Appendix 1:
Earth Sciences Course Offerings

EARTH SC 1G03 EARTH AND THE ENVIRONMENT

An introduction to environmental geology and geomorphology through study of the processes that form the earth and its surface features. A mandatory one day field trip will be held.

Two lectures, one tutorial, one lab (two hours); one term

Cross-List(s): *ENVIR SC 1G03*

EARTH SC 2B03 SOILS AND THE ENVIRONMENT

An introduction to the physical, chemical and biological properties of soil. Application to environmental and land use impacts.

Two lectures, one lab (three hours); one term

Prerequisite(s): *One of ENVIR SC 1A03, 1B03, 1G03, ISCI 1A24*

Cross-List(s): *ENVIR SC 2B03*

Antirequisite(s): *GEO 2B03*

EARTH SC 2C03 SURFACE CLIMATE PROCESSES AND ENVIRONMENTAL INTERACTIONS

The surface heat and water balance of natural and human-modified landscapes. Emphasis on interactions of people and the biosphere with climate.

Two lectures, one lab (two hours); one term

Prerequisite(s): *One of ENVIR SC 1A03, 1B03, 1G03, ISCI 1A24*

Cross-List(s): *ENVIR SC 2C03*

Antirequisite(s): *GEO 2C03*

EARTH SC 2E03 EARTH HISTORY

Geological evolution of the Earth and paleontological evidence for the evolution of marine life, with emphasis on the geological history of North America.

Two lectures, one lab (three hours); one term

Prerequisite(s): *ENVIR SC 1G03 or ISCI 1A24*

Cross-List(s): *ENVIR SC 2E03*

Antirequisite(s): *GEO 2E03*

EARTH SC 2EI3 INTRODUCTION TO ENVIRONMENTAL ISSUES

An introduction to issues, perspectives and models in environmental studies at local, regional, national and international scales.

Two lectures, one lab (two hours); one term

Prerequisite(s): *One of ENVIR SC 1A03, 1B03, 1G03, GEO 1HS3, 1HU3, GEOG 1HA3, 1HB3, ISCI 1A24*

Cross-List(s): *GEOG 2EI3*

Antirequisite(s): *GEO 2A03*

EARTH SC 2G03 EARTH SURFACE PROCESSES

An examination of the many dynamic processes that shape the face of the earth, including fluvial, eolian, coastal, mass wasting, karst and weathering processes.

Two lectures, one lab (two hours); one term

Prerequisite(s): *One of ENVIR SC 1A03, 1G03, ISCI 1A24. ENVIR SC 1G03 is strong recommended. Prerequisite (Beginning 2010-2011): ENVIR SC 1G03 or ISCI 1A24*

Cross-List(s): *ENVIR SC 2G03*

Antirequisite(s): *GEO 2G03*

EARTH SC 2GG3 NATURAL DISASTERS

A study of natural processes including plate tectonics, earthquakes, volcanoes, landslides, river erosion and climate change and their impacts on human populations.

Three lectures; one term

Prerequisite(s): *Registration in Level II or above*

Antirequisite(s): *GEO 2GG3*

EARTH SC 2GI3 INTRODUCTION TO GIS

Introduction to the principles and techniques underlying the use of Geographic information systems (GIS) for capturing and visualizing geographically referenced information. Databases, models and cartographic principles are also introduced emphasizing the production of effective thematic maps using GIS software.

Two lectures, one lab (two hours); one term

Prerequisite(s): *One of ISCI 1A24, MATH 1A03, 1AA3, 1B03, 1D03, 1LS3, SOC SCI 2J03, STATS 1CC3, 2B03. One of ENVIR SC 1G03, GEO 1HS3, 1HU3, GEOG 1HA3, 1HB3 is recommended. Prerequisite (Beginning 2010-2011): One of ENVIR SC 1G03, GEOG 1HA3, 1HB3 (GEO 1HS3, 1HU3)*

Cross-List(s): *ENVIR SC 2GI3, GEOG 2GI3*

Antirequisite(s): *GEO 2I03*

EARTH SC 2K03 OPTICAL CRYSTALLOGRAPHY AND MINERALOGY

Introduction to crystallography, optical theory, and the polarizing microscope. Identification of minerals in igneous and sedimentary rocks and discussion of their structure and chemistry.

Two lectures, one lab (three hours); one term

Prerequisite(s): *ENVIR SC 1G03 or ISCI 1A24*

Antirequisite(s): *GEO 2K03*

EARTH SC 2MB3 STATISTICAL ANALYSIS

An introduction to the nature of geographic data and organization, descriptive spatial statistics and inferential statistics.

Two lectures, one lab (two hours); one term

Prerequisite(s): *One of ENVIR SC 1A03, 1B03, 1G03, GEO 1HS3, 1HU3, GEOG 1HA3, 1HB3, ISCI 1A24. One of EARTH SC 2GI3, ENVIR SC 2GI3, GEO 2I03, GEOG 2GI3 is strongly recommended. Prerequisite (Beginning 2010-2011): One of EARTH SC 2GI3, ENVIR SC 2GI3, GEO 2I03, GEOG 2GI3*

Cross-List(s): *ENVIR SC 2MB3, GEOG 2MB3*

Antirequisite(s): *ECON 2B03, GEO 3S03, SOC SCI 2J03*

EARTH SC 2MM3 GEMSTONES: ORIGINS AND CHARACTERISTICS

An examination of gemstones focusing on their geologic origin, mineralogy, colour, chemistry, economic value and historical significance.

Three lectures; one term

Prerequisite(s): *Registration in Level II or above. ENVIR SC 1G03 is strongly recommended. Prerequisite (Beginning 2010-2011): ENVIR SC 1G03 and registration in Level II or above*

Antirequisite(s): *GEO 2MM3*

EARTH SC 2Q03 INTRODUCTION TO ENVIRONMENTAL GEOCHEMISTRY

Chemical principles applied to the understanding of processes in aquatic and environmental systems.

Two lectures, one lab (three hours); one term

Prerequisite(s): *CHEM 1A03 or ISCI 1A24*

Cross-List(s): *ENVIR SC 2Q03*

Antirequisite(s): *CHEM BIO 2P03, CHEM 2PA3, 2PB3, 2PD3, 2R03, GEO 2Q03*

EARTH SC 2W03 PHYSICAL HYDROLOGY: SURFACE

Hydrological processes including precipitation, snowmelt, hillslope runoff, streamflow and hydrological data analysis.

Two lectures, one lab (two hours); one term

Prerequisite(s): *One of ISCI 1A24, MATH 1A03, 1AA3, 1B03, 1D03, 1LS3, SOC SCI 2J03, STATS 1CC3, 2B03; and one of ENVIR SC 1A03, 1B03, 1G03*

Cross-List(s): *ENVIR SC 2W03*

Antirequisite(s): *GEO 2W03*

EARTH SC 2WW3 WATER AND THE ENVIRONMENT

Selected environmental issues related to water, including floods and droughts, irrigation, effects of water management projects and pollution. Examples from Canada and the world.

Three lectures; one term

Prerequisite(s): *Registration in Level II or above. One of BIOLOGY 1M03 (or 1AA3), ENVIR SC 1A03, 1B03, 1G03, ISCI 1A24 is strongly recommended. Prerequisite (Beginning 2010-2011): One of BIOLOGY 1M03 (or 1AA3), ENVIR SC 1A03, 1B03, 1G03, ISCI 1A24*

Antirequisite(s): *GEO 2WW3*

EARTH SC 3CC3 EARTH'S CHANGING CLIMATE

The earth's climatic history including natural causes of past climate change and human influences on climate will be explored.

Three lectures; one term

Prerequisite(s): *One of GEO 1HS3, 1HU3, GEOG 1HA3, 1HB3; ENVIR SC 1A03, 1B03, 1G03, ISCI 1A24; and registration in Level III or above. One of BIOLOGY 1M03 (or 1AA3), ENVIR SC 1A03, 1B03, 1G03, ISCI 1A24 is strongly recommended. Prerequisite (Beginning 2010-2011): One of BIOLOGY 1M03 (or 1AA3), ENVIR SC 1A03, 1B03, 1G03, ISCI 1A24; and registration in Level III or above*

Cross-List(s): *ENVIR SC 3CC3*

Antirequisite(s): *GEO 3CC3*

EARTH SC 3DD3 GEOARCHAEOLOGY OF THE UNDERWATER REALM

Methods in underwater exploration; geoarcheological record of human interaction with the marine environment and the effects of climate and sea level changes.

Three lectures; one term

Prerequisite(s): *Registration in Level III or above. ENVIR SC 1G03 is strongly recommended. Prerequisite (Beginning 2010-2011): ENVIR SC 1G03 or ISCI 1A24; and registration in Level III or above*

Antirequisite(s): *GEO 3DD3*

EARTH SC 3E03 SEDIMENTARY ENVIRONMENTS

Sedimentary processes, stratigraphy and depositional environments of clastic and carbonate systems.

Two lectures, one lab (two hours); one term

Prerequisite(s): *One of EARTH SC 2E03, ENVIR SC 2E03, GEO 2E03*

Cross-List(s): *ENVIR SC 3E03*

Antirequisite(s): *GEO 3E03*

EARTH SC 3FE3 FIELD CAMP

A field camp to introduce students to field equipment and methodologies used by earth and environmental scientists. Most of this course occurs outside the regular academic term, usually the two weeks preceding the start of term in September; details and applications are available in March.

Students enrolling in this course must pay both the incidental fees as

Students enrolling in this course must pay both the incidental fees as prescribed by the School and the regular tuition fees.

Prerequisite(s): *One of EARTH SC 2E03, ENVIR SC 2E03, GEO 2E03; and registration in Level III or above of Honours Earth and Environmental Sciences; and permission of the instructor*

Antirequisite(s): *GEO 3FE3*

EARTH SC 3GI3 ADVANCED RASTER GIS

Advanced treatment of geographic information systems (GIS) focusing on raster data models and techniques. Real-world problem solving emphasizes site selection and environmental applications. Topics include multi-criteria evaluation, terrain mapping and analysis, 3D visualization, spatial interpolation and watershed analysis.

Two lectures, one lab (two hours); one term

Prerequisite(s): *A minimum grade of C+ in one of EARTH SC 2GI3, ENVIR SC 2GI3, GEO 2I03, GEOG 2GI3*

Cross-List(s): *ENVIR SC 3GI3, GEOG 3GI3*

Antirequisite(s): *GEO 4I03*

EARTH SC 3IN3 INTERNSHIP IN EARTH AND ENVIRONMENTAL SCIENCES

The integration of academic learning with an employment or a volunteer experience, providing students the opportunity to explore careers and develop linkages between classroom knowledge and professional practice. Students are responsible to arrange a suitable internship and agreement of the supervisor.

This course is evaluated on a Pass/Fail basis.

Normally, students complete 130 hours of academic work through the duration of the employment or volunteer experience.

Prerequisite(s): *SCIENCE 2C00; and registration in Level III or above of an Honours Earth and Environmental Sciences program; and permission of the internship coordinator*

Antirequisite(s): *GEO 3IN3*

Note: Students participating in this course must be authorized to work in Canada (International students must provide proof of work authorization permit). Students intending to enrol in this course should submit an application to the internship coordinator two months prior to registration. Application forms are available from the School of Geography and Earth Sciences main office.

EARTH SC 3J03 CLIMATE CHANGE AND ECOSYSTEM IMPACTS

Past, present and future climate change is examined in terms of the underlying physical and global biogeochemical processes. The Kyoto Protocol and impacts of climate change on ecosystems are examined.

Three lectures; one term

Prerequisite(s): *One of BIOLOGY 2F03, EARTH SC 2B03, 2C03, ENVIR SC 2B03, 2C03, GEO 2B03, 2C03*

Cross-List(s): *ENVIR SC 3J03*

Antirequisite(s): *GEO 3J03*

EARTH SC 3K03 PETROLOGY

Introduction to igneous and metamorphic petrology, including thin section examination of rock suites, use of phase diagrams in petrology, and discussion of petrogenesis.

Two lectures, one lab (three hours); one term

Prerequisite(s): *EARTH SC 2K03 or GEO 2K03*

Antirequisite(s): *GEO 3K03*

EARTH SC 3L03 AQUATIC BIOGEOCHEMISTRY

This course introduces students to the chemical, physical, geological and biological interactions controlling lake behaviour, through lectures and direct hands-on sampling and analyses of samples. A mandatory afternoon field trip (during laboratory period) is held in September to collect samples from Lake Ontario.

Students enrolling in this course must pay both the incidental fees as prescribed by the School and the regular tuition fees.

Two lectures, one lab (four hours); one term

Prerequisite(s): *One of EARTH SC 2Q03, ENVIR SC 2Q03, GEO 2Q03; and one of EARTH SC 2E03, 2G03, 2W03, ENVIR SC 2E03, 2G03, 2W03, GEO 2E03, 2G03, 2W03; and permission of the School of Geography and Earth Sciences. Application must be received by March 31st of the academic year prior to registration.*

Cross-List(s): *ENVIR SC 3L03*

Antirequisite(s): *GEO 3L03, 4L03*

Enrolment is limited.

EARTH SC 3O03 ORGANIC CONTAMINANTS IN THE ENVIRONMENT

Primary factors controlling the distribution, transport and fate of organic compounds in the environment. Topics include sources, partitioning processes (sorption, volatilization, dissolution), transport, degradation (biotic, abiotic) and analytical techniques.

Two lectures, one lab (three hours); one term

Prerequisite(s): *One of CHEM BIO 2P03, EARTH SC 2Q03, GEO 2Q03; or registration in an Honours Chemistry program*

Cross-List(s): *ENVIR SC 3O03*

Antirequisite(s): *GEO 3O03*

EARTH SC 3P03 ENVIRONMENTAL PALEONTOLOGY

Paleontology as a paleoenvironmental indicator; important fossil groups, paleoecology and taphonomy will be emphasized.

Two lectures, one lab (three hours); one term

Prerequisite(s): *One of EARTH SC 2E03, ENVIR SC 2E03, GEO 2E03*

Antirequisite(s): *GEO 3P03*

EARTH SC 3RD3 RESEARCH DESIGN AND DISSEMINATION IN EARTH AND ENVIRONMENTAL SCIENCES

Review of approaches to the formulation of research questions, and to the gathering and interpretation of evidence, using a variety of environmental and earth sciences-based topics. The course includes the formulation of a research proposal, and develops skills in the communication of research results.

Two lectures, one lab (two hours); one term

Prerequisite(s): *Registration in Level III or above of an Honours B.Sc. program in the School of Geography and Earth Sciences*

Antirequisite(s): *GEO 3R03, GEOG 3MR3*

EARTH SC 3SA3 APPLIED SPATIAL STATISTICS

Advanced treatment of geographic data and organization, descriptive and inferential spatial statistics.

Two lectures, one lab (two hours); one term

Prerequisite(s): *One of EARTH SC 2MB3, ENVIR SC 2MB3, GEO 3S03, GEOG 2MB3, SOC SCI 2J03, STATS 1CC3, 2B03. One of EARTH SC 2GI3, ENVIR SC 2GI3, GEO 2I03, GEOG 2GI3; and one of EARTH SC 2MB3, ENVIR SC 2MB3, GEO 3S03, GEOG 2MB3 are strongly recommended. Prerequisite (Beginning 2010-2011): One of EARTH SC 2MB3, ENVIR SC 2MB3, GEO 3S03, GEOG 2MB3*

Cross-List(s): *ENVIR SC 3SA3, GEOG 3SA3*

Antirequisite(s): *GEO 4S03*

EARTH SC 3SR3 REMOTE SENSING

Aerial photography. Passive and active satellite direction systems. Image processing and interpretation procedures. Application to resource exploration and environmental management.

Two lectures, one lab (two hours); one term

Prerequisite(s): *One of EARTH SC 2GI3, ENVIR SC 2GI3, GEO 2I03, GEOG 2GI3*

Cross-List(s): *ENVIR SC 3SR3, GEOG 3SR3*

Antirequisite(s): *GEO 3Y03*

EARTH SC 3T03 GEOCHEMISTRY OF MINERALS AND ROCKS

Chemistry of the earth including formation of the solar system and the earth, water rock chemical interaction at the earth's surface, chemistry of environmentally-sensitive minerals, techniques for analysing minerals and rocks.

Three lectures; one term

Prerequisite(s): *EARTH SC 2K03 (GEO 2K03); and EARTH SC 2Q03 (GEO 2Q03) or ENVIR SC 2Q03*

Antirequisite(s): *GEO 3Q03*

EARTH SC 3U03 ENVIRONMENTAL SYSTEMS

Use of simple numerical models applied to solving environmental problems related to anthropogenic perturbations. Introduction to STELLA numerical simulator, statement of the problem and "what if" scenarios.

One lecture (three hours); one term

Prerequisite(s): *One of ISCI 1A24, MATH 1A03, 1LS3; and registration in Level II or above of an Environmental and Earth Sciences program, Level III or above of an Honours program in the Faculty of Science or Level III or above of an Engineering program*

Cross-List(s): *ENVIR SC 3U03*

Antirequisite(s): *CIV ENG 2J04, GEO 3U03*

EARTH SC 3V03 ENVIRONMENTAL GEOPHYSICS

Introduction to principles and applications of geophysics in groundwater and environmental investigations. Practical demonstrations in magnetics, gravity, shallow seismic, radar, borehole logging, surface EM and electrical methods.

Two lectures, one lab (three hours); one term

Prerequisite(s): *ISCI 1A24 or ENVIR SC 1G03; and PHYSICS 1B03 or 1L03*

Antirequisite(s): *GEO 3V03*

EARTH SC 3W03 PHYSICAL HYDROGEOLOGY

Mechanisms and processes of water movement in the subsurface including the saturated zone (groundwater) and the unsaturated zone (soil water).

Two lectures, one lab (three hours); one term

Prerequisite(s): *One of EARTH SC 2B03, 2G03, 2W03, ENVIR SC 2B03, 2G03, 2W03, GEO 2B03, 2G03, 2W03; and one of ISCI 1A24, MATH 1A03, 1B03, 1K03, 1LS3, 1M03, 1N03*

Cross-List(s): *ENVIR SC 3W03*

Antirequisite(s): *GEO 3W03*

EARTH SC 3Z03 STRUCTURAL GEOLOGY

Introduction to mapping and geometric description of geologic structures and analysis of stress and strain in the subsurface.

Two lectures, one lab (three hours); one term

Prerequisite(s): *One of EARTH SC 2E03, ENVIR SC 2E03, GEO 2E03*

Antirequisite(s): *GEO 3Z03*

EARTH SC 4B03 WATERSHED ECOHYDROLOGY

A course that emphasizes a watershed ecosystems approach to interactions of hydrological, ecological and biogeochemical processes in the study of the natural ecohydrological function and response to disturbance of stream, riparian and wetland ecosystems. A mandatory field trip will occur during lab time.

One lecture (two hours), one lab (four hours); one term

Prerequisite(s): *One of EARTH SC 2W03, 3J03, ENVIR SC 2W03, 3J03, GEO 2W03, 3B03, 3J03*

Cross-List(s): *ENVIR SC 4B03*

Antirequisite(s): *GEO 4B03*

EARTH SC 4C03 ADVANCED PHYSICAL CLIMATOLOGY

This course develops energy and mass exchange processes in the near surface layer, the lower atmosphere and at the earth-atmosphere interface. Sensitivities of these processes to environmental change and feedback mechanisms are examined. Seminars and individual presentations are emphasized.

One lecture (two hours), one lab (two hours); one term

Prerequisite(s): *One of EARTH SC 2C03, 2W03, ENVIR SC 2C03, 2W03, GEO 2C03, 2W03*

Cross-List(s): *ENVIR SC 4C03*

Antirequisite(s): *GEO 4C03*

EARTH SC 4E03 COASTAL ENVIRONMENTS

Topics in coastal systems evolution with an emphasis on the Holocene. A mandatory field trip (5 to 7 days in duration) to collect data followed by laboratory analysis will be included.

Students enrolling in this course must pay both the incidential fees as prescribed by the School and the regular tuition fees.

Two lectures, one lab (three hours); one term

Prerequisite(s): *One of EARTH SC 3E03, ENVIR SC 3E03, GEO 3E03*

Antirequisite(s): *GEO 4E03*

EARTH SC 4EA3 ENVIRONMENTAL ASSESSMENT

Technical and policy issues involved in the production and the appraisal of environmental impact assessments.

Two lectures, one lab; one term

Prerequisite(s): *One of EARTH SC 2EI3, GEO 2A03, GEOG 2EI3; or registration in Honours Biology, a Civil Engineering program, an Engineering and Society program, an Honours Integrated Science program or an Honours program in the School of Geography and Earth Sciences*

Cross-List(s): *ENVIR SC 4EA3, GEOG 4EA3*

Antirequisite(s): *GEO 4A03*

EARTH SC 4FE3 FIELD COURSE

Detailed study of a particular aspect of physical geography, earth sciences or environmental science in the field. Held immediately after the end of Level III or prior to Fall registration in Level IV; report to be submitted before the end of first term. Various topics and locations: details announced in March.

Students enrolling in this course must pay both the incidental fees, as prescribed by the School, and the regular tuition fees.

Prerequisite(s): *Registration in Level III or above of an Honours B.Sc. program in the School of Geography and Earth Sciences*

Antirequisite(s): *GEO 4FE3*

EARTH SC 4FF3 TOPICS OF FIELD RESEARCH

Selected topics in field research in the Earth Sciences. Topics may vary from year to year, and the timing of the course will depend on the offerings. Details will be posted in the School.

Students enrolling in this course must pay the incidental fees, as prescribed by the School, and the regular tuition fees.

Prerequisite(s): *Registration in Level III or above of an Honours B.Sc. program and permission of the instructor*

Antirequisite(s): *GEO 4FF3*

EARTH SC 4FF3 may be repeated, if on a different topic, with the permission of the School of Geography and Earth Sciences.

EARTH SC 4G03 GLACIAL SEDIMENTS AND ENVIRONMENTS

The development and movement of glaciers, glacial depositional processes and sedimentary successions in terrestrial, lacustrine and marine environments. A mandatory local field trip will be included.

Students enrolling in this course must pay both the incidential fees as prescribed by the School and the regular tuition fees.

Two lectures, one lab (two hours); one term

Prerequisite(s): *One of EARTH SC 2E03, 2G03, ENVIR SC 2E03, 2G03, GEO 2E03, 2G03*

Cross-List(s): *ENVIR SC 4G03*

Antirequisite(s): *GEO 4G03*

EARTH SC 4GI3 ADVANCED VECTOR GIS

Advanced treatment of GIS focusing on vector data models and techniques. Real-world problem solving emphasizes business and transportation applications. Global positioning system data collection and processing are addressed, along with basic programming using Visual Basic for Applications.

Two lectures, one lab (two hours); one term

Prerequisite(s): *A minimum grade of C+ in one of EARTH SC 2GI3, ENVIR SC 2GI3, GEO 2I03, GEOG 2GI3*

Cross-List(s): *ENVIR SC 4GI3, GEOG 4GI3*

Antirequisite(s): *GEO 3I03*

EARTH SC 4IN3 THESIS INTERNSHIP

The integration of academic learning allowing the student to explore careers and the development of linkages between classroom knowledge and professional practice. Students are responsible to arrange a suitable internship and agreement of the supervisor.

This course is evaluated on a Pass/Fail basis.

Normally, students complete 130 hours of academic work through the duration of the employment or volunteer experience.

Prerequisite(s): *SCIENCE 2C00; and registration in Level III or above of an Honours Earth and Environmental Sciences program; and permission of the internship coordinator*

Antirequisite(s): *GEO 4IN3*

Note: Students participating in this course must be authorized to work in Canada (International students must provide proof of work authorization permit). Students intending to enrol in this course should submit an application to the internship coordinator by March 1 of the academic year prior to registration. Application forms are available from the School of Geography and Earth Sciences main office.

EARTH SC 4J03 BASIN ANALYSIS

Focus on the evolution of sedimentary basins in a global context, based upon their structural and stratigraphic styles. Factors that affect basin evolution such as sea-level change, sediment supply and climate will be discussed. A review of the principles of sequence stratigraphy and its application to geologists, mining and petroleum exploration will be explored.

Two lectures, one lab (three hours); one term

Prerequisite(s): *One of EARTH SC 3E03, ENVIR SC 3E03, GEO 3E03; and EARTH SC 3Z03 or GEO 3Z03*

Antirequisite(s): *GEO 4J03*

EARTH SC 4L03 ENVIRONMENTAL MICROBIOLOGY AND GEOCHEMISTRY

Bacteria are found in almost every environment and are often profoundly important for key geochemical processes. The geomicrobiology of ancient and modern environments, the roles of bacteria in important elemental cycles and the emerging tools to characterize such interactions will be examined.

Two lectures, one lab (three hours); one term

Prerequisite(s): *One of EARTH SC 3L03, 3O03, ENVIR SC 3L03, 3O03, GEO 3L03, 3O03 or registration in an Honours Biology program; and permission of the School of Geography and Earth Sciences*

Cross-List(s): *ENVIR SC 4L03*

EARTH SC 4MR3 REVIEW PAPER

The student will conduct a comprehensive review of a selected topic. The review paper is due before the final examination period.

One seminar (two hours); one term

Prerequisite(s): *One of EARTH SC 3RD3, GEO 3R03, GEOG 3MR3; and registration in Level IV of an Honours program in the School of Geography and Earth Sciences*

Cross-List(s): *GEOG 4MR3*

Antirequisite(s): *EARTH SC 4MT6, GEO 4CC3, 4R06*

EARTH SC 4MT6 SENIOR THESIS

Students will select research topics and prepare a thesis either individually or in teams.

One seminar (two hours); two terms

Prerequisite(s): *Registration in Level IV or above in an Honours program in the School of Geography and Earth Sciences; and a CA of 7.5 or higher; and permission of the course coordinator. One of EARTH SC 3RD3, GEO 3R03, GEOG 3MR3 is strongly recommended. Prerequisite (Beginning 2010-2011): One of EARTH SC 3RD3, GEO 3R03, GEOG 3MR3; and registration in Level IV or above in an Honours program in the School of Geography and Earth Sciences; and a CA of at least 7.5; and permission of the course coordinator. Students intending to enrol in this course must submit an application to the course coordinator by March 1 of the academic year prior to registration. Application forms are available from the School of Geography and Earth Sciences main office after February 1. Students will be informed of acceptance of their application on March 15 subject to fulfillment of the CA requirement.*

Cross-List(s): *GEOG 4MT6*

Antirequisite(s): *EARTH SC 4MR3, GEO 4CC3, 4R06, GEOG 4MR3*

Enrolment is limited.

EARTH SC 4O03 ENVIRONMENTAL ISOTOPE GEOCHEMISTRY

Application of isotopic analysis to answer current questions in earth sciences, geochemistry, hydrogeology and microbiology. Topics include analytical techniques, principles of isotopic fractionation and applications of light and transition metal isotopes to environmental systems.

Two lectures, one lab (three hours); one term

Prerequisite(s): *One of EARTH SC 3O03, ENVIR SC 3O03, GEO 3O03*

Cross-List(s): *ENVIR SC 4O03*

Antirequisite(s): *GEO 4O03*

EARTH SC 4Q03 SEDIMENTARY GEOCHRONOLOGY

Geological age determination techniques for the near-surface sedimentary record focusing on the last five million years of earth history. Geochemical perspectives on the fundamentals of radioactive decay and radiation effects in datable minerals.

Two lectures, one tutorial; one term

Prerequisite(s): *One of EARTH SC 3Q03, ENVIR SC 3Q03, GEO 3Q03*

Antirequisite(s): *GEO 4Q03*

EARTH SC 4T03 PLATE TECTONICS AND ORE DEPOSITS

Synthesis of plate tectonics, with application to crustal evolution and genesis of ore deposits.

Two lectures, one lab (two hours); one term

Prerequisite(s): *EARTH SC 2E03 or ENVIR SC 2E03, and credit or registration in EARTH SC 3K03; or GEO 2E03, 3K03*

Antirequisite(s): *GEO 4T03*

EARTH SC 4V03 MINERAL EXPLORATION GEOPHYSICS

Principles of geophysical methods employed in mineral exploration. Use of gravity, magnetic and radiometric methods for surface and sub-surface geological mapping. Application to specific mineral deposit types.

Two lectures, one lab (two hours); one term

Prerequisite(s): *One of EARTH SC 2E03, ENVIR SC 2E03, GEO 2E03; and EARTH SC 3V03 or GEO 3V03*

EARTH SC 4W03 HYDROLOGIC MODELLING

Principles of numerical modelling and examination of selected hydrologic models including deterministic, conceptual and statistical models.

One lecture (two hours), one lab (two hours); one term

Prerequisite(s): *One of EARTH SC 2W03, 3W03, ENVIR SC 2W03, 3W03, GEO 2W03, 3W03*

Cross-List(s): *ENVIR SC 4W03*

Antirequisite(s): *GEO 4W03*

EARTH SC 4WB3 CONTAMINANT HYDROGEOLOGY

Physical and chemical aspects of the fate and transport of contaminants in soils and groundwater, including fundamental processes, multiphase flow and groundwater remediation.

Three lectures; one term

Prerequisite(s): *Credit or registration in EARTH SC 3W03 (GEO 3W03) or ENVIR SC 3W03*

Cross-List(s): *ENVIR SC 4WB3*

Antirequisite(s): *EARTH SC 4WW3, ENVIR SC 4WW3, GEO 4WW3*

EARTH SC 4Z03 MARINE GEOPHYSICS

Principles of geophysical exploration of lakes and marine environments. Applications in geoscience research, resource exploration and underwater archaeology.

Two lectures, one lab (two hours); one term

Prerequisite(s): *One of EARTH SC 2E03, ENVIR SC 2E03, GEO 2E03; and EARTH SC 3V03 or GEO 3V03*

Antirequisite(s): *GEO 4Z03, 4ZZ3*