Earth sciences

The subjects presented in the School of Earth Sciences cover all aspects of the study of the Earth - its composition, and the workings of the many complex systems that together make up our planetary environment. The major in Earth sciences can be taken within three specialisations: geology, atmosphere and ocean sciences, as well as a specialisation in environmental Earth science that is taken with the environmental science co-major. Geology subjects are concerned with all aspects of the solid Earth, while A&OS subjects cover the external fluid components of our planet, the atmosphere and oceans.

Specialisations offered

Geology

Geology is presented through a range of subjects that match the range of aspects of the discipline. The early subjects provide a broad introduction to the processes that shape the Earth and its environment, and proceed to comprehensive studies of the solid Earth, its materials, and its evolution as a dynamic planet. The school values the practice of teaching through field experience highly, and many subjects include field classes.

Atmosphere and ocean sciences

The specialisation in atmosphere and ocean sciences will provide an appreciation of the principal wind and current systems, of the ways in which these two media interact with each other and with the land surface to influence weather and climate, and of the inherent variability of the Earth's climate on a range of time scales.

Environmental Earth science

The school offers a sequence which concentrates on those aspects of geology which are more directly applicable to the study of present-day environmental processes. This sequence is complemented by the environmental science co-major, listed on page 15 and should only be taken in conjunction with that set of subjects.

Additional subjects, and majors

After completing Earth sciences 625-101, both 625-102 Geology and 625-103 Atmosphere and Ocean Science are available to students who wish to continue with their introduction to Earth sciences.

Geology

- Subjects from other departments can be selected at 200-level to prepare for a second major; chemistry, mathematics and statistics, environmental science, zoology, botany, or geography are some of the possibilities which support various aspects of geology. The atmosphere and ocean sciences specialisation is also available.
- Earth sciences 625-301, 625-302 plus two of 625-303, 625-304, 625-305, 625-307, 625-310, 625-311, 625-312 fulfil the requirements for the geology specialisation. Students proceeding to honours in geology should include at least one of the field subjects (Earth sciences 625-311 and 625-312) and should discuss their plans with school staff.
- Students may complete their degree by taking further subjects from the group described above, or by taking a major from another discipline.

Atmosphere and ocean sciences

Subjects from other departments can be selected at 200-level to prepare for a second major; physics, chemistry, mathematics and statistics, computer sciences or environmental science are possibilities which support various aspects of atmosphere and ocean sciences.

Earth sciences 625-331 and 625-332 fulfil the requirements for the atmosphere and ocean sciences specialisation.

Students may complete their degree by completing a second major, from those listed in *Majors (p.8)*.

Environmental Earth science

Students undertaking this specialisation should take the subjects required for the environmental science co-major, together with the following subjects in Earth Sciences: 625-301, 625-302, and 625-307, plus one of 625-303, 625-304, 625-305, 625-310, 625-311, 625-312. (These fulfil the requirements for the geology specialisation.) Students proceeding to honours in geology should include at least one of the field subjects (Earth Sciences 625-311 and 625-312) and should discuss their plans with school staff.

Bachelor of Science (Honours)

For information about the faculty and departmental entry requirements for the honours degree, please refer to *Bachelor of Science (Honours) and Bachelor of Information Systems (Honours) (p.1)*. These requirements should be considered when planning your course.

Further Information

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Subject descriptions

100-level subjects

625-101 Earth Sciences - The Global Environment

Note: Subject presented by Professor A J W Gleadow and Professor I R Plimer.

Credit points: 12.5 **HECS-band:** 2

Coordinator: Dr S Gallagher

Contact: 36 lectures (three per week), 36 hours practical (three hours per week) *(Semester 1)*.

Description: This subject examines five topics. *The Earth* covers the origin of the Earth in a planetary system; the physical and chemical structure of the Earth; the geosphere; hydrosphere; and atmosphere; and origin and composition of the atmosphere. *Geological Materials* covers minerals - the nature of crystalline substances; rocks as aggregates of minerals; an introduction to igneous, sedimentary and metamorphic rocks. *Plate Tectonics* covers why plate tectonics?; where plates collide-volcanoes, earthquakes, continental collision and mountain building; where plates part-continental drift, sea-floor spreading, mid-oceanic ridges; and within plates-uplift, weathering and erosion, transport of sediment, subsidence and sedimentation, volcanism. *The Basics of Weather and Climate* covers the Earth in space; the importance of its orbital characteristics; and cold poles and warm equator. *The Atmosphere* covers basic properties of the troposphere, stratosphere, mesosphere; the friction layer; the lapse-rate; and vertical and mean-sea-level distributions of pressure, temperature, rainfall.

On completion of this subject, students should comprehend the materials that the Earth is made of; the diverse processes from continent-scale to microscopic-scale which shape the Earth; the mode of formation of the rocks which make up the geological record; and the structure of the Earth's atmosphere. Students will have developed the skills to observe, in the laboratory and the field, basic properties of the global environment.

Assessment: A 3-hour end-of-semester written examination and a 2-hour practical examination during the semester. Short tests may also be held during the practical sessions. A reading topic will be assessed in the examination.

625-102 Understanding Planet Earth

Credit points: 12.5 **HECS-band:** 2

Coordinator: Dr S Gallagher

Prerequisites: None. Earth sciences 625-101 is recommended.

Contact: 36 lectures (three per week), 36 hours practical (3 hours per week) and two days field work *(Semester 2)*.

Description: This subject examines the fundamental elements that make up Planet Earth. Topics include identification of rock-forming and strategic ore-forming minerals; understanding how igneous, sedimentary and metamorphic rocks form and evolve and their plate tectonic context; the fundamental structure of the Earth is examined including origin of mountain ranges; and folding and faulting; the relationships between rock series in space and time; and dating of rocks in absolute and relative terms; the Palæontology part of this unit covers the nature of fossils; their use, evolution and extinctions; including a review of the key groups of fossil invertebrates on Planet Earth. Fieldwork trips to local Victorian sites are an opportunity to gain a foundation in geological techniques, observation and analysis and to collect fossils.

On completion of this subject, students should understand and be able to identify the basic components that make up Planet Earth; comprehend the diversity of the rock-forming minerals, the processes by which rocks form and evolve; the use of structural geology in interpreting the relationships between rock units in time and space; and the contribution of palæontology to the study of evolution. Students will appreciate the contribution of mineralogy, petrology, structural geology, sedimentology and palæontology to the interpretation of the history of Planet Earth.

Assessment: A 3-hour written examination and a 2-hour practical examination at the end of the semester. Short tests may also be held during the practical sessions. A reading topic will be assessed in the examination.

Prescribed texts: Hamblin and Christiansen, *Earth's Dynamic Systems*, 9th ed., Prentice Hall.

625-103 The Atmosphere and Oceans

Note: Credit may not be gained for 625-103 and 625-113 in the 1998 Handbook.

Credit points: 12.5 **HECS-band:** 2

Coordinator: To be announced

Prerequisites: None. Earth sciences 625-101 is recommended. A knowledge of VCE Physics and Mathematics is desirable but not essential.

Contact: 36 lectures (three per week), 36 hours practical work (3 hours per week) *(Semester 2).*

Description: Topics covered are solar energy and atmospheric/oceanic processes leading to the distribution of energy in other forms to generate weather, 'steady-state' climate; the general atmospheric circulation and ocean currents; morphology of ocean basins; climate change: warm ages and ice ages; and relationships between humans and climate.

On completion of this subject, students should comprehend the basic concepts of climate; and know how the climate system may be understood in terms of the solar energy input and its redistribution by atmospheric and oceanic processes.

Assessment: A 2-hour end-of-semester written examination. Essays, problems, and practical work assessment throughout the semester.

200-level subjects

625-221 Geological Methods

Note: Special Requirements: Geological hammer, hand lens and magnet. Consult the departmental noticeboard for dates, charges for excursions, accommodation and food, which will be fixed as early as possible in the first semester.

Credit points: 12.5 **HECS-band:** 2

Coordinator: Dr M W Wallace

Prerequisites: Earth sciences 625-102.

Contact: 6 lectures, 6 hours of practical work and 8 days of fieldwork *(Semester 1).*

Description: This subject will cover the basic methods used to gather large scale geological data, the major component of the subject being a field mapping exercise. The subject will provide a practical introduction to geological field mapping, air photo interpretation, and the use of remotely sensed data of various forms. The integration of geological and geophysical data sets (e.g. geological surface and subsurface data, magnetics, radiometrics, and digital topographic data, satellite imagery) will form a component of the subject.

Assessment: A written report and assessment of fieldwork totalling up to 20 pages.

625-222 Mineralogy and Igneous Petrology

Note: Special Requirements: Geological hammer, hand lens and magnet. Consult the departmental noticeboard and/or website for dates, charges for excursions, accommodation and food, which will be fixed as early as possible in the first semester.

Credit points: 12.5 **HECS-band:** 2

Coordinator: Assoc Prof J Hergt

Prerequisites: Earth sciences 625-102; corequisite Earth sciences 625-221; VCE Chemistry is desirable.

Contact: 24 lectures (two per week), 24 hours practical work (two hours per week), and 4 days field work (held on weekends throughout the semester) *(Semester 1).*

Description: Topics include an introduction to the optical properties of minerals in thin section, identification of common rock-forming minerals in thin section and hand specimen, chemical variations in minerals; melting, transport and crystallisation processes in the formation of igneous rocks; the classification and textures of igneous rocks; and igneous rocks in thin section, hand specimen and in the field.

On completion of this subject, students should be able to describe and identify the common rock-forming minerals in thin section and hand specimen; have an understanding of the processes involved in the formation of igneous rocks; and be able to recognise and describe the most important rock types in the laboratory and in the field.

Assessment: A 2-hour end-of-semester written examination; a 2-hour practical examination; and six short quiz exercises throughout the semester.

625-223 Sedimentary Geology & Hydrogeology

Credit points: 12.5 **HECS-band:** 2

Coordinator: Dr T Weaver

Prerequisites: Earth sciences 625-221 (or 625-211 in the 1996 Handbook).

Contact: 24 lectures (two per week), 24 hours practical (two hours per week) *(Semester 2).*

Description: Topics include sedimentary processes of transportation, deposition and diagenesis; formation of sedimentary structures; petrography of clastic and carbonate sedimentary rocks; principles of hydrogeology; and groundwater flow and chemistry in sedimentary basins.

On completion of this subject, students should have acquired an understanding of the process involved in the formation of sedimentary rocks and stratigraphic successions; be able to recognise, describe and interpret the common types of sedimentary rocks in the laboratory and in the field; and understand the processes controlling groundwater flow and chemistry in sedimentary rocks.

Assessment: A 2-hour end-of-semester written examination; a 2-hour practical examination or reports totalling up to 1500 words.

625-224 Tectonics

Note: Special Requirements: Geological hammer, hand lens and magnet. Consult the departmental noticeboard for dates, charges for excursions, accommodation and food, which will be fixed as early as possible in the first semester.

Credit points: 12.5 **HECS-band:** 2

Coordinator: Prof C J L Wilson

Prerequisites: Earth sciences 625-221 and 625-222

Contact: 24 lectures (two per week), 24 hours practical work (2 hours per week), and 4 days fieldwork (held on weekends during the semester) *(Semester 2).*

Description: Topics include mechanical aspects of rock deformation, stress and strain behaviour of materials, descriptive treatment of strain folds and cleavage, examination of deformed rocks in the laboratory and in the field; response of rocks to elevated temperature and pressure, the equilibrium metamorphic model and the facies concept, metamorphic rocks in thin section and in hand specimen, the relationship between mineral assemblages in metamorphic rocks and their conditions of formation; the evolution of pressure, temperature and deformation in orogeny; the acquisition, inversion and interpretation of magnetic, gravity and seismic data in tectonics contexts; and field mapping, including individual mapping projects.

On completion of this subject, students should have acquired an understanding of the effects of elevated pressure, temperature and stress on rocks; be able to recognise, describe and interpret rocks formed as a consequence of these effects in the laboratory and in the field; and understand the role of geophysical methods in establishing and testing tectonic models.

Assessment: A 2-hour end-of-semester written examination; a 2-hour practical examination or reports totalling up to 1500 words; a 5-page field report.

625-227 Weather and Climate Systems

Credit points: 12.5 **HECS-band:** 2

Coordinator: To be announced

Prerequisites: Earth sciences 625-103, or 625-113 (1998 Handbook), is strongly recommended. Students are assumed to have taken some first year mathematics and/or physics.

Contact: 24 lectures (two hours per week); 36 hours practical work (three hours per week). Some practical work may be computer-based and may take place at times decided by the students *(Semester 1).*

Description: This subject deals with weather systems ranging from global to human scales; dynamical features of a rotating earth; the boundary layer, emphasising the urban boundary layer; mesoscale systems and severe local weather; mid-latitude systems: extra-tropical cyclones; heat lows; anticyclones; and low latitude systems: subtropical and tropical cyclones, monsoons.

On completion of this subject, students should comprehend the interactions between atmospheric energy on various scales; have developed skills in interpreting standard Bureau of Meteorology products; and appreciate the distinction between weather and climate.

Assessment: Practical work; problem sheets; a 2-hour written examination.

625-228 Atmospheric Environment Processes

Note: Formerly available as 625-226. Students who have passed 625-226 may not enrol for this subject.

Credit points: 12.5 **HECS-band:** 2

Coordinator: To be advised

Prerequisites: Earth sciences 625-227.

Contact: 24 lectures (2 hours per week); 36 hours practical work (3 hours per week). Some practical work may be computer-based and take place at times decided by the students *(Semester 2)*.

Description: The subject addresses the fundamental processes and variables of atmospheric dynamics, thermodynamics and energetics and shows how these both influence, and are influenced by, human activities. Topics include climatological implications of the Earth in orbit; fundamental atmospheric properties; observational methods; the basic governing laws of atmospheric behaviour: equations of motion and state, conservation of mass and energy; thermodynamics, clouds and precipitation; and radiation and global climate.

On completion of this subject, students should comprehend the fundamental processes of atmospheric thermodynamics, dynamics and energetics; have developed skills in personal weather observation and in the use of standard meteorological instruments; and appreciate the relationship between human activities and the state of the atmospheric environment.

Assessment: Practical work; problem sheets; a 2-hour written examination.

300-level subjects

625-301 Structural Geology & Geodynamics

Note: Special Requirements: Geological hammer, hand lens and magnet. Consult the departmental noticeboard for dates, charges for excursions, accommodation and food, which will be fixed as early as possible in the first semester.

Credit points: 12.5 **HECS-band:** 2

Coordinator: Prof C J L Wilson

Prerequisites: Earth sciences 625-224

Contact: 24 lectures (two per week); 24 hours practical (two hours per week). A one or two day field trip may be substituted for some of the lectures and practical class time *(Semester 1)*.

Description: This subject covers topics in geological processes involved in large-scale tectonics. Topics include structure and composition of the Earth; plates defined in terms of the thermal and rheological structure of the outer part of the earth; isostasy; stress and strain in the crust and lithosphere; origin and processes in mobile belts and their relationship to continental amalgamation and fragmentation. Intraplate deformation; and convergent, divergent and transform plate boundaries.

On completion of this subject, students should comprehend the geometrical techniques of structural geology, how the plates which make up the Earth's surface are defined by large-scale thermal and rheological properties of the Earth, and the tectonic processes that may affect metamorphic rocks and ore bodies. They will have developed the skills in laboratory geology which are relevant to the understanding of deformed rocks, and the skills to draw together observations from petrology and structural geology to interpret Earth processes. They will appreciate how the processes which occur within and between plates can be interpreted in terms of the stress and strain in the outer parts of the Earth.

Assessment: A 3-hour written examination and a 3-hour practical examination, or its equivalent in practical class work in the form of reports totalling up to 3000 words.

625-302 Sedimentary Geology

Note: Special Requirements: Geological hammer, hand lens and magnet. Consult the departmental noticeboard for dates, charges for excursions, accommodation and food, which will be fixed as early as possible in the first semester.

Credit points: 12.5 **HECS-band:** 2

Coordinator: Dr M W Wallace

Prerequisites: Earth sciences 625-223

Contact: 24 lectures (two per week), 36 hours practical (three hours per week). A field trip may be substituted for some of the lectures and practical class time *(Semester 2)*.

Description: Topics covered include facies analysis and petrology of carbonate, terrigenous and chemical sediments; techniques used in stratigraphic analysis and sequence stratigraphy; sedimentary geochemistry and its applications; principles and applications of palæontology with respect to stratigraphy; post-depositional processes, including diagenesis and weathering, that alter rocks after their formation; chemical interactions between minerals and groundwater in weathered rocks and weathering products; the processes involved in hydrocarbon generation and organic maturation; and application of sedimentary geology to understanding sediment-hosted ore deposits.

Assessment: A 2-hour written examination, 1-hour practical exam or reports totalling up to 3000 words.

625-303 Geochemistry & Petrogenesis

Credit points: 12.5 **HECS-band:** 2

Coordinator: Dr J M Hergt

Prerequisites: Earth sciences 625-224

Contact: 24 lectures (two a week); 24 hours practical (2 hours a week) *(Semester 1)*.

Description: Topics cover mineral equilibria, igneous and metamorphic phase diagrams, principles of geochemistry; distribution of elements in rocks and minerals; isotope geochemistry; trace element geochemistry; and applications to petrogenetic problems.

On completion of this subject, students should appreciate concepts in phase equilibria, phase diagrams, isotope geochemistry and trace element geochemistry, understand the applicability of geochemistry in delineating and understanding petrogenetic problems, see order in the complexity of igneous and metamorphic rock-forming processes, and understand the approaches used to delineate the rock-forming processes.

Assessment: A 3-hour written examination and a 3-hour practical examination, or its equivalent in the form of reports totalling up to 3000 words.

625-304 Applied Geophysics

Credit points: 12.5 **HECS-band:** 2

Coordinator: To be announced

Prerequisites: Earth sciences 625-221

Contact: 12 lectures (one per week), 36 hours practical (three hours per week) *(Semester 2)*.

Description: The teaching of this subject follows these principles:

- The users of geophysical data (geologists, engineers, lawyers, accountants) need to know how geophysics should be done and what can be expected of the results. Geophysicists, in turn, need to know what the users will expect of them.
- The basis for a common understanding between geophysicists and the users of geophysical data lies in the formalisation of the exploration process, based on the scientific method, rather than a detailed understanding of the underlying mathematics.
- Modern computing technologies make it possible to use realistic modelling and simulation of the exploration process to teach by doing.

The subject is broken into modules, each dealing with one exploration method (gravity, magnetics, resistivity, and seismic) while avoiding all but the most elementary mathematics. Students learn the relevant physics at an intuitive level with the aid of a series of forward-modelling exercises presented in the context of responding to client-specific problems in the form of 'requests for bid'. Students learn by designing, conducting, and interpreting geophysical surveys that yield the greatest benefit-to-cost ratio. While completing these tasks, students learn how geophysicists think, what they do, and how much to trust their conclusions.

Assessment: A 1.5-hour end-of-semester written examination; four assignment reports of 1500-2000 words each.

625-305 Economic Geology

Credit points: 12.5 **HECS-band:** 2

Coordinator: Prof I R Plimer

Pre or Corequisites: Earth sciences 625-301, 625-302; 625-303 is strongly recommended.

Contact: 24 lectures (two per week); 36 hours practical (three hours per week). A field trip may be substituted for some of the lectures and practical class time *(Semester 2)*.

Description: Topics covered include the geological setting and genesis of major metalliferous deposits; magmatic, magmatic hydrothermal, submarine hydrothermal and surficial deposits of major metalliferous and non-metallic resources will be integrated with fluid inclusions, stable isotope, petrographic and field studies.

On completion of this subject, students should comprehend the wide variety of metalliferous-ore-forming processes. Students will have developed skills in interpreting ore deposits, and skills in exploration techniques based on ore-forming processes.

Assessment: A 3-hour written examination; reports totalling up to 3000 words.

625-307 Hydrogeology & Environmental Management

Credit points: 12.5 **HECS-band:** 2

Coordinator: Dr T R Weaver

Prerequisites: Earth sciences 625-223 is strongly recommended.

Contact: 24 lectures (two per week) and 24 hours practical (two hours per week) *(Semester 1)*.

Description: Topics covered include potential interactions between human activities and the hydrogeological environment; principles of groundwater flow and contaminant movement in groundwater; and prevention, management and remedial strategies to minimise the potential impacts of human activities. After taking this subject, students should have an understanding of

the sourced and chemical behaviour of common inorganic and organic contaminants in groundwater, principles of assessing the sustainability of groundwater resources in urban and rural environments, current policies regarding the protection of groundwater resources, and the assessment and management and clean-up of contaminated groundwater.

Assessment: Written examinations of up to 3 hours, and/or reports totalling up to 3000 words.

625-311 Field Applications of Structural Geology

Note: Special Requirements: Geological hammer, hand lens and magnet. Consult the departmental noticeboard for dates, charges for excursions, accommodation and food, which will be fixed as early as possible in the first semester.

Credit points: 12.5 **HECS-band:** 2

Coordinator: Prof C J L Wilson

Corequisites: Earth sciences 625-301

Contact: 10 days in the field *(Semester 2).*

Description: On completion of this subject, students will have developed the skills in field geology which are relevant to the understanding of deformed rocks, and the skills to draw together observations from petrology and structural geology to interpret Earth processes. They will appreciate how the processes which occur within and between plates can be interpreted in terms of the stress and strain in the outer parts of the Earth.

Assessment: Fieldwork is assessed by written reports and field exercises, up to 20 pages in total.

625-312 Field Geology

Note: Special Requirements: Geological hammer, hand lens and magnet. Consult the departmental noticeboard for dates, charges for excursions, accommodation and food, which will be fixed as early as possible in the first semester.

Credit points: 12.5 **HECS-band:** 2

Coordinator: Dr M Wallace

Corequisites: Earth sciences 625-302

Contact: Eight days of fieldwork *(Semester 2).*

Description: Students undertake field mapping in undeformed and mildly deformed sedimentary and volcanic sequences; and field investigations of mineral deposits and their host sequences. This field course complements other subject areas and will give students a range of experience in topics like regional geology, stratigraphy and rock relationships in the field, and mineral and rock identification in the field.

Assessment: Assessment of field work totalling up to 20 pages.

625-331 Atmosphere-Ocean Interaction

Credit points: 25 **HECS-band:** 2

Coordinator: Assoc Prof I H Simmonds

Prerequisites: Earth sciences 625-227, 625-228; mathematics 620-141, 620-142, 620-143 or equivalent.

Contact: 36 lectures (three per week), 60 hours practical (five hours per week) *(Semester 1).*

Description: Topics include circulation of the atmosphere and ocean and how they interact to influence weather and climate; El Niño-Southern Oscillation events, atmospheric and oceanic processes in the Antarctic region; the general circulation, Sverdrup transport, wind-driven ocean circulation; atmospheric and oceanic wave processes and instabilities, generation of eddies and 'weather'; turbulent structure of the ocean and atmosphere, the surface and boundary layers, Ekman flows; and air-sea interaction, exchanges of heat, moisture and momentum at the interface.

On completion of this subject, students should have an appreciation of atmospheric and oceanic motion and interactions on a range of time and spatial scales and their importance for climate.

Assessment: A 3-hour written examination. Practical work and assignments will also be assessed.

625-332 Climate: Mechanisms & Variability

Credit points: 25 **HECS-band:** 2

Coordinator: To be announced

Prerequisites: Earth sciences 625-227, 625-228; mathematics 620-141, 620-142, 620-143 or equivalent.

Contact: 36 lectures (three per week), 36 hours practical (three hours per week) *(Semester 2).*

Description: Topics include global climate as a holistic system; convection, radiation, and cloud processes; remote sensing of the climate system; climate variability on various time scales, climate shifts and global warming; El Niño-Southern Oscillation in the historic period and relationships with longer time-scale variability; and role of ice-sheets, Antarctic mass balance, large-scale water mass formation.

On completion of this subject, students should have an understanding of the workings and connectedness of the climate system as a whole, and of climate variability.

Assessment: Practical work and reports totally 5000 words, and a 3-hour written examination.

600-311 Research Project A

See full subject details on page 1.

600-312 Research Project B

See full subject details on page 1.

Earth sciences subjects available only to engineering students

625-023 Geology (Engineering Course)

Credit points: 12.5 **HECS-band:** 2

Coordinator: To be announced

Contact: 24 hours of lectures, 18 hours of laboratory work and a half-day field excursion *(Semester 2).*

Description: By the end of the course the student will know some of the basic concepts of geology that are pertinent to the practice of engineering. The student will learn sufficient mineralogy and petrology to identify the main minerals and rock types in the Earth's crust, and will learn how structural geology is used to explain the architecture of the Earth's crust. The student will comprehend how processes at the Earth's surface modify basic geological materials into forms whose properties are of direct relevance to engineering. The student will appreciate the methods, both direct and indirect, by which the properties of, and distribution of, rock materials near the surface of the Earth can be predicted and evaluated.

Topics covered include basic concepts in geology: mineralogy, petrology, structural geology, tectonic processes; rock weathering, formation of clay minerals and soils, soil profiles; development of landforms and landscapes; fluvial erosion; aerial photography and remote sensing; subsurface investigations by geophysical methods; underground water; and applied mineralogy and petrology.

Assessment: Two 2-hour examinations, one of which will be laboratory-based.