 and 4

BIOL 321, 380, 499; BIOL 430 or STATS 337
★9 from BIOL 331, BOT 332, FOR 322 or SOILS 330; ZOOL 332, 371
★6 from BOT 240, 250, 382; ENT 321; GENET 270, 275; MICRB 265; ZOOL 241, 242
★9 from list below
★9 Arts options
★12 Approved Options

Recommended options include, but are not restricted to the following:
BIOL 361, 366, 430, 433, 435, 464, 468; BOT 305, 306, 333, 431, 433, 520; EAS 250; INT D 421; ZOOL 301, 340, 405, 407, 408, 427, 434 465.

Science Chart 2 Course Sequence for Honors in Biological Sciences (cont'd)

Evolutionary Biology

Year 2

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

Year 3 and 4

BIOL 321, 335, 420, 435, 499
 ★3 from BOT 411, PALEO 318, 319.
 ★3 from BIOL 331, BOT 332, ZOOL 332.
 ★6 from BOT 302, 305, 306, 320; ZOOL 224, 405, 407, 408, 427; ENT 280; MICRB 265.
 ★9 Arts options
 ★12 from list below
 ★9 Approved options
 Recommended options include, but are not restricted to the following:
 BIOL 331, 430, 433, 520; BOT 250, 303, 309, 409, 431, 504, 505, 506, 511; ENT 321, 378; EAS 101, 230; MA SC 410, 412, 420, 430, 440, 445; PALEO 520; ZOOL 302, 303, 340, 352, 354, 355, 434, 472; PHYS 100 or 108.

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

Microbiology

Year 2

BIOCH 203, 205; BIOL 201, 207; GENET 270;
 MICRB 265
 ★6 Science options (List A or B)
 ★6 Arts options

Year 3 and 4

BIOL 208, 499; MICRB 311, 313, 343, 345; CHEM 211, 213
 ★6 Arts options
 ★12 in MICRB options (List A)
 ★6 Science options (List A or B)
 ★9 Approved options (List A, B or C)
 Recommended options include, but are not restricted to the following:
 A. Microbiology options:
 GENET 390; MICRB 295, 316, 391, 392, 401, 410, 415, 420, 450; INT D 224, 371, 372, 452; NU FS 361, 363, 402, 480; MMI 351, 352, 405, 415, 425, 427, 516, 520.
 B. Science options:
 BIOCH 410, 420, 430, 441, 450, 455, 460; BIOL 490, 498; BOT 306; CHEM 271, 273, 303, 361, 363; COMPUT 101 or 114; ENT 378; GENET 275, 301, 302, 304, 408; PHYS 100, 101; ZOOL 352, 452.
 C. Approved options:
 BIOL 380; BOT 380, 382, 383; CELL 300, 301; EAS 201; PHYSL 210; PSYCO 104; SOILS 210, 430.
 (Some of these approved options actually count as science courses, see §164).

Molecular Genetics

Year 2

BIOCH 203, 205; BIOL 207, 208; GENET 270, 275;
 MICRB 265
 ★6 Arts Options
 ★3 Science Option

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

Year 3 and 4

BIOL 201, 380, 499; GENET 301, 302, 304, 390
 ★12 from GENET 364, 408, 412, 418, 420
 ★6 Arts options
 ★6 Approved options
 ★12 from list below
 Recommended options include, but are not restricted to the following:
 BOT 250, 306, 382; BIOCH 401, 410, 420, 430, 450; BIOL 315, 321, 420, 445, 490, 498; CELL 300, 301; CHEM 271, 273; ENT 220, 321; GENET 375; INT D 224, 371; MICRB 311, 313, 316, 343, 345, 401, 415; PHYSL 210, 401; ZOOL 241, 242, 250, 302, 340, 342, 402, 441, 442.

Physiology and Developmental Biology

Year 2

BIOCH 203, 205
 BIOL 201, 207, 208
 ZOOL 225, 241, 242, 250
 ★3 Science option

Year 3 and 4

BIOL 499; ZOOL 302, 303, 344
 ★3 of ZOOL 402 or 441 or 442
 ★21 from list below
 ★12 Arts options
 ★9 Approved options
 Recommended options include, but are not restricted to the following:
 ANAT 415; BIOL 445; BOT 240, 306, 340, 431; CELL 300, 301; ENT 321; INT D 371, 452, 543, 544; GENET 301, 302, 304, 412; MICRB 265, 311, 313; PHYSL 372, 401, 402, 404; PMCOL 371; ZOOL 340, 341, 342, 343, 352, 355, 370, 402, 441, 442, 452.

Plant Biology

Year 2

BIOCH 220; BIOL 207, 208; CHEM 102; CHEM 163
 or 263; BOT 201, 210, 240
 ★3 Arts option
 ★3 Science option

Year 3 and 4

BIOL 201, 499; BOT 250, 309, 303, 320, 332; MICRB 265
 ★3 GENET
 ★9 Arts options
 ★3 Approved option
 ★18 Senior Botany Courses

Science Chart 3 Course Sequence for Specialization in Biological Sciences

Animal Biology

Year 2

BIOCH 220; BIOL 201, 207, 208; ZOO 224, 225;
ZOO 250 or ENT 220; ZOO 241 or 242
★3 Approved option
★3 Arts option

Year 3 and 4

BIOL 321; BIOL 331 or ZOO 332; ENT 220 or ZOO 250; GENET 275; ZOO 302 or 303; ZOO 352;
ZOO 370 or 371
★9 Arts options
★12 from List A
★3 from List B
★15 Approved options
List A: Recommended options include but are not restricted to the following:
BIOL 335, 380, 420, 430, 435, 498, 499; EAS 230; ENT 280, 321, 392; MA SC 410, 412, 430, 440;
PALEO 318, 319; ZOO 340, 341, 342, 351, 405, 407, 408, 427, 465.
List B: BIOL 445, 468; ZOO 402, 441, 442, 472.
Note: MA SC courses on this list are offered at Bamfield Marine Station.

Cell Biotechnology

Year 2

BIOCH 203, 205; BIOL 201, 207; GENET 270;
MICRB 265
★6 Approved Science options
★6 Arts options

Year 3 and 4

BIOL 208; GENET 301, 304, 390; GENET 420 or MICRB 343 and 345; MICRB 311, 313, 415, 450
★21 Approved options from list below
★6 Arts options
Recommended options include, but are not restricted to the following:
BIOCH 410, 420, 430, 450; BIOL 490, 498, 499; BOT 250, 380, 382; CHEM 211, 213, 361, 363;
GENET 302, 364, 375; INT D 224, 371; MMI 351, 352, 405, 415, 425, 520; MICRB 295, 316, 391, 410;
NU FS 363, 402. [Other options may be approved if suitable.]

Environmental Biology

Year 2

BIOCH 220; BIOL 207, 208; BOT 201 or 210;
CHEM 163 or 263; EAS 102; MATH 115 or
120; ZOO 224; ZOO 250 or ENT 220
★3 Arts option

Year 3 and 4

BIOL 430 or STATS 337; BIOL 321, 380
★9 from BIOL 331; BOT 332; FOR 322; or SOILS 330; ZOO 332, 371.
★6 from BOT 240, 250, 382; ENT 321; GENET 270, 275; MICRB 265; ZOO 241, 242.
★9 from list below
★9 Arts options
★18 Approved options
Recommended options include, but are not restricted to the following:
BIOL 361, 366, 430, 433, 435, 464, 468, 498, 499, 520; BOT 305, 306, 333, 431, 433; EAS 250; INT D
421; ZOO 301, 340, 405, 407, 408, 427, 434, 465.

Evolutionary Biology

Year 2

BIOCH 220; BIOL 207, 208, 380
★6 from BOT 201, 210; ENT 220; ZOO 224, 225,
250
★3 from BOT 240; ENT 321; ZOO 241, 242
★3 Arts option
★6 Approved options

Year 3 and 4

BIOL 321, 335, 420, 435
★3 from BOT 411, PALEO 318, 319
★3 from BIOL 331, BOT 332, ZOO 332
★6 from BOT 302, 305, 306, 320; ZOO 224, 405, 407, 408, 427; ENT 280; MICRB 265
★9 Arts options
★12 from list below
★15 Approved options
Recommended options include, but are not restricted to the following:
BIOL 331, 430, 433, 498, 499, 520; BOT 250, 303, 309, 409, 431, 504, 505, 506, 511; ENT 321, 378;
EAS 101, 230; MA SC 410, 412, 420, 430, 440, 445; PALEO 520; ZOO 302, 303, 340, 352, 354, 355,
434, 472; PHYS 100 or 108
Note: Marine Science courses on this list are offered at Bamfield Marine Station.

Microbiology

Year 2

BIOCH 203, 205; BIOL 201, 207; GENET 270;
MICRB 265
★6 Science options (List A or B)
★6 Arts options

Year 3 and 4

BIOL 208; CHEM 211, 213; MICRB 311, 313
★6 Arts options
★12 MICRB options (List A)
★12 Science options (List A or B)
★15 Approved options (List A, B or C)
Recommended options include, but are not restricted to the following:
A. Microbiology options:
GENET 390; INT D 224, 371, 372, 452; MICRB 295, 316, 343, 345, 391, 392, 401, 410, 415, 420, 450;
NU FS 361, 363, 402, 480; MMI 351, 352, 405, 415, 425, 427, 516, 520.
B. Science options:
BIOCH 410, 420, 430, 441, 450, 455, 460; BIOL 490, 498, 499; BOT 306; CHEM 271, 273, 303, 361,
363; CMPUT 101 or 114; ENT 378; GENET 275, 301, 302, 304, 408; PHYS 100, 101; ZOO 352, 452.
C. Approved options:
BIOL 380; BOT 380, 382, 383; CELL 300, 301; EAS 201, 203; PHYS 210; PSYCO 104; SOILS 210,
430. (Some of these approved options actually count as science courses, see §164).

Science Chart 3 Course Sequence for Specialization in Biological Sciences (cont'd)

Molecular Genetics	
Year 2	Year 3 and 4
BIOCH 203, 205; BIOL 207, 208; GENET 270, 275; MICRB 265 ★6 Arts Options ★3 Science option Note: GENET 270 and 275 must be taken during the second year to permit completion of the program in four years.	BIOL 201, 380; GENET 301, 302, 304, 390 ★12 from GENET 364, 408, 412, 418, 420 ★6 Arts options ★12 Approved options ★12 from list below Recommended options include, but are not restricted to the following: CELL 300, 301; BIOCH 401, 410, 420, 430, 450; BIOL 315, 321, 420, 445, 490, 498, 499; BOT 250, 306, 382; CHEM 271, 273; ENT 220, 321; GENET 375; INT D 224, 371; MICRB 311, 313, 316, 343, 345, 401, 415; PHYSL 210, 401; ZOOL 241, 242, 250, 302, 340, 342, 402, 441, 442.
Physiology and Developmental Biology	
Year 2	Year 3 and 4
BIOCH 203, 205; BIOL 201, 207, 208; ZOOL 225, 241, 242, 250 ★3 Science option	ZOOL 302, 303, 344 ★3 from ZOOL 402 or 441 or 442 ★12 Arts options ★12 Approved options ★24 from list below Recommended options include, but are not restricted to the following: ANAT 415; BIOL 445, 498, 499; BOT 240, 306, 340, 431; CELL 300, 301; ENT 321; INT D 371, 452, 543, 544; GENET 301, 302, 304, 412; MICRB 265, 311, 313; PHYSL 372, 401, 402, 404; PMCOL 371; ZOOL 340, 341, 342, 343, 352, 355, 370, 402, 441, 442, 452.
Plant Biology	
Year 2	Year 3 and 4
BOT 201, 210, 240; BIOCH 220; BIOL 207, 208; CHEM 102; CHEM 163 or 263 ★3 Arts option ★3 Science option	BIOL 201; BOT 250, 303, 309, 320, 332; MICRB 265 ★3 GENET ★9 Arts options ★9 Approved options ★18 Senior Botany Courses

163.3.6 Industrial Internship Program

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

Students approved to enter this stream register for a continuous sequence of at least two work experience (WKEXP) courses 941 and 942, starting in May, September or January. During the program, student are considered full-time students of the University. Work experience courses have no weight and are graded credit/no credit, and recorded on the student's transcript. The 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.

163.3.7 General Program in Biological Sciences

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

Courses which may be used toward a Biological Sciences major or minor include BIOL; BOT; ENT; GENET; MA SC; MICRB; PALEO; ZOOL; CELL 300, 301; INT D 224, 371, 372, 421, 452, 455; MMI 351, 352; NU FS 363; PHYSL 210, 372, 401, 404, 410; PMCOL 201, 305, 331, 335, 336, 371, 392, 403, 409, 412, 415

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

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

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

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

163.4 Cell Biology

163.4.1 Honors in Cell Biology

Continuation in the Honors Cell Biology program requires a minimum GPA of 6.5 in the preceding Fall/Winter. Graduation requires a minimum GPA of 6.5 on the last ★60 credited to the degree.

Year 1	Year 2
BIOL 107, 108 CHEM 101/102 CHEM 161/163 MATH 113 or 114, and 115 ★6 in an Arts option (English 101 recommended)	BIOCH 203/205 BIOL 201 BIOL 207/208 GENET 270 MICRB 265 PHYS 100, 101 ★3 in an Arts option ★3 from Group B Cell Biology Options
Year 3	Year 4
CELL 300, 301 CHEM 271 STAT 141 or 151 ★3 from Group A Cell Biology options ★6 from Group B Cell Biology options ★3 in an approved Science option ★6 in Arts options	BIOL 445 CELL 499 ★6 from Group A Cell Biology options ★6 from Group B Cell Biology options ★6 in approved Science options ★3 in an Arts option
Group A: Cell Biology Options	Group B: Cell Biology Options
BIOCH 420 BIOCH 430 or GENET 304 ZOO 342 or 303 or BOT 303	BIOCH 410, 441, 450, 455 BIOL 208 BOT 250, 303, 382 CHEM 271 and 273 GENET 275, 301, 302, 364, 390 INT D 224, 371 MICRB 316 PHYSL 401 STAT 337 ZOO 303, 342
Suggested Science Options	
BIOL 315, 321 CELL 495 CELL 498	BIOCH 401 GENET 375
Students registered in CELL 499 or BIOCH 401 can use ★3 toward lab component of Group A Cell Biology options	

163.4.2 Specialization in Cell Biology

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

Year 1	Year 2
BIOL 107, 108 CHEM 101/102 CHEM 161/163 MATH 113 or 114, and 115 ★6 in an Arts option (English 101 recommended)	BIOCH 203/205 BIOL 201 BIOL 207 GENET 270 MICRB 265 PHYS 100, 101 ★3 in an Arts option ★3 from Group B Cell Biology Options
Year 3	Year 4
CELL 300, 301 STAT 141 or 151 ★6 from Group A Cell Biology options ★9 from Group B Cell Biology options ★6 in Arts options	CELL 445 ★6 from Group A Cell Biology options ★9 from Group B Cell Biology options ★6 in an approved Science options ★3 in an Arts option ★3 in an approved option
Group A Cell Biology Options:	Group B Cell Biology Options:
BIOCH 420 BIOCH 430 or GENET 304 CELL 498 or GENET 375 ZOO 303, 342 or BOT 303	BIOCH 410, 441, 450, 455 BIOL 208 BOT 250, 303, 382 CHEM 271 and 273 GENET 275, 301, 302, 364, 390 INT D 224, 371 MICRB 316 PHYSL 401 STAT 337 ZOO 303, 342
Suggested Science Options	
BIOL 315, 321 BIOCH 401	CELL 495 CELL 499
Students registered in CELL 499 or BIOCH 401 can use ★3 toward lab component of Group A Cell Biology options	

163.5 Chemistry

163.5.1 Honors in Chemistry

Honors students in Chemistry must take a core of Chemistry and auxiliary courses. The core consists of ★42 in Chemistry courses, ★12 in Mathematics courses, ★9 in Physics courses, and ★18 in Arts courses. In addition to the core courses, honors students must complete at least six ★3 in senior courses in Chemistry. Four of these must be from Group A and the other two from either Group A or Group B. Finally, the honors student must include seven

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

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

Year 1	Year 2	Years 3 and 4
CHEM 101, 102, 161, 163 MATH 113 (or 114), 115 PHYS 100, 102 a junior course in English or ★3 in English and ★3 in an Arts option	CHEM 211, 213, 241 CHEM 271, 273 MATH 214, 215 PHYS 230 ★6 in an Arts option	CHEM 341, 361, 363, 381, 383 ★18 in senior chemistry courses ★21 in science options ★6 in Arts options
Group A	Group B	
BIOCH 203 CHEM 313, 437 CHEM 461, 465 CHEM 477, 479	BIOCH 205 CHEM 305, 401, 403 CHEM 413, 415, 417, 419, 421, 423 CHEM 433, 439 CHEM 467 CHEM 483, 489, 493	

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

163.5.2 Specialization in Chemistry

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

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

163.5.3 Industrial Internship Program

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

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

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

163.5.4 Concentration in Chemistry

Students in the BSc General program with a major in Chemistry should complete CHEM 100, 102, 161 (or 261), 163 (or 263); MATH 113 (or 114), 115, and ★6 of junior physics during the first two years of their programs. CHEM 101, 102, MATH 113 (or 114) and 115 should be taken in Year 1 because these provide maximum flexibility for course selection in Year 2 and

subsequent years of the program. To complete a major in Chemistry, students should select from the following senior courses: CHEM 211, 213, 271, 273, 331, 332, 361, 363, 375 and 313. Students majoring in Chemistry should consult the Chemistry Department Advisor before registering in second and later years of the program to plan a course of study and have their programs approved by the Advisor.

Students in the BSc General program with a minor in Chemistry should include CHEM 101, 102, 161 (or 261), and 163 (or 263) in their program. Other Chemistry courses to complete the minor may be selected from CHEM 211, 213, 271, 273, 303, 313, 331, 332, 361, 363, and 375.

163.5.5 Certificate of Specialization After a BSc Degree

All outstanding requirements of the Specialization Degree must be completed with an average of 5.5 or higher in all chemistry courses taken after the general degree. See §163.1.3.

163.5.6 Diploma After a Previous Degree

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

163.6 Computing Science

For admission requirements, see §15.15.

The Computing Science program has a limit on enrolment in the second year.

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

163.6.1 Honors in Computing Science

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

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

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

Year 2	Year 3	Year 4
CMPUT 201, 204, 229, 291 MATH 120, 214 (or 217), 215 (or 317) STAT 221 ★3 in an Arts option ★3 in an approved option	CMPUT 301, 304, 325, 379, 391 MATH 128 or 223 STAT 222 ★6 in Arts options ★3 in an approved option	CMPUT 366, 418 or 419, 474, and at least ★3 in CMPUT at the 300-level or higher ★9 in approved options ★6 in approved Science options ★3 in an Arts option

Notes

- (1) Honors students should take the Honors version of the Mathematics courses beginning in the first year.
- (2) Honors students must take CMPUT 495 (Honors Seminar) during their degree program.

163.6.2 Specialization in Computing Science

Continuation in the Specialization program requires a GPA of at least 5.5 in the preceding Fall/Winter. Graduation requires a GPA of at least 5.5 on the last ★90 credited to the degree.

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

Year 2	Year 3	Year 4
CMPUT 201, 204, 229, 291 MATH 120, 214 STAT 221 ★6 in Arts options ★3 in approved option	CMPUT 301, 325, 379 ★3 in CMPUT at the 300-level or higher STAT 222 ★3 in Arts option ★9 in approved options ★3 in Science option	CMPUT 340 ★6 in CMPUT at the 300- level or higher ★15 in approved options ★3 in approved Science option ★3 in Arts option

Notes

- (1) Students entering Year 2 of the program may register for no more than two Computing Science courses per term.
- (2) At least ★9 in approved options must be at the 300-level or higher.

163.6.3 Specialization in Computing Science—Minor in Business

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

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

The Business minor in Computing Science consists of the following:

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

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

163.6.4 Specialization in Computing Science—Software Quality Option

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

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

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

Year 2	Year 3
Same as for regular Specialization	CMPUT 300, 301, 325, 379 ★3 in CMPUT at the 300-level or higher STAT 222 ★6 in Business electives (see Note 1 below) ★3 in Arts option ★3 in Science option

Year 4	Year 5
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).	CMPUT 340, 400, 401, 402 ★3 in CMPUT at the 300-level or higher ★6 in Business electives (see Note 1 below) ★3 in Approved option ★3 in Science option ★3 in Arts option

Notes

- (1) Students in the Specialization Program with the Software Quality Option must choose ★12 from the following Business courses:
MGTSC 352, 422, 461, 465
MIS 412, 413, 414, 417
- (2) 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.

163.6.5 Industrial Internship Program

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

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

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

163.6.6 BSc General—Computing Science Minor

The Computing Science minor requires between ★24 and ★36 in Computing Science, with a maximum of ★18 at the 100-level. In addition, at least ★6 must be at the 300-level or above.

The typical program will include the following:

CMPUT 114/115 or 101/102/115 (see Note); CMPUT 272; CMPUT 201; CMPUT 204; CMPUT 291; CMPUT 3xx; CMPUT 3xx; plus up to three further CMPUT 3xx or 4xx as desired.

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

163.6.7 BSc Program in Computer Engineering

A four-year program in Computer Engineering is offered jointly by the Faculty of Science and the Faculty of Engineering (see §72.5).

For administrative purposes, students in the program will be registered in the Faculty of Engineering.

See admission requirements in §15.6.

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

163.7 Earth and Atmospheric Sciences

Earth and Atmospheric Sciences encompass the study of the atmosphere, surface and interior of the earth. The Department administers eight academic

programs: Honors and Specialization in Atmospheric Sciences, Honors and Specialization in Environmental Earth Science, Honors and Specialization in Geology, Honors in Paleontology, and BA Major in Human Geography. **For details on Major and Minor in Human Geography, see Faculty of Arts listing.**

163.7.1 Honors in Atmospheric Sciences

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

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

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

Year 1	Year 2
EAS 101 and 102 ENGL 101 CHEM 101 and 102 MATH 113 or 114 and 115 PHYS 100 and 102	EAS 220, 221, 270, 271 and 327 MATH 120, 214 and 215 PHYS 244 and 281
Year 3	Year 4
EAS 290 or 291, 370, 371 and 372 ★9 Arts options ★9 approved Science options (see Note below)	EAS 426 EAS 470 and either 471 or 472 ★21 approved Science options (see Note below)

Note: Approved Science options should be chosen from EAS 202, 208, 324, 325, 326, 352, 427, 451, 453, 454, 455, 457, 471, 472; CHEM 211, 213, 261, 263, 303; CMPUT 201, 204, 301, 304, 306, 340; ENCS 203, 360; FOR 340, 372; GEOPH 221, 429; MATH 121, 201, 280, 334, 337, 372, 380; PHYS 211, 261, 264, 364, 381, 481; SOILS 210, 330, 440. For students in the Industrial Internship Program: EAS 401, WKEXP 411, WKEXP 412. Recommended Arts options include any EAS X9X courses.

163.7.2 Specialization in Atmospheric Sciences

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

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

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

Year 1	Year 2
CHEM 101 and 102 EAS 101 and 102 ENGL 101 MATH 113 or 114 and 115 PHYS 100 and 102	EAS 220, 221, 270, and 271 MATH 120, 214 and 215 PHYS 244 and 281 ★3 in an Arts option
Year 3	Year 4
EAS 290 or 291, 327, 370, 371 and 372 ★6 Arts options ★9 approved Science options (see Note below)	EAS 470 and either 471 or 472 ★24 approved Science options

Note: Approved Science options should be chosen from EAS 202, 208, 324, 325, 326, 352, 427, 451, 453, 454, 455, 457, 471, 472; CHEM 211, 213, 261, 263, 303; CMPUT 201, 204, 301, 304, 306, 340; ENCS 203, 360; FOR 340, 372; GEOPH 221, 429; MATH 121, 201, 280, 334, 337, 372, 380; PHYS 211, 261, 264, 364, 381, 481; SOILS 210, 330, 440. For students in the Industrial Internship Program: EAS 401, WKEXP 411, WKEXP 412. Recommended Arts options include any EAS X9X courses.

163.7.3 Honors in Environmental Earth Sciences

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

Continuation in the Honors in Environmental Earth Sciences program requires a GPA of at least 6.5 on at least ★30 in the previous Fall/Winter.

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

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

Year 1	Year 2
CHEM 101 and 102 EAS 101 and 102 ENGL 101 MATH 113 or 114 and 115 PHYS 100 and 101	BIOL 108 EAS 220, 221, 222, 223, 224, 225, 250, and either 270 or 271, and either 290 or 291
Year 3	Year 4
EAS 320, 324 and 354 GEOPH 223 ★18 Optional Elements (see below)	EAS 426 ★27 Optional Elements (see below)
Optional Elements Students must take additional courses from each of the following six groups: Groups (1) At least ★3 (Field and Laboratory Methods) of EAS 233, 327, 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, 280, 334; STAT 141, 151 (4) At least ★3 (Geology) of EAS 207, 232, 321, 322, 330, 420, 421, 422, 425 (5) At least ★6 (Surface Processes and Quaternary Geology) of EAS 270, 271, 352, 370, 371, 453, 454, 455, 457; INT D 594 (6) At least ★9 of any EAS X9X courses.	

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

163.7.4 Specialization in Environmental Earth Sciences

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

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

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

Year 1	Year 2
EAS 101 and 102 ENGL 101 CHEM 101 and 102 MATH 113 or 114 and 115 PHYS 100 and 101	BIOL 108 EAS 220, 221, 222, 223, 224, 225, 250 and either 270 or 271, and either 290 or 291
Year 3	Year 4
EAS 320, 324 and 354 GEOPH 223 ★18 of Optional Elements (see below)	★30 Optional Elements (see below)
Optional Elements Students must take additional courses from each of the following six groups: Groups (1) At least ★3 (Field and Laboratory Methods) of EAS 233, 327, 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, 280, 334; STAT 141, 151 (4) At least ★3 (Geology) of EAS 207, 232, 321, 322, 330, 420, 421, 422, 425 (5) At least ★6 (Surface Processes and Quaternary Geology) of EAS 270, 271, 352, 370, 371, 453, 454, 455, 457; INT D 594 (6) At least ★9 of any EAS X9X courses.	

Note: An additional ★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.

163.7.5 Honors in Geology

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

Continuation in the Honors in Geology program requires a GPA of 6.5 on at least ★30 in the previous Fall/Winter.

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

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

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

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

163.7.6 Specialization in Geology

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

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

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

Year 1	Year 2
CHEM 101 and 102 EAS 101 and 103 ENGL 101 MATH 113 or 114 and 115 PHYS 100 and 101	EAS 220, 221, 223, 224, 225, 230, 231, 232, 233 and 234
Year 3	Year 4
EAS 320, 321, 322, 330, 331, 332 and 333 EAS 290 or 291 GEOPH 221 or 223 or 224 ★3 Arts option	GEOPH 221 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 Arts options

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

163.7.7 Professional Association

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

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

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

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

163.7.8 Honors in Paleontology

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

163.7.9 Industrial Internship Program

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 §163.1.9 for guidelines to the program). The Industrial Internship designation will appear on the degree parchments of students who have participated in the program.

Students approved to enter this stream register for a continuous sequence of at least two work experience (WKEXP) courses 411 and 412, starting in May, September or January. During the program, 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 411 and 412 plus EAS 400. EAS 400 must be taken in the first term immediately following completion of the WKEXP period. If required by the employer, the student's written report and oral presentation in EAS 400 may be classified confidential. The employer also assesses the student's performance during the work term. Based on the student's written report and oral presentation, and the report from the employer, students are awarded a grade in EAS 400.

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

163.8 Environmental Physical Sciences

163.8.1 Specialization in Environmental Physical Sciences

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

Year 1	Year 2
CHEM 101 and 102 MATH 113 or 114 MATH 115 PHYS 144, 146 EAS 101 and 102 ★6 in English (ENGL 101 recommended)	BIOL 108 CHEM 261 and 263 MATH 120 PHYS 201 EAS 220 and 221 (See Note 1) or PHYS 261 and 264 ★9 in Arts options or approved Science or other options (See Notes 2 and 3)
Year 3	Year 4
CHEM 211 and 213 EAS 220 and 221 (See Note 1) or PHYS 261 and 264, whichever were not previously taken. EAS 223 and 270 PHYS 294 PHYS 364 or approved Science option ★6 in Arts options or approved Science or other options. (See Notes 2 and 3)	CHEM 303 CHEM 305 or EAS 351 EAS 425 PHYS 364 or approved Science option, whichever was not previously taken. ★18 in Arts options or approved Science or other options. (See Notes 2 and 3)

Notes

- (1) In lieu of EAS 220, an approved course in computation, computing, or statistics may be taken.
- (2) ★6 to ★12 must be taken in Arts option, in addition to the ★6 in 100-level English. These may include EAS 290, 291, 390, 493; ECON 101; PHIL 355.
- (3) Approved Science or other options must total ★24 to ★30, such that a total of ★36 of optional courses are taken. These options include, but are not restricted to, CHEM 271, 273, 313, 331, 332, 415, 417; EAS 224, 225, 250, 327, 352, 457; ENCS 203, 352; GEOPH 223, 224; INT D 369; MATH 214, 215, 270; SOILS 210.

163.8.2 Industrial Internship Program

The Environmental Physical Sciences Program in the Faculty of Science offers an Industrial Internship Program which allows students to augment their 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 (★3), which is graded on the normal 9-point grading scale and which comprises the academic component of the IIP. The student will submit a report to the IIP Coordinator describing the project(s) undertaken and will make an oral presentation to an Advisory IIP committee. A grade will be assigned in ENVPS 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

	Course	Weight	Grade
Year 4	Fall WKEXP 421	0	CR/F
Year 4	Winter WKEXP 422	0	CR/F
Year 5	Fall ENVPS 403	3	9-point

163.9 Geophysics

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

163.9.1 Professional Association

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

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

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

163.10 Marine Science

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

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

Students are expected to take a full course load of ★15 during the fall term.

Courses run Monday to Saturday.

A refundable deposit of \$100 is payable at the time of application.

An extension fee of \$1000 must be paid on arrival at BMS to cover the cost of field trips, lab supplies and course materials.

There is a mandatory room and board charge of \$1840 for the 13 weeks.

Information concerning course prerequisites and application procedures for Marine Science may be obtained from the Department of Biological Sciences or the Office of the Dean of Science. Permission to register in these courses is available from the Director of the Bamfield Marine Station, to whom application should be made.

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

163.11 Mathematics

163.11.1 Honors in Mathematics

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

Year 1	Year 2	Years 3 and 4
MATH 117, 118, 125, 228 ★3 in a Computing Science option ★3 in an approved Science option ★6 in approved Arts options ★6 in approved options	MATH 217, 225, 317, either 229 or 334 ★6 in approved Science options ★6 in approved Arts options ★6 in approved options	★30 in Mathematics courses ★6 in approved Science options ★6 in approved Arts options ★18 in approved options

The program must include MATH 229, 334, 411, 417, 418, 426, 427, 447, 496; two of MATH 324, 347, 373, 412, 421, 486; one of MATH 325 or 329; and either MATH 446 or 448.

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

Honors in Applied Mathematics

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

Year 1	Year 2	Years 3 and 4
MATH 117, 118, 125, either 228 or 229 ★3 in a Computing Science option ★3 in an approved Science option ★6 in approved Arts options ★6 in approved options	MATH 217, 225, 317, 334 ★6 in approved Science options ★6 in approved Arts options ★6 in approved options	★21 in Mathematics courses ★12 in approved options at the 300-level in the field of application ★3 in an approved 300- or 400-level Mathematics and/or Mathematical Physics option ★12 in approved Science options ★6 in approved Arts options ★6 in approved options

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

Minor in Statistics

The degrees 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, 266, 378, 466, 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, 272, 280, 285, 291, and at least ★12 in Computing Science at the 300- or 400-level chosen with approval of both the Computing Science Department Honors Advisor and the Mathematical Sciences Department Honors Advisor.

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

Honors in Mathematical Physics

See §163.16.3 for details.

163.11.2 Specialization in Actuarial Science—Business Minor

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

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

Year 1	Year 2
CMPUT 101, 102 or 114, 115 ECON 101 MATH 114, 115 MATH 125 STAT 141 or 151 ★6 in a junior English ★3 in Science	ECON 102 MATH 214, 215 MATH 225 MATH 253 STAT 265, 266 ★3 in Arts ★3 in Science ★3 option

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

Notes

- (1) Students are strongly encouraged to choose their Business options from the following list of recommended courses: ACCTG 322, 413, 414; FIN 412, 413, 414, 416, 422, 434, 442; MGTSC 352, 404, 405, 422; MARK 301, 412, 422; ORG A 301, 321, 402.
- (2) Students are strongly encouraged to choose their other options from the following list of recommended courses: ECON 281, 282, 323, 341, 353, 378; CMPUT 201, 204, 272, 280, 285, 291; MATH 280, 300, 314, 334, 337, 373, 380; STAT 332, 454, 472.
- (3) Each student's program must have the approval of the Department of Mathematical Sciences and must include:
 - ★18 Arts
 - At least ★18 and not more than ★24 in Business
 - ★69 in Science courses, of which ★60 must be MATH and STAT
 - ★24 MATH and STAT courses at the 300-level or higher

163.11.3 Specialization in Mathematics

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

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

Year 1	Year 2
MATH 114, 115 MATH 125 ★6 from CMPUT 101, 102 or 114, 115 ★6 in approved options ★6 in a junior English ★3 in approved Science option	MATH 214, 215 MATH 225 One of MATH 228, 229 ★3 in Mathematics ★3 in an approved Science option ★6 in an Arts option ★6 in an approved option
Year 3	Year 4
MATH 314/414 ★6 in Mathematics ★6 in an approved Science option ★6 in an Arts option ★6 in an approved option	★12 in a 300- or 400-level Mathematics ★6 in approved Science options ★12 in approved options

Notes

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

163.11.4 Mathematics and Economics

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

Honors in Mathematics and Economics

Year 1	Year 2	Years 3 and 4
ECON 101, 102 MATH 117, 118, 125, 228 ★6 in a junior English ★6 in approved Science options	ECON 281, 282 MATH 217, 317 STAT 265, 266 ★6 in approved Science options ★6 in approved options	★24 in Economics ★24 in Mathematics or Statistics courses ★6 in approved Science options ★6 in approved options

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

Specialization in Mathematics and Economics

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

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

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

Year 1	Year 2	Years 3 and 4
ECON 101, 102 MATH 114, 115 MATH 125 ★6 in a junior English ★6 in Science options ★3 in option	ECON 281, 282 MATH 214, 215 MATH 225 STAT 151 and 265 or STAT 265 and 266 ★6 in Science options ★3 in option	★24 in Economics including either ECON 399 or ECON 407, 408 ★18 in Mathematics ★18 in options

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

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

Notes

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

163.11.5 Specialization in Mathematics and Finance

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

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

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

Year 1	Year 2
MATH 114, 115 MATH 125 CMPUT 101, 102 or 114, 115 ECON 101/102 ★6 of junior English ★3 in option	MATH 214/215 MATH 225 MATH 253 STAT 151/265 or 265/266 ACCTG 311 ECON 281 ★6 in options
Year 3	Year 4
MATH 353 MATH 314/414 MATH 373 FIN 301 FIN option ECON 399 or STAT 378 ★9 in options	★3 in MATH options ★6 in FIN options ★12 in Science options ★9 in options

Notes

- (1) Approved ACCTG, ECON, FIN and MGTSC options include ACCTG 413; ECON 282, 384, 385, 407, 408, 481, 482; FIN 412, 413, 414, 416, 422, 434, 442; MGTSC 352, 404, 405, 428, 456.
- (2) Students should choose some of their MATH and Science options from the following recommended courses: MATH 334, 337, 432, 470; MATH 280, 380; MATH 354; STAT 466, 471, 472, 479.
- (3) Each program must have the approval of the Department of Mathematical Sciences and must include
 - ★18 in Arts Courses;
 - ★63 in Science courses, including ★36 of MATH with at least ★12 of these at the 300-level or higher;
 - ★36 in ECON, ACCTG, FIN, or MGTSC, including ★9 of 400-level FIN.
- (4) A corresponding Honors Mathematics course can be substituted for any Mathematics course listed. For example, MATH 117 can be substituted for MATH 114.

163.11.6 Industrial Internship Program

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

Students approved to enter this stream register for a continuous sequence of at least two work experience (WKEXP) courses 951 and 952, starting in

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

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

163.12 Neuroscience

163.12.1 Honors in Neuroscience

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

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

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

Continuation in the honors program requires a minimum GPA of 7.0 in the preceding Fall/Winter. Graduation requires a minimum GPA of 7.0 on ★60 in Years 3 and 4 of the program. Each program of study must be approved by the coordinator in the Division of Neuroscience.

Year 1	Year 2
CHEM 101, 161 BIOL 107, 108 MATH 113 or 114 MATH 115 or STAT 151 PHYS 100, 101 or PHYS 108, 109 ENGL 101	BIOCH 220 CHEM 263 BIOL 207 PHYSL 210 or 211 PSYCO 104, 275 ★6 in Science options ★3 in an Arts option
Year 3	Year 4
PMCOL 371 PHYSL 372 PSYCO 377 ZOOL 342 ★12 in approved Science options ★6 in Arts options	NEURO 450, 451 ★12 chosen from ANAT 415, NEURO 472, PMCOL 407, 412, 509, 512, PHYSL 527, PSYCI 511, PSYCO 475, 478 ★9 in approved Science options (PHYSL 401 and 402 recommended) ★3 in an Arts option

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

163.13 Northern Studies

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

163.14 Paleontology

The Honors in Paleontology program is for Honors students in Geology, Zoology, and Anthropology interested in vertebrate and invertebrate paleobiology, including evolution and systematics, historical biogeography,

functional morphology and stratigraphic distribution. The program may be entered through the framework of existing programs in the Departments of Earth and Atmospheric Sciences, Biological Sciences, and Anthropology. Interested students should consult their Honors advisor to prepare their programs.

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

Honors in Paleontology

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

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

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

Year 1	Year 2
BIOL 107 and 108 CHEM 101 and 161 or 102 EAS 101 and 103 ENGL 101 MATH 113 or 114 or 120 STAT 151	BIOL 207 and 208 BOT 210 EAS 230, 231, 233 and 234 ZOOL 224, 225 and 250
Year 3	Year 4
ANTHR 390 or 391 BIOL 321 and 361 BIOL 335 or BOT 411 EAS 225 and 330 PALEO 414 or approved option ★6 approved Arts options ★3 approved option	BIOL 335 or BOT 411 BIOL 499 or EAS 427 and 428 PALEO 318 and 319 PALEO 414 or approved option ★3 Arts option ★9 approved courses

Note: PALEO 414 is offered in alternate years but must be taken in Year 3 or 4. For information regarding new Biological Sciences and Earth and Atmospheric Sciences courses, please consult your Department advisor.

163.15 Pharmacology

163.15.1 Honors in Pharmacology

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

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

Year 1	Year 2
BIOL 107, 108 CHEM 101, 102 CHEM 161, 163 MATH 113 (or 114) STAT 141 ★6 in approved Arts options (ENGL 101 recommended)	BIOCH 203, 205 MICRB 265 PHYSL 210 or 211 PMCOL 201 ★6 in Science options from BIOCH, BIOL, CHEM, GENET, MATH, MICRB, PHYS, PHYSL, PMCOL, or ZOOL ★6 in an approved Arts option ★3 in an approved option
Year 3	Year 4
PMCOL 305 PMCOL 342 PMCOL 403 or 415 ★6 in Science options as indicated for Year 2. ★6 in approved Arts options ★6 in approved options	PMCOL 337, 407, 409, 412, 403 or 415, 498 ★6 in Science options as indicated for Year 2. ★3 in an approved option

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

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

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

163.15.2 Specialization in Pharmacology

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

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

Year 1	Year 2
BIOL 107, 108 CHEM 101, 102 CHEM 161, 163 MATH 113 or 114 STAT 141 ★6 in approved Arts options (ENGL 101 recommended)	BIOCH 203/205 PHYSL 210 or 211 PMCOL 201 ★6 in Science options from: BIOCH, BIOL, CHEM, GENET, MATH, MICRB, PHYS, PHYSL, PMCOL, or ZOOL ★6 in an approved Arts option ★3 in approved options
Year 3	Year 4
PMCOL 305 PMCOL 342 PMCOL 403 or 415 ★6 in Science options for Year 2 ★6 in approved Arts options ★6 in approved options	PMCOL 337, 407, 409, 412, 403 or 415 ★9 in Science options for Year 2 ★6 in approved options

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

163.16 Physics

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

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

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

Notes

- (1) Students interested in the Engineering-Physics program should consult §27.7 of the Faculty of Engineering section.
- (2) Honors and Specialization Physics students must consult an advisor in the Department of Physics regarding their programs. Note to third- and fourth-year students: Not all 300-level and 400-level Physics and Geophysics courses are offered every year.

163.16.1 Honors in Physics

Notes

- (1) By the end of their programs, students must have taken ★18 of Arts options.
- (2) Students must take ★27 from Pools A and B.
Pool A: PHYS 362, 395, 413, 415, 420, 472, 481, 484, 485, 491, 499; MA PH 343, 451.
Pool B: All 300- and 400-level ASTRO, PHYS, MA PH, and GEOPH courses, unless otherwise indicated in the course descriptions, plus all 400-level MATH courses. With consent of the Department, other courses may be taken for credit.
- (3) Students wishing to qualify for an Honors degree must take a minimum of ★18 from Pool A including PHYS 472 and 481.

Year 1	Year 2	Years 3 and 4
PHYS 144, 146 MATH 113 (or 114, or 117), 115 (or 118) MATH 120 (or 125 for more theoretically inclined students) ★9 in Science options (★3 in Computing Science recommended; other suggested options are in Astronomy, Chemistry, or Earth and Atmospheric Sciences) ★6 in Arts options (English recommended) (see Note 1 above)	PHYS 211, 244, 271, 281, 295, 297 MATH 225 MATH 214 (or 217), 215 (or 317) ★3 in an Art option	PHYS 311, 351, 372, 381, 397, 472, 481 MATH 311 (or 411), 334 (or 336), 337 ★30 in other courses (See Notes 1, 2, and 3 above). In Year 4, students are also expected to take part in the weekly Physics Colloquium.

163.16.2 Honors in Geophysics

The Honors and Specialization (see §163.16.5) programs are identical except for the GPA requirements (see §162.6.1) and residency requirements (see §163.1).

Notes

- Students must complete EAS 101 and CHEM 101 and 102 by the end of the second year.
- Students must take ★18 from Geophysics Core courses and a minimum of ★9 from Geophysics Pool courses.
Core: GEOPH 221, 325, 326, 426, 438, 429.
Pool: GEOPH 421, 424, 437; MA PH 467; PHYS 372, 499; CMPUT 340; PET E 465; EAS 321.
Not all 300-level and 400-level courses are offered every year. Students must consult the Department of Physics for approval of third- and fourth-year programs.
- By the end of their programs, students must have taken ★15 in Science options (at least ★3 of which must be in Computing Science) and ★12 in Arts options.

Year 1	Year 2	Years 3 and 4
PHYS 144, 146 MATH 113 (or 114 or 117), 115 (or 118), 120 (or 125 for more theoretically inclined students) ★6 from EAS 101, CHEM 101, CHEM 102, ★3 Arts option (see Note 1) ★3 in Computing Science (see Note 3) ★6 in Arts options (English recommended)	PHYS 211, 244, 271, 281, 295 MATH 214 (or 217), 215 (or 317) GEOPH 221 ★6 from: EAS 101, CHEM 101, CHEM 102, a three credit Arts option, whichever were not taken previously (see Note 1)	(see Notes 1, 2, and 3) PHYS 381, 481 MATH 311 (or 411), 334, (or 336), 337 EAS 233 EAS 222 (or 103 or 224) ★15 in approved Geophysics Core courses ★9 in approved Geophysics Pool courses ★12 in approved Science options ★3 in an Arts option

163.16.3 Honors in Mathematical Physics

Year 1	Year 2	Years 3 and 4
MATH 117, 118, 125, 229 PHYS 144, 146 ★6 in Science options (★3 in Computing Science recommended); ★6 in Arts options (English recommended)	MATH 217, 225, 317 MATH 334 or 336 PHYS 211, 244, 271, 281, 295 ★3 in an Arts option	MATH 311 (or 411), 337, 417 MA PH 343 MA PH 451 or MATH 436 PHYS 311, 351, 372, 381, 420, 472, 481 ★15 approved Science options ★9 Arts options

163.16.4 Specialization in Physics

Notes

- By the end of their programs, students must have taken ★18 of Arts options.
- Students must take ★27 from Pools A and B.
Pool A: PHYS 362, 395, 413, 415, 420, 472, 481, 484, 485, 491, 499, MA PH 343, 451.
Pool B: All 300- and 400-level ASTRO, PHYS, MA PH, and GEOPH courses, unless otherwise indicated in the course descriptions, plus all 400-level MATH courses. Specialization students may take 200-level courses from Science departments other than Physics and Mathematical Sciences. With consent of the Department, other courses may be taken for credit.
- Students wishing to qualify for a Specialization degree must take a minimum of ★9 from Pool A.
- The courses listed below comprise a minimum program. Students may, in consultation with the Department, select more advanced courses in place of those listed. A suitably enriched program can be used for admission to graduate work in Physics if satisfactory standing is obtained.

Year 1	Year 2	Years 3 and 4
PHYS 144, 146 MATH 113 (or 114 or 117), 115 (or 118), 120 (or 125 for more theoretically inclined students) ★9 in Science options (★3 in Computing Science recommended) ★6 in Arts options (English recommended) (see Note 1 above)	PHYS 211, 244, 271, 281, 295, 297 MATH 214 (or 217), 215 (or 317), 225 ★3 in an Arts option (see Note 1 above)	PHYS 311, 351, 372, 381, 397 MATH 311 (or 411), 334 (or 336), 337 ★36 in other courses (see Notes 1, 2 and 3 above)

163.16.5 Specialization in Geophysics

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

Notes

- Students must complete EAS 101 and CHEM 101 and 102 by the end of the second year.
- Students must take ★18 from Geophysics Core courses and a minimum of ★9 from Geophysics Pool courses.
Core: GEOPH 221, 325, 326, 426, 438, 429.
Pool: GEOPH 421, 424, 437; MA PH 467; PHYS 372, 499; CMPUT 340; PET E 465; EAS 321.
Not all 300-level and 400-level courses are offered every year. Students must consult the Department of Physics for approval of third- and fourth-year programs.
- By the end of their programs, students must have taken ★15 in Science options (at least ★3 of which must be in Computing Science) and ★12 in Arts options.

Year 1	Year 2	Years 3 and 4
PHYS 144, 146 MATH 113 (or 114 or 117), 115 (or 118), 120 (or 125 for more theoretically inclined students) ★6 from EAS 101, CHEM 101, CHEM 102, ★3 Arts option (see Note 1) ★3 in Computing Science (see Note 3) ★6 in Arts options (English recommended)	PHYS 211, 244, 271, 281, 295 MATH 214 (or 217), 215 (or 317) GEOPH 221 ★6 from: EAS 101, CHEM 101, CHEM 102, ★3 Arts option, whichever were not taken previously (see Note 1)	(see Notes 1, 2, and 3) PHYS 381, 481 MATH 311 (or 411), 334 (or 336), 337 EAS 233 EAS 222 (or 103 or 224) ★15 in approved Geophysics Core courses ★9 in approved Geophysics Pool courses ★12 in approved Science options ★3 in an Arts option

163.16.6 Industrial Internship Program

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

Students approved to enter this stream register for a continuous sequence of at least two work experience (WKEXP) courses 421 and 422, starting in May, September or January. During the program, student are considered full-time students of the University. Work experience courses have no weight and are graded credit/no credit, and recorded on the student's transcript. The Industrial Internship Program Advisor maintains contact at approximately three-month intervals with the student and the person designated by the employer to be responsible for the student's progress. This arrangement ensures satisfaction on all sides. If the review shows the situation is not satisfactory, the internship may be terminated and the student would then return to classes at the next available opportunity. The graduation requirements for the Industrial Internship program designation include successful completion of at least WKEXP 421 and 422 plus PHYS 400. PHYS 400 must be taken in the first term immediately following completion of the WKEXP period. If required by the employer, the student's written report and oral presentation in PHYS 400 may be classified confidential. The employer also assesses the student's performance during the work term. Based on the student's written report and oral presentation, and the report from the employer, students are awarded a grade in PHYS 400.

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

163.16.7 Concentration in Physics

Students considering Physics as their major subject of concentration in the four-year General BSc program should include PHYS 124/126 or 144/146, and 201 and 208 as early as possible in their program. To complete a major in Physics, PHYS 294 is strongly recommended. Students majoring in Physics should normally select from PHYS 301, 302, 307, 309, 319, and 364. They must also consult a Physics Department advisor before registering in second or later years of the program to have their programs approved, as not all 300-level PHYS courses are offered each year. Students wishing to combine a major in Physics with a minor in Arts or Business should consult a Physics Department advisor (§§163.1.3 and 163.1.4).

163.17 Physiology

163.17.1 Honors in Physiology

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

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

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

The course requirements in the program are as follows:

Year 1	Year 2
BIOL 107, 108 CHEM 101, 102, 161, 163; ENGL 101 ★6 in approved Science or Arts options (see Note 1)	BIOCH 203, 205 BIOL 201, 207 PHYS 211 PHYS 100, 101 ★6 in approved Science or Arts options (see Note 1)
Year 3	Year 4
CELL 300 PMCOL 342, 371 PHYS 372, 401, 404 STAT 141 or 151 ★6 in an approved Science or Arts option (see Note 1)	PHYS 402, 465, 466 ★12 from PHYS 501, 512, 513, 527, 545 BIOL 445, INT D 543, 544, PMCOL 509, 515 or another approved senior-level science course with Department approval ★9 in approved options (see Note 1)

Notes

- 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.
- Approved Science options may be chosen only from the following: Junior Courses: PSYCO 104; PHYS 100, 101 or 102; MATH 113 or 114, 115; CMPUT 114. Advanced Courses: BIOCH 410, 420, 430, 441, 450, 455, 460; BIOL 301, 315, 585; CHEM 211, 213, 419; CMPUT 251, 252; ENT 292; GENET 270, 275, 301, 302, 304, 390, 418, 421, 471; INT D 371, 372; MATH 214, 215; MICRB 265; PH AS 221; PMCOL 305, 407, 412, 415, 505, 506, 508; PSYCO 275, 281, 371, 377, 381, 459, 476, 478; STAT 252, 341, 368; ZOOL 225, 226, 241, 242, 311, 340, 341, 342, 343, 412, 422, 445.
- Approved non-Science/non-Arts options must be chosen from the following: AN SC 310, 311, 374, 410, 484; ASM 513, 563; IMMUN 370, 451; INT D 224; MMI 351, 520; NU FS 225, 227, 301, 302, 452, 468; OCCTH 106, 107; PEDS 200; PSYCI 511.
- Recommended Arts options may be chosen from the following: CHRTC 352; ENGL 310; LING 321, 323, 499; PHIL 101, 250, 265, 412, 415, 417; POL S 212; PSYCO 105, 223, 258, 425; SOC 100, 300, 382, 462, 473; WRITE 298.
- Other options may be acceptable with permission of an advisor.
- MATH 113 or 114 is a recommended option.
- Honors students are also encouraged to attend all department seminars.

163.18 Psychology

163.18.1 Honors in Psychology

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

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

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

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

Year 1	Year 2
ENGL 100 or 101 PSYCO 104, 105 BIOL 107, 108 ★6 from CMPUT 101, 102, 114, 115, MATH 113, 114, 115, 117, 118, 120, 125, STAT 252, 341, or other computing science, mathematics or statistics course approved by the Honors Advisor ★6 in approved Science options	STAT 151 and PSYCO 212 ★6 (two of) from PSYCO 223, 233, 241, 258 ★6 (two of) from PSYCO 267, 275, 281 ★6 from approved courses offered by the Departments of Anthropology, Economics, Linguistics, Political Science and/or Sociology ★6 in approved Science options
Year 3	Year 4
PSYCO 300, 390, 391 ★3 (one of) PSYCO 356, 364, 410, 411, 431, 441, 475, 476, 482, 493, or other advanced research methods course approved by the Honors Advisor ★9-★12 in approved Science options ★6-★9 in approved options	PSYCO 400, 490 ★6 (two of) in a 400-level Psychology course other than 400, 410, 411, 431, 441, 475, 476, 482, 490, 493, 496, 497, 498, except as approved by the Honors Advisor ★9-★15 in approved Science options ★3-★9 in approved options

Notes

- In addition to the courses specifically listed above, the program must include, among the student's optional courses, a minimum of ★12 in one or more disciplines relevant to Psychology, e.g., Anthropology, Biology, Chemistry, Computing Science, Economics, Genetics, Linguistics, Mathematics, Neuroscience, Pharmacology, Philosophy, Physics, Physiology, Political Science, Sociology, Statistics, and applied Probability, and Zoology. These courses may not overlap those used to fulfil the Computing/Mathematics/Statistics, Natural Science and Social Science requirements listed above.
- Under the supervision of a faculty member in the Department of Psychology, students undertake a year-long research apprenticeship (PSYCO 390) during the third year and conduct and write an empirical thesis (PSYCO 490) during the fourth year. Third-year students present their thesis research proposals, and fourth-year students present the results of their thesis research at the annual Honors Psychology Conference in April.

163.18.2 Specialization in Psychology

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

Year 1	Year 2
PSYCO 104, 105 BIOL 107/108 ★6 in an English course (ENGL 101 is recommended) ★6 from junior courses offered in the departments of Computing Science and Mathematics ★6 from junior courses offered in the departments of Chemistry and Physics	STAT 151 ★9 from PSYCO 258, 266 or 267, 275, 281 ★3 in an approved Arts option ★6 in approved Science options ★9 in approved options
Year 3	Year 4
★6 in approved Arts options (a) for students meeting Year 2 requirements by taking PSYCO 258: ★15 in approved Science options ★9 in approved options or (b) for students meeting Year 2 requirements by taking courses other than PSYCO 258: ★12 in approved Science options ★12 in approved options	★21 in approved Science options ★9 in approved options

To fulfil the degree requirements, students must complete a minimum of ★36 in Science Psychology courses, or PSYCO 258 and a minimum of ★33 in Science Psychology courses. At least ★12 must be in Science Psychology courses at the 300-level or above. Students may take a maximum of ★48 from PSYCO courses listed in the Arts and Science Course Listing sections.

163.18.3 Industrial Internship Program

An Industrial Internship Program, similar to a co-op program, is offered to students in the Specialization or Honors programs in Psychology (see

\$163.1.9 for guidelines to the program). The Industrial Internship designation will appear on the degree parchments of students who have participated in the program.

Students approved to enter this stream register for a continuous sequence of at least two work experience (WKEXP) courses 931 and 932, 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 931 and 932 plus PSYCO 400. PSYCO 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 PSYCO 400 may be classified confidential. The employer also assesses the student's performance during the work term. Based on the student's written report and oral presentation, and the report from the employer, students are awarded a grade in PSYCO 400.

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

163.19 Statistics and Applied Probability

163.19.1 Honors in Statistics

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

Graduation requires a GPA of 7.0 on all Statistics and Mathematics courses taken and a GPA of 6.0 on the last ★30 credited to the degree.

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

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

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

163.19.2 Specialization in Statistics

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

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

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

Year 1	Year 2	Years 3 and 4
STAT 141 or 151 MATH 114, 115 MATH 125	STAT 252, 265, 266 MATH 214, 215 MATH 225	STAT 312, 368, 378, 466, 471 Four of STAT 361, 377, 432, 441, 453, 472, 479
★18 in approved options. See Note (1) below.	★12 in approved options. See Note (1) below.	★33 in approved options

Notes

- (1) The program must include ★6 in English and either CMPUT 101, 102 or 114, 115. These courses should be taken in the first two years of the program.
- (2) The program must include at least ★18 in a single field of applications. The student is advised to consult the Department of Mathematical Sciences regarding specific program recommendations for the field of applications.
- (3) The program must meet the requirements of the Faculty of Science (§163.1.2) and include ★18 in Arts courses.
- (4) A corresponding Honors Mathematics course can be substituted for any Mathematics course listed. For example, MATH 117 can be substituted for MATH 114.
- (5) Each program must be approved by the Department of Mathematical Sciences.

163.19.3 Industrial Internship Program

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

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

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

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

Courses Related to the Industrial Internship Program

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

163.20 Preprofessional Programs

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

163.20.1 Preprofessional Requirements for Medicine and Dentistry

For admission requirements for the DDS Degree program and the MD Degree program, see §15.8.3 and §15.8.4, respectively. Students planning to apply for admission to one of these degree programs may take the required courses while registered in a degree program in Science. See §15.15.8 for Grade 12 requirements for the preprofessional program.

163.20.2 Preprofessional Requirements for Veterinary Medicine

See §§15.15 and 34.4.7. Students may take the required courses while registered in a BSc General program or one of the BSc Specialization or BSc Honors programs. Students should consult the Faculty Office regarding appropriate courses.

163.20.3 Preprofessional Requirements for Rehabilitation Medicine

See §§15.13.3 and 15.15. Students may take the required courses while registered in a BSc General program or one of the BSc Specialization or BSc Honors programs.

163.20.4 Preprofessional Requirements for Optometry

A maximum of seven students from Alberta wishing to enter the School of Optometry at the University of Waterloo may complete the required preprofessional courses at the University of Alberta. Applicants must be Canadian Citizens or be residents of Canada who have held permanent

resident (landed immigrant) status for at least 12 months before the registration day of the Fall Term.

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

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

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

163.20.5 Preprofessional Requirements for Medical Laboratory Science

Admission requirements for the BSc Medical Laboratory Science program are given in §15.8.1. Students planning to apply for admission to Medical Laboratory Science may take the required courses while registered in the Faculty of Science.

164 Details of Courses

164.1 Course Listings

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

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

164.2 Prerequisites

Where a prerequisite is stated in a course description, it is understood that equivalent courses may satisfy the requirement. Also, the department

offering a course with prerequisite requirements may waive the prerequisite in writing. (Prerequisite waiver forms are available from the Faculty of Science office and the Department offices.)

164.3 Biochemistry Courses

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

164.4 Computing Science Courses

Introductory

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

Specialization and Honors

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

164.5 Food Science Courses

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

164.6 Immunology Courses

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

164.7 Medical Microbiology Courses

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

164.8 Pharmacology Courses

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

164.9 Physiology Courses

The following may be used by students in the Faculty of Science as science courses: PHYSL 210, 211, 401, 402, 404, 410, 465 and 466.

164.10 Graduate Courses

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