Chapter Contents

SECTION 1: History and Guiding Principles

SECTION 2: Admission to the Clayton H. Riddell Faculty of Environment, Earth, and Resources
2.1 Admission from University 1
2.2 External Transfer Students
2.3 Visiting Students
2.4 Second Degree Students
2.5 Special Students
2.6 Auditing Students

SECTION 3: Degree Regulations and Services Applicable to all Programs in the Clayton H. Riddell Faculty of Environment, Earth, and Resources
3.1 Degrees Offered
3.2 Courses Offered in Other Faculties and Schools Acceptable for Credit in the Clayton H. Riddell Faculty of Environment, Earth, and Resources
3.3 Available Minors in Departments and Faculties
3.4 University Written English and Mathematics Requirements
3.5 University 1 Requirements from Faculty of Arts and Faculty of Science Courses
3.6 Changes in Program Requirements
3.7 Prerequisite, Corequisite, Recommended Courses and Course Availability: Definitions
3.8 Repeated Courses and Attempted Credit Hours
3.9 Voluntary Withdrawals
3.10 Authorized Withdrawals
3.11 Residence Requirement
3.12 Letter of Permission to Take Courses at Another University
3.13 Dean’s Honour List and Graduating with Distinction or First Class Honours
3.14 Academic Warning, Probation and Academic Suspension
3.15 Academic Dishonesty
3.16 Termwork and Debarment
3.17 Deferred Examinations
3.18 Challenge for Credit
3.19 Appeals Involving Academic Regulations
3.20 Incidental Fees
3.21 Student Advisor Office Hours
3.22 Student Responsibility
3.23 Maximum Number of Courses During a Term
3.24 Course Space Availability
3.25 Registration
3.26 Interfaculty Option in Aging

SECTION 4: Department of Environment and Geography
4.1 Academic Staff
4.2 Undergraduate Programming Available in the Department of Environment and Geography

SECTION 5: Bachelor of Arts in Geography Degree Regulations and Program Description
5.1 Program Information
5.2 Entrance Requirements
5.3 Minimum Performance Requirements
5.4 Dean’s Honour List and Graduating with Distinction or First Class Honours
5.5 B.A. Geography Program Chart
5.6 Systematic Courses (HS, PS, TS) and Area Studies (A)
Note: Geography course descriptions are found in Section 6.6 of this Chapter.

SECTION 6: Bachelor of Science in Physical Geography Degree Regulations and Program Description
6.1 Program Information
6.2 Entrance Requirements
6.3 Minimum Performance Requirements for Continuation and Graduation
6.4 Dean’s Honour List and Graduating with Distinction or First Class Honours
6.5 B.Sc. Physical Geography Program Chart
6.6 Geography Course Descriptions

SECTION 7: Bachelor of Environmental Science and Environmental Studies Degree Regulations and Program Descriptions
7.1 Program Information
7.2 Entry Requirements
7.3 Minimum Performance Requirements for Continuation and Graduation
7.4 Dean’s Honour List and Graduating with Distinction or First Class Honours
7.5 Bachelor of Environmental Science Program Chart
7.6 Bachelor of Environmental Studies Program Chart
7.7 Environmental Science and Environmental Studies Course Descriptions

SECTION 8: Department of Geological Sciences: Bachelor of Geological Sciences - Geology and Geophysics Degree Regulations and Program Descriptions
8.1 Academic Staff
8.2 Program Information
8.3 Degree Regulations
8.4 Bachelor of Science in Geological Sciences (Geology) Program Chart
8.5 Bachelor of Science in Geological Sciences (Geophysics) Program Chart
8.6 Bachelor of Science in Geological Sciences (General) Program Chart
8.7 Geological Sciences Course Descriptions
SECTION 1: History and Guiding Principles

History
The Clayton H. Riddell Faculty of Environment, Earth, and Resources is the University of Manitoba’s newest Faculty, the first to be created in many years. In 2002, the University of Manitoba’s Board of Governors approved implementation of a new Faculty to focus on 'environmental issues and concerns’. In September of 2003, Senate and the Board of Governors approved a structure for the Faculty consisting of three units: the existing Department of Geological Sciences, the Natural Resources Institute and a new Department of Environment and Geography.

Purpose
Our Noble Purpose is to contribute to understanding the changing Earth and human condition and to disseminate and apply this knowledge for the benefit of the present and future.

Mission
Our Mission is to create an intellectual environment conducive to becoming a premier teaching and research Faculty in the broad areas of Earth, environment, sustainable development, resources and human activities. We will accomplish this by using the unique synergies of our inter-dependent disciplines and developing academic programs that respond to the needs of students, changing societal conditions and worldviews and opportunities for research and outreach.

Vision
Our Vision is to be a Faculty of outstanding merit in teaching, research and outreach concerned with complexities of the Earth, environment, sustainable development, resources and human activities.

Our aim is to be a Faculty that:
• is recognized for graduates with skills, competencies, and knowledge required by the needs of society;
• promotes individual excellence and collaboration in research, teaching, and outreach;
• is recognized for community engagement and leadership;
• promotes ethical principles and diversity and an understanding of cultural issues; and
• has the resources required to facilitate pursuit of our mission.

Values
The Clayton H. Riddell Faculty of Environment, Earth, and Resources recognizes that its strength is its people and that the most important measure of its success is the educational achievement of its students. The Faculty will strive to offer all students, staff and faculty a healthy, safe, open, friendly, supportive, consultative and stimulating environment conducive to individual intellectual growth, personal fulfillment and career progress. We embrace the principles of academic freedom and responsibility, education, individual intellectual growth, personal fulfilment and career progress. We will accomplish this by using the unique synergies of our inter-dependent disciplines and developing academic programs that respond to the needs of students, changing societal conditions and worldviews and opportunities for research and outreach.

Learning - at the centre of what we do, we promote learning as a lifelong process in our faculty, staff, students and communities - for individual enrichment and the sustainability and betterment of society and our Earth.

Discovery - we promote the creation of new knowledge and its application to societal and environmental problems.

Leadership - we aspire to intellectual, moral, and environmental leadership and to promote environmental responsibility in the university and our communities, local to global.

Diversity/Inclusiveness - we promote and celebrate diversity and open access to education and knowledge and we embrace difference; we value the diverse contributions of the disciplines, cultures, fields and professions that comprise the Faculty; we actively seek participation of groups not well represented in the Faculty, especially the aboriginal people of Manitoba and Canada.

Ethical Practice - we promote ethical practice and integrity in all of our activities and respect for individuals, cultures and ecosystems.

Interdisciplinarity - to understand the complexities of human-environment interactions in all ecological, social, economic, cultural dimensions, we seek to integrate and synthesize knowledge across the disciplines - in the Faculty, University and beyond.

Excellence - we are dedicated to promoting and rewarding excellence in teaching, research and service.

Service/Responsiveness - we seek to identify, respond to, and serve the needs of our students, University, professions and communities - local to global.

Sustainability - we strive to demonstrate our environmental values in all our activities and promote the sustainability of our communities, ecosystems and the Earth.

Innovation - as a new Faculty, we shall adopt responsive and innovative approaches, methods, and technologies in education, curricula, research and service.

Key areas of focus in teaching and research include, inter alia:

- Applied Geography
- Earth Observation Science
- Ecotoxicology and Ecological Risk Assessment
- Lithospheric Geophysics and Environmental Geophysics
- Arctic Systems Science
- Meteorological Atmospheric Science
- Integrated Environmental Management and Policy
- Optics and Spectroscopy of Minerals
- Ecosystem Management and Conservation of Biological Diversity
- Sustainability
- Management of Mining and Energy Extraction
- Common Property Resources
- Environmental Chemistry
- Biogeochemistry
- Fate and Effects of Contaminants in the Environment
- Integrated Water Resources Management
- Natural Disasters and Risk Assessment
- Environmental Impact Assessment
- Crystallography and Mineralogy
- Petrology and Geochemical Evolution of Earth Materials
- Environmental Geochemistry
- Sedimentology and Paleoenvironmental Reconstruction of Glacial Lake Agassiz and Saline Lakes
- Sedimentology and Invertebrate Paleontology of Paleozoic Successions
- Environmental and Natural Resources Policy and Law

In February 2005, the University of Manitoba named the Clayton H. Riddell Faculty of Environment, Earth, and Resources in honour of Dr. Clayton Riddell, a prominent University of Manitoba graduate, entrepreneur, and exploration geologist. In addition to being a distinguished graduate of the Department of Geological Sciences, an Honorary degree recipient in 2004, and a long-time friend and supporter of the University, Dr. Riddell made a $10-million gift to the University of Manitoba to create an endowment fund to ensure the success of this Faculty. The $10-million endowment fund will provide significant support for long-term planning, including funding to recruit and retain top quality faculty members; offer research grants to leverage funding from national granting bodies; develop new areas of curriculum and course delivery; and establish scholarships for outstanding undergraduate and graduate students.

This Faculty is the choice for students who are concerned about the environment in all of its facets from learning about the history of the Earth, to the interaction of human and natural systems, to understanding and acting upon environmental problems, to communicating the importance of 'Environment' to all members of our World. The Clayton H. Riddell Faculty of Environment, Earth, and Resources is a truly exciting, innovative and forward-thinking place, and is home to outstanding teachers, courses, and cutting-edge research. Teaching, research, extension, and learning take place on- and off-campus, and may include activities in places like the High Arctic, Churchill, Delta Marsh, Star Lake, Vancouver Island, Labrador, the United States, India, Dominica, or New Zealand. We believe in practical, hands-on education, focusing on current issues and problems, and we immerse our students into the world of the working environmental professional through courses, cooperative education programs, fieldwork and extensive partnerships.
SECTION 2: Admission to the Clayton H. Riddell Faculty of Environment, Earth, and Resources

2.1 Admission from University 1

Most students newly admitted from high school and those who have completed less than 24 credit hours at another post-secondary institution will complete the first year of their degree program in University 1. In University 1, students will select courses from a wide variety of offerings in Facilities across campus. For information about University 1, see the chapter on University 1 in this Calendar.

University 1 students are encouraged to apply for admission to a degree program in the Clayton H. Riddell Faculty of Environment, Earth, and Resources once they have completed 24 credit hours of course work and have met the minimum entrance requirements of their intended degree program. Students must apply to be considered eligible for admission to the Faculty. Application information is available from the Admissions Office, Enrolment Services, 424 University Centre. This information is also available in the Faculty general office, 440 Wallace Building, and is posted on the University’s website (www.umanitoba.ca/admissions).

Faculty admission is determined on the basis of a 2.00 Grade Point Average on a minimum of 24 credit hours of course work from a recognized institution. Note: For students completing the Bachelor of Arts in Geography entry, based on a Degree Standards Table found in section 5.2.2 in this chapter.

Degree programs may define additional entrance requirements and students are referred to the appropriate section of this Chapter for further details as follows:

Section 5: Bachelor of Arts in Geography Degree Regulations and Program Description.

Section 6: Bachelor of Science in Physical Geography Degree Regulations and Program Description.

Section 7: Bachelor of Environmental Science and Bachelor of Environmental Studies Degree Regulations and Program Descriptions.

Section 8: Bachelor of Science in Geological Sciences (Geology and Geophysics) Degree Regulations and Program Descriptions.

2.2 External Transfer Students

Students applying for admission from other recognized universities or colleges are called “external transfers”. For the University of Manitoba’s general policy on external transfer students and advanced standing, see the chapter on Admission to the University of Manitoba in this Calendar.

To be eligible for admission to the Clayton H. Riddell Faculty of Environment, Earth, and Resources, external transfer students must have completed no fewer than 24 credit hours of university level course work and satisfied the minimum performance requirements of the intended degree program. External transfer students who have completed less than 24 credit hours must register in University 1 or Extended Education to complete the required credit hours of course work. Students with more than 24 credit hours who are not admissible to this Faculty should consider applying to the Faculties of Arts or Science or Extended Education as their alternative choice.

Students on academic suspension as a result of work completed at another post-secondary institution will not normally be considered for admission to the Clayton H. Riddell Faculty of Environment, Earth, and Resources until the suspension has been served.

Transfer of Credit

Internal: Refer to the General Academic Regulations and Policy, Transfer of Credit in this Calendar for further information.

External: See the Admissions section of this Calendar. Courses completed at an external institution ten years prior to registration in the Clayton H. Riddell Faculty of Environment, Earth, and Resources are not considered for transfer credit. Students should contact a student advisor regarding transfer credit policies.

2.3 Visiting Students

Visiting students may apply for admission to the Clayton H. Riddell Faculty of Environment, Earth, and Resources on the basis of a Letter of Permission from the registrant or appropriate Dean of his/her home institution. Certain restrictions may be placed on the kind and number of courses in which a student will be allowed to register. Visiting students may wish to contact the Faculty student advisor in the Faculty general office for further information.

2.4 Second Degree Students

Students possessing a first degree from a recognized university program are eligible for admission as a Second Degree student provided they attained a minimum cumulative Grade Point Average of 2.00 on their first degree.

Second Degree requirements may be shortened by up to 60 credit hours and, once admitted, students will be expected to satisfy all continuation and graduation requirements in the degree program. Second Degree students are not required to satisfy the University written English and mathematics requirement. Specific information on degree requirements following completion of the first degree is available in the Faculty general office.

2.5 Special Students

A Special Student is someone who is not a regular student proceeding towards a degree and is permitted by the Associate Dean (Academic) to take courses of interest.

After Degree Special Student

Students who have successfully completed a first degree from a recognized university program with a cumulative Grade Point Average of 2.00 or better are eligible for admission as Special Students.

Undergraduate Special Student

Undergraduate students in the Faculty may take extra courses as Special Students but these courses do not count towards the degree or in the determination of the Grade Point Average. The marks will appear on the student’s history and courses taken as a Special Student will count in the student’s term load. Students may change their course classification from that of a Regular Student to a Special Student (and vice versa) only until the end of the registration revision period. Courses classified as special do not have to be courses that are acceptable for credit in the Faculty, however, registration in such courses cannot be authorized without the written permission of the department and Faculty offering the course.

2.6 Auditing Students

Students who wish to audit courses must have written permission from the instructor of the desired course before they can register. Auditing students must register in-person in the Faculty general office. The Clayton H. Riddell Faculty of Environment, Earth, and Resources prohibits auditors from registering in courses until after the initial access period.

SECTION 3: Degree Regulations Applicable to all Programs in the Clayton H. Riddell Faculty of Environment, Earth, and Resources

The Clayton H. Riddell Faculty of Environment, Earth, and Resources offers degree programs in Environmental Science, Environmental Studies, Geography, Physical Geography, Geological Sciences, Geology, and Geophysics. All students are advised to examine their interests and future goals carefully to make appropriate program choices. Consultation with Faculty student advisors and/or department representatives is strongly encouraged.

3.1 Degrees Offered

Geography

Bachelor of Arts in Geography

Minimum time to graduation: Three years (University 1, plus two years). This degree is also called the General program. There is no time limit to complete the degree.
Bachelor of Arts in Geography (Advanced)
Minimum time to graduation: Four years (University 1, plus three years). There is no time limit to complete the degree.

Bachelor of Arts in Geography (Honours)
Minimum time to graduation: Four years (University 1, plus three years). There is no time limit to complete the degree.

Physical Geography
Bachelor of Science in Physical Geography (Major)
Minimum time to graduation: Four years (University 1, plus three years). There is no time limit to complete the degree.

Bachelor of Science in Physical Geography (Major Coop)
Minimum time to graduation: Four years (University 1, plus three years). There is no time limit to complete the degree.

Bachelor of Science in Physical Geography (Honours)
Minimum time to graduation: Four years (University 1, plus three years). There is no time limit to complete the degree.

Bachelor of Science in Physical Geography (Honours Coop)
Minimum time to graduation: Four years (University 1, plus three years). There is no time limit to complete the degree.

Environmental Science
Bachelor of Environmental Science
Minimum time to graduation: Three years (University 1, plus two years). This degree is also called the General program. There is no time limit to complete the degree.

Bachelor of Environmental Science (Major)
Minimum time to graduation: Four years (University 1, plus three years). There is no time limit to complete the degree.

Bachelor of Environmental Science (Major Coop)
Minimum time to graduation: Four years (University 1, plus three years). There is no time limit to complete the degree.

Bachelor of Environmental Science (Honours)
Minimum time to graduation: Four years (University 1, plus three years). There is no time limit to complete the degree.

Bachelor of Environmental Science (Honours Coop)
Minimum time to graduation: Four years (University 1, plus three years). There is no time limit to complete the degree.

Environmental Studies
Bachelor of Environmental Studies
Minimum time to graduation: Three years (University 1, plus two years). This degree is also called the General program. There is no time limit to complete the degree.

Bachelor of Environmental Studies (Major)
Minimum time to graduation: Four years (University 1, plus three years). There is no time limit to complete the degree.

Bachelor of Environmental Studies (Major Coop)
Minimum time to graduation: Four years (University 1, plus three years). There is no time limit to complete the degree.

Bachelor of Environmental Studies (Honours)
Minimum time to graduation: Four years (University 1, plus three years). There is no time limit to complete the degree.

Bachelor of Environmental Studies (Honours Coop)
Minimum time to graduation: Four years (University 1, plus three years). There is no time limit to complete the degree.

Geological Sciences
Bachelor of Science in Geological Sciences
Minimum time to graduation: Three years (University 1, plus two years). This degree is also called the General program. There is no time limit to complete the degree.

Geology
Bachelor of Science in Geological Sciences - Geology (Major)
Minimum time to graduation: Four years (University 1, plus three years). There is no time limit to complete the degree.

Bachelor of Science in Geological Sciences - Geology (Honours)
Minimum time to graduation: Four years (University 1, plus three years). There is an eight-year time limit to complete the degree.

Geophysics
Bachelor of Science in Geological Sciences - Geophysics (Major)
Minimum time to graduation: Four years (University 1, plus three years). There is no time limit to complete the degree.

Bachelor of Science in Geological Sciences - Geophysics (Honours)
Minimum time to graduation: Four years (University 1, plus three years). There is an eight-year time limit to complete the degree.

Reminder
It is the student’s responsibility to ensure that degree requirements are met. Faculty student advisors are available to clarify faculty and university regulations and degree requirements. A final and thorough program check is done after students have registered for their last year or course. The Clayton H. Riddell Faculty of Environment, Earth, and Resources is not responsible for those students who do not satisfy degree requirements.

The provision of the chapter, General Academic Regulations and Requirements, and the chapter, University Policies in this Calendar, apply to all students. In addition, the Faculty has regulations and requirements, published below, that apply specifically to our students.

3.2 Courses Offered in Other Faculties and Schools Acceptable for Credit in the Clayton H. Riddell Faculty of Environment, Earth, and Resources
Students who are registered in the Clayton H. Riddell Faculty of Environment, Earth, and Resources may take any course offered by another faculty or school for credit towards their degree, subject to permission from the department head (or designate) and/or the Faculty student advisor.

3.3 Available Minors in Departments and Faculties
Students in the Major and Honours degree programs in the B.Env.Sc., B.Env.St., B.Sc. Geological Sciences and B.Sc. Physical Geography may, if they wish, declare and complete a Minor from departments and interdisciplinary programs in which a Minor is offered. Students registered in the B.A. Geography (General; Advanced) and B.Sc. Geological Sciences (General) are required to complete a minor prior to graduation. Students may not, however, declare both their Major and Minor from the same subject area. It should be noted that for Honours students any consideration of completing a Minor should be made early due to restricted opportunities in later years in their programs.

A Minor will normally consist of at least 18 credit hours, with a minimum of 12 credit hours being at the 2000-, 3000-, and 4000-levels (although there are some exceptions). It should be noted that no course can be used as part of a prescribed Honours or Major program and also be part of a prescribed Minor. An alternate course will have to be selected to satisfy the Minor requirement. For example: if a course in Economics is part of the student’s Major or Honours program in B.Env.Sc., then that course may not be used as part of a Minor in Economics.

3.4 University Written English and Mathematics Requirement
Students are required to complete the University written English and Mathematics requirement as outlined in the chapter, General Academic Regulations and Requirements of this Calendar. It is recommended that students complete these requirements while in University 1 or in Year 2 of their program.

A list of all courses that satisfy the written English and Mathematics requirements also appears in Appendix A of the chapter, General Academic Regulations and Requirements of this Calendar. Course numbers of designated written English courses are marked with a ‘W’ and designated mathematics courses are marked with an ‘M’. Students may wish to consider GEOL
3.5 University 1 Requirements of Faculty of Arts and Faculty of Science Courses

Students are required to take 6 credit hours from the Faculty of Arts, 6 credit hours from the Faculty of Science, and 6 credit hours from the Clayton H. Riddell Faculty of Environment, Earth, and Resources or the Faculty of Science or the Faculty of Arts. See the chapter University 1 for further details.

3.6 Changes in Program Requirements

Once students have successfully completed any portion of a degree program, they will not be required to meet new course requirements subsequently stipulated for that portion of the program, whether the requirements be for the Faculty or for an individual degree program. Students are required to complete their program in its entirety as outlined in the Calendar effective upon the point of admission to the Faculty and program.

3.7 Prerequisite, Corequisite, Recommended Courses and Course Availability: Definitions

Prerequisite: If a course is prerequisite to a second course, the prerequisite must be met in order to continue in the second course. The department giving the second course may require a minimum grade of ‘C’ in the first course to register in the second course. All courses offered by the Clayton H. Riddell Faculty of Environment, Earth, and Resources stipulate a grade of ‘C’ in the prerequisite course(s), unless waived by the department head.

Some prerequisite courses may be taken concurrently. In this instance, the course description will indicate that a specific course is a pre- or corequisite for the course in which you wish to register. If you have not previously taken the course, you may register for it in the same term.

Recommended: If a course is strongly recommended relative to other courses in a program, a student is advised to take it. The final decision as to whether or not to take the course rests with the student. Students are advised to consult with their department head (or designate) or the Faculty student advisor in the general office for guidance.

NOTES: Students who are allowed to enroll in courses or programs provisionally pending satisfactory completion of pre- or corequisites must, if unsuccessful, withdraw or amend their registration accordingly within the stipulated course revision deadline. Those students who do not may be withdrawn automatically and may relinquish the opportunity to add appropriate courses.

Any prerequisite, prerequisite or concurrent requirement or corequisite may be waived with written consent of the department head or designate.

Course Availability: All courses listed in this Calendar are not offered every year. The course(s) offered for the current academic term are published in the online undergraduate calendar (www.umanitoba.ca/calendar). The Department of Environment and Geography offer numerous courses under the following course numbers: GEOG 3770 Special Topics in Geography (3), GEOG 4670 Selected Issues (3), GEOG 3740 Field Studies in Geography (6), GEOG 3750 Field Studies in Geography (3), GEOG 3760 Special Topics in Geography (6), ENVR 2010 Field Topics in Environment (1.5), ENVR 2020 Extended Field Topics in Environment (3), ENVR 3000 Multidisciplinary Topics in Environmental Science (3), ENVR 3010 Field Topics in Environmental Science 1 (1.5), ENVR 3020 Extended Field Topics in Environmental Science 1 (3), ENVR 4000 Multidisciplinary Topics in Environmental Science (3), ENVR 4010 Field Topics in Environmental Science 2 (1.5), and ENVR 4020 Extended Field Topics in Environmental Science 2 (3). Students are referred to the Department of Environment and Geography and the online calendar for current information.

3.8 Repeated Courses and Attempted Credit Hours

Clayton H. Riddell Faculty of Environment, Earth, and Resources students are subject to the University of Manitoba General Academic Regulations and Policy, Repeating a Course as described in this Calendar. Each grade received for a repeated course will appear on the transcript with only the last attempt included in the calculation of the cumulative and degree Grade Point Average, unless otherwise stipulated by the degree program.

Students may not repeat a course more than once unless approved by the Faculty Student Appeals and Discipline Committee.

There is no limit to the number of credit hours permitted in the degree programs in the Faculty provided a student does not exceed the credit hour limit of failed and/or repeated courses stated for specific programs.

Degree programs may define additional requirements regarding repeated courses and attempted credit hours and students are referred to the appropriate section of this Chapter for further details as follows:

Section 5: Bachelor of Arts in Geography Degree Regulations and Program Description.

Section 6: Bachelor of Science in Physical Geography Degree Regulations and Program Description.

Section 7: Bachelor of Environmental Science and Bachelor of Environmental Studies Degree Regulations and Program Descriptions.

Section 8: Bachelor of Science in Geological Sciences Degree Regulations and Program Descriptions

3.9 Voluntary Withdrawals

The responsibility for initiating withdrawals rests solely with the student. When eligible to do so, Voluntary Withdrawals must be done through Aurora Student, otherwise withdrawals must be authorized first by the Faculty general office and then through the Registrar’s Office. No withdrawals will be permitted after the deadlines posted in the Academic Schedule.

3.10 Authorized Withdrawals

Subject to the provision of satisfactory documentation to the Faculty student advisor in the Faculty general office, Authorized Withdrawals (AWS) may be permitted on medical or compassionate grounds.

3.11 Residence Requirement

Students are required to complete a minimum number of credit hours at the University of Manitoba. Students should refer to their degree program in the appropriate section 5, 6, 7, or 8 of this chapter for further information. The courses used to satisfy the residence requirement must be acceptable for credit by the degree program in the Clayton H. Riddell Faculty of Environment, Earth, and Resources. Residence requirements apply to both first and second degree students.

3.12 Letter of Permission to Take Courses at Another University

Students wishing to complete courses at another institution for credit at this university must obtain written permission from the Registrar’s Office prior to registering at the other institution or no credit will be permitted. Any earned grades are transferred and form part of the degree Grade Point Average, when applicable. Students who register for courses elsewhere without a Letter of Permission must reapply to the Faculty.

Students who are on academic suspension may not elect courses at another institution for credit toward an Environment, Earth, and Resources degree at this university.

Attendance at Other Institutions

Students who attend other post-secondary institutions without a Letter of Permission must reapply for admission to the Faculty before the application deadline and be academically competitive for admission. Similarly, students registered in the Clayton H. Riddell Faculty of Environment, Earth, and Resources may not be registered at another academic institution at the same time unless they are registered elsewhere on a Letter of Permission. The penalty for unauthorized or undisclosed attendance may be disciplinary withdrawal or academic suspension.
3.13 Dean’s Honour List and Graduating with Distinction or First Class Honours

Dean’s Honour List

A student’s eligibility for the Dean’s Honour List designation is evaluated after each term.

To qualify for the Dean’s Honour List, a student must complete a minimum of 12 credit hours in a term and achieve a term Grade Point Average as specified by the degree program. Where the degree program specifies a minimum number of credit hours in an academic term in excess of this, the assessment for Dean’s Honour List shall be based on completion of at least 80 per cent of the workload. The Dean’s Honour List designation will appear on the student’s transcript of marks. Students should refer to their degree program in section 5, 6, 7, or 8 for further information.

With Distinction

To obtain a Degree with Distinction, a student must achieve a minimum degree Grade Point Average as specified by the degree program calculated on the basis of a minimum number of credit hours of course work. Students should refer to their degree program in section 5, 6, 7, or 8 of this chapter for further information.

The term ‘Degree with Distinction’ will appear both on the parchment and on the student’s transcript of marks.

First Class Honours

To graduate with First Class Honours, a student must achieve a minimum degree Grade Point Average as specified by the degree program calculated on the basis of a minimum number of credit hours of course work. Students should refer to their degree program in section 5, 6, 7, or 8 of this chapter for further information.

The term ‘First Class Honours’ will appear both on the parchment and on the student’s transcript of marks.

3.14 Academic Warning, Probation and Academic Suspension

Assessment will take place after each term only if a student completes more than 4.0 credit hours in any given term.

Students will receive an academic warning if, at the point of assessment following a term, he/she fails to achieve the required minimum performance level. The notation ‘Academic Warning’ will be recorded on the student’s transcript of marks.

While on academic warning, students in the Faculty are permitted to register for two additional terms up to a maximum of 30 credit hours to attain the minimum performance requirements. Those who fail to meet this standard will be placed on probation for the next two terms of registration. The notation ‘On Probation’ will be recorded on the student’s transcript of marks.

While on probation, students are permitted to register for two additional terms up to a maximum of 30 credit hours to attain the minimum performance requirements. Those who fail to meet this standard will be placed on academic suspension for one year. The notation, ‘Academic Suspension for One Year’ will be recorded on the student’s transcript of marks. A student placed on academic suspension is not allowed to register in the Clayton H. Riddell Faculty of Environment, Earth, and Resources during the duration of the suspension.

A student will be placed on academic suspension for two years under the following circumstances:

- Upon return from one year suspension, the student fails to attain a 2.00 degree grade point average in the following two terms after the probationary assessment (see the Faculty student advisor for information).
- The Faculty calculates that it is mathematically impossible for the student to clear his/her probationary standing by the following assessment period.
- The student exceeds the maximum number of credit hours of failed and/or repeated courses.

The notation, ‘Academic Suspension for Two Years’, will be recorded on the student’s transcript of marks. Those serving two-year suspensions are required to start the degree afresh should they choose to return to the Clayton H. Riddell Faculty of Environment, Earth, and Resources. Students may appeal for transfer of credit up to 30 credit hours in courses in which a minimum grade of ‘C’ was achieved.

Students should consult with a Faculty student advisor for further assistance in clearing their academic warning, probation or suspension.

3.15 Academic Dishonesty

Academic dishonesty is intentional cheating, fabrication, impersonation, or plagiarism. It is also knowingly helping or attempting to help others to be dishonest. Academic dishonesty lowers scholastic quality and defrauds others who will eventually depend on their own knowledge and integrity.

Plagiarism or any other form of cheating on examinations, term tests, or assignments is subject to academic penalty as serious as suspension or expulsion from the Faculty or University.

Students who are unsure of what constitutes academic dishonesty should refer to the regulations in the chapter, General Academic Regulations and Policy, Plagiarism and Cheating in this Calendar and consult with your professor or instructor.

3.16 Termwork and Debarment

A student is responsible for the completion of laboratory work, assignments, tests and other class work as prescribed by the course syllabus. A student who does not meet termwork requirements to the satisfaction of the Associate Dean (Academic) will receive a warning to this effect. If this warning is ignored, a student may be debarred from the course. Any student debarred from a course receives an automatic grade of ‘F’ in that course.

3.17 Deferred Examinations

A student who is unable to write a final examination because of illness or other incapacity or compassionate reasons must file an application for deferred examination in the Clayton H. Riddell Faculty of Environment, Earth, and Resources general office. The application must be filed within seven working days of the last examination that the student is scheduled to write in that series. Appropriate documentation must be provided that verifies the incapacity existed at the time the examination was to be written.

A deferred examination is offered in a manner prescribed by the department concerned. This is normally written within 30 working days of the last examination in that series.

Students requesting deferred examinations on the grounds that the examinations conflict with vacation or holiday plans shall not be granted deferrals.

A deferred examination is not normally granted to a student who has written the final examination.

3.18 Challenge for Credit

Any student wishing to challenge a course for credit should contact the Clayton H. Riddell Faculty of Environment, Earth, and Resources general office.

3.19 Appeals Involving Academic Regulations

The Committee on Student Appeals and Discipline in the Faculty considers appeals from students who request special consideration with respect to the rules and regulations governing their degree program and qualifications for graduation.

Appeals should be addressed to: Student Advisor, Secretary, Committee on Student Appeals and Discipline, General Office, Clayton H. Riddell Faculty of Environment, Earth, and Resources, 440 Wallace Building.

3.20 Incidental Fees

Incidental fees are assessed for some courses. This information is available in the department offices as well as the Clayton H. Riddell Faculty of Environment, Earth, and Resources general office, 440 Wallace Building.

3.21 Student Advisor Office Hours

Monday through Friday: 9:00 a.m. to 4:00 p.m.

Evening appointments: In exceptional cases, evening appointments can be arranged.

Program Information Sessions: Contact the Faculty general office for dates and times.
3.22 Student Responsibility

It is your responsibility to be familiar with the regulations, course and graduation requirements of your degree program. You are advised to review the appropriate sections of this Calendar carefully when selecting your courses to ensure compliance with degree program requirements. If you are not sure of how regulations and requirements apply to your case, please consult your Faculty student advisor. Since a complete graduation check is not done until you have indicated your intention to graduate, you are encouraged to make an appointment with your Faculty student advisor prior to your initial registration access date to confirm you are meeting the degree requirements. Ultimately you are responsible to ensure compliance with degree program requirements.

Note: While we welcome the opportunity to assist you, it is important for you to realize that it is your responsibility to be familiar with university and Faculty academic regulations and registration procedures as they are described in this publication.

3.23 Maximum Number of Courses During a Term

You may attempt a maximum of 15 credit hours in any one term unless otherwise stipulated by your program. If you wish to exceed the normal load you may apply in-person at the Faculty General Office, or complete the form available on the Faculty web page. (www.umanitoba.ca/environment)

3.24 Course Space Availability

The initial registration access time is based on academic performance from the Fall and/or Winter terms; therefore, space in all courses is available on the system from the beginning of the registration period for Fall and Winter terms.

3.25 Registration

Before the initial access begins

- Review your program requirements as outlined in the appropriate section of this Calendar and see a Faculty student advisor.
- Obtain written approvals, including Major, Advanced, and Honours forms, prerequisite waivers, course and term overloads, etc., and deliver them to the general office to ensure that they are programmed into your academic record. You should consult with a Faculty student advisor for final approval.
- Know your registration time. See above for information and review the registration instructions in the chapter, the Aurora Student Registration System.

What Aurora Student cannot do:

Aurora Student will not check degree requirements. You are responsible for knowing the requirements of your degree. Consult a Faculty student advisor for advice and assistance if degree requirements are unclear. You cannot add or change a course classification through Aurora Student. Therefore, if you are an undergraduate student and wish to take a course as a Special Student, as an Auditor, or as Challenge for Credit, you must add this course in-person in the Faculty general office within the normal deadlines for such activity.

3.26 Interfaculty Option in Aging

Students in the B. Env. Sc., B. Env. St. and B.A. in Geography program may, if they wish, declare and complete the Option in Aging.

The Option in Aging spans six faculties, each of which offers its own specialized and targeted courses on aging. It is an opportunity to expand a student’s area of study into several faculties, classrooms and learning experiences, giving a diverse and well-rounded educational experience.

To complete the Option, Clayton H. Riddell Faculty of Environment, Earth, and Resources students will need to complete the following courses, for a total of 18 credit hours of aging-related course work.

1) Two required courses of all students in the Option in Aging:
   a. KIN /NURS 2610 Health and Physical Aspects of Aging (3 credits hours)
   b. HMEC/REC 5260 Social Aspects of Aging (3 credits hours)

2) Two courses required of all Clayton H. Riddell Faculty of Environment, Earth, and Resources students in the Option in Aging:
   a. GEOG 4710 Geography of the Elderly and Aging (3 credit hours)
   b. GEOG 4290 Geographies of Health and Health Care (3 credit hours)

3) An additional 6 credit hours of aging-related course work from any of the other faculties participating in the Option. This includes units in the Faculties of:
   - Arts
   - Human Ecology
   - Nursing
   - Kinesiology and Recreation Management
   - Social Work

Students are encouraged to meet with a student advisor to select aging-related courses from other units. They may also find guidance on the Option in Aging website (www.umanitoba.ca/option_in_aging).

Upon completion of these requirements, a ‘notation’ will be added to the student’s transcript indicating they have completed the Option in Aging.

SECTION 4: Department of Environment and Geography

Department Head

Contact Information

General Office: 211 Isbister Building
Telephone: (204) 474-9081
Fax: (204) 474-7699
Website: www.umanitoba.ca/environment
Email: envirogeog@umanitoba.ca

4.1 Academic Staff

Distinguished Professor

Smil, V., M.S. (Prague), Ph.D. (Pennsylvania State), F.R.S.C.

Senior Scholars

Brierley, J.S., B.A. (Victoria), Dip.Ed. (Oxford), M.A. (Alberta), Ph.D. (Edinburgh); Dahlgren, W., BPE, M.A.(Alberta), Ph.D. (Manitoba); Foster, R.H., B.A. (Berkley), M.A. (San Francisco State), Ph.D. (Berkeley); Tiwari, R.C., M.A. (Agra), Ph.D. (Reading).

Professors


Associate Professors

Benbow, S.M.P., B.A.(Hons.), Ph.D. (Liverpool); Hallman, B.C., B.A., M.A., Ph.D. (Guelph); Hanesiak, J.M., B.Sc. (Winnipeg), M.Sc. (York), Ph.D. (McMaster); McNichol, S.M., B.Sc. (Hons.) (McMaster), M.Sc. (Guelph), Ph.D. (York); Papakriou, T.N., B.Sc. (McMaster), M.Sc. (Queens), Ph.D. (Waterloo); Wang, F., B.Sc. (Wuhan), Ph.D. (Peking).

Assistant Professors

Hanson, M.L., B.Sc.(Hons) (Toronto), Ph.D. (Guelph); Walker, D.J., B.Sc.(Hons), M.Sc., Ph.D. (Manitoba).

Instructors

Hunter, K., B.Sc. (Manitoba) (Instructor II); Iaccozza, J., B.Sc. (McMaster), M.A. (Manitoba) (Instructor II); Kaktins, S.L., B.Sc. (Hons.) (Brandon); M.Env.Studies (Dalhousie).

4.2 Undergraduate Programming in the Department of Environment and Geography

The fields of study in this department can be divided into four overlapping areas: environmental sciences, environmental studies, human geography and physical geography. These areas are built on a diverse range of academic frameworks or foundations, including: natural, physical and social sciences, education, law, agriculture, management, medicine, humanities and architecture.

Environmental Science applies scientific knowledge from many disciplines to issues and questions relating to an increasing human population, the
sustainability of resource use, degradation caused by pollution and disturbance, and the endangerment and extinction of species and natural systems. Environmental Studies applies the theory and practice of group and organizational communication, understanding public policies and programs that underscore environmental concerns, and the need to integrate diverse social, institutional, political and legal considerations inherent in attaining environmental objectives. (Students have the opportunity to focus advanced studies in one of several areas, defined through consultation with the Faculty student advisor.)

“Human Geography examines how people have been influenced by the environment and how, in turn, they have left their mark on the environment,” Dr. Daniel Todd, Human Geographer. Students may choose to focus their studies into one of several areas including Human-Environment Relations, Urban and Rural Development, Social Cultural Geography, Population, Resources and Development, and Area Studies.

Areas of physical geography include the study of the environment through aspects of atmospheric science, geomatics, biogeography, and hydrology. Streams are currently available in Atmospheric and Hydrological Sciences, Geomatics (an emerging subfield, referring to the techniques of spatial data acquisition, handling and analysis) and Physical Geography.

Potential careers for graduates of these programs include a diverse array of possibilities in the natural sciences, social sciences, or a combination of both. Graduates are poised to assume positions where they identify and analyze the local, regional, national, and global patterns that shape our lives. As well, technical skills such as geographic information systems and remote sensing are demanded in several of the environmental sectors. Graduates of these programs can expect to enter the workforce in private, government, research, or not-for-profit sectors.

SECTION 5: Bachelor of Arts in Geography Degree Regulations and Program Description

Department Head Contact Information
General Office: 211 Ibister Building
Telephone: (204) 474-9081
Fax: (204) 474-7699
Website: www.umanitoba.ca/environment/envirogeog/
Email: envirogeog@umanitoba.ca

5.1 Program Information

There are four broad categories of courses in the Geography discipline: physical geography is concerned with physical features on and over the globe; human geography examines the products of human activity; regional geography attempts to achieve a synthesis of physical and human geography of a particular place; and techniques in geography focus on analytical methods.

The attraction of Geography as a discipline lies in its diverse interests and approaches to knowledge building while being centred on the fundamental concepts of human-environment relations, location/place and space/distance. Geographers see the world and want to know how physical processes and systems shape the land, air, water, flora and fauna around them and how these are influenced by human activity. We want to know how human societies, cultures, and economies work and how these human systems are interdependent with each other and with natural systems. We work at a variety of geographic scales, from the micro-scale of local communities and regions, through the macro-scale of global human and physical systems. Geography embraces the study of topics as wide-ranging as: weather and climate, population distribution, agricultural systems, globalisation, landforms and geomorphology, environmental perceptions, health and healthcare, and biogeography. Therefore, by selecting courses from within the department, as well as complementary courses from other academic units of the University, students can develop fascinating, focused and challenging degree programs that will prepare them for careers in a variety of areas.

The General degree in Geography provides students with a basic level of understanding of the discipline and its inter-relationships. This degree is also a useful consideration for students planning to complete the After-Degree Bachelor of Education program (see Faculty of Education chapter of this Calendar). The General degree program may be completed entirely by Distance Education (see the Distance Education Guide for further details). The Advanced degree program in Geography provides opportunities for students who desire a broad geographical education along with a reasonable degree of specialization in a particular field of Geography. Students planning a professional career or a high degree of specialization in Geography are strongly advised to enter the Honours degree program. The Honours degree demands the highest scholastic performance of all programs available. Students are strongly advised to enter an Honours degree program with their admission to the Bachelor of Arts in Geography. Consultation with the department head is also advised.

Structure of the B.A. Geography Degree Program

The structure of the B.A. Geography degree is summarized as follows:

A Geography (Major) component that varies in credit hour requirement depending on the degree program; 30 credit hours in the General; 54 credit hours in the Advanced; and 72 credit hours in the Honours. Students are not permitted to declare a second major.

Advanced and General degree students must complete a minor of 18 credit hours from a department recognized by the Faculty. Students can declare only one minor and this can be chosen from one of the other programs in the Clayton H. Riddell Faculty of Environment, Earth, and Resources, a department in the Faculty of Arts, Faculty of Science, or the minor available through the Faculty of Human Ecology, School of Art, the Faculty of Music or the I.H. Asper School of Business [Management minor]. Entry to the Management minor consists of any 18 credit hours in courses offered by the Asper School of Business. Enrolment in this program is limited. Students must attain a grade of 'C' or better in the minor prerequisite course(s).

Students must complete 5 subject fields with 6 credit hours in each (30 credit hours). For example: 6 credit hours in Geography, plus 6 credit hours in Environmental Science, plus 6 credit hours in Geological Sciences, plus 6 credit hours in Anthropology, plus 6 credit hours in Native Studies.

Students must also complete 6 credit hours in Humanities and 6 credit hours offered by the Faculty of Science. Note: Students can satisfy both a Humanity (or Science) and one of the 5 subject fields required with the same 6 credit hours of courses.

Humanities

Course subjects taught by the Faculty of Arts that can be applied to the Humanities requirement include: Asian Studies, Canadian Studies, Catholic Studies, Classical Studies, Drama, English, Film Studies, French, German, Greek, History, Icelandic, Italian, Latin, Native Languages, Native Studies, Near Eastern and Judaic Studies, Philosophy, Polish, Religion, Russian, Spanish, Theatre, Ukrainian, and Yiddish. In addition the following courses may be used: Women’s Studies WOMN 1530, WOMN 2530, WOMN 3570, and others including ARTS 1140, ARTS 1150, ARTS 2640 and ARTS 2650. Music and History of Art may also be eligible courses. Students should see the Faculty student advisor for further information.

Sciences

Course subjects offered by the Faculty of Science include: Astronomy, Biology, Botany, Chemistry, Computer Science, Forensics, Mathematics, Microbiology, Physics, Statistics, and Zoology.

The qualifications of the degree programs are summarized as follows:

General

To qualify for the degree Bachelor of Arts in Geography, students must complete 90 credit hours including: all course requirements in their Geography major; a chosen minor field; the requirements in the five subject fields; and areas of Humanities and Sciences. As well, students must satisfy the Faculty regulations outlined in section 3 of this Chapter. Minimum performance requirements include passing grades ('D' or better) in each course and a minimum degree Grade Point Average of 2.00 on Geography courses as well as the 90 credit hours that constitute the degree. Students cannot exceed 48 credit hours of failed and/or repeated courses.

Advanced

To qualify for the Bachelor of Arts in Geography (Advanced) degree, students must complete 120 credit hours including: all courses and performance requirements in their Geography advanced major; a chosen minor field; the requirements in the five subject fields; and areas of Humanities and Sciences. As well, students must satisfy the Faculty regulations outlined in section 3 of this Chapter. Minimum performance requirements include passing grades ('D' or better) in each course and a minimum degree Grade Point Average of 2.00 on Geography courses and the 120 credit
hours which constitute the degree. Students cannot exceed 18 credit hours of failed and/or repeated courses.

Honours

To qualify for the Bachelor of Arts in Geography (Honours) designation, students must complete 120 credit hours including: all course and performance requirements; the requirements in the five subject fields, and the areas of Humanities and Sciences. As well, students must satisfy the Faculty regulations outlined in section 3 of this Chapter. Minimum performance requirements include passing grades (‘D’ or better) in each course and a minimum degree Grade Point Average of 3.00 on Geography courses and the 120 credit hours which constitute the degree. Students cannot exceed 18 credit hours of failed and/or repeated courses.

5.2 Entrance Requirements

Students are required to attain a minimum degree Grade Point Average of 2.00 based on the Degree Standards Table in Section 5.2.2 to be eligible for admission to the B.A. in Geography. Students who are admitted will be placed in the General degree program. Students may be eligible for transfer to either the Advanced or Honours degree program provided they satisfy the entry requirements defined in 5.2.1. To enter the Advanced or Honours degree program, a student must consult with the Faculty student advisor in the Faculty general office.

<table>
<thead>
<tr>
<th>Degree Program in B.A. Geography</th>
<th>Minimum Number of Credit Hours</th>
<th>Minimum Degree Grade Point Average</th>
<th>Maximum Credit Hours of Repeated/Failed courses</th>
<th>Additional Entrance Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>24</td>
<td>2.00</td>
<td>48</td>
<td>grade of ‘C’ in GEOG 1200 (see 5.2.2).</td>
</tr>
<tr>
<td>Advanced</td>
<td>24</td>
<td>2.00</td>
<td>18</td>
<td>grade of ‘B’ in GEOG 1200 (see 5.2.2).</td>
</tr>
<tr>
<td>Honours</td>
<td>24</td>
<td>3.00</td>
<td>18</td>
<td>GPA of 3.00 or better in all Geography courses.</td>
</tr>
</tbody>
</table>

1 Minimum Grade Point Average for entry into the General degree program is determined using the Degree Standards Table in 5.2.2.
2 GEOG 1201 or both GEOG 1281 and GEOG 1291 may be used in lieu of GEOG 1200, or GEOG 1280 and GEOG 1290, respectively.

5.2.2 Grade Point Average Calculation for Entry and Continuation

General degree students in the B.A. Geography must attain a minimum 2.00 Grade Point Average at each point of assessment. The Degree Standards Table listed below is used to determine a student’s eligibility for admission to the Faculty as well as evaluate a student’s performance after each term.

<table>
<thead>
<tr>
<th>Credit hours</th>
<th>Minimum Degree GPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>24-30</td>
<td>1.80</td>
</tr>
<tr>
<td>33-45</td>
<td>1.85</td>
</tr>
<tr>
<td>48-60</td>
<td>1.90</td>
</tr>
<tr>
<td>63-75</td>
<td>1.95</td>
</tr>
<tr>
<td>78-90</td>
<td>2.00</td>
</tr>
<tr>
<td>93+ hours</td>
<td>2.00</td>
</tr>
</tbody>
</table>

5.3 Minimum Performance Requirements

A student’s academic performance is assessed first with his/her application for admission to the Faculty and then following each term in which the student is registered in more than 4.0 credit hours. To be in good standing, permitted to continue in a degree program, a student must achieve the minimum standards outlined for his/her degree program at each point of assessment. For General degree students, this includes the Degree Standards Table outlined above in 5.2.2, as well as the requirements outlined in 5.3.1. Students in the Advanced and Honours degrees are required to satisfy the requirements listed in 5.3.1. Minimum academic performance is based on the degree Grade Point Average and number of repeated and/or failed courses. Prior to each registration, Advanced and Honours degree students must have their course selections approved by the Faculty student advisor. Students may not make any subsequent changes without receiving prior written permission.

To graduate with a B.A. Geography with the intended degree designation, a student must achieve the minimum performance standards and graduation requirements outlined in 5.3.1 following their last term of registration and satisfy all faculty and degree requirements in Geography as defined in sections 5.3.1 and 5.5 of this Chapter.

Students in the Honours and Advanced degree programs who do not meet these minimum performance requirements will be withdrawn from their existing program and placed in the Advanced and General degrees respectively. Students who do not meet the minimum performance requirements for the General degree program will receive an academic warning, be placed on probation or academic suspension as defined in section 3.14 Academic Warning, Probation and Academic Suspension in this Chapter. Students withdrawn from the Honours degree program may be eligible to enter the Advanced program and are required to obtain permission from the Faculty student advisor.

Students withdrawn from the Honours degree program will have the notation, ‘Required to Withdraw from the Honours Program’, recorded on their transcript of marks. Similarly, students withdrawn from the Advanced program will have the notation, ‘Required to Withdraw from the Advanced Program’, recorded on their transcript of marks.

<table>
<thead>
<tr>
<th>Degree Program (Cr.Hrs.)</th>
<th>Minimum Degree Grade Point Average (GPA)</th>
<th>Maximum Cr. Hrs. Failures/Repeated Courses</th>
<th>Minimum Degree GPA in Geography Courses Cr. Hr. Requirement (see 5.5 also)</th>
<th>Geography Courses Cr. Hr. Requirement (see 5.5 also)</th>
<th>Residence Requirement (Cr. Hrs.) (see section 3.10 also)</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>2.00; see 5.2.2 for continuation</td>
<td>48</td>
<td>2.00</td>
<td>30</td>
<td>48 cr. hrs. total or the final 30 cr. hrs.</td>
</tr>
<tr>
<td>Advanced</td>
<td>2.00</td>
<td>18</td>
<td>2.00</td>
<td>54</td>
<td>60</td>
</tr>
<tr>
<td>Honours</td>
<td>3.00</td>
<td>18</td>
<td>3.00</td>
<td>72</td>
<td>60</td>
</tr>
</tbody>
</table>

1 The courses required in this program will satisfy the university mathematics requirement.
2 Within the first 60 credit hours of courses, General degree students must have completed 6 credit hours in each of 5 subject fields (totaling 30 credit hours). See section 5.1 for details.
3 General and Advanced degree students are required to maintain a Degree Grade Point Average of 2.00 on the courses defining their Geography Major.

Note: Students must complete all prerequisite courses with minimum ‘C’ grades.
5.4 Dean's Honour List and Graduating with Distinction or First Class Honours

Dean's Honour List

Students enrolled in a minimum of 12 credit hours of course work during a term and who achieve a term Grade Point Average of 3.50 or higher will be placed on the Dean’s Honour List.

With Distinction

Students graduating with a B.A. Geography (General) degree will have their degree granted 'With Distinction' if they have a minimum degree Grade Point Average of 3.80 and provided a minimum of 90 credit hours of acceptable course work is completed at the University of Manitoba.

Students graduating with a B.A. Geography (Advanced) degree will have their degree granted 'With Distinction' if they have a minimum degree Grade Point Average of 3.80 and provided a minimum of 90 credit hours of acceptable course work is completed at the University of Manitoba.

5.5 B.A. Geography

<table>
<thead>
<tr>
<th>UNIVERSITY 1</th>
<th>YEAR 2</th>
<th>YEAR 3</th>
<th>YEAR 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>HONOURS1</td>
<td>120 CREDIT HOURS (72 credit hours in Geography)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GEOG 1200 (or GEOG 1280 and GEOG 1290)</td>
<td>GEOG 2200, GEOG 2250, GEOG 2530</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plus 6 credit hours from the Faculty of Arts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plus 6 credit hours from the Faculty of Science</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GEOG 3680</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plus 18 credit hours in Geography courses numbered at the 2000- or 3000-level3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 credit hours in ancillary options3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GEOG 4660</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 credit hours in Geography courses numbered at the 4000-level</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 credit hours in ancillary options3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

It is recommended that students complete the W course in University 1 or Year 2

ADVANCED1 | 120 CREDIT HOURS (54 credit hours in Geography) |
| GEOG 1200 (or GEOG 1280 and GEOG 1290) |
| Plus 6 credit hours from the Faculty of Arts |
| Plus 6 credit hours from the Faculty of Science |
| GEOG 2200, GEOG 2250, GEOG 2530 |
| 9 credit hours in Geography courses numbered at the 2000- or 3000-level3 |
| 6 credit hours in ancillary options3 |
| GEOG 3680 |
| Plus 6 credit hours in Geography courses numbered at the 3000-level3 |
| GEOG 4660 |
| 18 credit hours in Geography courses numbered at the 4000-level |
| Plus 6 additional credit hours in Geography at the 2000-level or above |

It is recommended that students complete the W course in University 1 or Year 2

GENERAL | 90 CREDIT HOURS (30 credit hours in Geography) |
| GEOG 1200 (or GEOG 1280 and GEOG 1290) |
| Plus 6 credit hours from the Faculty of Arts |
| Plus 6 credit hours from the Faculty of Science |
| 12 credit hours in Geography courses numbered at the 2000-level3 |
| 12 credit hours in Geography courses numbered at the 3000-level or 4000-level3 |

It is recommended that students complete the W and M courses in University 1 or Year 2. Note: 30 credit hours, with 6 credit hours in each of 5 subject fields, must be completed in the first 60 credit hours.

MINOR | 18 CREDIT HOURS |
| GEOG 1200 (or GEOG 1280 and GEOG 1290) |
| 6 credit hours in Geography courses numbered at the 2000-level |
| 6 credit hours in Geography courses numbered at the 3000-level |

NOTES:

1 Entry into the Honours and Advanced degree programs is summarized in 5.2.1. The courses required in this program will satisfy the university mathematics requirement.

2 Entry into the General degree program is summarized in 5.2.1 and 5.2.2.

3 Ancillary options are chosen in consultation with the department head.

4 Among the 2000- and 3000-level courses, at least 6 credit hours must be systematic and at least 6 must be area studies. Systematic courses and area studies courses are listed in Section 5.6.

5 Among the 2000- and 3000-level courses, at least 12 credit hours must be systematic and at least 6 must be area studies. Systematic courses and area studies courses are listed in Section 5.6. Students wishing to transfer from the General to the Advanced degree program are permitted to take either GEOG 2200 and GEOG 2250, or GEOG 2530 in either third or fourth year.

6 Equivalent courses offered through Collège universitaire de Saint-Boniface may be used in lieu of the specified courses identified in the degree program chart. Collège universitaire de Saint-Boniface courses end in the number "1" (e.g. GEOG 1291).

Note: Honours in Geography may be taken in combination with the program of Central and East European Studies (see the department head). Cross-disciplinary Minor programs are available using GEOG 2490 and GEOG 3590 (Asian Studies program) and GEOG 2350 (Latin American Studies program). In addition, courses GEOG 2450, GEOG 2570, GEOG 3431, GEOG 34806 and GEOG 37006 may be used in combination with the Honours, Advanced, and Minor programs in Canadian Studies.

7 To fulfill prerequisite requirements, a grade of “C” must be achieved, unless otherwise stated, in any course stipulated as a prerequisite to a further course.

8 Students should review the current course topics available through GEOG 3740 (6), GEOG 3750 (3), GEOG 3760 (6), GEOG 3770 (3) and GEOG 4670 (3). Also, all courses are not offered every year or every term. The course schedule for the current academic term is available from the online calendar at www.umanitoba.ca/calendar.

9 Students registering in certain courses may be required to participate in field trips or field components and pay a portion of the associated expenses. For details, contact the Department of Environment and Geography general office.

5.6 Systematic Courses (HS, PS, TS) and Area Studies (A)

Courses numbered at the 2000- and 3000-level are arranged into Systematics (PS, HS and TS) and Area Studies (A). B.A. Geography students may specialize in the Physical Geography (designated by (PS) after the title in the descriptions below); Human Geography (HS); Techniques (TS); Area Studies (A) but it is not compulsory for them to do so. B.A. Geography students wishing to specialize in Physical Geography should take at least three options (18 credit hours) from courses designated 'PS'. B.A. Geography students wishing to specialize in Human Geography should take at
least three options (18 credit hours) from courses designated ‘HS’. Students should discuss these options with the Faculty student advisor.

B.A. Geography students wishing to specialize in Applied Geography should include 2000-level courses from GEOG 2200, GEOG 2210, GEOG 2250, GEOG 2310, GEOG 2410, GEOG 2440, GEOG 2480, GEOG 2510, GEOG 2520, GEOG 2530 and GEOG 2620, and 3000-level courses from GEOG 3200, GEOG 3320, GEOG 3460, GEOG 3480W, GEOG 3510, GEOG 3520, GEOG 3540, GEOG 3580W, GEOG 3680M, GEOG 3710, GEOG 3720 and GEOG 3800.

Physical Geography (PS)
GEOG 2300 Atmosphere, Thermodynamics, Clouds and Precipitation 3
GEOG 2310 Introduction to Process Hydrology 3
GEOG 2440 Geography of Natural Hazards 6
GEOG 2540 Weather and Climate 3
GEOG 2541 Météorologie et climatologie 3
GEOG 2550 Geomorphology 3
GEOG 2551 Géomorphologie 3
GEOG 2620 Geography of Environmental Changes 3
GEOG 3310 Atmospheric Dynamics, Storms and Radar 3
GEOG 3320 Introduction to Microclimates and Micrometeorology 3
GEOG 3411 Géographie de l'eau 3
GEOG 3580W Landforms 3

Human Geography (HS)
GEOG 2210 Economic Geography 6
GEOG 2211 Géographie Économique 6
GEOG 2410 Geography of Tourism and Recreation 6
GEOG 2430 Political Geography 6
GEOG 2480 Population Geography 6
GEOG 2481 Géographie de la population 3
GEOG 2520 Geography of Natural Resources 3
GEOG 2630 Geography of Culture and Environment 3
GEOG 2640 Geography of Culture and Inequality 3
GEOG 2651 Géographie politique 3
GEOG 2661 Géographie politique 2 3
GEOG 3421 L’eau, enjeu géostatistique 3
GEOG 3460 Urban Geography 6
GEOG 3510W Agricultural Geography 6
GEOG 3520 Energy and Society 6
GEOG 3530 An Introduction to Land-Resource Management 6
GEOG 3540 Regional Development Planning Theory and Practice 6
GEOG 3710 Population and the Third World 3
GEOG 3720 Refugees, Displacedes, Exiles 3
GEOG 3800 Geography of Transportation Development 3
GEOG 3821 Les territoires de la francophonie mondiale 3
GEOG 3831 L’espace francophone panaméricain 3
GEOG 3841 Les espaces francophones de l’Afrique, de l’Asie et de l’Océanie 3

Techniques (TS)
GEOG 2200 Introduction to Thematic Cartography 3L
GEOG 2221 Introduction à la cartographie et analyse de la carte numérique 6
GEOG 2250 Introduction to Geographic Information Systems 3L
GEOG 2253 Introduction to Scientific Geographic Research 3
GEOG 3200 Introduction to Remote Sensing 3L
GEOG 3680M Research Methods in Geography 6
GEOG 3730 Geographic Information Systems 3L
GEOG 3740 Field Studies in Geography 6
GEOG 3750 Field Studies in Geography 3

Area Studies (Regional) (A)
GEOG 2350 Latin America 6
GEOG 2450 The Making of the Prairie Landscape 6
GEOG 2460 Geography of Africa 6
GEOG 2490 Geography of Modern China 3
GEOG 2560 Geography of North America 6
GEOG 2570 Geography of Canada 3
GEOG 2580 Geography of the United States 3
GEOG 3431 Géographie du Canada 3
GEOG 3480W Canadian Problems 3
GEOG 3481 Particularités de la Géographie du Canada 3
GEOG 3500 Geography of Europe 6
GEOG 3501 Géographie de l’Europe 6
GEOG 3590 Geography of Developing Countries 6
GEOG 3591 Géographie des pays en voie de développement 6
GEOG 3600 Geography of Ukraine 3
GEOG 3700 Canada: The Making of the Human Landscape 6
GEOG 3701 Canada: Évolution de l’Économie 6
GEOG 3740 Field Studies in Geography 6
GEOG 3750 Field Studies in Geography 3
GEOG 3821 Les territoires de la francophonie mondiale 3
GEOG 3831 L’espace francophone panaméricain 3
GEOG 3841 Les espaces francophones de l’Afrique, de l’Asie et de l’Océanie 3

See Section 6.6 for Geography Course Descriptions (located at the end of the B.Sc. Physical Geography program).

SECTION 6: Bachelor of Science in Physical Geography Degree Regulations and Program Description

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Department General Office: 211 Isbister Building
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Fax: (204) 474-7699
Website: www.umanitoba.ca/environment/envirogeog
Email: envirogeog@umanitoba.ca

6.1 Program Information

Physical geography includes the study of the environment through aspects of atmospheric science, geomorphology, biogeography, and hydrology, all of which draw upon the natural and applied sciences to understand the natural environment. Atmospheric sciences examine the physical and biophysical processes at and near the earth’s surface shaping climate and determining the weather. These processes are examined over cascading scales, local to global. Hydrology studies the flow of water between the Earth’s surface and the atmosphere, including the quantity and quality of water resources as well as the spatial variability in the hydrologic cycle. The examination of processes at the earth’s surface and the associated landforms is called geomorphology. Various sub-disciplines in geomorphology include weathering and erosional processes, volcanoes, glacial and river systems. Biogeography studies the interrelationships between the biospheric environment and the physical environment. Formation of soils, ecosystem and biome cycles and components, as well as human interaction with the physical environment are all topical areas in biogeography.

Geomatics is an emerging field referring to the techniques of spatial data acquisition, handling, and analysis. Included within this field have been geographic applications of computer analysis and spatial modeling, spatial statistics, remote sensing technology, and geographic information systems. Many of these techniques have their origins in the applied sciences, but both physical and human geographers have contributed greatly to their development and application. The application of such methodologies in geographic fields, such as resource management, urban geography, climate change, and applied geography has also provided closer co-operation between human and physical geography, as well as promoting considerable interdisciplinary research with other University disciplines.

The Major and Honours B.Sc. degree programs in Physical Geography serve students who desire advanced study in the academic subject matter of various themes contained within Physical Geography. The Honours program in particular is intended for students interested in the opportunity for exposure to advanced geographic research. As such, the Honours program demands higher academic performance. Students who are ineligible to enter Honours in their second year may establish this in the following year on the basis of their improved scholastic performance. The degree programs may be pursued on a full or part-time basis.

Minor in Another Department

Students in the B.Sc. Physical Geography have the opportunity to complete a Minor of 18 credit hours from a department offering this option at the University of Manitoba. Students are not permitted, however, to complete this Minor in the B.A. Geography. Students can declare only one Minor. The Minor requirements are described in section 3.3 of this Chapter. Contact the Faculty student advisor in the Faculty general office for further information about eligible Minors.
Streams

Students are required to complete a stream approved by the Faculty student advisor. Students in the Major or Major (Coop) programs are required to complete a minimum of 30 credit hours of 2000- (or higher) level courses, of which at least 18 credit hours must be at or above the 3000-level. The B.Sc. Honours and Honours (Coop) programs require students to complete 39 credit hours in a Stream, of which at least 24 credit hours are defined at or above the 3000-level and must include GEOG 4660 Honours Thesis (6). Streams are currently available in Atmospheric and Hydrological Sciences, Geomatics and Physical Geography. See the department and/or Faculty student advisor for current information about these Streams.

Major

To qualify for the degree, Bachelor of Science in Physical Geography (Major), a student must complete 120 credit hours with passing grades (‘D’ or better) and a minimum degree grade point average of 2.00. Major (Coop) students must attain a minimum degree Grade Point Average of 2.50. Students must complete all faculty requirements. There is no limit to the number of credit hours a student completes provided he/she does not exceed 18 credit hours of failed and/or repeated courses.

Honours

To qualify for the degree Bachelor of Science in Physical Geography (Honours and Honours Coop), a student must complete 120 credit hours with passing grades (‘D’ or better) and a minimum degree grade point average of 3.00 in the courses that constitute the degree. Students must complete all faculty requirements. There is no limit to the number of credit hours a student completes provided he/she does not exceed 18 credit hours of failed and/or repeated courses.

Cooperative Education Option

A Cooperative Education Option is available to students registered in either the Major or Honours degree programs in Physical Geography. Coop is an arrangement whereby students spend alternating periods in university and employment. There are several advantages to a cooperative education program for students. One benefit is that students are able to acquire both theoretical knowledge and practical experience. This experience assists them in selecting areas of specialization for their senior courses in their chosen Stream. As well, Coop assists students in their professional development by enhancing networking opportunities, participation in conferences and workshops and provides the foundation of skills and strategies required in searching and acquiring employment after graduation. Students can also defray some of the costs of their university education through these work term placements. Further information about Cooperative Education and student eligibility is available from the Faculty student advisor available in the Faculty general office.

Students electing to participate in the Cooperative Education Option will be assessed a program fee with their formal admission into the program. Once a student has accepted a position with a Coop employer, no portion of the program fee will normally be refunded.

The Cooperative Education Option consists of two employment work terms, each over a minimum period of four months, and contributes 6 credit hours towards the four year degree program. Students complete ENVR 2900 Professional Development I (1.5), ENVR 3990 Professional Development 2 (1.5), work term placements ENVR 3980 Work Term 1 (0), ENVR 3990 Work Term 2 (0), and the work term report courses ENVR 3910 Work Term Report 1 (1.5) and ENVR 3920 Work Term Report 2 (1.5). Additional work terms are available to interested students. Each academic term and each employment term commence in January, May or September. While on an employment term, a Cooperative Education Option student is not permitted to take more than three additional credit hours of academic work outside of the requirements of the Coop placement without permission of the Faculty student advisor.

Students are required to register in the appropriate Coop courses and pay course fees prior to beginning their placement.

6.2 Entrance Requirements

Students complete the first-year of their degree program in University 1 where they select courses from a wide variety of offerings including from the Clayton H. Riddell Faculty of Environment, Earth, and Resources. Students admitted from University 1 are placed in the Major degree program until they have completed a minimum of 48 credit hours after which they may transfer to the Honours program or remain in the Major. To make a program transfer, students must consult the Faculty student advisor.

6.3 Minimum Performance Requirements for Continuation and Graduation

A student’s academic performance will be assessed with his/her application for admission to the Clayton H. Riddell Faculty of Environment, Earth, and Resources and following each term thereafter. The Faculty student advisor must approve a student’s registration each Fall/Winter and Summer term. Any revisions in this schedule should also be approved prior to the end of the registration revision period.

To be in good standing and permitted to continue in a degree program, a student must achieve the minimum standards at each point of assessment. This assessment is based on the student’s minimum degree Grade Point Average; the grades received in each of GEOG 1290 or GEOG 1291, GEOG 2200 (or GEOG 2221), GEOG 2250 (or
To graduate from the Bachelor Science in Physical Geography with the intended degree designation, a student must achieve the minimum standards and graduation requirements outlined above in 6.3.1 following the final term of registration and satisfy all degree course requirements in the foundation, physical geography core and Stream.

Students in the Honours program who do not meet these minimum performance requirements for continuation or graduation will be withdrawn from the degree program and placed in the Major provided they are eligible based on their performance. Students who do not meet the minimum performance requirements of the Major will be placed on academic warning, probation or academic suspension as defined in section 3.14 Academic Warning, Probation and Academic Suspension in this Chapter.

Students withdrawn from the Honours program as a result of their inability to meet minimum performance requirements will have the notation, ‘Required to Withdraw from the Honours Program,’ recorded on their transcript of marks. Similarly, students withdrawn from the Major program will have the notation, ‘Required to Withdraw from the Major Program,’ recorded on their transcript of marks.

6.4 Dean’s Honour List and Graduating with Distinction or First Class Honours

Students enrolled in a minimum of 12 credit hours of course work during a term and achieve a term Grade Point Average of 3.50 or higher will be placed on the Dean’s Honour List.

Students graduating with a B.Sc. Physical Geography (Major) degree will have their degree granted ‘With Distinction’ if they have a minimum Degree Grade Point Average of 3.50 on all course work.

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**6.3.1 Minimum Performance Requirements**

<table>
<thead>
<tr>
<th>Degree Program (Credit Hours)</th>
<th>Minimum Degree Grade Point Average (DGPA)</th>
<th>Maximum Credit Hours of Failures/Repeated Courses</th>
<th>Physical Geography Core: Minimum Grade Requirements in GEOG 1290[^2], GEOG 2200[^2], GEOG 2250[^2], GEOG 2310, GEOG 2440, GEOG 2550, GEOG 3680</th>
<th>Graduation Requirements[^1]</th>
<th>Coop Option Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major (120)</td>
<td>2.00</td>
<td>18</td>
<td>'C'</td>
<td>30 credit hours of which at least 18 credit hours must be at the 3000-level or higher; minimum Degree GPA of 2.00.</td>
<td>ENVR 2900, ENVR 3900, ENVR 3910, ENVR 3980, ENVR 3990; (ENVR 4910 and ENVR 4980 are optional)</td>
</tr>
<tr>
<td>Major Coop (120)</td>
<td>2.50</td>
<td></td>
<td></td>
<td></td>
<td>ENVR 2900, ENVR 3900, ENVR 3910, ENVR 3980, ENVR 3990; (ENVR 4910 and ENVR 4980 are optional)</td>
</tr>
<tr>
<td>Honours (120)</td>
<td>3.00</td>
<td>18</td>
<td>'B' in GEOG 1290; 'C+' in others</td>
<td>39 credit hours of which at least 24 credit hours must be at the 3000-level or higher; completion of GEOG 4660; minimum 'C+' grade in each course.</td>
<td>ENVR 2900, ENVR 3900, ENVR 3910, ENVR 3980, ENVR 3990; (ENVR 4910 and ENVR 4980 are optional)</td>
</tr>
<tr>
<td>Honours Coop (120)</td>
<td>3.00</td>
<td></td>
<td></td>
<td></td>
<td>ENVR 2900, ENVR 3900, ENVR 3910, ENVR 3980, ENVR 3990; (ENVR 4910 and ENVR 4980 are optional)</td>
</tr>
</tbody>
</table>

[^1]: B.Sc. Physical Geography students must successfully complete a minimum of 60 credit hours at the University of Manitoba to satisfy the Residence Requirement. The courses used to satisfy the requirement must be acceptable for credit in the Clayton H. Riddell Faculty of Environment, Earth, and Resources.

[^2]: Equivalent courses offered through Collège universitaire de Saint-Boniface may be used in lieu of the specified courses identified in the degree program chart. Collège universitaire de Saint-Boniface courses end in the number 1 (e.g. GEOG 1201).
### 6.5 B.Sc. Physical Geography\(^{1,2}\)

<table>
<thead>
<tr>
<th>UNIVERSITY 1</th>
<th>YEAR 2</th>
<th>YEAR 3</th>
<th>YEAR 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HONOURS 120 CREDIT HOURS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GEOG 1290(^d) (or GEOG 1200(^d))</td>
<td>GEOG 2200(^d), GEOG 2250(^d), GEOG 2300, GEOG 2310, GEOG 2440, GEOG 2550</td>
<td>GEOG 2620, GEOG 3680</td>
<td>GEOG 4660</td>
</tr>
<tr>
<td>PHYS 1020(^d), MATH 1500(^d)</td>
<td>Whichever of: PHYS 1030(^d), MATH 1300(^d), or 6 credit hours from GEOL 1340(^d), COMP 1010, CHEM 1300, CHEM 1310, STAT 1000, STAT 2000, BIOL 1020(^d), BIOL 1030(^d), MATH 1700(^d) not yet taken</td>
<td>9 credit hours from GEOL 1340(^d), COMP 1010, CHEM 1300, CHEM 1310, STAT 1000, STAT 2000, BIOL 1020(^d), BIOL 1030(^d), MATH 1700(^d) not yet taken</td>
<td></td>
</tr>
<tr>
<td>PHYS 1030(^d), MATH 1300(^d), or 6 credit hours from GEOL 1340(^d), COMP 1010, CHEM 1300, CHEM 1310, STAT 1000, STAT 2000, BIOL 1020(^d), BIOL 1030(^d), MATH 1700(^d)</td>
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<tr>
<td></td>
<td>Plus 6 credit hours from the Faculty of Arts</td>
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<tr>
<td><strong>HONOURS COOPERATIVE OPTION 120 CREDIT HOURS</strong></td>
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<td></td>
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<tr>
<td>GEOG 1290(^d) (or GEOG 1200(^d))</td>
<td>GEOG 2200(^d), GEOG 2250(^d), GEOG 2300, GEOG 2310, GEOG 2440, GEOG 2550</td>
<td>GEOG 2620, GEOG 3680</td>
<td>GEOG 4660</td>
</tr>
<tr>
<td>PHYS 1020(^d), MATH 1500(^d)</td>
<td>Whichever of: PHYS 1030(^d), MATH 1300(^d), or 6 credit hours from GEOL 1340(^d), COMP 1010, CHEM 1300, CHEM 1310, STAT 1000, STAT 2000, BIOL 1020(^d), BIOL 1030(^d), MATH 1700(^d) not yet taken</td>
<td>9 credit hours from GEOL 1340(^d), COMP 1010, CHEM 1300, CHEM 1310, STAT 1000, STAT 2000, BIOL 1020(^d), BIOL 1030(^d), MATH 1700(^d) not yet taken</td>
<td></td>
</tr>
<tr>
<td>PHYS 1030(^d), MATH 1300(^d), or 6 credit hours from GEOL 1340(^d), COMP 1010, CHEM 1300, CHEM 1310, STAT 1000, STAT 2000, BIOL 1020(^d), BIOL 1030(^d), MATH 1700(^d)</td>
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<tr>
<td></td>
<td>Plus 6 credit hours from the Faculty of Arts</td>
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<tr>
<td><strong>MAJOR 120 CREDIT HOURS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GEOG 1290(^d) (or GEOG 1200(^d))</td>
<td>GEOG 2200(^d), GEOG 2250(^d), GEOG 2300, GEOG 2310, GEOG 2440, GEOG 2550</td>
<td>GEOG 2620, GEOG 3680</td>
<td>GEOG 4660</td>
</tr>
<tr>
<td>PHYS 1020(^d), MATH 1500(^d)</td>
<td>Whichever of: PHYS 1030(^d), MATH 1300(^d), or 6 credit hours from GEOL 1340(^d), COMP 1010, CHEM 1300, CHEM 1310, STAT 1000, STAT 2000, BIOL 1020(^d), BIOL 1030(^d), MATH 1700(^d) not yet taken</td>
<td>9 credit hours from GEOL 1340(^d), COMP 1010, CHEM 1300, CHEM 1310, STAT 1000, STAT 2000, BIOL 1020(^d), BIOL 1030(^d), MATH 1700(^d) not yet taken</td>
<td></td>
</tr>
<tr>
<td>PHYS 1030(^d), MATH 1300(^d), or 6 credit hours from GEOL 1340(^d), COMP 1010, CHEM 1300, CHEM 1310, STAT 1000, STAT 2000, BIOL 1020(^d), BIOL 1030(^d), MATH 1700(^d)</td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td>Plus 6 credit hours from the Faculty of Arts</td>
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<td></td>
</tr>
<tr>
<td><strong>MAJOR COOPERATIVE OPTION 120 CREDIT HOURS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GEOG 1290(^d) (or GEOG 1200(^d))</td>
<td>GEOG 2200(^d), GEOG 2250(^d), GEOG 2300, GEOG 2310, GEOG 2440, GEOG 2550</td>
<td>GEOG 2620, GEOG 3680</td>
<td>GEOG 4660</td>
</tr>
<tr>
<td>PHYS 1020(^d), MATH 1500(^d)</td>
<td>Whichever of: PHYS 1030(^d), MATH 1300(^d), or 6 credit hours from GEOL 1340(^d), COMP 1010, CHEM 1300, CHEM 1310, STAT 1000, STAT 2000, BIOL 1020(^d), BIOL 1030(^d), MATH 1700(^d) not yet taken</td>
<td>9 credit hours from GEOL 1340(^d), COMP 1010, CHEM 1300, CHEM 1310, STAT 1000, STAT 2000, BIOL 1020(^d), BIOL 1030(^d), MATH 1700(^d) not yet taken</td>
<td></td>
</tr>
<tr>
<td>PHYS 1030(^d), MATH 1300(^d), or 6 credit hours from GEOL 1340(^d), COMP 1010, CHEM 1300, CHEM 1310, STAT 1000, STAT 2000, BIOL 1020(^d), BIOL 1030(^d), MATH 1700(^d)</td>
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<tr>
<td></td>
<td>Plus 6 credit hours from the Faculty of Arts</td>
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<td></td>
</tr>
<tr>
<td><strong>MINOR 18 CREDIT HOURS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GEOG 1290(^d) (or GEOG 1200(^d))</td>
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<tr>
<td></td>
<td>15 credit hours selected from 2000-, 3000-, or 4000-level courses designated as Physical Geography (PS) or Techniques (TS) courses in the Geography course descriptions defined in sections 5.6 in this Chapter.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^{1}\) It is recommended that students complete the W course in University 1 or Year 2.

\(^{2}\) Plus a Stream approved by the Faculty student advisor. Honours Stream requirements are as follows: 39 credit hours of 2000- (or higher) level courses, of which 24 credit hours must be at the 3000- or 4000-level and include GEOG 4660.

\(^{3}\) It is recommended that students complete the W course in University 1 or Year 2.

\(^{4}\) Plus a Stream approved by the Faculty student advisor. Honours Stream requirements are as follows: 39 credit hours of 2000- (or higher) level courses, of which 24 credit hours must be at the 3000- or 4000-level and include GEOG 4660.

\(^{5}\) It is recommended that students complete the W course in University 1 or Year 2.

\(^{6}\) Plus a Stream approved by the Faculty student advisor. Honours Stream requirements are as follows: 39 credit hours of 2000- (or higher) level courses, of which 24 credit hours must be at the 3000- or 4000-level.

\(^{7}\) MAJOR COOP Stream requirements are as follows: 30 credit hours of 2000- (or higher) level courses, of which 18 credit hours must be at the 3000- or 4000-level.

\(^{8}\) MAJOR COOP Stream requirements are as follows: 30 credit hours of 2000- (or higher) level courses, of which 18 credit hours must be at the 3000- or 4000-level.

\(^{9}\) It is recommended that students complete the W course in University 1 or Year 2.

\(^{10}\) Plus a Stream approved by the Faculty student advisor. MAJOR Stream requirements are as follows: 30 credit hours of 2000- (or higher) level courses, of which 18 credit hours must be at the 3000- or 4000-level.

\(^{11}\) NOTE: Students in the MAJOR COOP are required to maintain an overall degree Grade Point Average of 2.50.
6.6 Geography Course Descriptions

All courses are not offered every year. The course schedule for the current academic term is available from the online calendar at www.umanitoba.ca/calendar.

Note: Students registering in certain courses may be required to participate in field trips or field components and pay a portion of the associated expenses. For details, refer to the online calendar (www.umanitoba.ca/calendar) and/or contact the Department of Environment and Geography general office.

GEOG 1200 Introduction to Human Geography Cr.Hrs.6 (Formerly 053.120) This course studies aspects of the human and physical worlds and their interrelationships. Not to be held with GEOG 1201(053.120), or GEOG 1290 or GEOG 1291(053.129), or GEOG 1280 or GEOG 1281(053.128).

GEOG 1280 Introduction to Physical Geography Cr.Hrs.3 (Formerly 053.128) This course studies aspects of the human world: population, settlement and resources. Not to be held with GEOG 1200 or GEOG 1201(053.120), or GEOG 1281(053.128).

GEOG 1290 Introduction to Physical Geography Cr.Hrs.3 (Formerly 053.129) This course studies aspects of our physical environment: climate, landforms, soils and vegetation. Not to be held with GEOG 1291(053.129), or GEOG 1200 or GEOG 1201(053.120).

GEOG 2200 Introduction to Thematic Cartography (TS) Cr.Hrs.3 (Lab Required) (Formerly 053.220) An introduction to the principles of map compilation and reproduction, including analysis and cartographic display of spatially referenced data. Emphasis will be placed on cartographic data manipulation, generalization, and symbology, map design, visualization and communication. Not to be held with GEOG 2221(053.222). Prerequisite: a grade of "C" or better in a minimum of three credit hours Geography courses numbered at the 1000 level, or permission of department head.

GEOG 2210 Economic Geography (HS) Cr.Hrs.6 (Formerly 053.221) An introduction to spatial aspects of economic activities. It includes consideration of natural resource extraction and development, industrial location theory, agriculture, and the basis of regional development. Prerequisite: GEOG 1200 or GEOG 1201 (053.120) (C), or GEOG 1280 or GEOG 1281 (053.128) (C), or permission of department head.

GEOG 2250 Introduction to Geographic Information Systems (TS) Cr.Hrs.3 (Lab Required) (Formerly 053.225) An introduction to the fundamental theoretical concepts of geographic information systems including acquisition, processing and analyzing environmental and socio-economic data. Topics to be covered include georeferencing, spatial data structures, processing, output and applications. Not to be held with GEOG 2221(053.222). Prerequisite: a grade of "C" or better in a minimum of three credit hours Geography courses numbered at the 1000 level, or permission of department head.

GEOG 2300 Atmospheric Thermodynamics, Clouds and Precipitation (PS) Cr.Hrs.3 (Formerly 053.230) Critical thermodynamic processes are discussed that are associated with the Earth’s atmosphere including dry and moist processes, phases of water stability, cloud development and precipitation processes. Prerequisites: (GEOG 1290 or GEOG 1291(053.129)(C), or GEOG 1200 or GEOG 1201 (053.120) (C), and (MAT150 (053.150) (C), or MATH 1510 (053.151) (C), or MATH 1520 (136.152) (C), or MATH 1530 (136.153) (C)).

GEOG 2310 Introduction to Process Hydrology (PS) Cr.Hrs.3 (Formerly 053.231) This course introduces students to the near-surface components of the hydrological cycle, including the processes of precipitation, evaporation, water-biosphere interactions, inland and streamflow. Not to be held with the former GEOG 336. Prerequisites: (GEOG 1290 or GEOG 1291 (C), or GEOG 1200 or GEOG 1201(053.120) (C)), and (PHYS 1020 or PHYS 1021 (016.102) (C), or PHYS 1050 or PHYS 1057 (016.103) (C), or MATH 1500 or MATH 1501 (136.150) (C), or MATH 1510 (136.151) (C), or MATH 1520 (136.152) (C), or MATH 1530 (136.153) (C), or permission of department head.

GEOG 2400 Geography of Modern China (A) Cr.Hrs.3 (Formerly 053.240) Survey of the People’s Republic of China. Discussion of China’s population, food and energy production, industrial achievements, and internal politics will be preceded by a description of the country’s environmental conditions and resources and concluded by an assessment of China’s international position and future prospects. Prerequisite: a grade of "C" or better in a minimum of three credit hours from Geography courses numbered at the 1000 level, or permission of department head.

GEOG 2410 Geography of Tourism and Recreation (HS) Cr.Hrs.6 (Formerly 053.241) The course treats the economic, social, and physical dimensions of tourism and recreation. It studies forecasting, planning and management, and recreation resources, in both spatial and environmental context. The course focuses on Canadian experience. Prerequisite: GEOG 1200 or GEOG 1201 (053.120) (C) or GEOG 1280 or GEOG 1281 (053.128) (C), or permission of department head.

GEOG 2430 Political Geography (HS) Cr.Hrs.6 (Formerly 053.243) A study of the relationships existing between land and the state – its location, boundaries, and regional differences; elements of strength in relation to space, resources, population, and ethnic groups at international, national and local levels. Not to be held with GEOG 2621 (053.265), or GEOG 2661 (053.266). Prerequisite: a grade of "C" or better in a minimum of three credit hours from Geography courses numbered at the 1000 level, or permission of department head.

GEOG 2440 Geography of Natural Hazards (PS) Cr.Hrs.6 (Formerly 053.244) Physical environmental hazards to human settlement and economy are examined with particular attention to meteorological, soil erosion, mass wasting, earthquake, and volcanic phenomena. Prerequisite: a grade of "C" or better in a minimum of three credit hours from Geography courses numbered at the 1000 level, or permission of department head.

GEOG 2450 The Making of the Prairie Landscape (A) Cr.Hrs.6 (Formerly 053.245) Traces the evolution of the cultural landscape of Western Canada including Indian occupancy, environmental perception, urban and rural landscapes, and regional images in art and literature. Prerequisite: a grade of "C" or better in a minimum of three credit hours from Geography courses numbered at the 1000 level, or permission of department head.

GEOG 2460 Geography of Africa (A) Cr.Hrs.6 (Formerly 053.246) A systematic and regional survey of the contemporary political and economic geography of Africa. Emphasizes the variability and viability of the physical and human resource base, as well as political and social impacts on Africa’s development. Prerequisite: a grade of "C" or better in a minimum of three credit hours from Geography courses numbered at the 1000 level, or permission of department head.

GEOG 2480 Population Geography (HS) Cr.Hrs.6 (Formerly 053.248) An examination of the factors controlling the number and distribution of human population. Variations in fertility, mortality, and mobility will be analyzed and the causes and consequences reviewed. Prerequisite: a grade of "C" or better in a minimum of three credit hours from Geography courses numbered at the 1000 level, or permission of department head.

GEOG 2490 Geography of Modern China (A) Cr.Hrs.3 (Formerly 053.249) Survey of the People's Republic of China. Discussion of China's population, food and energy production, industrial achievements, and internal politics will be preceded by a description of the country's environmental conditions and resources and concluded by an assessment of China's international position and future prospects. Prerequisite: a grade of "C" or better in a minimum of three credit hours from Geography courses numbered at the 1000 level, or permission of department head.

GEOG 2500 Geography of Natural Resources (HS) Cr.Hrs.3 (Formerly 053.252) An introduction to the basic concepts of the subject and the distribution of resources. Students will be placed on Canadian resources and resource requirements but examples from other resource systems will also be used. Prerequisite: a grade of "C" or better in a minimum of three credit hours from Geography courses numbered at the 1000 level, or permission of department head.

GEOG 2530 Introduction to Scientific Geographic Research (TS) Cr.Hrs.3 (Formerly 053.233) An introduction to the use of scientific methodology in geography and resource extraction and development, industrial location theory, agriculture, and the basis of geographical study. Note: Students registering in certain courses may be required to participate in field trips or field components and pay a portion of the associated expenses. For details, contact the Department of Environment and Geography general office.
the application of scientific explanatory frameworks to geographic research projects. Data collection procedures are discussed with particular emphasis on measurement, sampling designs, and interview surveying techniques. May not be held with former GEOG 2560. Prerequisite: a grade of "C" or better in a minimum of three credit hours from Geography courses numbered at the 1000 level, or written consent of department head.

GEOG 2570 Geography of Canada (A) Cr.Hrs.3 (Formerly 053.257) A regional study of Canada. Lecture is the same as those given in one term of GEOG 2560 (053.256). Not to be held with GEOG 2560 (053.256), GEOG 2561 or GEOG 3431 (053.343). Prerequisite: a grade of "C" or better in a minimum of three credit hours from Geography courses numbered at the 1000 level, or permission of department head.

GEOG 2580 Geography of the United States (A) Cr.Hrs.3 (Formerly 053.258) A regional study of the United States. Lectures are the same as those given in one term of GEOG 2560 (053.256). Not to be held with GEOG 2560 (053.256), GEOG 2561 or GEOG 3431 (053.343). Prerequisite: a grade of "C" or better in a minimum of three credit hours from Geography courses numbered at the 1000 level, or permission of department head.

GEOG 2620 Geography of Environmental Changes (PS) Cr.Hrs.3 (Formerly 053.262) This course will introduce concepts of environmental change and examine in detail past, present and future environmental changes. The human response to, and the role of policy in dealing with environmental change will be discussed. Prerequisite: a grade of "C" or better in a minimum of three credit hours from Geography courses numbered at the 1000 level, or permission of department head.

GEOG 2640 Geography of Culture and Inequality (HS) Cr.Hrs.3 (Formerly 053.264) An introduction to the cultural geographic study of human and place inequalities, focusing on the role of policy in dealing with environmental change will be discussed. Prerequisite: a grade of "C" or better in a minimum of three credit hours from Geography courses numbered at the 1000 level, or permission of department head.

GEOG 2700 Introduction to Remote Sensing (TS) Cr.Hrs.3 (Lab Required) (Formerly 053.323) This course introduces the concept of energy balance climatology and examines relationships among climate, microclimate, and environments of the Earth's surface and human-made environments. Studies include bioclimates and hydrolcimates. Prerequisites: GEOG 2310 (053.231) (C), and GEOG 2300 (053.230) (C), or permission of department head.

GEOG 3840 Urban Geography (HS) Cr.Hrs.6 (Formerly 053.346) The course studies the processes of urbanization: the clarification of cities; central-place theory; cities as systems; land-use patterns; social forces and factorial ecology; and urban transport problems. Prerequisite: GEOG 1200 or GEOG 1201 (053.120) (C), or GEOG 1280 or GEOG 1281 (053.128) (C), or permission of department head.

GEOG 3850 Canadian Problems (A) Cr.Hrs.3 (Formerly 053.348) The geographical basis of forested problems (eg. regional, urban, rural, resource, land use) are examined. Prerequisites: GEOG 2560 (053.256) (C), or GEOG 2570 (053.257) (C), or GEOG 3431 (053.343) (C), or permission of department head.

GEOG 3520 Economy and Society (HS) Cr.Hrs.6 (Formerly 053.352) The course reviews in detail the role of energy in modern society. Explanation of basic energy laws and flows in the biosphere precedes discussion of energy resources, technologies, us- es, and forms as well as the activities of rivers comprise the other. Human modification of the environment is discussed. Not to be held with GEOG 3490 (007.349), Prerequisite: GEOG 1200 or GEOG 1201 (053.120) (C), or GEOG 1280 or GEOG 1281 (053.128) (C), or GEOG 2210 or GEOG 2211 (053.221) (C), or permission of department head.

GEOG 3540 Regional Development Theory and Practice (HS) Cr.Hrs.6 (Formerly 053.354) The course considers regional disparities in a range of Western economies including Canada. The regional problem is explored theoretically and in the application of policies to alleviate disparities. Prerequisite: GEOG 1200 or GEOG 1201 (053.120) (C), or GEOG 1280 or GEOG 1281 (053.128) (C), or GEOG 2210 or GEOG 2211 (053.221) (C), or permission of department head.

GEOG 3580 Landforms (PS) Cr.Hrs.6 (Formerly 053.358) Present-day and Pleis- tocene glacial processes and landforms are examined in one term; slope processes and forms as well as the activities of rivers comprise the other. Human modification of the environment is discussed. Not to be held with GEOG 3490 (007.349), Prerequisite: GEOG 1200 or GEOG 1201 (053.120) (C), or GEOG 1280 or GEOG 1281 (053.128) (C), or GEOG 2210 or GEOG 2211 (053.221) (C), or permission of department head.

GEOG 3700 Canada: The Making of the Human Landscape (A) Cr.Hrs.6 (Formerly 053.370) Emphasis is on the European settlement of Canada from the early 17th century until Confederation and the impact of this settlement upon the land. Prerequisite: a grade of "C" or better in six credit hours from Geography courses numbered at the 1000 level, or permission of department head.

GEOG 3710 Population and the Third World (HS) Cr.Hrs.3 (Formerly 053.371) This course examines the policies and problems associated with population growth and redistribution in the Third World. Prerequisite: GEOG 2480 or GEOG 2481 (HS) Cr.Hrs.3 (Formerly 053.372) or permission of department head.

GEOG 3720 Refugees, Displacees, Exiles (HS) Cr.Hrs.3 (Formerly 053.372) This course surveys the geographic dimensions of the nature, causes and consequences of past and contemporary involuntary migrations. Prerequisite: GEOG 1200 or GEOG 1201 (053.120) (C), or GEOG 1280 or GEOG 1281 (053.128) (C), or GEOG 2210 or GEOG 2211 (053.221) (C), or GEOG 2540 or GEOG 2541 (053.254) (C), or permission of department head.

GEOG 3730 Geographic Information Systems (TS) Cr.Hrs.3 (Formerly 053.373) Weekly two-hour lab. An introduction to geographic information systems (GIS) input, processing, output and applications. Prerequisite: GEOG 2250 (053.225) (C), or permission of department head.

GEOG 3740 Field Studies in Geography (A,T) Cr.Hrs.6 (Formerly 053.374) A field course designed to introduce students to either a detailed area study or to field techniques employed for specific geographic enquiry. Prerequisite: permission of department head.

GEOG 3750 Field Studies in Geography (A,T) Cr.Hrs.3 (Formerly 053.375) A field course designed to introduce students to either a detailed area study or to field techniques employed for specific geographic enquiry. Prerequisite: a grade of "C" or better in a minimum of three credit hours from Geography courses numbered at the 1000 level, or permission of department head.

GEOG 3760 Special Topics in Geography Cr.Hrs.6 (Formerly 053.376) This course will vary from year to year depending on the needs of students and the interests of instructors. Prerequisite: permission of department head.

GEOG 3770 Special Topics in Geography Cr.Hrs.3 (Formerly 053.377) This course will vary from year to year depending on the needs of students and the interests of instructors. Prerequisite: permission of department head.

GEOG 3800 Geography of Transportation Development (HS) Cr.Hrs.3 (Formerly 053.386) This course examines the development of selected modes of transportation and their associated route and network development. Emphasis is on the place of transportation in the cultural, economic, and physical landscape of Canada and the United States since 1800. Prerequisite: a grade of "C" or better in a minimum of three credit hours from Geography courses numbered at the 1000 level, or permission of department head.

Environment, Earth, and Resources / 299
GEOG 4350 Topics in Air Pollution: Climatology, Location, and Planning Cr.Hrs.3 (Formerly 053.435)重点包括了对空气污染源的识别、气象学和污染浓度的计算；影响和控制；环境保护政策。Prerequisite: permission of department head.

GEOG 4560 Techniques in Climatology Cr.Hrs.3 (Formerly 053.456)仪器学，包括对气候数据的处理，以及使用卫星摄影学，作为方法学的分析和预测。Prerequisite: permission of department head.

GEOG 4570 Techniques in Geomorphology Cr.Hrs.3 (Formerly 053.457)每周的研讨会包括对实验室和实验室技术的研究，以及在某一特定主题中所使用的技术的调研。Prerequisite: permission of department head.

GEOG 4580 Concepts and Methods in Geography Cr.Hrs.6 (Formerly 053.458)这些课程涵盖了历史、自然和社会的地理学。Prerequisite: permission of department head.

GEOG 4590 Spatial Analysis Cr.Hrs.3 (Lab Required) (Formerly 053.459)这些技术包括了空间统计数据分析、假设检验和理论推断。Prerequisites: A grade of “C” or better in GEOG 3680 or GEOG 3760 (053.368) and (MATH 1300 or MATH 1301 or MATH 1310 or MATH 1311). or written consent of department head.

GEOG 4600 Cognitive-Behavioural Geography Cr.Hrs.3 (Formerly 053.460)理论和实践的地理学，可以用来查看地理学的培养和制定。Prerequisite: permission of department head.

GEOG 4640 Models in Urban Geography Cr.Hrs.3 (Formerly 053.464)这些主题包括了：空间分析的复习，重力和潜力模型，以及离散和动态模型。Prerequisite: permission of department head.

GEOG 4650 Models in Regional Analysis Cr.Hrs.3 (Formerly 053.465)重点放在了远程比例技术的应用，以及在某些地区分析中的应用。所有地区科学的应用和应用都是在研究的课程中讨论。Prerequisite: permission of department head.

GEOG 4660 Honours Thesis Cr.Hrs.6 (Formerly 053.466)这些课程包括了对一个论文的监督，以及对一个部门成员的法律问题。Prerequisite: permission of department head.

GEOG 4670 Selected Issues Cr.Hrs.3 (Formerly 053.467)这些课程包括了空间和地理学问题。Prerequisite: permission of department head.

GEOG 4690 Natural Hazards and Disasters Cr.Hrs.3 (Formerly 053.469)一个概念性的方法学的地理学，以及对自然灾害的理论分析和应用。Prerequisite: GEOG 2440 (053.244)(C), and GEOG 2550 (053.255) (C), and (GEOG 3580 (053.358) (C), or permission of department head.

GEOG 4710 Geography of the Elderly and Aging Cr.Hrs.3 (Formerly 053.471)地理学，包括了对老年人和老龄群体的研究。Prerequisite: permission of department head.

GEOG 4720 Advanced Methods in Geographic Information Systems Cr.Hrs.3 (Lab Required) (Formerly 053.472)每周两次的课程包括了对空间分析技术的复习和使用，以及地理信息系统的开发和应用。Prerequisite: permission of department head.

Courses offered at the Collège universitaire de Saint-Boniface

GEOG 1201 Introduction à la géographie Cr.Hrs.6 (l’ancien 053.120) Étude des aspects physiques et humains du défi et de leur interdépendance. L’étudiant ne peut se faire créditer avec GEOG 1200 (053.120), ou GEOG 1290 ou GEOG 1291 (053.120), ou GEOG 1280 ou GEOG 1281 (053.128).Donné au Collège universitaire de Saint-Boniface.

GEOG 1281 Introduction à la géographie humaine Cr.Hrs.3 (l’ancien 053.128) Étude des aspects humains de la gestion durable des ressources naturelles. L’étudiant ne peut se faire créditer avec le GEOG 1280, ou GEOG 1290 ou GEOG 1291 (053.129), ou GEOG 1280 ou GEOG 1281 (053.128).Donné au Collège universitaire de Saint-Boniface.

GEOG 1291 Introduction à la géographie physique Cr.Hrs.3 (l’ancien 053.129) Étude des divers aspects de l’environnement physique: le climat, le relief, les sols et la végétation. L’étudiant ne peut se faire créditer avec le GEOG 1280, ou GEOG 1290 ou GEOG 1291 (053.129), ou GEOG 1280 ou GEOG 1281 (053.128).Donné au Collège universitaire de Saint-Boniface.

GEOG 2211 Géographie économique (HS) Cr.Hrs.6 (l’ancien 053.221) Introduction à l’expression spatiale des activités économiques. Le cours traite du concept de ressource, de la localisation et de l’utilisation des ressources naturelles, des théories sur les facteurs de localisation des activités industrielles, de l’agriculture et des fonde- mens du développement régional. Donné au Collège universitaire de Saint-Boniface. Prerequisite: une note minimale de C dans un minimum de 3 heures- crédits de géografia de niveau 1000 ou l’autorisation écrite du professeur.

GEOG 2221 Introduction à la cartographie et analyse de la carte numérique (TS) Cr.Hrs.6 Deux heures de laboratoire par semaine. Une étude de la production et de
l’analyse de cartes, en tenant compte de la cartographie assistée par ordinateur. Ce cours est une introduction aux techniques de l’expression cartographique et à l’utilisation des données. En fin de leçon, il porte une attention spéciale à la représentation précise des statistiques.

**GEOG 2481 Géographie de la population (HS) Cr.Hrs.6** (L’ancien 053.248) Une étude des facteurs exerçant un contrôle sur l’ampleur et la répartition des populations humaines; l’analyse des variations de l’écondité, de mortalité et de mobilité ainsi que leurs causes et conséquences. Donné au Collège universitaire de Saint-Boniface. Préalable: une note minimale de C dans un minimum de 3 heures-crédits de géographie de niveau 1000 ou l’autorisation écrite du professeur.

**GEOG 2541 Météorologie et climatologie (PS) Cr.Hrs.3** (L’ancien 053.254) Étude de la nature, des contrôles et des observations du temps et des variations spatio-temporelles du climat. Donné au Collège universitaire de Saint-Boniface. Préalable: une note minimale de C dans un minimum de 3 heures-crédits de géographie de niveau 1000 ou l’autorisation écrite du professeur.

**GEOG 2531 Géomorphologie (PS) Cr.Hrs.3** (L’ancien 053.255) Vue d’ensemble des reliefs variés de la surface du globe et des processus géomorphologiques responsables de leur formation. (Laboratoire hébdomadaire). Donné au Collège universitaire de Saint-Boniface. Préalable: une note minimale de C dans un minimum de 3 heures-crédits de géographie de niveau 1000 ou l’autorisation écrite du professeur.

**GEOG 2651 Géographie politique I Cr.Hrs.3** (L’ancien 053.265) Étude des relations qui existent entre l’État et son territoire: sa localisation, ses frontières et ses disparités régionales. L’étudiant ne peut se faire créditer avec le GEOG 2430 (053.243). Donné au Collège universitaire de Saint-Boniface. Préalable: une note minimale de C dans un minimum de 3 heures-crédits de géographie de niveau 1000 ou l’autorisation écrite du professeur.

**GEOG 2661 Géographie politique II Cr.Hrs.3** (L’ancien 053.266) Étude des rapports de force entre les États et leurs relations à l’espace, aux ressources, à la population et aux groupes ethniques. L’étudiant ne peut se faire créditer avec le GEOG 2430 (053.243). Donné au Collège universitaire de Saint-Boniface. Préalable: une note minimale de C dans le GEOG 2651 (053.265) ou l’autorisation écrite du professeur.

**GEOG 3411 Géographie de l’eau Cr.Hrs.3** (L’ancien 053.341) L’eau, élément essentiel de la géographie physique: bilan d’eau, cycle hydrologique, infiltration, percolation et écoulement, eaux souterraines, hydrologie fluviale et marine: cours d’eau, lacs et océans, environnement. Donné au Collège universitaire de Saint-Boniface. Préalable: une note minimale de C dans le GEOG 1290 ou GEOG 1291 (053.129), ou l’autorisation écrite du professeur.

**GEOG 3421 L’eau, enjeu géostatistique Cr.Hrs.3** (L’ancien 053.342) L’eau, un enjeu stratégique d’importance: un survol historique des enjeux liés à l’eau et les enjeux actuels et futurs du partage des ressources. Donné au Collège universitaire de Saint-Boniface. Préalable: une note minimale de C dans le GEOG 1290 ou GEOG 1291 (053.129), ou l’autorisation écrite du professeur.

**GEOG 3431 Géographie de la mer Cr.Hrs.3** (L’ancien 053.341) L’eau, élément essentiel de la géographie physique: bilan d’eau, cycle hydrologique, infiltration, percolation et écoulement, eaux souterraines, hydrologie fluviale et marine: cours d’eau, lacs et océans, environnement. Donné au Collège universitaire de Saint-Boniface. Préalable: une note minimale de C dans le GEOG 1290 ou GEOG 1291 (053.129), ou l’autorisation écrite du professeur.

**GEOG 3591 Géographie des pays en voie de développement (HS) Cr.Hrs.6** (L’ancien 053.350) Le thème principal sera la modernisation des pays en voie de développement. Les étudiants ne peuvent se faire créditer avec le GEOG 3590 (053.359). Donné au Collège universitaire de Saint-Boniface.

**GEOG 3701 Canada : Évolution de l’écoumène (A) Cr.Hrs.6** (L’ancien 053.370) Étude de l’impact qu’a eu l’arrivée des Européens, au début du XVIIe siècle, sur les différents aspects de l’environnement canadien; évolution de la nature de l’utilisation de l’espace canadien. L’étudiant ne peut se faire créditer avec le GEOG 3700 (053.370) ou l’autorisation écrite du professeur.


**GEOG 3831 L’espace francophone panaméricain (A, HS) Cr.Hrs.3** (L’ancien 053.383) L’étude des communautés francophones des Amériques dans le temps et dans l’espace. La mise en place de la francophonie panaméricaine et les circonstances de son développement. Les infrastructures, les institutions et les réseaux francophones. Donné au Collège universitaire de Saint-Boniface. Préalable: une note minimale de C dans le GEOG 3821 (053.382).


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**SECTION 7: Bachelor of Environmental Science and Environmental Studies Degree Regulations and Program Descriptions**

**Department Head Contact Information**

General Office: 211 Isbister Building

Telephone: (204) 474-9081

Fax: (204) 474-7699

Website: www.umanitoba.ca/environment/envirogeog

Email: envirogeog@umanitoba.ca

**7.1 Program Information**

The Clayton H. Riddell Faculty of Environment, Earth, and Resources offers General, Major, and Honours degree programs leading to a Bachelor of Environmental Science (B.Env.Sc.) and Bachelor of Environmental Studies (B.Env.St.). Through an interdisciplinary approach, environmental issues relating to human populations, sustainable resource development, pollution and conservation, environmental health, and endangerment and preservation of species are explored in conjunction with alternative conditions that have the potential to reverse current trends and contribute to ecological sustainability. Students have access to undergraduate courses offered by the Clayton H. Riddell Faculty of Environment, Earth, and Resources as well as the Faculties of Agricultural and Food Sciences, Arts, Law, Engineering, Architecture, and Science in order to complete their education. They are expected to take many courses outside the Faculty enabling them to obtain a truly interdisciplinary education.

The Major and Honours degree programs serve students who desire advanced study in an environmental field. The programs are intended for students interested in professional training and the opportunity for advanced research. Honours degree students who successfully complete the academic performance and lead most directly to graduate studies. Students who are ineligible to enter the Honours degree program in their third year may establish this in the following year on the basis of their improved scholastic performance. See the Faculty student advisor in the Faculty general office for information. The degree programs may be pursued on a full- or part-time basis.

The B.Env.Sc. and B.Env.St. degree programs share a general structure that includes a foundation of either introductory Sciences or Social Sciences/Humanities. Students complete an environmental core and a Focus Area that is defined through consultation with the Faculty student advisor in the Faculty general office. Students completing the General degree program are required to complete 9 credit hours in a Focus Area; Major, Major Coop, Honours and Honours Coop students complete 33 credit hours in a Focus Area. Other Focus Area requirements are defined in the graduation requirements in section 7.3.1 in this Chapter.

**General**

To qualify for the degree Bachelor of Environmental Science (General) or Bachelor of Environmental Studies (General), students must complete 90 credit hours including all faculty and degree requirements (including the foundation, environmental core and 9 credit hours of minimum 2000-level courses in a Focus Area). Minimum performance requirements include passing grades (’D’ or better) in each course and a minimum degree Grade Point Average of 2.00. There is no limit to the number of credit hours a stu-
of skills and strategies required in searching and acquiring employment after graduation. Students can also defray some of the costs of their university education through these work term placements. Further information about Cooperative Education and student eligibility is available from the Faculty student advisor available in the Faculty general office.

Students electing to participate in the Cooperative Education Option will be assessed a program fee with their formal admission into the program. Once a student has accepted a position with a Coop employer, no portion of the program fee will normally be refunded.

The Cooperative Education Option consists of two employment work terms, each over a minimum period of four months, and contributes 6 credit hours towards the four year degree program. Students complete ENVR 2900 Professional Development 1 (1.5), ENVR 3900 Professional Development 2 (1.5), work term placements ENVR 3980 Work Term 1 (0), ENVR 3990 Work Term 2 (0), and the work term report courses ENVR 3910 Work Term Report 1 (1.5) and ENVR 3920 Work Term Report 2 (1.5). Additional work terms are available to interested students. Each academic term and each employment term commence in January, May or September. While on an employment term, a Cooperative Education Option student is not permitted to take more than three additional credit hours of academic work outside of the requirements of the Coop placement without permission of the Faculty student advisor.

Students are required to register in the appropriate Coop courses and pay course fees prior to beginning their placement.

### 7.2 Entry Requirements

Students admitted from University 1 are placed in the Major degree program in either the Bachelor of Environmental Science or Bachelor of Environmental Studies until they have completed a minimum of 48 credit hours after which they can transfer to the General or Honours program or remain in the Major. To make a program transfer, students must consult with the Faculty student advisor.

External transfer students, Second Degree students and those from the Environmental Science Program in the Faculty of Science may be eligible for direct entry into the General or Honours programs. These students should consult with the Faculty student advisor in the general office.

7.2.1 and 7.2.2 define the entry requirements for the degree programs in the Bachelor of Environmental Science and Bachelor of Environmental Studies, respectively.

<table>
<thead>
<tr>
<th>7.2.1 Bachelor of Environmental Science Entry Requirements</th>
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<tbody>
<tr>
<td><strong>Degree Program in B.Env.Sc.</strong></td>
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<tr>
<td>---------------------------------</td>
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<tr>
<td>Honours</td>
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<tr>
<td>Honours (Coop)</td>
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<tr>
<td>Major</td>
</tr>
<tr>
<td>Major (Coop)</td>
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<tr>
<td>General</td>
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</tbody>
</table>

*Students may be permitted to enter the program without satisfying all requirements listed. Students should consult with the Cooperative Education Coordinator for further information.

1Equivalent courses offered through Collège universitaire de Saint-Boniface may be used in lieu of the specified course identified in the entry requirements chart. Collège universitaire de Saint-Boniface courses end in the number ‘1’ (e.g. CHEM 1301).
7.3 Minimum Performance Requirements for Continuation and Graduation

A student’s academic performance will be assessed with his/her application for admission to the Clayton H. Riddell Faculty of Environment, Earth, and Resources and following each term thereafter. The Faculty student advisor must approve a student’s registration each Fall/Winter and Summer term. Any revisions to this schedule should also be approved prior to the end of the registration revision period.

To be in good standing and permitted to continue in a degree program, a student must achieve the minimum standards outlined in 7.3.1 at each point of assessment. This assessment is based on the student’s minimum Degree Grade Point Average and the number of failures and/or repeated courses after admission to the Faculty.

### 7.3.1 Minimum Performance Requirements

<table>
<thead>
<tr>
<th>Degree Program (Credit Hours)</th>
<th>Minimum Performance Requirements</th>
<th>Additional Graduation Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>General (90)</td>
<td>2.00</td>
<td>48 credit hours</td>
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<tr>
<td>Major (120)</td>
<td>2.00</td>
<td>18 credit hours</td>
</tr>
<tr>
<td>Major (Coop) (120)</td>
<td>2.50</td>
<td>33 credit hours</td>
</tr>
<tr>
<td>Honours (120)</td>
<td>3.25</td>
<td>18 credit hours</td>
</tr>
</tbody>
</table>

1Students may be permitted to enter the program without satisfying all requirements listed. Students should consult with the Cooperative Education Coordinator for further information.

2Equivalent courses offered through Collège universitaire de Saint-Boniface may be used in lieu of the specified course identified in the entry requirements chart. Collège universitaire de Saint-Boniface courses end in the number ‘1’ (e.g. GEOG 12101).
To graduate from either a Bachelor of Environmental Science or the Bachelor of Environmental Studies with the intended degree designation, a student must achieve the minimum standards and graduation requirements outlined in 7.3.1 following the final term of registration and satisfy all degree course requirements in the foundation, environment core and Focus Area as defined in section 7.1 of this Chapter. In addition, students must satisfy the residence requirement by completing either a total of 48 credit hours or their last 24 credit hours at the University of Manitoba. These courses must be acceptable for credit in either the Bachelor of Environmental Science or the Bachelor of Environmental Studies.

Students who do not meet these minimum performance requirements for continuation or graduation will be required to transfer to the appropriate program based on their performance and eligibility as defined in 7.3.1. Students who do not meet the minimum performance requirements for the General degree program will be placed on probation or academic suspension as defined in section 3.14 Academic Warning, Probation and Academic Suspension in this Chapter.

Students required to withdraw out of the Honours degree program will have the statement 'Required to Withdraw from the Honours Program' recorded on their transcript of marks. Similarly, students required to withdraw out of the Major degree program will have the statement 'Required to Withdraw from the Major Program' recorded on their transcript of marks.

### 7.4 Dean's Honour List and Graduating with Distinction or First Class Honours

Students enrolled in a minimum of 12 credit hours of course work during a term and achieve a term Grade Point Average of 3.50 or higher will be placed on the Dean's Honour List.

Students graduating with a Bachelor of Environmental Science (General) or Bachelor of Environmental Studies (General) degree will have their degree granted 'With Distinction' if they have a minimum Degree Grade Point Average of 3.50 on all course work.

Students graduating with a Bachelor of Environmental Science (Major) or Bachelor of Environmental Studies (Major) degree will have their degree granted 'With Distinction' if they have a minimum Degree Grade Point Average of 3.50 on all course work.

The term Degree with Distinction will appear both on the parchment and on the student’s transcript of marks.

### 7.5 Bachelor of Environmental Science

#### UNIVERSITY 1 YEAR 2 YEAR 3 YEAR 4

**HONOURS 120 CREDIT HOURS**

<table>
<thead>
<tr>
<th>Course</th>
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</tr>
</thead>
<tbody>
<tr>
<td>ENVR 1000, ENVR 2000, BIOL 1020, BIOL 1030, CHEM 1300, CHEM 1310, MATH 1500, STAT 1000</td>
<td>ENVR 2170, ENVR 2650, BOTN 2370 (ZOO 2370 or AGEC 2370), ECON 2390 (ABIZ 2390), PHYS 1020, STAT 2000</td>
<td>ENVR 4110, ENVR 4500</td>
</tr>
<tr>
<td>Plus 6 credit hours from the Faculty of Arts</td>
<td>One of PHYS 1030, MATH 1200, MATH 1300, MATH 1700</td>
<td>Plus 33 credit hours in an approved Focus Area</td>
</tr>
<tr>
<td></td>
<td>One of GEOG 1290 or GEOL 1340 (or GEOL 1440)</td>
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</tr>
</tbody>
</table>

It is recommended that students complete the W course in University 1 or Year 2

**HONOURS COOPERATIVE OPTION 120 CREDIT HOURS**

<table>
<thead>
<tr>
<th>Course</th>
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<th>Course</th>
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</thead>
<tbody>
<tr>
<td>ENVR 1000, ENVR 2000, BIOL 1020, BIOL 1030, CHEM 1300, CHEM 1310, MATH 1500, STAT 1000</td>
<td>ENVR 2170, ENVR 2650, BOTN 2370 (ZOO 2370 or AGEC 2370), ECON 2390 (ABIZ 2390), PHYS 1020, STAT 2000, ENVR 2900</td>
<td>ENVR 4110, ENVR 4500</td>
<td></td>
</tr>
<tr>
<td>Plus 6 credit hours from the Faculty of Arts</td>
<td>One of PHYS 1030, MATH 1200, MATH 1300, MATH 1700</td>
<td>Plus 33 credit hours in an approved Focus Area</td>
<td></td>
</tr>
<tr>
<td></td>
<td>One of GEOG 1290 or GEOL 1340 (or GEOL 1440)</td>
<td>(ENVR 3900, ENVR 3910, ENVR 3980, ENVR 3920, ENVR 3990; (ENVR 4910 and ENVR 4980 are optional)</td>
<td></td>
</tr>
</tbody>
</table>

It is recommended that students complete the W course in University 1 or Year 2

**MAJOR 120 CREDIT HOURS**

<table>
<thead>
<tr>
<th>Course</th>
<th>Course</th>
<th>Course</th>
<th>Course</th>
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</thead>
<tbody>
<tr>
<td>ENVR 1000, ENVR 2000, BIOL 1020, BIOL 1030, CHEM 1300, CHEM 1310, MATH 1500, STAT 1000</td>
<td>ENVR 2170, ENVR 2650, BOTN 2370 (ZOO 2370 or AGEC 2370), ECON 2390 (ABIZ 2390), PHYS 1020, STAT 2000</td>
<td>ENVR 4110</td>
<td></td>
</tr>
<tr>
<td>Plus 6 credit hours from the Faculty of Arts</td>
<td>One of PHYS 1030, MATH 1200, MATH 1300, MATH 1700</td>
<td>Plus 33 credit hours in an approved Focus Area</td>
<td></td>
</tr>
<tr>
<td></td>
<td>One of GEOG 1290 or GEOL 1340 (or GEOL 1440)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

It is recommended that students complete the W course in University 1 or Year 2
### MAJOR COOPERATIVE OPTION 120 CREDIT HOURS

- ENVR 1000, ENVR 2000, BIOL 1020, BIOL 1030, CHEM 1300, CHEM 1310, MATH 1500, STAT 1000
- Plus 6 credit hours from the Faculty of Arts
- ENVR 2170, ENVR 2650, BOTN 2370 (ZOOL 2370 or AGEC 2370), ECON 2390 (ABIZ 2390), PHYS 1020, STAT 2000, ENVR 2900
- One of PHYS 1030, MATH 1200, MATH 1300, MATH 1700
- One of GEOG 1290 or GEOL 1340 (or GEOL 1440)
- ENVR 4110

**Notes:**
- It is recommended that students complete the W course in University 1 or Year 2
- Plus 3 credit hours in an approved Focus Area
- ENVR 3900, ENVR 3980, ENVR 3990, ENVR 3910, ENVR 3920 (ENVR 4980 and ENVR 4910 are optional)

### GENERAL 90 CREDIT HOURS

- ENVR 1000, ENVR 2000, BIOL 1020, BIOL 1030, CHEM 1300, CHEM 1310, MATH 1500, STAT 1000
- Plus 6 credit hours from the Faculty of Arts
- ENVR 2170, ENVR 2650, BOTN 2370 (ZOOL 2370 or AGEC 2370), ECON 2390 (ABIZ 2390), PHYS 1020, STAT 2000
- One of PHYS 1030, MATH 1200, MATH 1300, MATH 1700
- One of GEOG 1290 or GEOL 1340 (or GEOL 1440)
- ENVR 4110

**Notes:**
- Plus 9 credit hours in an approved Focus Area

### MINOR 18 CREDIT HOURS

- ENVR 1000, ENVR 2000
- 12 credit hours of ENVR courses number at the 2000-level or above

**Notes:**
- It is recommended that students complete the W course in University 1 or Year 2

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### 7.6 Bachelor of Environmental Studies

#### UNIVERSITY 1

<table>
<thead>
<tr>
<th>HONOURS 120 CREDIT HOURS</th>
<th>YEAR 2</th>
<th>YEAR 3</th>
<th>YEAR 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENVR 1000, ENVR 2000, GEOG 1280, GEOG 1290, NATV 1220, BIOL 1010, STAT 1000</td>
<td>ENVR 2350, ENVR 2650, ECON 2390 (ABIZ 2390), BOTN 2280 (ZOOL 2290)</td>
<td>GEOG 3680, ENVR 4110, ENVR 4500</td>
<td>Plus 3 credit hours in an approved Focus Area</td>
</tr>
<tr>
<td>Plus 3 credit hours from the Faculty of Arts</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Plus 3 credit hours from List B</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- It is recommended that students complete the W course in University 1 or Year 2

#### HONOURS COOPERATIVE OPTION 120 CREDIT HOURS

| ENVR 1000, ENVR 2000, GEOG 1280, GEOG 1290, NATV 1220, BIOL 1010, STAT 1000 | ENVR 2350, ENVR 2650, ECON 2390 (ABIZ 2390), BOTN 2280 (ZOOL 2290) | GEOG 3680, ENVR 4110, ENVR 4500 | Plus 33 credit hours in an approved Focus Area |
| Plus 3 credit hours from the Faculty of Arts |
| Plus 3 credit hours from List B |

**Notes:**
- It is recommended that students complete the W course in University 1 or Year 2

#### MAJOR 120 CREDIT HOURS

| ENVR 1000, ENVR 2000, GEOG 1280, GEOG 1290, NATV 1220, BIOL 1010, STAT 1000 | ENVR 2350, ENVR 2650, ECON 2390 (ABIZ 2390), BOTN 2280 (ZOOL 2290) | GEOG 3680, ENVR 4110 | Plus 33 credit hours in an approved Focus Area |
| Plus 3 credit hours from the Faculty of Arts |
| Plus 3 credit hours from List B |

**Notes:**
- It is recommended that students complete the W course in University 1 or Year 2

---

**Environment, Earth, and Resources / 305**
MAJOR COOPERATIVE OPTION 120 CREDIT HOURS

<table>
<thead>
<tr>
<th>Courses</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENVR 1000, ENVR 2000, GEOG 1280&lt;sup&gt;1&lt;/sup&gt;, GEOG 1290&lt;sup&gt;1&lt;/sup&gt;, NATV 1220&lt;sup&gt;1&lt;/sup&gt;, BIOL 1010&lt;sup&gt;1&lt;/sup&gt;, STAT 1000</td>
<td>30</td>
</tr>
<tr>
<td>Plus 3 credit hours from the Faculty of Arts&lt;sup&gt;6&lt;/sup&gt;</td>
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</tr>
</tbody>
</table>

It is recommended that students complete the W course in University 1 or Year 2.

GENERAL 90 CREDIT HOURS

<table>
<thead>
<tr>
<th>Courses</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENVR 1000, ENVR 2000, GEOG 1280&lt;sup&gt;2&lt;/sup&gt;, GEOG 1290&lt;sup&gt;2&lt;/sup&gt;, NATV 1220&lt;sup&gt;2&lt;/sup&gt;, BIOL 1010&lt;sup&gt;2&lt;/sup&gt;, STAT 1000</td>
<td>90</td>
</tr>
<tr>
<td>Plus 3 credit hours from the Faculty of Arts&lt;sup&gt;6&lt;/sup&gt;</td>
<td></td>
</tr>
</tbody>
</table>

MINOR 18 CREDIT HOURS

<table>
<thead>
<tr>
<th>Courses</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENVR 1000, ENVR 2000</td>
<td>12</td>
</tr>
<tr>
<td>Plus 3 credit hours from List B&lt;sup&gt;7&lt;/sup&gt;</td>
<td></td>
</tr>
</tbody>
</table>

NOTES:
1. Entry into the degree programs is summarized in 7.2.2.
2. The courses required in this program will satisfy the university mathematics requirements.
3. GEOG 1200, GEOG 1210, GEOG 1211 and GEOG 1291 may be used in lieu of GEOG 1280 and GEOG 1290.
4. Students are permitted to substitute NATV 1220 with another 3 credit hours from the department or approved alternative course. See the student advisor for assistance.
5. Students with an interest in the Conservation and Biodiversity Focus Area are advised to complete the combination of BIOL 1202 and BIOL 1030 as well as BOTN 2370 (ZOOL 2370 or AGEC 2370) instead of BOTN 1010 and BOTN 2280 (ZOOL 2290).
6. It is recommended that students consider a selection from List A below when selecting courses from the Faculty of Arts.
7. Students must complete 3 credit hours of course work containing significant international content. Students are referred to List B for a list of available courses. Students may substitute with another course as approved by the student advisor.
8. Focus Area courses must include a minimum of 21 credit hours at the 3000- and/or 4000-level. Focus Area performance requirements are defined in section 7.3 of this Chapter.

7.7 Environmental Science and Environmental Studies Course Descriptions

All courses are not offered every year. The course schedule for the current academic term is available from the online calendar at www.umanitoba.ca/calendar. There are several course titles available under the topics courses including ENVR 2010, ENVR 2020, ENVR 3000, ENVR 3010, ENVR 3020, ENVR 4000, ENVR 4010 and ENVR 4020.

Note: Students registering in a certain course may be required to participate in field trips or field components and pay a portion of the associated expenses. For details refer to the online calendar(www.umanitoba.ca/calendar) and/or contact the Department of Environment and Geography general office.

ENVR 1000 Environmental Science 1 - Concepts Cr.Hrs.3 (Formerly 128.100) This course will introduce students to the conceptual framework of the environment by examining its physical, biological, and social components. General topics to be considered will include ecological principles and the responses of natural and managed systems to disturbance; population growth; biodiversity and conservation; and environmental sustainability. Not to be held for credit with BIOL 1340 (071.134).

ENVR 2000 Environmental Science 2 - Issues Cr.Hrs.3 (Formerly 128.200) This course will briefly review the major features of the structure and function of natural systems along with the degree to which these have been compromised. The main component of the course, however, will concentrate on the identification of the issues that underlie environmental degradation, while exploring alternative conditions that have the potential to reverse current trends and ultimately contribute to ecological sustainability. Prerequisite: ENVR 1000 (128.100) (C).

ENVR 2010 Field Topics in Environment Cr.Hrs.1.5 Field and practical experience in selected topics of current interest in Environmental Science and Studies, with the content to vary depending on the needs of students and faculty. Prerequisite: permission of department head.

ENVR 2020 Extended Field Topics in Environment Cr.Hrs.3 Field and practical experience in selected topics of current interest in Environmental Science and Studies, with the content to vary depending on the needs of students and faculty. Prerequisite: permission of department head.

List A: Recommended List of Faculty of Arts Electives. Students may wish to consider courses from the following list when identifying appropriate selections from the Faculty of Arts.

- ANTH 1210 Human Origins and Antiquity Cr.Hrs.3
- ANTH 1220 Cultural Anthropology Cr.Hrs.3
- ANTH 1520 Critical Cultural Anthropology Cr.Hrs.3
- ECON 1200 Principles of Economics Cr.Hrs.6
- ECON 1210 Introduction to Canadian Economic Issues and Policies Cr.Hrs.3
- ECON 1220 Introduction to Global and Environmental Economic Issues and Policies Cr.Hrs.3
- NATV 1200 The Native Peoples of Canada Cr.Hrs.6
- NATV 1240 The Native Peoples of Canada, Part 2 Cr.Hrs.3
- PHIL 1200 Introduction to Philosophy Cr.Hrs.6
- PHIL 1290 Critical Thinking Cr.Hrs.3
- PHIL 1320 Introductory Logic Cr.Hrs.6
- PHIL 1330 Introduction to Symbolic Logic Cr.Hrs.6
- PHIL 1510 Historical Introduction to Philosophy Cr.Hrs.6
- RLGN 1420 Ethics in World Religions Cr.Hrs.3
- RLGN 2180 Theory of Nature Cr.Hrs.3

List B: Courses containing significant international content:

- ABIZ 1010 Economics of World Issues and Policies Cr.Hrs.3
- ECON 2550 Political Economy 2: Economic Growth and Fluctuations in a Global Economic Environment Cr.Hrs.3
- ECON 3670 International Trade Cr.Hrs.3
- POLS 2040 Introduction to International Relations Cr.Hrs.6
- POLS 3220 Globalization and the World Economy Cr.Hrs.3
- POLS 3250 International Political Economy Cr.Hrs.3
- GEOG 4260 Sacred Lands Cr.Hrs.3

or approved by the student advisor.
ENVR 2170 Environmental Problem Solving Cr.Hrs.3 (Formerly 128.217) A survey of mathematical and scientific approaches to environmental problems. A multi-disciplinary approach to the analysis of problems, using current technologies (plants and animals, as well as physical and geo-chemical) and different levels of biological organization, from the individual to the ecosystem. Not to be held with the former ENVR 3300. Prerequisite: a minimum grade of C in each of ENVR 2180 (or BOTN 2180, ZOOL 2180 or AGRI 2180) and a second year course in the Faculty of Science or the Faculty of Agricultural and Food Sciences that has a laboratory component, or written permission of the department head.

ENVR 3250 Environmental Assessment Cr.Hrs.3 (Lab Required) (Formerly 128.325) The theory, principles and practices of environmental assessment as a planning and decision-making process to identify and mitigate adverse effects of development projects as defined in the context of federal and provincial legislation, and applicable standards and guidelines. Laboratory assignments involve practical experiences, case study review and basic report preparation. Prerequisites: (ABIZ 3550 (061.355) (C) or ENVR 3150 (128.315) (C)) and (BOTN 2370 or BOTN 2371 (022.237) (C), or AGEC 2370 065.237) (C), or permission of department head.

ENVR 3340 Circumpolar Cultures and Lifestyles Cr.Hrs.3 This course provides an introduction to the culture, lifestyles, belief systems, material culture, environment, social and political processes of groups ranging from the Inuit of Canada, Greenland, Alaska, Siberia and Scandinavia. Prerequisite: written permission of the department head.

ENVR 3350 Environmental Management Systems Cr.Hrs.3 (Formerly 128.335) This course provides an introduction to environmental management systems and specific material on the ISO 14001 international EMS standard. Auditing principles and techniques are described with specific guidance on auditing an ISO 14001 EMS. Prerequisite: Permission of department head.

ENVR 3400 Introduction to Environment and Health Cr.Hrs.3 (Formerly 128.340) An overview of the linkages between human health and environmental issues. The course explores the nature of human health hazards, and the health outcomes. Major environmental and human health issues such as air pollution, hazardous substances, endocrine disruptors and products in the home are covered. Not to be held with credit with (128.421). Prerequisite: 60 credit hours of university credit.

ENVR 3500 Project in Environmental Science Cr.Hrs.3 (Formerly 128.350) A research project in any aspect of environmental science, chosen in consultation with the department head and an appropriate supervising faculty member. Written reports and oral presentations on the results of the project will be required. The course is normally available only to final year students in the Environmental Science or Studies Program. Prerequisite: Permission of department head.

ENVR 3550 Environmental Analysis Cr.Hrs.3 (Lab Required) (Formerly 128.355) An introduction to classical and modern techniques for sampling, sample pre-treatment, and analysis of chemical substances in aquatic atmospheric and terrestrial environmental samples. Prerequisites: (CHEM 1310 or CHEM 1311 (002.131) (C)), and (CHEM 2550 or (002.255). Prerequisite: CHEM 3590 or (002.347) or (002.355). Prerequisite: ENVR 2550 (128.255) (C), or CHEM 2550 (022.255) (C), or CHEM 2470 (022.247) (C), or permission of department head.

ENVR 3750 Green Building and Planning Cr.Hrs.3 An overview of the concepts and tools of Green building design and Green Planning. The course covers the history and trends in Green Building and Planning, related policies, tools and techniques. There is a strong emphasis on learning from local case-studies through seminars and field trips. Prerequisite: ENVR 2000 and 57 credit hours of course work, or permission of department head.

ENVR 3850 Sustainable Manitoba Cr.Hrs.3 This course approachess sustainable development issues from an interdisciplinary perspective. By looking at the ecological, social and economic aspects from a variety of discipline perspectives, a fuller understanding of sustainability is achieved. The broad range of perspectives is achieved through participation in the field with ENVR 3850 or (002.347) or (002.355). Prerequisite: ENVR 2550 (128.255) (C), or CHEM 2550 (022.255) (C), or CHEM 2470 (022.247) (C), or permission of department head.

ENVR 3900 Professional Development in the Environmental Sectors 2 Cr.Hrs.3 (Formerly 128.390) Attendance and participation in seminars, conferences and workshops to foster greater interaction between students and practitioners in the environmental sectors. Students improve professional skill sets through assignments and mock interviews. The normal sequence for participation is after completion of ENVR 3980 (128.398). Prerequisites: ENVR 2900 (128.290) (C), and 60 credit hours of university credit.

ENVR 3910 Coop Work Term Report 1 Cr.Hrs.1.5 (Formerly 128.391) Work term report, completed in conjunction with the coop placement, designed to integrate professional experiences with the concepts and theories explored through academic study. Students must be admitted into the Coop program to be registered, and receive credit. Prerequisite: ENVR 2900 (128.290) (C). Prerequisite or Concurrent Requirement: ENVR 3980 (128.398).

ENVR 3920 Coop Work Term Report 2 Cr.Hrs.1.5 (Formerly 128.392) Work term report, completed in conjunction with the coop placement, designed to integrate professional experiences with the concepts and theories explored through academic study. Students must be admitted into the Coop program to be registered, and receive credit. Prerequisite: ENVR 3980 (128.398) (P). Prerequisite or Concurrent Requirement: ENVR 3900 (128.390), and ENVR 3990 (128.399).

ENVR 3980 Coop Work Term 1 Cr.Hrs.1 (Formerly 128.398) Work assignments in business, industry, research or government for students registered in the Honours or Major Cooperative program. This course is graded pass/fail. Prerequisite or Concurrent Requirement: ENVR 2900 (128.290) (C).

ENVR 3990 Coop Work Term 2 Cr.Hrs.0 (Formerly 128.399) Work assignments in business, industry, research or government for students registered in the Honours or...
**SECTION 8: Department of Geological Sciences: Bachelor of Science in Geological Sciences - Geology and Geophysics Degree Regulations and Program Descriptions**

**Department Head Contact Information**

General Office: 240 Wallace Building  
Telephone: (204) 474-9371  
Fax: (204) 474-7623  
Email: brenda_miller@umanitoba.ca  
Website: www.umanitoba.ca/geoscience

**8.1 Academic Staff**

**Distinguished Professor**  
Hawthorne, F.C., O.C., B.Sc. (Spec.) (Imperial College), A.R.S.M. (Royal School of Mines), Ph.D. (McMaster), F.R.S.C., F.G.A.C., F.M.S.A., Killam Fellow, Canadian Research Chair, P. Geo.

**Professors Emeriti**  

**Senior Scholars**  
Ayres, L.D., B.A. (Saskatchewan), Ph.D. (Princeton); Clark, G.S., B.Sc., M.Sc. (New Brunswick), Ph.D. (Columbia); Moon, W., B.Sc. (Seoul), B.A.Sc. (Elect.Eng.) (Toronto), M.Sc. (Columbia), Ph.D. (UBC), F.R.A.S.

**Turnock, A.C., B.Sc., M.Sc. (Manitoba), Ph.D. (Johns Hopkins).**

**Professors**  
Chow, N., B.Sc. (Hons.)(Calgary), Ph.D. (Memorial), P. Geo; Elias, R.J., B.Sc. (Hons.)(Manitoba), M.Sc., Ph.D. (Cincinnati), P. Geo; Ferguson, I.J., B.Sc., Ph.D. (Australian National), P. Geo; Halden, N.M., B.Sc. (Hons.), Ph.D. (Glascow), P. Geo; Last, W.M., B.Sc. (Wisconsin), M.Sc., Ph.D. (Manitoba) F.G.A.S.A., P. Geo; Sherriff, B.L., B.Sc. (Leicester), M.Sc. (Brock), Ph.D. (McMaster), P. Geo; Sukolova, E., Dipl. (Hons.), Ph.D. (Moscow State); Teller, J.T., B.Sc. (Cincinnati), M.Sc. (Ohio State), Ph.D. (Cincinnati), P. Geo.

**Associate Professors**  
Chakhmouradian, A., M.Sc., Ph.D. (St. Petersburg), P. Geo; Fayeck, M., B.Sc. (Hons.) (Carleton), Ph.D. (Saskatchewan), Canada Research Chair

**Assistant Professors**  
Bekker, A., Dipl. (Leningrad Mining Institute), M.Sc. (Minnesota), Ph.D. (Virginia Polytechnic); Camacho, A., B.Sc. (Hons.), M.Sc. (La Trobe), Ph.D. (Australian National); Frederiksen, A., B.Sc.(Hons)(McGill), M.Sc., Ph.D.(UBC), P. Geo.

**Instructors**  
Mandziuk, W., B.Sc., B.Ed., M.Sc. (Manitoba) (Instructor II), Young, J., B.Sc., M.Sc. (Manitoba) (Instructor II).

**8.2 Program Information**

The Geological Sciences deal with the history of the Earth and its life, especially that which is recorded in rocks. Different component parts of the Earth system, the **lithosphere**, **biosphere**, atmosphere and **hydrosphere**, operate at different length and time scales. During interactions between the spheres there is feedback between the component parts as energy and mass are exchanged, transferred and redistributed. In a geological context, the feedback can occur on a global scale, or on very small scales such as that which we see in minerals. More recently humans have become a major force in this Earth system because we have intervened in many of these exchanges.

Considering the Earth’s past, geoscientists typically work with long time scales (in the order of millions to billions of years). We also use Hutton’s original philosophy of uniformitarianism, stated as the present is the key to the past, to solve geological problems. However, as we see changes at the Earth’s surface (our environment) occurring on very short time scales we need to learn to extract the signal of human activity from the Earth’s pre-human past. Once we understand and quantify the nature and extent of the
Earth’s natural evolution as well as our more recent environmental impact, geological sciences can help predict future changes to the Earth.

Geology and Geophysics are the sciences that provide the quantitative data on the physical and chemical behaviour and characteristics of Earth materials - rocks, minerals, fluids and gases. These data are needed to model the behaviour of minerals in natural as well as many industrial systems. The theoretical and instrumental expertise needed to tackle many resource extraction, mineral processing and environmental problems is resident in geological science departments. From a broad Earth, environmental and resource perspective our collective future will depend on sustainable use of our Earth’s resources and care of the environment.

The three-year General program in Geological Sciences is designed to give students a basic understanding of the discipline in combination with a concentration of courses in a second subject area. The General Program is not intended for those students who seek a career in the geosciences. Rather, it is a useful consideration for students planning to enter the Bachelor of Education program (see Faculty of Education in this calendar) or other programs that require an undergraduate degree for admission. Students intending to pursue a career in the geosciences or graduate study should hold an Honours or Major degree (comprising at least 120 credit hours) in Geology or Geophysics.

**Professional Registration**

The professional practice of geoscience in certain provinces and territories in Canada is governed by provincial/territorial law and is regulated by professional geoscience associations. In Manitoba, the Association of Professional Engineers and Geoscientists (APEGM) regulates professional practice. The requirements for professional registration are acceptable academic preparation and a subsequent period of acceptable geoscience experience. Students considering professional registration should take the B.Sc. Geological Sciences Honours or Major degree and make appropriate course selections, particularly in the basic sciences. Students should consult with the Department of Geological Sciences. Graduates who do not meet the academic requirements may be required by the professional association to take additional courses or examinations. Current registration information for APEGM is available in the department or from the association’s web site: www.apegm.mb.ca/register/index.html

**Geological Sciences Prerequisite Information**

To fulfil prerequisite requirements, a grade of ‘C’ must be achieved in any course stipulated as a prerequisite to a further course in Geological Sciences.

### 8.3 Degree Regulations

#### 8.3.1 B.Sc. in Geological Sciences (Major) Geology or Geophysics

The Major programs in Geology and Geophysics are designed for students interested in combining an in-depth study of Geology and Geophysics with broad coverage of another subject or subjects of their choice (Science or non-Science). Admission to graduate programs may be conditional upon completion of additional courses or require a period of pre-Master’s study. Students intending to proceed to a Master’s degree must consult with the department at the beginning of their second year of undergraduate study and in each subsequent year. The Major program may be pursued on a part-time basis, although it must be recognized that students may require additional terms to complete degree requirements.

To qualify for the degree, a student must complete a minimum of 120 (Geology) or 121 (Geophysics) credit hours with passing grades (‘D’ or better) in each course and with a minimum degree grade point average of 2.00 as indicated in the Graduation Requirements Table (see section 8.3.4). Students must complete all Faculty requirements as well as the university written English and Mathematics requirement as described in the chapter, General Academic Regulations and Policy, in this Calendar.

Students admitted to the Major program will normally have completed University 1 requirements, which include six credit hours of courses from the Faculty of Arts, six credit hours of courses from the Faculty of Science and six credit hours from either the Clayton H. Riddell Faculty of Environment, Earth, and Resources, the Faculty of Arts or the Faculty of Science. Students who do not meet this requirement while in University 1 must do so within the Major program.

**Minor in Another Department**

Students in the B.Sc. Geological Sciences have the opportunity to complete a Minor of 18 credit hours from a department offering this option at the University of Manitoba. Students are not permitted, however, to complete this Minor in the same department. Students may declare only one Minor. The Minor requirements are described in section 3.3 of this Chapter. Contact the department and/or Faculty student advisor in the Faculty general office for further information about eligible Minors.

**Entrance to the Major**

To enter a Major program in Geology or Geophysics, a student must have completed at least 24 credit hours with a minimum Grade Point Average of 2.00 as stipulated in Entry and Continuation Requirements Table (see section 8.3.4). In addition, the student must attain the minimum grade requirements specified for individual Year 1 courses according to the program tables for the Major in Geology (section 8.4) or the Major in Geophysics (see section 8.5). Students who do not obtain the entrance requirements for the Major program in their first year but who are interested in obtaining the Major degree should consult with the department.

**Continuation in the Major**

A student’s academic performance is assessed first with his/her application for admission to the Faculty and then following each term in which the student is registered. To be in good standing and permitted to continue in the degree program, a student must maintain a minimum Grade Point Average of 2.00 as stipulated in the Entry and Continuation Requirements Table (section 8.3.4). Students are not limited in the number of repeated courses and failures. Students who do not meet the minimum performance requirement will be placed on academic warning, probation or academic suspension as outlined in section 3.14 Academic Warning, Probation and Academic Suspension in this chapter. Students who do not maintain this minimum average to remain in the program will be required to withdraw from the Major program. Students will have the notation ‘Required to Withdraw from the Major Program’, recorded on their transcript of marks.

**Failed courses**

A student is required to repeat those failed courses that are specified as required courses for the program. Students may not repeat a course more than once. Students who need to repeat a course more than once to fulfill degree requirements must make application to the Faculty Appeals and Discipline committee.

**Program approval**

The department head (or designate) and Faculty student advisor in the Faculty general office must approve a student’s Major program each term. Students must also obtain departmental approval for all revisions to their programs.

**Graduation in the Major**

In order to graduate from the Geology and Geophysics Major, students must complete all degree program and faculty requirements as stipulated in sections 3 and 8 of this chapter. Students must also achieve the minimum performance requirements as outlined in the Graduation Requirements Table (see section 8.4.4). This is defined as a minimum Grade Point Average of 2.00 on 120 or 121 credit hours which constitute the degree.

**Residence Requirement for Major Students**

A student must successfully complete a minimum of 60 credit hours at the University of Manitoba. The courses used to satisfy the requirement must be acceptable for credit in the Clayton H. Riddell Faculty of Environment, Earth, and Resources.

**Recognition of Academic Merit**

**Dean’s Honour List**

Students enrolled in a minimum of 12 credit hours of course work during a term and achieve a term Grade Point Average of 3.50 or higher will be placed on the Dean’s Honour List.

**Degree with Distinction**

To obtain a degree with distinction a student must achieve a minimum 3.50 Grade Point Average on all courses constituting the Major degree. The term ‘Degree with Distinction’ will appear both on the parch- ment and student’s transcript of marks.

#### 8.3.2 B.Sc. in Geological Sciences (Honours) Geology or Geophysics

The Honours programs are the most heavily concentrated programs offered and lead most directly to graduate studies. A student is required to achieve higher grade standards than in the Major degree program. The Honours degree may be pursued on a part-time basis, although it must be recognized that students will require additional terms to complete degree require-
ments. Students must complete the degree program within 8 years of gaining initial admission to the Honours program. Failure to complete the Honours degree within the 8-year time limit may require a student to transfer into the Major program.

A student will normally begin the Honours program in second year and must meet the entrance requirements set out below. Students in full-time study can expect to complete the prescribed courses in three years beyond the first year of University. Honours programs lead to either the B.Sc. Geological Sciences (Hons.) (Geology) or the B.Sc. Geological Sciences (Hons.) (Geophysics).

To be eligible for any award granted exclusively on the basis of academic performance, a student must normally be enrolled in a full-time program as defined by the department.

Students must complete the university written English and Mathematics requirement as described in the chapter, General Academic Regulations and Policy, of this Calendar.

Entrance to Honours
To enter the Honours program in Geology or Geophysics, a student must have completed at least 24 credit hours with the minimum Degree Grade Point Average of 2.00. In addition, a student must have completed GEOL 1340 with the minimum Grade of ‘C’. Refer to Table 8.6 for further program requirements.

Continuation in Honours
A student's academic performance is assessed first with his/her application for admission to the Faculty and then following each term in which the student is registered. To be in good standing and permitted to continue in the degree program, a student must maintain the performance requirement as stipulated in the Entry and Continuation Requirements Table (section 8.3.4). Students who are ineligible to enter Honours with their admission to the Faculty may establish eligibility the following year on the basis of their second year of academic performance.

To enter the Honours degree program, a student must complete a program approval form available in the department general office and have it approved by the department head, or designate, and the Faculty student advisor in the Faculty general office.

Program Approval
The department head (or designate) and Faculty student advisor in the Faculty general office must approve a student’s Honours program each term. Students who do not maintain this minimum average to remain in the program will be required to withdraw from the Honours program and, if eligible, will be placed in the Major program. Students who wish to enter the Honours Geophysics Option and have not completed GEOL 1400, GEOL 1410, or GEOL 1420 may arrange with the department to make up this credit. Students must contact the department during the spring preceding entrance to the Honours program. All course choices in the Honours program should be made after consultation with the coordinator of the Geophysics program.

Recognition of Academic Merit

Dean's Honour List
Students enrolled in 12 credit hours of course work during a term and achieve a term Grade Point Average of 3.50 or higher will be placed on the Dean's Honour List.

First Class Honours
To graduate with First Class Honours, a student must achieve a Degree Grade Point Average of 3.50. The term 'First Class Honours' will appear both on the parchment and on the student's transcript of marks.

Honours Program Notes:

Double Honours Programs
Double Honours programs may be available. The program must be arranged in consultation with the departments concerned.

Honours Requirements and Options
Students who do not obtain the entrance requirements for the Honours program in their first year but who are interested in obtaining an Honours degree should consult with the department before registering for their second year.

Honours Geology Options
Students who wish to enter the Honours Geophysics Option and have not taken 6 credit hours of introductory Geological Sciences (e.g., GEOL 1340 and one of GEOL 1400, GEOL 1410, or GEOL 1420) may arrange with the department to make up this credit. Students must contact the department during the spring preceding entrance to the Honours program. All course choices in the Honours program should be made after consultation with the coordinator of the Geophysics program.

8.3.3 B.Sc. in Geological Sciences (General)

Degree Program Structure
- A Geological Sciences component consisting of a minimum of 30 credit hours.
- A minor concentration of 18 credit hours (minimum) in a different department or an interdisciplinary program. e.g. in the Clayton H. Riddell Faculty of Environment, Earth, and Resources, or the Faculty of Arts, or the Faculty of Science. The Minor requirements are described in section 3.3 of this Chapter.
- Students will normally have completed University 1 requirements, which include 6 credit hours from the Faculty of Arts, 6 credit hours from the Faculty of Science and 6 credit hours from either Arts, Science or the Clayton H. Riddell Faculty of Environment, Earth, and Resources. Students who have not met these requirements while in University 1, must meet the requirements prior to graduation.

High School Requirements
It is important to note that the equivalent of Manitoba 40S Chemistry or CHEM 0900 will be required to proceed in the program as GEOL 2540 stipulates this course as a prerequisite.

Entrance to the General
To be admitted to the General program, a student must have completed at least 24 credit hours with a minimum Cumulative Grade Point Average of 2.00. In addition, a student must have completed GEOL 1340 with the grade of 'C'. Refer to Table 8.6 for further program requirements.

Continuation in the General
A student's academic performance is assessed first with his/her application for admission to the Faculty and then following each term in which the student is registered. To be in good standing and permitted to continue in the degree program, a student must maintain a minimum Degree Grade Point Average of 2.00 as stipulated in the Entry and Continuation Requirements Table (section 8.3.4). Students are not limited in the number of repeated
courses and failures. Students who do not meet the minimum performance requirement will be placed on academic warning, probation or academic suspension as outlined in section 3.14 Academic Warning, Probation and Academic Suspension in this chapter.

Failed courses: A student is required to repeat those failed courses that are specified as required courses for the program. Students may not repeat a course more than once. Students are subject to the University of Manitoba regulations on repeating a course (see General Academic Regulations and Policy, Repeating a Course) and the Clayton H. Riddell Faculty of Environment, Earth, and Resources regulations with regard to eligibility to repeat a course. Students who need to repeat a course more than once to fulfil degree requirements must make application to the Faculty Appeals and Discipline committee.

Graduation in the General

To qualify for the degree, students must complete 90 credit hours, inclusive of Geological Sciences courses, a minor in a second department or program, and any University 1 requirements. Minimum performance requirements include passing grades ("D" or better) in each course, a minimum degree grade point average of 2.00 in Geological Sciences courses, and an overall degree grade point average of 2.00 on the 90 credit hours which constitute the degree. Note: Where a Geological Sciences course listed in the calendar has required prerequisites, a student must hold a minimum grade of "C" in each prerequisite course.

Residence Requirement for General Students

Students must complete a total of 48 credit hours at the University of Manitoba, or they must complete their final 30 credit hours at the University of Manitoba in order to satisfy the residency requirement. The courses used to satisfy the requirement must be acceptable for credit in the Clayton H. Riddell Faculty of Environment, Earth, and Resources.

### Recognition of Academic Merit

#### Dean’s Honour List

Students enrolled in a minimum of 12 credit hours of course work during a term and achieve a term Grade Point Average of 3.50 or higher will be placed on the Dean’s Honour List.

#### Degree with Distinction

To obtain a degree with distinction, a student must achieve a minimum 3.50 Degree Grade Point Average on all courses constituting the General degree. The term ‘Degree with Distinction’ will appear both on the parchment and on the student’s transcript of marks.

### 8.3.4 Geological Sciences Entry and Continuation Requirements

<table>
<thead>
<tr>
<th>Degree Program</th>
<th>Minimum Degree Grade Point Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major (Geology)</td>
<td>2.00</td>
</tr>
<tr>
<td>Major (Geophysics)</td>
<td>2.00</td>
</tr>
<tr>
<td>Honours (Geology)</td>
<td>3.00</td>
</tr>
<tr>
<td>Honours (Geophysics)</td>
<td>2.80</td>
</tr>
<tr>
<td>General (Geological Sciences)</td>
<td>2.00</td>
</tr>
</tbody>
</table>

**Notes:**
1. In addition to the minimum degree grade point average noted in this chart, specific courses (with minimum grades) are required for entry and these are noted in the program chart for each program.

### 8.3.5 Geological Sciences Graduation Requirements

<table>
<thead>
<tr>
<th>Degree Program</th>
<th>Minimum Degree Grade Point Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major (Geology) (120)</td>
<td>2.00</td>
</tr>
<tr>
<td>Major (Geophysics) (121)</td>
<td>2.00</td>
</tr>
<tr>
<td>Honours (Geology) (120)</td>
<td>3.00</td>
</tr>
<tr>
<td>Honours (Geophysics) (121)</td>
<td>2.80</td>
</tr>
<tr>
<td>General (Geological Sciences)</td>
<td>2.00</td>
</tr>
</tbody>
</table>

### 8.4 B.Sc. Geological Sciences (Geology)¹,²

#### UNIVERSITY 1

<table>
<thead>
<tr>
<th>HONOURS GEOLOGY 120 CREDIT HOURS</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEOL 1340 (B) and one of GEOL 1400, GEOL 1410, or GEOL 1420</td>
</tr>
<tr>
<td>6 credit hours from the Faculty of Arts</td>
</tr>
<tr>
<td>GEOL 2440, GEOL 2500, GEOL 2520, GEOL 2530, GEOL 2800, GEOL 2770, GEOL 3910⁶</td>
</tr>
<tr>
<td>GEOL 2060, GEOL 3110, GEOL 3130, GEOL 3310, GEOL 3490, GEOL 3900, GEOL 4910⁸</td>
</tr>
<tr>
<td>CHEM 1300, PHYS 1020², and one of MATH 1500³ or MATH 1300⁴ must be completed in University 1 or Year 2. It is recommended that students complete the W course in University 1 or Year 2.</td>
</tr>
<tr>
<td>GEOL 4670, GEOL 4920</td>
</tr>
</tbody>
</table>

#### MAJOR GEOLOGY 120 CREDIT HOURS

| GEOL 1340 (C+) and one of GEOL 1400, GEOL 1410, or GEOL 1420 |
| 6 credit hours from the Faculty of Arts |
| GEOL 2440, GEOL 2500, GEOL 2520, GEOL 2530, GEOL 2800, GEOL 2770, GEOL 3910⁶ |
| GEOL 2060, GEOL 3110, GEOL 3130, GEOL 3310, GEOL 3490, GEOL 3900, GEOL 4910⁸ |
| CHEM 1300, PHYS 1020², and one of MATH 1500³ or MATH 1300⁴ must be completed in University 1 or Year 2. It is recommended that students complete the W course in University 1 or Year 2. |

¹In addition to the minimum degree grade point average noted in this chart, specific courses (with minimum grades) are required for entry and these are noted in the program chart for each program.
Notes:
1 The courses required in this program will satisfy the University mathematics requirement.
2 PHYS 1050 may be used in lieu of PHYS 1020.
3 MATH 1510, MATH 1520 or MATH 1530 may be used in lieu of MATH 1500.
4 MATH 1310 may be used in lieu of MATH 1300.
5 Among the Geological Sciences Electives, all students must complete at least 12 credit hours from List A. In addition, Honours students must complete 15 credit hours from List B or courses from List A not yet completed; Major students must complete at least 6 credit hours from List B or courses from List A not yet completed. NOTE: With departmental approval, students may substitute 6 credit hours of 2000-level or higher courses from other departments in order to satisfy professional registration requirements. See Other Note 1 below.
6 Students will register for GEOL 3910 and GEOL 4910 in Summer term. NOTE: Students should be aware that they are expected to contribute to transportation and accommodation costs. See the department office at the beginning of each year for information.
7 IMPORTANT: The Honours and Major programs need not be completed in the manner prescribed in the chart above. The chart indicates one possible arrangement of the required courses and is meant to be a guide around which students can plan their program. (Letters in brackets indicate the minimum prerequisite standing required for further study).
8 Students who have GEOL 1440 (007.144) or the former 007.124 should consult with the department. At the discretion of the department, GEOL 1440 (007.144) or 007.124 may be permitted in lieu of GEOL 1340 for entry. One of GEOL 1400, GEOL 1410, or GEOL 1420 is highly recommended to be taken in Year 1, but will not be considered when assessing entry requirements to the program. If this requirement is not fulfilled in Year 1, it must be completed by the end of Year 2.
   • To fulfill prerequisite requirements, a grade of ‘C’ must be achieved in any course stipulated as prerequisite to a further course in Geological Sciences.
   • All courses are not offered every year. The course schedule for the current academic term is available from the online calendar at www.umanitoba.ca/calendar.
   • Students registering in certain courses may be required to pay a portion of the costs associated with field trips. For details, contact the department general office.
   • Equivalent courses offered through Collège universitaire de Saint-Boniface may be used in lieu of the specified courses identified in the degree program chart. Collège universitaire de Saint-Boniface courses end in the number ‘1’ (e.g. CHEM 1301).

Other Note 1: Geological Sciences - Geology Electives Lists A and B

List A Electives: Honours and Major students must complete a minimum of 12 credit hours from the following courses:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEOL 2390</td>
<td>Environmental Geology (3)</td>
</tr>
<tr>
<td>GEOL 3290</td>
<td>Metamorphic Structure and Tectonics (3)L</td>
</tr>
<tr>
<td>GEOL 4280</td>
<td>Instrumental Techniques In Geology (3)L</td>
</tr>
<tr>
<td>GEOL 4300</td>
<td>Mineral Deposits (3)L</td>
</tr>
<tr>
<td>GEOL 4520</td>
<td>Petroleum Geology (3)L</td>
</tr>
<tr>
<td>GEOL 4890</td>
<td>Basin Analysis (3)L</td>
</tr>
</tbody>
</table>

List B Electives: Honours students are required to complete a minimum of 15 credit hours; Major students must complete a minimum of 6 credit hours from the following courses:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEOL 2390</td>
<td>Environmental Geology (3)</td>
</tr>
<tr>
<td>GEOL 3290</td>
<td>Metamorphic Structure and Tectonics (3)L</td>
</tr>
<tr>
<td>GEOL 3740</td>
<td>Exploration Seismology (3)L</td>
</tr>
<tr>
<td>GEOL 3130</td>
<td>Gemology (3)L</td>
</tr>
<tr>
<td>GEOL 3420</td>
<td>Engineering Geology (3)</td>
</tr>
<tr>
<td>GEOL 3740</td>
<td>Geology and Geophysics of the Planets (3)L</td>
</tr>
<tr>
<td>GEOL 3910</td>
<td>Geophysics Field School (6)</td>
</tr>
<tr>
<td>GEOL 4130</td>
<td>Paleontologic Principles (3)L</td>
</tr>
<tr>
<td>GEOL 4260</td>
<td>Advanced Studies in Earth Sciences (3)</td>
</tr>
<tr>
<td>GEOL 4270</td>
<td>Applied Geophysics Field Course (3)</td>
</tr>
<tr>
<td>GEOL 4290</td>
<td>Topics in Environmental Geosciences (3)L</td>
</tr>
<tr>
<td>GEOL 4310</td>
<td>Volcanology (3)L</td>
</tr>
<tr>
<td>GEOL 4370</td>
<td>Global Change (3)</td>
</tr>
<tr>
<td>GEOL 4630</td>
<td>Geolimnology (3)</td>
</tr>
<tr>
<td>GEOL 4660</td>
<td>Geophysical Principles (3)L</td>
</tr>
<tr>
<td>GEOL 4740</td>
<td>Geophysics Field School (6)</td>
</tr>
</tbody>
</table>

8.5 B.Sc. Geological Sciences (Geophysics) 4,5,7

<table>
<thead>
<tr>
<th>UNIVERSITY 1</th>
<th>YEAR 2</th>
<th>YEAR 3</th>
<th>YEAR 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>HONOURS GEOPHYSICS 121 CREDIT HOURS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GEOL 1340(B)5 and one of: GEOL 1400, GEOL 1410, or GEOL 1420</td>
<td>GEOL 2060, GEOL 2440, GEOL 2520, GEOL 2530, GEOL 2540</td>
<td>GEOL 3130, GEOL 3740, GEOL 3810, GEOL 4670, GEOL 47404</td>
<td></td>
</tr>
<tr>
<td>PHYS 1050(B) or PHYS 1020(B)1</td>
<td>PHYS 2390, PHYS 2490, MATH 21301, MATH 21322, COMP 1010</td>
<td>GEOL 4810, GEOL 4870, CHEM 1300, PHYS 2600, MATH 21205</td>
<td></td>
</tr>
<tr>
<td>PHYS 1070(B), MATH 1210, MATH 1510(B), and MATH 1710(B)1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plus 6 credit hours from the Faculty of Arts, which should include the required 'W' course</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 Credit Hours</td>
<td>30 Credit Hours</td>
<td>61 Credit Hours for Year 3 and 4</td>
<td></td>
</tr>
</tbody>
</table>

MAJOR GEOPHYSICS 121 CREDIT HOURS | | | |
| GEOL 1340(C)+5 and one of: GEOL 1400, GEOL 1410, or GEOL 1420 | GEOL 2060, GEOL 2440, GEOL 2520, GEOL 2530, GEOL 2540 | GEOL 3130, GEOL 3740, GEOL 3810, GEOL 4670, GEOL 47404 | | |
| PHYS 1050(C) or PHYS 1020(B), PHYS 1070(C), MATH 1210, MATH 1510(C), MATH 1710(C) | PHYS 2390, PHYS 2490, MATH 2130, MATH 2132, COMP 1010 | GEOL 4810, GEOL 4920, CHEM 1300, PHYS 2600, MATH 21205 | | |
| Plus 6 credit hours from the Faculty of Arts, which should include the required 'W' course | | | | |
| 30 Credit Hours | 30 Credit Hours | 61 Credit Hours for Year 3 and 4 | | |
NOTES:
1MATH 1680 or MATH 1690 may be taken in place of MATH 1500 or MATH 1510 and MATH 1700 or MATH 1710 and MATH 1300 may be taken in place of MATH 1210.
2MATH 2720 and MATH 2730 may be taken in place of MATH 2130 and MATH 2132. Students should note that MATH 1300 is a prerequisite to MATH 2720 and a corequisite to MATH 2730.
3MATH 2600 may be taken in place of MATH 2120.
4GEOL 4740 will normally be taken immediately following the spring examinations on or about May 1 and will continue for approximately three weeks. Registration will show as Summer Term.
5The courses required in this program satisfy the university mathematics requirement.
6Students who have GEOL 1440 (007.144) or the former 007.124 should consult with the department. At the discretion of the department, GEOL 1440 (007.144) or 007.124 may be permitted in lieu of GEOL 1340 for entry.
One of GEOL 1400, GEOL 1410, or GEOL 1420 is highly recommended to be taken in Year 1, but will not be considered when assessing entry requirements to the program.
7IMPORTANT: The Honours and Major programs need not be completed in the manner prescribed in the chart above. The chart indicates one possible arrangement of the required courses and is meant to be a guide around which students can plan their program. (Letters in brackets indicate the minimum prerequisite standing required for further study)

OTHER NOTES:
• To fulfil prerequisite requirements, a grade of 'C' must be achieved in any course stipulated as prerequisite to a further course in Geological Sciences.
• All courses are not offered every year. The course schedule for the current academic term is available from the online calendar at www.umanitoba.ca/calendar
• Students registering in certain courses may be required to pay a portion of the costs associated with field trips. For details, contact the department general office.
• Equivalent courses offered through Collège universitaire de Saint-Boniface may be used in lieu of the specified courses identified in the degree program chart. Collège universitaire de Saint-Boniface courses end in the number '1' (e.g. PHYS 1051).

List A Electives: Honours students are required to complete a minimum of 9 credit hours; Major students must complete a minimum of 6 credit hours from the following courses:
- GEOL 4250 Theory and Application of Geophysical Inversion (3)
- GEOL 4320 Physics of the Earth: Seismology and Heat Flow (3)
- GEOL 4330 Physics of the Earth: Geomagnetism and Gravity (3)

List B Electives: Honours students are required to complete a minimum of 9 credit hours; Major students must complete a minimum of 6 credit hours from the following courses:
- GEOL 2390 Environmental Geology (3)
- GEOL 3110 Petrogenesis of Igneous Rocks (3)
- GEOL 3290 Metamorphic Structure and Tectonics (3)
- GEOL 3420 Engineering Geology (3)
- GEOL 3490 Glacial Geology and Geomorphology (3)
- GEOL 3750 Geology and Geophysics of the Planets (3)
- GEOL 3900 Sedimentology (3)
- GEOL 3910 Introduction to Field Mapping (3)
- GEOL 4270 Advanced Studies in Earth Sciences (3)
- GEOL 4300 Mineral Deposits (3)
- GEOL 4370 Global Change (3)
- GEOL 4520 Petroleum Geology (3)
- GEOL 4830 Remote Sensing and Geological Information Systems (3)
- GEOL 4890 Basin Analysis (3)
- GEOL 4910 Advanced Field Mapping (3)
- Any List A or P not already taken, or any advanced level Geological Sciences, Physics or Mathematics course(s) approved by department.

List P Electives: Honours students are required to complete a minimum of 6 credit hours; Major students must complete a minimum of 3 credit hours from the following courses:
- CHEM 2290 Chemical Energetics and Dynamics: Macroscopic Descriptions (3)
- MECH 2260 Introduction to Fluid Mechanics (3)
- PHYS 2610 Circuit Theory and Introductory Electronics (3)
- PHYS 2650 Classical Mechanics 1 (3)
- PHYS 3630 Electro - and Magnetostatic Theory (3)
- PHYS 3670 Classical Thermodynamics (3)
- Or alternate physical Science course(s) approved by department.

8.6 B.Sc. Geological Sciences (General)

<table>
<thead>
<tr>
<th>UNIVERSITY 1</th>
<th>YEAR 2</th>
<th>YEAR 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>GENERAL 90 CREDIT HOURS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GEOL 1340(^1) (C) plus one of GEOL 1400, GEOL 1410, or GEOL 1420</td>
<td>GEOL 2540(^2) plus a further 21 credit hours in Geological Sciences courses numbered at the 2000-level or above</td>
<td></td>
</tr>
<tr>
<td>A minimum grade of 'C' on 6 credit hours from a second department or program for a minor(^4)</td>
<td>A further 12 credit hours for the minor(^4)</td>
<td></td>
</tr>
<tr>
<td>Meet any University 1 requirements(^5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>It is recommended that students complete the M and W course in University 1 or Year 2.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| MINOR GEOLOGICAL SCIENCES 18 CREDIT HOURS | | |
| GEOL 1340 and one of GEOL 1400, GEOL 1410, or GEOL 1420 | Plus 12 credit hours chosen from 2000- and 3000-level courses | |
8.7 Geological Sciences Course Descriptions

All courses are not offered every year. The course schedule for the current academic term is available from the online calendar at www.umanitoba.ca/calendar.

Note: Students registering in a certain course may be required to participate in field trips or field components and pay a portion of the associated expenses. For details refer to the online calendar (www.umanitoba.ca/calendar) or contact the Department of Geological Sciences general office.

GEOL 1340 The Dynamic Earth Cr.Hrs.3 (Lab Required) (Formerly 007.134) An introduction to dynamics of the Earth’s interior and surface that created the environment in which life evolved and that continue to change the world in which people now live. Taught with GEOL 2320. Not to be held with GEOL 1440 (007.144) or GEOL 2350 (007.139) or GEOL 2350 (007.140) or GEOL 2350 (007.124). Required for students intending to proceed in further courses in the Geological Sciences.

GEOL 1400 Time-Trekker’s Travelog: Our Evolving Earth Cr.Hrs.3 Take a trip across billions of years, as we explore awesome times in the evolution of our planet and its life – from dust to us! Not to be held with the former GEOL 1350 (007.135) or 007.123.

GEOL 1410 Natural Disasters and Global Change Cr.Hrs.3 Discover how and when natural disasters occur, and how to identify and recognize them. Explore the Earth processes that lead to natural disasters and global change. Not to be held with the former GEOL 1370 (007.137) or 007.123.

GEOL 1420 Exploring the Planets Cr.Hrs.3 Discover the Solar System as we explore ancient ideas and modern concepts. Emphasis will be on recent space exploration and a comparison of the Earth and its neighbours. Not to be held with the former GEOL 1370 (007.137) or 007.123.

GEOL 2390 Environmental Geology Cr.Hrs.3 (Formerly 007.239) Examination of geological processes and material as they interact with human activities, environmental planning, and management. Also available by correspondence. Prerequisite: university geology or GEOG 1281. Not to be held with GEOG 1281 (053.129) (C), or GEOG 1200 or GEOG 1201 (053.120) (C), or permission of department head.

GEOL 2440 Structural Geology 1 Cr.Hrs.3 (Lab Required) (Formerly 007.244) Elementary mechanical principles of rock deformation, brittle and continuous deformation, geometry of faults, folds, joints, cleavage, lineations. Descriptive geometric and stereonet solution to structural geology problems, cross sections, structural contour maps. Prerequisite: GEOL 1340 (007.134) (C), or GEOL 2440 (007.134) (C), or 007.123 (C), or 007.124 (C).

GEOL 2500 Introduction to Mineralogy Cr.Hrs.3 (Lab Required) (Formerly 007.250) An introduction to the chemistry, physics and classification of minerals. Brief, systematic description of about 200 of the most important minerals. Laboratory: hand specimen identification. For Major and Honours Geology students only. Entry to other students would be after consultation with the department and by permission only. Not to be held with GEOL 2540 or the former 007.207 or 007.262. Prerequisites: GEOL 1340 (007.134) (C), or GEOL 2440 (007.134) (C), or GEOL 2440 (007.134) (C), or GEOL 1340 (007.134) (C), or GEOL 1440 (007.144) (C), or (007.123) (C), or (007.124) (C), or (007.132) (C), or 007.133, 007.134, or 007.144 (c) or consent of the department. CHEM 1300 (002.130) is highly recommended.

GEOL 2520 Igneous and Metamorphic Petrology Cr.Hrs.3 (Lab Required) (Formerly 007.252) An introduction to the chemistry, occurrence and origin of igneous and metamorphic rocks. The study and identification of rocks using hand specimens and thin sections. Prerequisites: GEOL 2500 (007.250) (C) and GEOL 2800 (C), or (007.260) (C), or GEOL 2540 (C).

GEOL 2530 Introductory Sedimentary Petrology and Stratigraphy Cr.Hrs.3 (Lab Required) (Formerly 007.253) An introduction to sedimentary deposits and principles of stratigraphic analysis. Occurrence, classification and origin of sedimentary deposits. Facies concept, stratigraphic classification and correlation. Prerequisites: (GEOL 2500 (007.250) (C), or GEOL 2800 (C), or 007.260) (C), or GEOL 2540 (C).

GEOL 2540 Introductory Mineralogy with Essential of Mineral Optics Cr.Hrs.3 (Lab Required) An introduction to the chemical composition, crystal structure, physical and optical properties of the most common minerals. Discussion of the occurrence of minerals in nature. Laboratory: Identification of minerals in hand specimens and thin sections. Not intended for students in Major or Honours Geology programs. Not to be held with GEOL 2500 (007.250). Prerequisites: (405 Chemistry, CHEM 0900 (002.090) (Pass) or equivalent), and (GEOL 1340 (007.134) (C), or GEOL 1440 (007.144) (C), or (007.123) (C), or (007.124) (C), or permission of department head. CHEM 1300 (002.130) is highly recommended.

GEOL 2570 Energy and Mineral Resources Cr.Hrs.3 (Formerly 007.257) An introduction to the geological factors and processes responsible for the origin, concentration and distribution of fuels, geothermal resources, metallic and nonmetallic minerals. Available by correspondence only. Not for credit in a Major or Honours program in Geological Sciences. Prerequisite: Any university-level Geology course or permission of department.

GEOL 2770 Principles of Inorganic Geochemistry Cr.Hrs.3 (Lab Required) (Formerly 007.277) The cosmic abundance of the elements, nucleosynthesis, geological differentiation of the elements; chemical petrology of igneous, metamorphic and sedimentary rocks. An introduction to aqueous and low-temperature geochemistry. Prerequisite: GEOL 2500 (007.250) (C), or GEOL 2540 (C). Prerequisite or Concurrent Requirement: CHEM 1300 (002.130).

GEOL 2800 Optics and Spectroscopy of Minerals Cr.Hrs.3 Use of the petrographic microscope; microscopic recognition of common rock-forming minerals; introduction to spectroscopic techniques in geosciences (including optical, vibrational and luminescence techniques). Not to be held with GEOL 2600 (C), or Corequisite: GEOL 2500 (007.250) (C) or consent of department.

GEOL 3110 Petrogenesis of Igneous Rocks Cr.Hrs.3 (Lab Required) (Formerly 007.311) Crystalization processes in magma and resultant textures; physical, chemical, and kinetic processes of magmatic systems. Prerequisites: GEOL 2520 (007.252) (C), and GEOL 2770 (007.277) (C).

GEOL 3130 Communication Methods in the Geological Sciences Cr.Hrs.3 (Lab Required) (Formerly 007.313) Practice in oral and written description of geographic subjects; tools of library and database research; manuscript organization; abstract writing; computer-aided table, figure, and slide preparation. Prerequisites: GEOL 2500 (007.250) (C), and GEOL 2440 (007.244) (C). This course is for students in the Honours and Major Geological Sciences programs only.

GEOL 3140 Geochemistry Cr.Hrs.3 (Lab Required) (Formerly 007.314) An introduction to the scientific study of natural and synthetic gem materials, methods of their identification and principles of gemstone appraisals. Laboratory: Identification of gemstones using optical methods. Offered in 2008-2009 and in alternate years thereafter. Prerequisites: (GEOL 2500 (007.250) (C)), and (GEOL 2800 (C), or 007.260) (C), or GEOL 2540 (C).

GEOL 3290 Metamorphism, Structure and Tectonics Cr.Hrs.3 (Lab Required) (Formerly 007.329) Deformation and metamorphism in orogenic terranes, crustal heat flow, and the application of pressure, temperature and time paths to study metamorphic equilibria. Offered in 2008-2009 and in alternate years thereafter. Prerequisites: GEOL 2440 (007.244) (C), and (GEOL 2520 (007.252) (C)), and (GEOL 2770 (007.277) (C)).

GEOL 3310 Palaeontology Cr.Hrs.3 (Lab Required) (Formerly 007.331) The study of fossils: investigating paleontology, with an introduction to paleontologic principles, vertebrate paleontology, and paleobotany. Prerequisite: GEOL 1340 (007.134) (C), or GEOL 1440 (007.144) (C), or 007.123 (C), or (007.124) (C), or permission of department head.

GEOL 3420 Engineering Geology Cr.Hrs.3 (Formerly 007.342) Engineering properties of rocks, laboratory testing and site investigations in engineering geology. Rocks as construction materials, engineering geology of tunnels, bridges, dams, reservoirs, shorelines, sanitary landfills, landslides, seismic risk areas, etc. Offered in 2008-2009 and in alternate years thereafter. Prerequisites: GEOL 2440 (007.244) (C), and (GE-
OL 2520 (007.252) (C), and (GEOL 2530 (007.253) (C).

GEOL 3490 Glacial Geology and Geomorphology Cr.Hrs.3 (Lab Required) (Formerly 007.349) Principles of landform development with emphasis on glacial deposition. Aerial photo and map interpretation in lab. Not to be held with GEOL 3580 (053.358). Prerequisite: GEOL 2530 (007.253) (C).

GEOL 3740 Exploration Seismology Cr.Hrs.3 (Lab Required) (Formerly 007.374) Collection of seismic data (land and sea); simple elastic wave theory; geometry of reflection and refraction seismology; rock velocity determination; seismic noise and signal; data reduction and enhancement techniques; representation of data; survey procedures. Prerequisites: (GEOL 2060 (007.206) (C), and (MATH 1500 (136.150) (C), or MATH 1510 (136.151) (C), or MATH 1520 (136.152) (C), or MATH 1530 (136.153) (C), or MATH 1690 (136.169) (C).

GEOL 3750 Geology and Geophysics of the Planets Cr.Hrs.3 (Lab Required) (Formerly 007.375) Physical and chemical nature of the inner and outer planets and their satellites, asteroids and meteorites. The application of geophysical, geochemical and petrological techniques to planetology; remote sensing study of geological features of planetary surfaces and atmospheric structures. Offered in 2009-2010 and in alternate years thereafter. Prerequisite: GEOL 2060 (007.206) (C), or permission of department head.

GEOL 3810 Applied Geophysics Cr.Hrs.3 (Lab Required) (Formerly 007.381) The application of geophysical methods including gravity, magnetics, seismic reflection and refraction, electrical and electromagnetic methods in exploration, and environmental and engineering problems. Prerequisite: GEOL 2060 (007.206) (C).

GEOL 3900 Sedimentology Cr.Hrs.3 (Lab Required) (Formerly 007.390) The study of depositional environments of sedimentary rocks. Facies analysis and modeling of sedimentary deposits. Prerequisite: GEOL 2530 (007.253) (C).

GEOL 3910 Introduction to Field Mapping Cr.Hrs.3 (Formerly 007.391) Twelve day course introducing field mapping techniques including field navigation and basic field interpretations. Students are responsible for costs of room and board during the field course. Offered in the Summer term. Not to be held with (007.449). Prerequisites: (GEOL 2440 (007.244) (C), and (GEOL 2520 (007.252)(C), and (GEOL 2530 (007.253) (C), and consent of department.

GEOL 4250 Theory and Application of Geophysical Inversion Methods Cr.Hrs.3 (Lab Required) (Formerly 007.425) Introduction to generalized and linear/non-linear inversion theory. Inversion techniques for the potential field, electrical and seismic data will be discussed. Application to global problems will also be discussed. Offered in 2009-2010 and in alternate years thereafter. Prerequisites: GEOL 2060 (007.206) (C), and (MATH 2100 (136.210) (C), or MATH 1310 (136.131) (C).

GEOL 4260 Applied Geophysics Field Course Cr.Hrs.3 (Formerly 007.426) One and one-half weeks field instruction in the planning and execution of geophysical surveys and their application to problems in the earth sciences. Offered in alternate Summer terms. Taught with the first half of GEOL 4740 (or 007.474). Not to be held for credit with GEOL 4740 (or 007.474). Prerequisite: GEOL 3810 (or 007.381) or GEOL 380 (or 007.380) (C), and consent of department.

GEOL 4270 Advanced Studies in Earth Sciences Cr.Hrs.3 (Formerly 007.427) Advanced study in a selected subject in Earth sciences. Prerequisite: Permission of department head.

GEOL 4280 Instrumental Techniques in Geology Cr.Hrs.3 (Lab Required)(Formerly 007.428) Lecture and laboratory course covering the application of microwave, mass spectrometer, diffusion and wet geochemical analytical techniques in mineralogy and geochemistry. Includes coverage of ICP, PIXE, powder and single crystal diffraction and electron microprobe analysis. Offered in 2009-2010 and in alternate years thereafter. Prerequisites: GEOL 2520 (007.252) (C), and GEOL 2530 (007.253) (C), and consent of department.

GEOL 4290 Topics in Environmental Geoscience Cr.Hrs.3 (Formerly 007.429) Advanced concepts and discussion of selected topics in the areas of human interaction with the geological environment and the influence of natural geological processes on human activities. Offered in 2009-2010 and in alternate years thereafter. Prerequisite or Concurrent Requirement: GEOL 3900 (007.390).

GEOL 4300 Mineral Deposits Cr.Hrs.3 (Lab Required) (Formerly 007.430) The textonic setting and deformational and structural nature of ore deposits. The physics and chemistry of ore deposition and ore bearing fluids. The mineralogical, textural and environmental constraints on resource exploitation. Prerequisites: GEOL 3110 (007.311) (C), and (GEOL 3900 (007.390) (C).

GEOL 4310 Paleontologic Principles Cr.Hrs.3 (Lab Required) (Formerly 007.431) Interpretation of Earth history using fossils; topics in taxonomy, functional morphology, paleoecology, evolution, biostratigraphy, and biogeography. Offered in 2008-2009 and in alternate years thereafter. Prerequisite: GEOL 3310 (007.331) (C), or permission of department head.

GEOL 4320 Physics of the Earth: Seismology and Heat Flow Cr.Hrs.3 (Formerly 007.432) Seismology and the structure, physical properties and equations of state of the Earth’s interior; thermal constitution and the history of the Earth. Offered in 2008-2009 and in alternate years thereafter. Prerequisites: (GEOL 2060 (007.206) (C), and (PHYS 2370 (016.237) (C).