# GEOPHYSICS, B.SC. MAJOR

## Degree Requirements

| Course | Title | Hours |
|---|---|---|
| **Year 1** | | |
| GEOL 1340 | The Dynamic Earth (C+) | 3 |
| MATH 1210 | Techniques of Classical and Linear Algebra [2] | 3 |
| CHEM 1100 | Introductory Chemistry 1: Atomic and Molecular Structure and Energetics | 3 |
| CHEM 1120 | Introduction to Chemistry Techniques | 3 |
| One of the following: [1] | | 3 |
| GEOL 1400 | Time-Trekker's Travelog: Our Evolving Earth | |
| GEOL 1410 | Natural Disasters and Global Change | |
| GEOL 1420 | Exploring the Planets | |
| One of the following: | | 3 |
| PHYS 1050 | Physics 1: Mechanics (C) | |
| PHYS 1020 | General Physics 1 (C+) | |
| One of the following: | | 3 |
| PHYS 1070 | Physics 2: Waves and Modern Physics (C) | |
| PHYS 1030 | General Physics 2 (C+) | |
| One of the following: | | 3 |
| MATH 1510 | Applied Calculus 1 (C+) [2] | |
| MATH 1500 | Introduction to Calculus (C+) | |
| One of the following: | | 3 |
| MATH 1710 | Applied Calculus 2 (C) [2] | |
| MATH 1700 | Calculus 2 (C) | |
| | **Hours** | **27** |
| **Year 2** | | |
| GEOL 2060 | Introductory Geophysics | 3 |
| GEOL 2440 | Structural Geology 1 | 3 |
| GEOL 2500 | Introduction to Mineralogy | 3 |
| GEOL 2520 | Igneous and Metamorphic Petrology | 3 |
| GEOL 2530 | Introductory Sedimentary Petrology and Stratigraphy | 3 |
| GEOL 2800 | Optics and Spectroscopy of Minerals | 3 |
| MATH 2130 | Engineering Mathematical Analysis 1 [4] | 3 |
| MATH 2132 | Engineering Mathematical Analysis 2 [4] | 3 |
| 3 credit hours from the Faculty of Arts [6] | | 3 |
| | **Hours** | **27** |
| **Years 3-4** | | |
| GEOL 3130 | Communication Methods in the Geological Sciences | 3 |
| GEOL 3740 | Exploration Seismology | 3 |
| GEOL 3810 | Applied Geophysics | 3 |
| GEOL 4670 | Global Tectonics | 3 |
| GEOL 4740 | Geophysics Field Course [5] | 6 |
| GEOL 4810 | Geophysical Data Analysis | 3 |
| COMP 1012 | Computer Programming for Scientists and Engineers | 3 |
| PHYS 2600 | Electromagnetic Field Theory | 3 |
| MATH 3132 | Engineering Mathematical Analysis 3 [4] | 3 |
| 9 credit hours from the Geophysics Course Electives List | | 9 |
| 3 credit hours from the Physical Science Course Electives List | | 3 |
| 6 credit hours from the Earth Science Course Electives List | | 6 |
| 3 credit hours from the Faculty of Arts [6] | | 3 |
| Enough elective credit to total 120 credit hours for the program | | 15 |
| | **Hours** | **66** |
| | **Total Hours** | **120** |

1. GEOL 1400 is highly recommended to be taken in Year 1, but GEOL 1410 or GEOL 1420 may be substituted.
2. MATH 1690 may be taken in place of MATH 1230 or MATH 1500 (or MATH 1510) and MATH 1700 (or MATH 1710); MATH 1300 may be taken in place of MATH 1210. Selection of MATH 1300 or MATH 1210 will determine the prerequisite background for Mathematics courses required in years 2, 3 and 4.
3. The former CHEM 1300 may be used in lieu of CHEM 1100 and CHEM 1120. CHEM 1122 and CHEM 1126 may be used in lieu of CHEM 1120.
4. MATH 2720 may be taken in place of MATH 2130. PHYS 2496 may be taken in place of MATH 2132. PHYS 3496 may be taken in place of MATH 3132. Normally, students select (MATH 2130, MATH 2132, and MATH 3132) or (MATH 2720, PHYS 2496, and PHYS 3496).
5. GEOL 4740 will normally be taken immediately following the Winter term examinations and will continue for approximately three weeks. Registration will show as Summer Term. **Note:** Students are expected to contribute to the costs of transportation, lodging, and food. Contact the Department for further information.
6. The course selected must meet the University's Written English requirement (https://catalog.umanitoba.ca/undergraduate-studies/general-academic-regulations/#Residence-Written-English).

The courses required in this program will satisfy the University Mathematics Requirement (https://catalog.umanitoba.ca/undergraduate-studies/general-academic-regulations/#Residence-Written-English).

**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)

**Notes:**

- To fulfil prerequisite requirements, a grade of 'C' must be achieved in any course stipulated as prerequisite to a further course in Earth Sciences, unless a higher prerequisite grade is stipulated in a course description.
- All courses are not offered every year. The course schedule for the current academic term is available from the Class Schedule (https://aurora.umanitoba.ca/banprod/bwckschd.p_disp_dyn_sched/) in Aurora
- 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 Université de Saint-Boniface may be used in lieu of the specified courses identified in the degree program chart.

# Geophysics Electives Lists

## Geophysics Course Electives List

- Major students must complete a minimum of 9 credit hours from the following courses:

| Course | Title | Hours |
|---|---|---|
| GEOL 4250 | Theory and Application of Geophysical Inversion Methods | 3 |
| GEOL 4320 | Physics of the Earth: Seismology and Heat Flow | 3 |
| GEOL 4330 | Physics of the Earth: Geomagnetism and Gravity | 3 |
| GEOL 4920 | Technical Report | 3 |

## Earth Science Course Electives List

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

| Course | Title | Hours |
|---|---|---|
| GEOL 2390 | Environmental Geology | 3 |
| GEOL 2570 | Energy and Mineral Resources | 3 |
| GEOL 2770 | Principles of Inorganic Geochemistry | 3 |
| GEOL 3110 | Petrogenesis of Igneous Rocks | 3 |
| GEOL 3420 | Engineering Geology | 3 |
| GEOL 3440 | Structure and Metamorphism | 3 |
| GEOL 3450 | Hydrogeology | 3 |
| GEOL 3490 | Glacial Geology | 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 4360 | Mineral Exploration Techniques | 3 |
| GEOL 4370 | Global Change | 3 |
| GEOL 4380 | Mineral Resource Development | 3 |
| GEOL 4520 | Petroleum Geology | 3 |
| GEOL 4890 | Basin Analysis | 3 |
| GEOL 4910 | Advanced Field Mapping | 3 |
| ENVR 2550 | Environmental Chemistry | 3 |
| GEOG 2300 | Atmospheric Thermodynamics, Clouds and Precipitation (PS) | 3 |
| GEOG 2310 | Introduction to Process Hydrology (PS) | 3 |
| GEOG 2550 | Geomorphology (PS) | 3 |
| GEOG 2930 | Introduction to Oceanography | 3 |
| GEOG 3200 | Introduction to Remote Sensing (TS) | 3 |
| GEOG 3310 | Atmospheric Dynamics, Storms and Radar (PS) | 3 |
| GEOG 3320 | Introduction to Microclimates and Micrometeorology (PS) | 3 |
| GEOG 3730 | Geographic Information Systems (TS) | 3 |

Any course from the Geophysics Course Electives List or the Physical Science Course Electives List not already taken, or any advanced level Earth Sciences, Physics or Mathematics course(s) approved by department

## Physical Science Course Electives List

| Course | Title | Hours |
|---|---|---|
| ASTR 2000 | Foundations of Astrophysics | 3 |
| ASTR 3180 | Stars | 3 |
| CHEM 2600 | Physical Chemistry 1 | 3 |
| CHEM 3600 | Physical Chemistry 2 | 3 |
| PHYS 2152 | Modern Physics for Engineers | 3 |
| PHYS 2260 | Optics | 3 |
| PHYS 2610 | Circuit Theory and Introductory Electronics | 3 |
| PHYS 2650 | Classical Mechanics 1 | 3 |
| PHYS 3630 | Electro - and Magnetostatic Theory | 3 |
| MECH 2262 | Fundamentals of Fluid Mechanics | 4 |

Or alternate physical science course(s) approved by department