

Course List – Fall 2026 / Winter 2027
Graduate Teaching Assistants
Department of Geological Sciences and Geological Engineering

- Teaching Assistant (TA) positions are available to graduate students for the courses below.
- TAs are 65 hours, with a few exceptions.
- GEOE indicates Geological Engineering; GEOL is Geological Science; GEOL/E is combined Geological Science and Geological Engineering; APSC indicates Applied Science.
- Courses are numbered according to year level (100s are first-year courses, 200s are second-year, etc.).
- Please note that the course list is subject to change.

Introductory and Cross-Disciplinary

APSC 151 - Earth Systems Engineering (F26)

An introduction to the complex Earth System (the solid earth, hydrosphere, atmosphere, and biosphere). The science behind our exploration and understanding of our planet and its ongoing evolution is explored in combination with the engineering geology of geo-materials, geo-resources, geo-dynamics and geo-risk.

GEOL 104 - The Dynamic Earth (F26, W27)

Introduction to the internal structure of the Earth and the processes that have shaped its surface. Global tectonics and continental movement, rock genesis, mountain building, glaciations and geological time. Laboratories include rock and mineral identification, and problem solving in historical geology, earthquakes, groundwater flow and coastal erosion.

GEOL 106 - Environmental Geology and Natural Hazards (F26, W27)

The relationship between humankind 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, and of public perception of and response to geological risk.

GEOL 200 - Oceanography (F26)

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.

GEOL/E 204 - Geology of the Solar System (W27)

Provides an overview of the Solar System from a geologic perspective. In addition to introducing the origin and evolution of our planetary neighbourhood, discussion will extend to new frontiers of exploration, habitation and mining in space, and the geoengineering challenges that these present. Emphasis on investigating the processes that shape planetary bodies in the Solar System and how these processes may have shaped the evolution of life.

GEOL 290 - World Building (W27)

A blended in-person and online lecture and design studio course on the design of worlds for fiction, art, game-design, communications, and more. Lectures emphasize the requisite science, humanities, and social sciences to constrain a collaborative worldbuilding exercise delivering a partially realized world.

Mineralogy, Petrology, and Structural Geology

GEOL/E 221 - Geological Field Methods (F26)

The field study of surficial deposits, rock types, and geological processes, based on the geology of the Kingston area. Descriptions, samples and measurements acquired on several field trips will be analyzed, and the results recorded in maps, sections, and reports throughout the course.

GEOL/E 232 - Mineralogy (F26)

Characterization of rock- and soil-forming silicate and non-silicate minerals (their crystallography, optical and physical behaviour, and crystal chemistry), at the macroscopic and microscopic scales. The structural, chemical and genetic aspects of the crystalline state as displayed by minerals are considered.

GEOL/E 235 - Igneous and Metamorphic Petrology (W27)

Introduction to the genesis and characterization of igneous and metamorphic rocks. Students will acquire skills to classify rocks and the theoretical background to place these rocks in the context of where, why, and how they form with implications for resource exploration and utilization. Macroscopic and microscopic properties will be studied.

GEOL/E 300 - Geological Field School (F26)

An intensive field course in which teams design and implement a geological field investigation program to produce and interpret geological field maps. The course takes place at a field camp north of Kingston, lasting 8-10 days, immediately before the beginning of third year.

GEOL/E 321 - Analysis of Rock Structures (F26)

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 of brittle and ductile deformation features, and examination of deformation styles in selected tectonic environments.

GEOL/E 362 - Petrology Applied to Ore Deposits (F26)

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 paragenetic sequences, estimation of ore grade and evaluation of issues related to ore processing and site contamination.

GEOL/E 400 – Advanced Geological Field School (F26)

Intensive one-week field course taken after third year. Field assignments of geological interest, local and regional geology and tectonic evolution of the area visited. Daily assignments when in the field on a diversity of geological problems.

Sedimentology, Stratigraphy, and Paleontology

GEOL 107 / GEOE 207 - History of Life (F26)

The inter-relationship between organic evolution and global change since the inception of life 4 billion years ago. Coevolution of early life and the atmosphere; development of marine animals; invasion of the land; dinosaurs and their world; mass extinctions; the Age of Mammals; and hominid evolution.

GEOL/E 238 - Sedimentation and Stratigraphy (W27)

An examination of the 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 sedimentary structures; depositional environments and stratigraphic successions; stratigraphic principles, application to sedimentary basins and hydrocarbon genesis; interaction of natural processes with human society.

GEOL/E 337 - Paleontology (W27)

Review of the major groups of invertebrate fossils, emphasizing functional morphology, paleoecology, evolution, and geological significance.

Geophysics and Remote Sensing

GEOL/E 249 - Geophysical Characterization of the Earth (W27)

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.

GEOL/E 319 - Applied Geophysics (W27)

Geophysical methods (gravity, magnetic, electrical, and seismic) applied to engineering problems, including resource exploration and site investigation. Design of field programs considering physical principles, instrumentation, limitations, field procedures and data interpretation. Laboratory projects with geophysical equipment are undertaken.

GEOL/E 333 - Terrain Evaluation (W27)

An introduction to the principles of geomorphology relevant to Geological Sciences and Geological Engineering. Identification and evaluation of terrain features using analog and digital imagery via traditional and digital (GIS) methods. Digital terrain model acquisition and analysis. Introduction to digital terrain analysis.

GEOL/E 463 - Spatial Information Management in the Geosciences

An introduction to spatial information management focusing on methods to support and extend geological mapping, mineral and petroleum exploration, and engineering site investigation. Computers and computation, GIS software and theory, spatial simulation and analysis, databases and data management, and design of effective decision support solutions.

Geochemistry

GEOL/E 365 - Geochemical Characterization of Earth Processes (F26)

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 practicum involving problems, laboratory experience and field experience will be part of the course.

Geological Engineering & Hydrogeology

GEOE 281 - Introduction to Geological Engineering (F26)

Introduction to all integrated fields of Geological Engineering and the essence of engineering design in an earth-systems context. Focus is on geological engineering properties and processes and their impact on design, with a particular focus on scale dependency, natural variability, and risk-assessment. Introductory geotechnical engineering, applied geophysics, resource engineering, hydrogeology and geo-environmental engineering is highlighted with emphasis on the following: mining related site investigation and design, tunnelling, infrastructure development, natural-hazard mitigation and environmental remediation and resource exploration and management. A one-day field trip is required.

GEOE 262 - Aspects of Ore Deposits for Mining Engineers (W27)

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.

GEOE 313 – Engineering Geomechanics and Rock Engineering Design (W27)

Application of geomechanical principles to rock characterization, engineering analysis and design problems related to surface and underground construction in rock and surface slope stability. Presentation and discussion of geomechanics theory, including stress, strain, strength of materials and post yield behaviour, and analysis tools with application to typical rock engineering problems and to case histories involving empirical, analytical, and numerical solutions. Emphasis on the inherent variability of geomaterials at the lab and field scale and implications for design.

GEOL/E 343 – Applied Hydrogeology (W27)

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.

GEOE 345 - Site Investigation (W27)

The course involves a team approach to tackling current geological engineering problems and developing innovative design solutions. Critical site investigation and site selection decisions are proposed, undertaken, and tested with consideration of “downstream” engineering issues and constraints. Additionally, topics such as professional liability and ethics, equity, environmental legislation, and the Occupational Health and Safety Act are presented and discussed. Formalized engineering design tools including FMEA, QRA will be utilized. Course includes a major geological engineering design project.

GEOL/E 359 - Applications of Quantitative Analysis (F26)

The theory and use of numerical computational procedures to solve geo-engineering and geoscience problems. The utility, significance and widespread applicability of analytical and numerical techniques will be illustrated in the evaluation and solution of practical problems.

GEOE 413 - Rock Engineering Design (F26)

Rigorous application of geomechanics and rock engineering principles to open-ended design problems related to surface and underground excavation, construction, and geo-hazard mitigation. Student-led projects will compliment presentation and discussion of design methodologies and case histories are followed up by related analysis and design problems incorporating industry standard software. Emphasis on the inherent variability of geomaterials and implications for integrated site-investigation planning, quantitative risk assessment, design decision-making and performance-monitoring.