GEOLOGICAL SCIENCES (GEOL)

GEOL 1340 The Dynamic Earth 3 cr
(Lab required) 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. Not to be held with the former GEOL 1440 or the former GEOL 2250. Required for students intending to proceed in further courses in the Geological Sciences
Mutually Exclusive: GEOL 1440, GEOL 2250
Attributes: Recommended Intro Courses

GEOL 1400 Time-Trekker's Travelog: Our Evolving Earth 3 cr
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 GEOL 1350.
Equiv To: GEOL 1350
Attributes: Recommended Intro Courses

GEOL 1410 Natural Disasters and Global Change 3 cr
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 1360.
Equiv To: GEOL 1360
Attributes: Recommended Intro Courses

GEOL 1420 Exploring the Planets 3 cr
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.
Equiv To: GEOL 1370
Attributes: Recommended Intro Courses

GEOL 2060 Introductory Geophysics 3 cr
(Lab required) An introduction to geophysical exploration, Earth physics, seismology, electrical methods, and potential fields. Emphasis will be on quantitative modeling and will include geophysical measurements and handling of data.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: [GEOL 1340 (or the former GEOL 1440)], and [MATH 1300 or MATH 1301 or MATH 1310 or MATH 1500 or MATH 1501 or MATH 1510 or MATH 1520 or the former MATH 1530], and [PHYS 1020 or PHYS 1021 or PHYS 1050 or PHYS 1051].

GEOL 2350 Canada Rocks: The Geology of Canada 3 cr
This is a general interest course. Journey through the spectacular story of Canada's geology- its rocks and how they were assembled over time into the amazing country that we live in today.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: [a minimum of 3 credit hours of university-level geology] or [GEOG 1290 or GEOG 1291] or [the former GEOG 1200 or the former GEOG 1201] or EER 1000.

GEOL 2390 Environmental Geology 3 cr
Examination of geological processes and material as they interact with human activities, environmental planning, and management.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: [Minimum 3 credit hours of university-level geology] or [GEOG 1290 or GEOG 1291], or [the former GEOG 1200 or GEOG 1201].

GEOL 2440 Structural Geology 1 3 cr
(Lab Required) 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.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: GEOL 1340 (C+), and [MATH 1300, or MATH 1210, or MATH 1500, or MATH 1510, or MATH 1520].

GEOL 2500 Introduction to Mineralogy 3 cr
(Lab Required) 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. Not to be held with the former GEOL 2540.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: GEOL 1340 (C+) and [one of Chemistry 40S (50%), CKSL 0100 (P) or the former CHEM 0900 (Pass)]. (CHEM 1100 or CHEM 1101) and (one of CHEM 1120, CHEM 1121, or CHEM 1126) are highly recommended.
Mutually Exclusive: GEOL 2540

GEOL 2520 Igneous and Metamorphic Petrology 3 cr
(Lab Required) The classification, occurrence and origin of igneous and metamorphic rocks. The study and identification of rocks using hand specimens and thin sections.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: [GEOL 2500 and GEOL 2800] or [the former GEOL 2540].

GEOL 2530 Introductory Sedimentary Petrology and Stratigraphy 3 cr
(Lab Required) An introduction to sedimentary deposits and principles of stratigraphic analysis. Occurrence, classification and origin of sedimentary deposits. Facies concept, stratigraphic classification and correlation.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: [GEOL 2500 and GEOL 2800] or [the former GEOL 2540].

GEOL 2570 Energy and Mineral Resources 3 cr
An introduction to the geological factors and processes responsible for the origin, concentration and distribution of fuels, geothermal resources, metallic and nonmetallic minerals.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: Any university-level Geology course.

GEOL 2770 Principles of Inorganic Geochemistry 3 cr
(Lab Required) 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.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: [GEOL 2500 or the former GEOL 2540] and [one of MATH 1300, MATH 1301, MATH 1210, MATH 1211, MATH 1230, MATH 1500, MATH 1501, MATH 1510, or MATH 1520]. Pre or Corequisite: [(CHEM 1100 or CHEM 1101) and (one of CHEM 1120, CHEM 1121 or CHEM 1126)] or the former CHEM 1300 or the former CHEM 1301.

GEOL 2800 Optics and Spectroscopy of Minerals 3 cr
(Lab Required) Use of the petrographic microscope; microscopic recognition of common rock-forming minerals; introduction to spectroscopic techniques in geosciences (including optical, vibrational and luminescence techniques).
PR/CR: A minimum grade of C is required unless otherwise indicated.
Pre- or Corequisite: GEOL 2500 or the former GEOL 2540.

GEOL 3110 Petrogenesis of Igneous Rocks 3 cr
(Lab Required) Crystallization processes in magma and resultant textures; physical, chemical, and kinetic processes of magmatic systems.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: GEOL 2520 and GEOL 2770.

GEOL 3130 Communication Methods in the Geological Sciences 3 cr
(Lab Required) Practice in oral and written description of geologic subjects; tools of library and database research; manuscript organization; abstract writing; preparation of tables, figures, and audio-visual material. This course is for students in the Honours and Major Geological Sciences programs only.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: GEOL 2440 and GEOL 2520 and GEOL 2530.
Attributes: Written English Requirement

GEOL 3140 Gemology 3 cr
(Lab Required) 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.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: [GEOL 2500 and GEOL 2800] or [the former GEOL 2540].

GEOL 3310 Paleontology 3 cr
(Lab Required) The study of fossils: invertebrate paleontology, with an introduction to paleontologic principles, vertebrate paleontology, and paleobotany.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: [GEOL 1340 (C+) and GEOL 1400] or [BIOL 1030 or BIOL 1031].

GEOL 3420 Engineering Geology 3 cr
Engineering properties of rocks and soils, laboratory testing and site investigations in engineering geology. Engineering geology of tunnels, bridges, dams, reservoirs, shorelines, sanitary landfills, landslides, seismic risk areas, etc.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: GEOL 2440 and GEOL 2520 and GEOL 2530.

GEOL 3440 Structure and Metamorphism 3 cr
(Lab required) Structural and metamorphic geology, links between deformation and metamorphism, and the application of pressure-temperature and time paths to study metamorphic equilibria. Not to be held with the former GEOL 3290.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: GEOL 2440 and GEOL 2520 and GEOL 3910.
Equiv To: GEOL 3290

GEOL 3450 Hydrogeology 3 cr
(Lab required) The hydrologic cycle and basic hydrologic processes; properties of aquifers and principles of groundwater flow; well hydraulics and groundwater resource evaluation; regional groundwater flow and subsurface geology; and basic chemical hydrogeology. May not be held with CIVL 4250.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: [MATH 1230 or MATH 1500 or MATH 1501 or MATH 1510 or MATH 1520] and [PHYS 1020 or PHYS 1021 or PHYS 1050 or PHYS 1051] and [(CHEM 1100 or CHEM 1101) and (one of CHEM 1120, CHEM 1121, or CHEM 1126)] or [the former CHEM 1300 or the former CHEM 1301] and [GEOL 2060 or GEOG 2310 or (one of STAT 1000, or STAT 1001, or STAT 1150)] and [GEOL 2530].
Mutually Exclusive: CIVL 4250

GEOL 3490 Glacial Geology 3 cr
(Lab required) Principles of landform development with emphasis on glacial deposition. Aerial photo and map interpretation in lab. Not to be held with the former GEOG 3580.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: GEOL 2530.
Mutually Exclusive: GEOG 3580

GEOL 3740 Exploration Seismology 3 cr
(Lab required) Collection of seismic data (land and sea); simple elastic wave theory; geometry of refraction and reflection seismology; rock velocity determination; seismic noise and signal; data corrections; data enhancement techniques; representation of data; survey procedures.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: [GEOL 2060] and [MATH 1500 or MATH 1501 or MATH 1510 or MATH 1520 or the former MATH 1530 or MATH 1690].

GEOL 3750 Geology and Geophysics of the Planets 3 cr
(Lab required) 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 atmospheres.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: GEOL 2060, GEOL 2520, and GEOL 2530, or permission of department.

GEOL 3810 Applied Geophysics 3 cr
(Lab required) The application of geophysical methods in exploration and in environmental and engineering projects.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: [GEOL 2060] and [GEOL 2500 or the former GEOL 2540].

GEOL 3900 Sedimentology 3 cr
(Lab Required) The study of depositional environments of sedimentary rocks. Facies analysis and modeling of sedimentary deposits.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: GEOL 2530.

GEOL 3910 Introduction to Field Mapping 3 cr
Course introducing field mapping techniques including field navigation and basic geologic interpretations. Students are responsible for costs of room and board during the field course. Offered in the Summer Term.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: GEOL 2440 and GEOL 2520 and GEOL 2530 and permission of department.

GEOL 4250 Theory and Application of Geophysical Inversion Methods 3 cr
(Lab required) Introduction to linear and non-linear geophysical inversion theory.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: [GEOL 2060] and [MATH 1210 or MATH 1300 or MATH 1301 or MATH 1310].

GEOL 4260 Applied Geophysics Field Course 3 cr
Field instruction in the planning and execution of geophysical surveys and the use of geophysical equipment; analysis, interpretation and reporting of acquired geophysical data. Taught with the first half of GEOL 4740 in the summer term. Students are responsible for costs of room and board during the field course. Not to be held with GEOL 4740.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: GEOL 3810, GEOL 2440, GEOL 2520, GEOL 2530, and permission of department.
Mutually Exclusive: GEOL 4740

GEOL 4270 Advanced Studies in Earth Sciences 3 cr
Advanced study in a selected subject in Earth sciences. As the course content will vary from year to year, students may take this course more than once for credit.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: Permission of department head.

GEOL 4280 Instrumental Techniques in Geology 3 cr
(Lab required) Lecture and laboratory course introducing modern instrumental techniques for the characterization of materials. Includes coverage of diffraction, spectroscopy, mass spectrometry, electron and scanning probe techniques. Emphasis is placed on basic principles, instrument operation, data analysis and sample preparation.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: GEOL 2520 and GEOL 2530 and GEOL 2770 and permission of department.

GEOL 4300 Mineral Deposits 3 cr
(Lab required) The tectonic 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.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: GEOL 3110 and GEOL 3900.

GEOL 4310 Paleontologic Principles 3 cr
(Lab required) Interpretation of Earth history using fossils: topics in taxonomy, functional morphology, paleoecology, evolution, biostratigraphy, and biogeography.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: GEOL 3310 or permission of department.

GEOL 4320 Physics of the Earth: Seismology and Heat Flow 3 cr
Seismology and the structure, physical properties and equations of state of the Earth's interior; thermal constitution and the history of the Earth.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: GEOL 2060 and [MATH 2130 or MATH 2720 or MATH 2721]. Pre- or co-requisite: MATH 3132 or PHYS 2490 or PHYS 3496.

GEOL 4330 Physics of the Earth: Geomagnetism and Gravity 3 cr
Potential field theory; magnetic properties of Earth materials; figure and rotation of the Earth; theory and application of Earth's gravity and magnetic fields.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: GEOL 2060 and [MATH 2130 or MATH 2720 or MATH 2721]. Co-requisite: MATH 3132 or PHYS 2490 or PHYS 3496..

GEOL 4360 Mineral Exploration Techniques 3 cr
(Lab required) Methodologies used in exploration and evaluation of Canadian mineral deposits and case studies illustrating the application of these methods.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: GEOL 3910 and GEOL 2770. Recommended pre- or corequisite: GEOL 4300.

GEOL 4370 Global Change 3 cr
Examination of the major processes controlling global change through time. The causes, magnitude, and periodicity of changes in the geological record resulting from the variability and interaction of continents, oceans, atmospheres, climate, Earth-sun relationships, and ice sheets, with an emphasis on paleoclimate.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: GEOL 3900. Pre- or corequisite: GEOL 3490.

GEOL 4380 Mineral Resource Development 3 cr
Examination of economic, political, social, and environmental considerations that affect exploration and mining activity.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: GEOL 3130 (C+). Pre- or corequisite: GEOL 4300 or GEOL 3810.

GEOL 4520 Petroleum Geology 3 cr
(Lab required) A study of the physical properties, origins and maturation, migration, and accumulation of petroleum products.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: [GEOL 2060 and GEOL 3900] or [GEOL 2530 and either (GEOL 3810 or GEOL 3740)].

GEOL 4670 Global Tectonics 3 cr
(Lab required) The structure and properties of, and physical processes taking place within, the Earth's interior. Continental cratons and their margins, orogenic belts, structural and petrologic features of the ocean basins, modern diastrophism, global tectonic theories.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: [GEOL 3110, GEOL 3440 (or the former GEOL 3290), GEOL 3900] or [GEOL 2440, GEOL 2520, GEOL 2530 and two of the following courses: GEOL 4250, GEOL 4320, GEOL 4330, GEOL 4810].

GEOL 4740 Geophysics Field Course 6 cr
Field instruction in planning and execution of geophysical surveys and use of geophysical equipment; analysis, interpretation and reporting of acquired geophysical data. Students are responsible for costs of room and board during the field course. Taught in the summer term. Not to be held with GEOL 4260.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: GEOL 2440, GEOL 2520, GEOL 2530, GEOL 3810, and permission of department.
Mutually Exclusive: GEOL 4260

GEOL 4810 Geophysical Data Analysis 3 cr
(Lab Required) The theory and application of spectral methods in geophysics. The use of Fourier Transforms, convolution, power spectra, coherence, transfer functions, covariance, correlation and filtering.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MATH 2132 or PHYS 2490 or PHYS 2496 or permission of department.

GEOL 4870 Honours Thesis 6 cr
A thesis based on a geoscience research project conducted by a fourth-year student in Geology or Geophysics. Selection of a project and supervisor to be arranged prior to registration, submitted in writing to and approved by the department head. This course is for Honours students only and is to be taken in the student's final year before graduation. Not to be held with GEOL 4920.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: GEOL 3130 and permission of department head.
Mutually Exclusive: GEOL 4920

GEOL 4890 Basin Analysis 3 cr
(Lab required) The study of major sedimentary basins. Qualitative and quantitative aspects of basin origin, classification, evolution, fluid content and diagenesis, and sedimentary facies architecture.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: [GEOL 3900 and GEOL 2060] or [GEOL 2530 and (GEOL 3740 or GEOL 3810)].

GEOL 4910 Advanced Field Mapping 3 cr
Course developing field mapping techniques including independent mapping and interpretation and synthesis in complex geological terrains. Students are responsible for costs of room and board during the field course. Offered in the summer term.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: GEOL 3440 or (the former GEOL 3290), GEOL 3110, GEOL 3900, GEOL 3910, and permission of department.

GEOL 4920 Technical Report 3 cr
A technical report based on a geoscience research project conducted by a fourth year Major student in Geology or Geophysics. Selection of a project and supervisor to be arranged prior to registration, submitted in writing to and approved by the department head. This course is for students in the Major program only and is available during the student's final year of study before graduation. Not to be held with GEOL 4870. Technical reports written for this course are not considered compliant with National Instrument 43-101.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: GEOL 3130 and permission of department head.
Mutually Exclusive: GEOL 4870