

Although every effort has been made to avoid errors, this is an Unofficial version From the Arts and Science 2011-2012 Calendar. Refer to the Queen's University Arts and Science website for the official version

GEOL 104/3.0 The Dynamic Earth 3L;1P

An introduction to the internal structure of the earth and to the dynamic processes which have shaped the earth's surface. An integrated study of global tectonics and continental movement, rock genesis, mountain building, glaciation and geological time. Laboratories give an overview of the earth scientist's toolbox including rock and mineral identification, geochronology, geomorphology and structural geology.

NOTE Lab manual and materials: about \$20.

GEOL 106/3.0 Environmental Geology and Natural Hazards 3L

The relationship between human-kind and our ever-changing planet, with a focus on natural geologic hazards (volcanic eruptions, earthquakes, landslides, tsunamis, mass movement, floods, extraterrestrial impacts, etc.), and environmental impacts which result from population and land-use expansion and our increased use of water, energy and mineral resources. A study of the sources and impact of pollution and global climate change. Public perception of and response to geological risk.

GEOL 107/3.0 History of Life 3L;1P

The history of life, from its inception four billion years ago to the present day, focusing on the inter-relationship between organic evolution and global change. Coevolution of early life and the atmosphere; development of marine animals and their ecosystems; invasion of the land; dinosaurs and their world; mass extinctions; the Age of Mammals; and hominid evolution. Lectures plus three three-hour laboratories.

GEOL 200/3.0 Oceanography 3L

Introduction to marine science. Topics include: ocean basins and their sediments; seawater chemistry/biochemistry; ocean waves, tides and currents; ocean-atmosphere interaction; polar to tropical organism communities; marine resources; environmental concerns; global change.

PREREQUISITE PHYS 104/6.0 or PHYS 106/6.0 or PHYS 107/6.0 or PHYS 117/6.0 or CHEM 112/6.0 or CHEM 116/6.0 or BIOL 102/3.0 or BIOL 103/3.0 or GEOL 104/3.0 or GEOL 106/3.0 or GEOL 107/3.0.

GEOL 212/3.0 Introduction to Mineralogy 2L;2P

An introduction to the crystallography and crystal chemistry of rock-forming minerals for students not in the Geological Sciences. The structural, chemical and genetic aspects of the crystalline state as displayed by minerals are considered.

RECOMMENDATION 4U Chemistry is required.

COREQUISITE GEOL 104/3.0 or permission of the Department.

EXCLUSION No more than 3.0 units from GEOL 212/3.0; GEOL 232/3.0.

GEOL 221/3.0 Geological Field Methods 5P;2L

An introduction to the field study and description of surficial deposits, sedimentary, igneous and metamorphic rocks, and geological processes, based on geological features of the Kingston area. Descriptions, samples and measurements acquired on weekly field trips during the first part of the course will be analyzed, and the results will be recorded in maps, sections, data bases, and reports during the second part of the course.

PREREQUISITE GEOL 104/3.0 or permission of the Department.

COREQUISITE GEOL 232/3.0 or permission of the Department.

GEOL 232/3.0 Mineralogy 3L;3P

Characterization of rock- and soil-forming silicate and non-silicate minerals (their crystallography, optical and physical behaviour, and crystal chemistry). The structural, chemical and genetic aspects of the crystalline state as displayed by minerals are considered. Implications of mineral properties for the engineering behaviour of soils and rocks, and for human needs, are discussed.

RECOMMENDATION 4U Chemistry is required.

COREQUISITE GEOL 104/3.0

EXCLUSION No more than 3.0 units from GEOL 212/3.0; GEOL 232/3.0.

GEOL 235/3.0 Genesis and Characterization of Solid Earth Materials 3L;3P

Macroscopic and microscopic characterization of igneous, sedimentary and metamorphic rocks. Processes by which rocks are formed and transformed, and influence of genesis on shape, distribution, and rock-mass character of rock bodies. Implications and consequences of rock-forming processes for mineral exploration and production, fossil-fuel exploration and production, and engineering site investigation.

PREREQUISITE GEOL 232/3.0.

GEOL 238/3.0 Surficial Processes, Sedimentation and Stratigraphy 3L;2P

An examination of the genetic link between surficial geological processes and the sedimentary record produced by these processes. Students obtain an integrated overview of the nature and operation of the Earth-surface environment. Topics include origin of sedimentary rocks and their sedimentary structures, depositional environments and stratigraphic successions; stratigraphic principles and their application to sedimentary basins, with implications for hydrocarbon genesis; interaction of natural processes with human society.

PREREQUISITE GEOL 104/3.0 or permission of the Department.

GEOL 249/3.0 Geophysical Characterization of the Earth 3L;1T

The application of physical principles to examine and characterize the Earth at all scales. The Earth's physical properties and dynamic processes will be assessed and evaluated by integrating such topics as gravity, seismology, magnetism, geochronology, and heat flow, as related to scientific and engineering problems.

COREQUISITES GEOL 104/3.0 and (MATH 120/6.0 or MATH 121/6.0 or MATH 122/6.0 or [MATH 123/3.0 and MATH 124/3.0]) and (PHYS 104/6.0 or PHYS 106/6.0 or PHYS 107/6.0 or PHYS 117/6.0), or permission of the Department.

EXCLUSION No more than 3.0 units from GEOL 249/3.0; GEOL 269/3.0.

GEOL 262/3.0 Geological Aspects of Mineral Deposits 3L;1.5P

The basic mineralogy and petrology of mineral deposits are examined. The formation and classification of mineral deposits, considering such aspects as tectonic setting, age, rock composition, geometry, and mineralogy are investigated. Emphasis is placed on the processes by which mineral deposits are formed and transformed, and their influence on mining and production. Laboratory work integrates geological information from the scale of hand samples to regional maps as tools to assist with mine design, estimation of ore grade and evaluation of issues related to ore processing.

PREREQUISITE GEOL 104/3.0.

ONE-WAY EXCLUSION May not be taken with or after GEOL 232/3.0; GEOL 362/3.0.

GEOL 269/3.0 Physics of the Earth 3L;1T

An examination of the physical principles and properties exhibited by the Earth which can be used to understand its origin, structure, dynamic processes, and evolution through time. Topics such as gravity, seismology, magnetism, geochronology, and heat flow are discussed in conjunction with the unifying theory of plate tectonics.

RECOMMENDATION 4U Physics is required.

COREQUISITES GEOL 104/3.0 and (MATH 120/6.0 or MATH 121/6.0 or MATH 122/6.0 or [MATH 123/3.0 and MATH 124/3.0]), or permission of the Department.

EXCLUSION No more than 3.0 units from GEOL 249/3.0; GEOL 269/3.0

GEOL 282/3.0 Managing Earth Systems: Resources and Environment 2L;3P

An earth-system engineering perspective on the nature, acquisition and utilization of energy, mineral and water resources, with particular emphasis on the environmental considerations in their extraction, processing, and use. Criteria for designing resource exploration programs are examined. Practical exercises, projects and seminars (team and individual) deal with these issues, and include the design of risk-management plans, environmental life-cycle assessments, sustainable systems and ore-reserve estimations.

PREREQUISITES GEOL 221/3.0 or GEOL 232/3.0, or permission of the Department.

GEOL 300/3.0 Geological Field School

An intensive two-week course taken immediately after final examinations in second year (see Sessional Dates). Teams of students use geological field methods as the basis for an assessment of overburden and bedrock for a specific outcome. A final report is presented and defended. The cost of accommodation and food (\$600 in 2011, but subject to change) will be borne by the student.

PREREQUISITES GEOL 221/3.0 and GEOL 235/3.0 or permission of the Department.

GEOL 319/3.0 Applied Geophysics

3L;1T

Techniques of geophysics (including gravity, magnetic, electrical, and seismic) applied to engineering problems, including resource exploration and site investigation. Physical principles, instrumentation, field procedures, data interpretation, and design of field programs are covered for each of the major methods.

PREREQUISITES GEOL 249/3.0 and MATH 232/3.0, or permission of the Department.

GEOL 321/3.0 Analysis of Rock Structures 3L;3P

Application of material mechanics to rock deformation. The nature, origin and interpretation of deformation and fracture of rocks, and the application of structural methods to site-investigation and resource exploitation. Topics include geometric, kinematic and dynamic analysis; mechanical analysis (stress and strain theory); geologic mapping and map interpretation; engineering rockmass classification and rock engineering in structurally controlled ground, introduction to geotectonics with examination of selected tectonic associations. Application of structural geology and geomechanics to design issues related to construction, mining, natural hazards, and resource exploitation. Required full-day field trip and several half day excursions.

PREREQUISITE GEOL 300/3.0 or permission of the Department.

GEOL 323/3.0 Quaternary Glacial Geology 3L;2P;1S

Quaternary paleoclimates and ice ages. Glacial and proglacial processes, environments and landforms. Dating techniques. Glacial-interglacial history and stratigraphy of selected areas in Canada. One or more one-day field trips may be required. Not offered in 2011-12.

PREREQUISITE GEOL 238/3.0 or permission of the Department.

GEOL 333/3.0 Terrain Evaluation 3L;2P

The nature and origin of surficial deposits and landforms are investigated with emphasis on their recognition and their inter-relationships with, and influence on, engineering activities. Air-photo interpretation is a major component of the course. Techniques of remote sensing are investigated. Students design terrain-evaluation maps, based on air-photo studies to solve scientific and engineering problems.

PREREQUISITE GEOL 104/3.0 or GEOL 106/3.0 or GPHY 208/3.0 or GPHY 242/3.0 or permission of the Department.

GEOL 337/3.0 Paleontology 3L;2P

Review of the major groups of invertebrate fossils, emphasizing functional morphology, and geological significance. Introduction to paleoecology and biostratigraphy. Course includes a required paleontological field trip.

PREREQUISITE GEOL 238/3.0 or (a grade of B in GEOL 107/3.0) or BIOL 202/3.0 or permission of the Department.

GEOL 343/3.0 Hydrogeology 3L;2P

Development of the equations governing flow and transport; sensitivity to sub-surface complexities. Field instrumentation, installation and sampling protocols, elements of groundwater investigation. Assessment of measurement techniques and interpretation of fundamental hydrogeological properties. Groundwater occurrence, flow system analysis, with a focus on designing extraction scheme.

PREREQUISITES GEOL 238/3.0 and (CHEM 112/6.0 or CHEM 116/6.0) or permission of the Department.

GEOL 352/3.0 Topics in Mineralogy 2L;3P

Through lectures, seminars and assigned readings selected topics in mineralogy are explored. Emphasis on the current literature and the details of mineralogical phenomena will lead to better understanding of petrologic systems.

NOTE Next offered in 2012-2013, and alternate years thereafter.

PREREQUISITE GEOL 232/3.0 or GEOL 212/3.0.

GEOL 362/3.0 Petrology Applied to Ore Deposits 3L;3P

Characterization of major ore deposit types using petrological, geochemical and geophysical engineering sciences. Tectonic setting, age, rock composition, geometry, mineralogy and textures, geochemical and geophysical signatures. Metallogenic epochs and provinces. Design and evaluation of ore deposit models and exploration programs, including ore processing and environmental issues. Laboratory work integrates techniques of ore microscopy to determine paragenetic sequences, estimation of ore grade and evaluation of issues related to ore processing and site contamination.

PREREQUISITE GEOL 235/3.0 or permission of the Department.

GEOL 365/3.0 Geochemical Characterization of Earth Processes 3L;2P

The application of thermodynamics and kinetics to the understanding of natural processes in the Earth Sciences. Distribution of the elements, and practical uses of isotopes and elemental tracers. Geochemical actions and transactions within, and among, the lithosphere, hydrosphere, atmosphere and biosphere, including the impact of human evolution and environmental geochemistry. Practical application of geochemistry to solving problems in natural systems will be emphasized. A practical involving problems, laboratory experience and field experience will be part of the course.

PREREQUISITES (CHEM 112/6.0 or CHEM 116/6.0) and GEOL 232/3.0 and GEOL 235/3.0, or permission of the Department.

GEOL 368/3.0 Carbonate Sedimentology 3L;3P

The origin, composition and diagenesis of carbonate rocks. Study of modern carbonate sediments and depositional environments; development of facies models; petrographic and geochemical analysis of limestones and dolostones. Required extended field trip during term.

PREREQUISITE GEOL 238/3.0 or permission of the Department.

GEOL 409/3.0 Applied Geophysics Laboratory 1L;3P;4T

Local field exercises and laboratory assignments using a variety of exploration methods. Lectures will be used to teach basic instrument theory, and to teach the principles of exploration program design. The course includes a four-day field exercise to design and carry out an integrated geophysical investigation. Evaluation is based on submitted technical reports arising from the practical assignments.

NOTE Not offered in 2011-2012.

PREREQUISITE GEOL 319/3.0 or permission of the Department.

GEOL 418/3.0 Petroleum Geology 3L;3P

The origin, migration and accumulation of petroleum resources, emphasizing typical reservoir styles, potential reservoir lithologies, methods of exploration and basic concepts of formation evaluation. Concepts and applications equip students with the basic principles necessary to undertake petroleum industry exploration and production. Laboratory exercises include a major exploration problem and presentation.

NOTE Next offered in 2011-2012 and in alternate years thereafter.

PREREQUISITES GEOL 238/3.0 and GEOL 321/3.0, or permission of the Department.

GEOL 421/3.0 Igneous Petrology 2L;3P

Rock classification and tectonic associations, petrochemistry, petrogenesis; the origin and differentiation of primary magmas, plate tectonics and magmatic evolution. Phase diagrams of igneous minerals. Laboratory study of rock suites and special projects.

NOTE Next offered in 2011-2012 and in alternate years thereafter.

PREREQUISITE GEOL 235/3.0.

GEOL 422/3.0 Metallogeny and Mineral Exploration 2L;3P

Integration of geological, mining and metallurgical engineering, economic, political, social and environmental issues, and application of ore deposit modeling and geophysical and geochemical exploration methods, in the design of comprehensive exploration programs for the discovery and development of Earth materials in an economic and environmentally responsible manner.

NOTE Next offered in 2014-2015, and alternate years thereafter.

COREQUISITE GEOL 362/3.0 or permission of the Department.

GEOL 435/3.0 Topics in Petrology and Mineral-Deposits Geology 3S;L

A course on a topic in the field of igneous and metamorphic petrology, geochemistry, and/or mineral-deposits geology.

NOTE Consult the Chair of Undergraduate Studies for details of specific course offerings each academic year.

PREREQUISITE Level 3 or above in a GEOL Major, Medial or Specialization Plan.

GEOL 438/3.0 Topics in Sedimentary and Petroleum Geology 3S/L

A course on a topic in the field of sedimentary geology, sedimentary geochemistry, basin analysis and/or petroleum geology.

NOTE Consult the Chair of Undergraduate Studies for details of specific course offerings each academic year.

PREREQUISITES Level 3 or above in a GEOL Major, Medial or Specialization Plan.

GEOL 452/3.0 Instrumental Techniques Applied to the Study of Solids 2L;3P

The theory and practical aspects of the techniques of X-ray powder diffraction and scanning electron microscopy are studied. Other techniques including Mossbauer, infra-red spectroscopy, and nuclear magnetic resonance spectroscopy will also be covered. An extensive term project is required where the student employs these techniques to study a material of their choice.

NOTE Next offered in 2012-2013 and in alternate years thereafter.

PREREQUISITE GEOL 232/3.0 or permission of the Department.

GEOL 463/3.0 Methods of Geological Data Analysis 2L;3P

Digital and analog methods, for collection, correction, and analysis of geologic data. Field collection using GPS and hand computers. Geographic Information Systems technology, and acquisition and distribution of data across the Internet. Air photo and remotely-sensed imagery to evaluate geologic sensing systems including Radar and Hyperspectral methods. Labs on resource and environment assessment.

NOTE Next offered in 2012-2013 and alternate years thereafter.

PREREQUISITE GEOL 211/3.0 or GEOL 221/3.0 or permission of the Department.

EXCLUSION No more than 3.0 units from GPHY 243/3.0 (formerly GISC 201/3.0, GISC 410/3.0); GPHY 463/3.0.

GEOL 465/3.0 Exploration Geochemistry 2L;3P

Principles of geochemistry in mineral exploration, and the use of geochemistry in tracing specific paleohydrologic flow in complex, multicomponent media in systems that deposit ores. Primary and secondary dispersion and their significance in geochemical exploration. Selected case histories. Field and analytical techniques, and interpretation of geochemical data. Design of exploration programs. NOTE Next offered in 2012-2013 and alternate years thereafter.

PREREQUISITE GEOL 362/3.0 or permission of the Department.

GEOL 466/3.0 Isotopes and the Environment 3L;2P

This course is designed to expose advanced students in the fields of biology, chemistry, geography or geology to the principles of stable isotope and radiogenic isotope systematics in natural processes. Emphasis will be placed on the use of isotopes in tracing elemental cycles, biological cycles and hydrologic cycles and how some isotopes can be used to place constraints on the timing of specific events in these cycles.

NOTE Next offered in 2011-2012 and alternate years thereafter.

PREREQUISITE CHEM 112 or permission of the Department.

GEOL 472/3.0 Economic Analysis Methods in Geological Engineering 3L;1T

Cost, risk, and return characteristics of mineral exploration; introduction to economic evaluation; cash flow and time value concepts; discounted cash flow methods; mining taxation considerations; sensitivity and risk analysis techniques; exploration economics and strategies; evaluation of exploration projects; exploration planning issues.

PREREQUISITES GEOL 235/3.0 and permission of the Department.

GEOL 478/3.0 Terrigenous Clastic Sedimentology 3L;3P/S

Principles of sequence stratigraphy. Depositional processes, facies models, and sequence stratigraphy of fluvial, coastal, shelf, and deep-marine environments. Introduction to analysis of sedimentary basins. Required extended field trip during term.

NOTE Next offered in 2011-2012 and alternate years thereafter.

PREREQUISITE GEOL 238/3.0 or permission of the Department.

GEOL 481/3.0 Advanced Structural Analysis 2L;3P

Applications of the principles of brittle and ductile deformation to the fabric analysis of rocks in the optimization of strategies for open-ended resource exploration, resource engineering, continental tectonics studies, and geotechnical engineering problems. Emphasis is on fracture, fault, and vein analysis; structures in fold and thrust belts and continental collision zones; and studies of superposed deformation and their impact on effective and economical mineral resource development.

NOTE Next offered in 2011-2012 and alternate years thereafter.

PREREQUISITE GEOL 321/3.0 or permission of the Department.

GEOL 485/3.0 Environmental Aqueous Geochemistry 3L

Examination of rock-water interaction, and the geological controls on the chemical evolution and anthropogenic modification of surface- and ground-water, as applied to environmental problems. Application of thermodynamics, activity diagrams, and computer models in the design of assessment systems and mitigation schemes for problems of water contamination. Students evaluate, and design solutions related to, case studies in the areas of geochemical hazards to human health and the environmental impacts of mining, including acid mine drainage.

NOTE Next offered in 2012-2013 and alternate years thereafter.

PREREQUISITE GEOL 232/3.0 or permission of the Department.

GEOL 488/3.0 Geology of North America 3L

An advanced course discussing the principles of earth evolution as exemplified by North America. The holistic approach illustrates the way in which geodynamics, geochemistry, sedimentation, paleo-biology and oceanography are used to unravel the history of the continent.

PREREQUISITE GEOL 107/3.0, GEOL 235/3.0, GEOL 249/3.0, GEOL 238/3.0, GEOL 300/3.0 and GEOL 365/3.0 or permission of the Department.

COREQUISITE GEOL 321/3.0

GEOL 543/6.0 Research and Thesis

Directed, independent research on geological problems. The thesis may be based on data or material collected during summer fieldwork or in the fall/winter around Kingston, on laboratory research, or using published data. Monthly tutorials will cover various aspects of literature review, writing skills and oral presentations. A seminar concerning the thesis topic will be presented at the end of Winter term.

NOTE An electronic copy of the final thesis, formatted to the supervisor's satisfaction, must be uploaded to Qspace. The supervisor may require one hardcopy.

PREREQUISITE Level 4 in a GEOL Major or Specialization Plan and permission of the Department.