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. Two majors can be taken in earth sciences: geology (including areas of environmental earth science) and atmosphere and ocean sciences. Geology subjects are concerned with all aspects of the solid earth (and the interaction of these with groundwater), while atmosphere and ocean science subjects cover the external fluid components of our planet, the atmosphere and oceans.

Majors

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. For those with an interest in the environment, this major provides electives which concentrate on those aspects of geology more directly applicable to the study of present-day environmental processes.

Atmosphere and ocean sciences

The major in atmosphere and ocean sciences provides 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.

Suggested subjects

After completing 625-101 Earth Sciences: The Global Environment, both 625-102 Understanding Planet Earth and 625-103 The Atmosphere and Oceans 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 and geography are some of the possibilities which support various aspects of geology. The atmosphere and ocean sciences major is also available.
- Earth sciences 625-301, 625-302 plus two of 625-303, 625-304, 625-305, 625-307, 625-308 and 625-313 fulfil the requirements for the geology major. Students wishing to undertake 600-311 or 600-312 as part of their major should consult with school staff. Students proceeding to honours in geology would normally include the field subject 625-313 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 and 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 major.

Students may complete their degree by completing a second major selected from those listed in *Planning a science major (p.11)*. Students wishing to undertake 600-311 or 600-312 as part of their major should consult with school staff.

Bachelor of Science (Degree with Honours)

For information about the faculty and departmental entry requirements for the BSc (Honours) program, please refer to *Bachelor of Science (Degree with Honours) and Bachelor of Information Systems (Degree with 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, Dr T Lane and Professor M Sandiford.

Credit points: 12.5

Coordinator: Dr S Gallagher

Contact: 36 lectures (three per week) and 36 hours of practical work (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: Short tests held during practical sessions (10%); a 2-hour practical examination held during the semester (40%); a 3-hour written examination in the examination period (50%). A reading topic will be assessed in the examination.

625-102 Understanding Planet Earth

Credit points: 12.5

Coordinator: Dr S Gallagher

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

Contact: 36 lectures (three per week), 36 hours of practical work (three 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 including the origin of mountain ranges; folding and faulting; the relationships between rock series in space and time; and dating of rocks in absolute and relative terms. The palaeontology 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: Assessment of field exercises during the semester (15%); short tests held during practical sessions (5%); a 2-hour practical examination held during the semester (30%); a 3-hour written examination in the examination period (50%). A reading topic will be assessed in the examination.

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

625-103 The Atmosphere and Oceans

Credit points: 12.5

Coordinator: A/Prof K Walsh

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

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

Description: Topics covered are solar energy and the atmospheric/oceanic processes that generate weather and climate; the general atmospheric circulation and ocean currents; the coastal ocean; 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: Ongoing assessment of practical work in the form of short reports, written assignments and problem solving exercises totalling not more than 2500 words due during the semester (40%); a 2-hour written examination in the examination period (60%).

200-level subjects

625-201 Geology of Southeast Australia

Note: Special Requirements: Geological hammer, hand lens and magnet. Students should consult the Earth Sciences web site for dates, charges for excursions, accommodation and food and other information including safety requirements.

Credit points: 12.5

Coordinator: Dr M W Wallace; Dr S Gallagher

Prerequisites: Earth sciences 625-102, or equivalent, is highly recommended.

Contact: This subject is offered in February. Total formal contact is 42 hours, comprising 36 hours of fieldwork (one six-day excursion) and six hours of lectures *(Summer semester)*.

Description: Topics to be covered include:

- reconstruction of the geological architecture and the geological history of southeast Victoria;
- field identification of geological relationships between rock units, including the timing of emplacement of igneous bodies;
- examination of the Cambrian basalts, the overlying Ordovician and Devonian limestone, sandstone, shale deposits and younger coal measures; characterisation of the deformation features that these units preserve as a result of subsequent tectonic events;
- introduction to the techniques that are used to evaluate the geomorphic evolution and neotectonics of southeast Australia.

At the end of this subject, students will have the skills to:

- identify, describe and evaluate simple geological histories in the field; and
- read and construct geological cross sections.

Assessment: A written report of up to 2000 words due at the end of the subject (60%); assessment of field exercises during the subject (40%).

625-202 Sedimentary Basins to Mountain Belts

Note: Special Requirements: Geological hammer, hand lens and magnet. Students should consult the Earth Sciences web site for dates, charges for excursions, accommodation and food and other information including safety requirements.

Credit cannot be gained for both this subject and 625-224 (prior to 2004).

Credit points: 12.5

Coordinator: Prof C J L Wilson

Prerequisites: Earth sciences 625-102.

Corequisites: Earth sciences 625-222.

Contact: 24 lectures (two per week), 24 hours of practical work (two hours per week), and four days of fieldwork (held on weekends during the semester) *(Semester 1)*.

Description: This subject will evaluate the processes that operate to create sedimentary rocks that fill sedimentary basins, and that operate on these rocks during the formation of mountain belts, deforming them and metamorphosing them. Topics to be covered include:

- tectonic settings in which sedimentary basins and mountain belts develop;
- sedimentary processes of transportation, deposition and diagenesis; formation of sedimentary structures and sequences;
- response of rocks to stress: descriptive treatment of strain, folds and cleavage;
- mechanical aspects of rock deformation, stress and strain behaviour of rocks;
- examination of deformed rocks in the laboratory and in the field;
- response of rocks to elevated temperature and pressure; relationship between mineral assemblages in metamorphic rocks and their conditions of formation;
- metamorphic rocks in thin section and in hand specimen; and
- the evolution of pressure, temperature and deformation during orogeny.

At the end of this subject, students will have acquired an understanding of tectonic settings, 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 their applications in establishing and testing tectonic models.

Assessment: A 2-hour practical examination during the semester (20%); a 1500-word field report due at the end of semester (20%); a 2-hour written examination in the examination period (60%).

625-203 Dangerous Earth

Credit points: 12.5

Coordinator: Prof A J W Gleadow

Prerequisites: At least one of Earth sciences 625-101, 625-102, 625-103 or 600-201 is recommended.

Contact: 24 lectures (two per week), 24 hours of practical work (two hours per week), some of which may be replaced by computer-based assignments conducted by students in their own time *(Semester 2)*.

Description: This subject provides an introduction to the study of natural hazards on the Earth on various spatial and temporal scales. It will cover hazards of geological and meteorological origin, as well as major catastrophes such as those produced by extraterrestrial impact and climate change. Topics will include:

- earthquakes and their consequences;
- tsunamis in the ocean basins;
- volcanoes and volcanic activity;
- land instability and mass movements;
- floods, drought and fire;
- thunderstorms and tornadoes;
- tropical cyclones;
- extraterrestrial impacts and mass extinction;
- climate change and its implications for human populations;
- managing and reducing the risks from natural hazards.

At the end of this subject, students will have acquired a detailed understanding of the nature and causes of natural hazards, be informed of the linkages between these, know the potential effects of various kinds of natural disasters for human populations and activities, and have an appreciation of what can be done to manage and minimise the dangers posed by natural environmental hazards.

Assessment: Practical assignments totalling up to 3000 words due during semester (40%); a 2-hour written examination in the examination period (60%).

625-222 Minerals and Magmas

Note: Special Requirements: Geological hammer, hand lens and magnet. Students should consult the Earth Sciences web site for dates, charges for excursions, accommodation and food and other information including safety requirements.

Credit points: 12.5

Coordinator: Dr D Phillips

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

Contact: 24 lectures (two per week), 24 hours of practical work (two hours per week), and four days of 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, and 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; be able to explain certain processes involved in the formation of igneous rocks and related ore deposits; and be able to recognise and describe the most important rock types in the laboratory and in the field.

This subject should help develop your ability to synthesise data and interpret your observations, allowing you to tackle the description and identification of unfamiliar samples. Opportunities will be provided for you to work with other students during laboratory and in a fieldwork environment.

Assessment: Four short quiz exercises (5% each) throughout the semester (including one held on the Western Victorian Volcanoes field excursion); participation in both field excursions (5%); a 2-hour practical examination during the semester (20%); a 2-hour written examination in the examination period (55%).

625-223 Field Geology

Note: Special Requirements: Geological hammer, hand lens and magnet. Students should consult the Earth Sciences web site for dates, charges for excursions, accommodation and food and other information including safety requirements.

Credit cannot be gained for both this subject and 625-221 (prior to 2003).

Credit points: 12.5

Coordinator: Dr M W Wallace

Prerequisites: Earth sciences 625-102.

Contact: Eight days of field work *(Semester 2).*

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

Students will acquire generic skills in:

- creativity and imaginative thinking;
- problem solving in complex field and geological situations; and
- working and communicating within a team environment.

Assessment: A written report and assessment of fieldwork totalling up to 4000 words due in the middle of the semester (100%).

625-227 Weather and Climate Systems

Credit points: 12.5

Coordinator: A/Prof K Walsh

Prerequisites: Earth sciences 625-103 is recommended. Students are assumed to have taken some first-year mathematics and/or physics.

Contact: 24 lectures (two hours per week), 36 hours of 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, and 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 totalling not more than 3500 words due during the semester (50%); a 2-hour written examination in the examination period (50%).

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

Coordinator: Dr T Lane

Prerequisites: Earth sciences 625-227.

Contact: 24 lectures (two hours per week); 36 hours of practical work (three 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 stability, thermodynamics and energetics and shows how these both influence, and are influenced by, human activities. Topics include fundamental atmospheric properties; observational methods; equations of motion and state, conservation of mass and energy; thermodynamics, clouds and precipitation; air quality and air pollution; surface energy exchanges; and boundary layer physics.

On completion of this subject, students should comprehend the fundamental processes of atmospheric thermodynamics, stability and energetics; and appreciate the relationship between human activities and the state of the atmospheric environment.

Assessment: Practical work/problem sheets totalling not more than 3500 words due during the semester (50%); a 2-hour written examination in the examination period (50%).

300-level subjects

625-301 Structural Geology & Geodynamics

Note: Special Requirements: Geological hammer, hand lens and magnet. Students should consult the Earth Sciences web-site for dates, charges for excursions, accommodation and food and other information including safety requirements.

Credit points: 12.5

Coordinator: Prof C J L Wilson

Prerequisites: Earth sciences 625-202 (or prior to 2004: 625-224). An additional 37.5 points selected from 625-201, 625-222, 625-203 or 625-223 is strongly recommended.

Contact: 24 lectures (two per week); 12 hours of practical work (two hours per week for six weeks) and five days of fieldwork *(Semester 1).*

Description: This subject covers topics in geological processes involved in large-scale tectonics. Topics include the 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; the 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 that 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 that 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 that occur within and between plates can be interpreted in terms of the stress and strain in the outer parts of the Earth.

Assessment: A written field report of up to 1500 words due during the semester (20%); assessment of practical and field mapping exercises totalling not more than 1000 words due during the semester (10%); a survey of a geodynamics literature topic of up to 1500 words due during the semester (30%); a 2-hour written examination in the examination period (40%). Hurdle requirement: students must make an oral presentation of their geodynamics literature survey.

625-302 Sedimentary Geology

Note: Special Requirements: Geological hammer, hand lens and magnet. Students should consult the Earth Sciences web site for dates, charges for excursions, accommodation and food and other information including safety requirements.

Credit points: 12.5

Coordinator: Dr M W Wallace

Prerequisites: Earth sciences 625-223. An additional 37.5 points selected from 625-201, 625-211, 625-222, 625-203, 625-224 (prior to 2004) or 625-202 is strongly recommended.

Contact: 24 lectures (two per week), 36 hours of practical work (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 palaeontology 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 1-hour practical examination held during the semester (30%); written reports totalling not more than 3000 words due during the semester (10%); a 2-hour written examination in the examination period (60%).

625-303 Geochemistry & Petrogenesis

Credit points: 12.5

Coordinator: Assoc Prof J Hergt

Prerequisites: 625-202 (or prior to 2004: 625-224). An additional 37.5 points selected from 625-201, 625-211, 625-222, 625-203 or 625-223 is strongly recommended.

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

Description: Solving geological problems requires unravelling what happened and when. Petrogenesis is literally 'the origin of rocks' and in this subject several essential tools geologists employ to unravel the complexity of earth processes using chemical information preserved in rocks and minerals

will be presented. These include mineral equilibria, phase diagrams, and major, trace element and isotope geochemistry. Most of this subject relates to igneous and metamorphic processes, however many of the tools can be applied to a broad range of geological problems (eg. dating the formation of sedimentary rocks and ore deposits).

In addition to learning the principles that underpin these techniques, emphasis is placed on how or when they are best applied. It is expected that by the end of the semester you will be able to explain how specific tools work and demonstrate both when it is appropriate, and how to apply them, to resolve petrogenetic problems.

In this subject, students should recognise the importance of integrating the knowledge and skills obtained through years of study to tackle new and unfamiliar problems. This will require critical thinking and the organisation of materials delivered in lectures, together with the development of problem-solving skills via the laboratory exercises.

Assessment: A 2-hour practical examination during the semester (25%); a written assignment up to 2000 words due at the end of semester (20%); a 2-hour written examination in the examination period (55%).

625-304 Applied Geophysics

Credit points: 12.5

Coordinator: Dr T Rawling

Prerequisites: Earth sciences 625-102. 50 points of geology subjects selected from 625-201, 625-202, 625-211, 625-222, 625-224, 625-203 or 625-223 are strongly recommended.

Contact: 12 lectures (one per week) and 36 hours of practical work (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: Practical work/problem sheets totalling not more than 3500 words due during the semester (50%); a 2-hour written examination in the examination period (50%).

625-305 Economic Geology

Credit points: 12.5

Coordinator: Dr D Phillips

Pre or Corequisites: Fifty points of 200-level Earth sciences subjects selected from 625-201, 625-202, 625-211, 625-222, 625-224, 625-203, 625-223.

625-301, 625-302 and 625-303 are strongly recommended.

Contact: 24 lectures (two per week) and 36 hours of practical work (three hours per week) *(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, skills in exploration techniques based on ore-forming processes, and skills in communication.

Assessment: A 2-hour practical examination held during the semester (20%); five written assignments of up to 2000 words each during the semester (30%); assessment of practical exercises throughout the semester (10%); a 2-hour written examination during the examination period (40%).

625-308 Digital Geoscience

Note: Credit cannot be gained for this subject and 625-211 (in 2003).

Credit points: 12.5

Coordinator: Dr T Rawling

Prerequisites: At least 50 points selected from Earth sciences 625-201, 625-222, 625-203, 625-223, 625-224 or 625-202 is strongly recommended.

Contact: 24 lectures (two per week) and 36 hours of practical work (three hours per week), some of which may be replaced by computer-based assignments conducted by students in their own time *(Semester 1).*

Description: The rapid acceleration in the development and deployment of a wide range of Earth-observing satellite systems, and of digital spatial information technology in general, has fundamentally changed the way in which Earth and environmental scientists observe and monitor the Earth's environment and its resources. In addition recent advances in computer-based three dimensional modelling and visualisation technology have revolutionised the way geoscientists can view, manipulate and interact with complex geospatial datasets.

This subject examines the wide range of digital geoscience information available and provides hands-on experience of computer software and methods which enable this type of information to be processed and integrated with field-based observations. Topics will include data acquisition and management, the use of geographic information systems (GIS) and global positioning systems (GPS), digital image manipulation and analysis, three dimensional modelling and visualisation and computer-based simulation of Earth systems. Students will be taught how these techniques are used in research and exploration environments and will apply them to create their own two and three dimensional digital datasets and maps.

Assessment: Four equally weighted practical exercises to be completed during the scheduled sessions including written reports not exceeding 3000 words in total due during the semester (40% total); a 2-hour written examination in the examination period (60%).

625-313 Advanced Field Geology

Note: Special Requirements: Geological hammer, hand lens and magnet. Students should consult the Earth Sciences web site for dates, charges for excursions, accommodation and food and other information including safety requirements.

Credit cannot be gained for both this subject and either 625-311 or 625-312 (prior to 2004).

Credit points: 12.5

Coordinator: Prof C J L Wilson

Prerequisites: Earth sciences 625-223 and 625-301 or equivalent.

Contact: This subject is offered over a two-week period either between Semesters 1 and 2 (July) and/or in the Semester 2 break (September). Total contact is 66 hours comprising 60 hours of fieldwork (10 days) and six hours of lectures *(Semester 2).*

Description: Excursion sites that may be visited include:

- Broken Hill and regions within the Curnamona Craton of South Australia and New South Wales in which students will be introduced to skills that are relevant to the understanding of packages of deformed and metamorphosed rocks and their interpretation in a region where there is a world-class ore body;
- Central Australia in which students will be introduced to an intracontinental fold and thrust belt and its relationship to the adjacent metamorphic basement and sedimentary basin;
- Flinders Ranges of South Australia where students will be introduced to the style of sedimentation and nature of deformation and exhumation of portions of the Adelaide geosyncline;
- Gawler Craton of South Australia where students will be introduced to relationships between palaeoproterozoic metasedimentary, volcanic, granitoid and basic igneous complexes, mineral deposits and younger sequences.

If there is sufficient interest, some overseas excursions may be offered.

At the end of this subject, students will have skills in field geology that will enable them to identify unfamiliar minerals and rocks in the field, collate and interpret observations from stratigraphy and rock relationships and structural geology. They will appreciate how observable geological phenomena can be documented, analysed and interpreted to provide an understanding of Earth processes.

Assessment: A written report of up to 2500 words due at the end of semester (75%); field notebooks (10%); field exercises (15%).

625-331 Atmosphere-Ocean Interaction

Credit points: 25

Coordinator: Prof I H Simmonds

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

At least one of mathematics 620-231 and 620-232 is recommended.

Contact: 36 lectures (three per week) and 60 hours of practical work (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: Weekly written reports of practical work of up to 500 words each during semester (35%); written assignments totalling up to 3000 words due during semester (10%); a 3-hour written examination in the examination period (55%).

625-332 Climate: Mechanisms & Variability

Credit points: 25

Coordinator: Prof I H Simmonds

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

Earth sciences 625-331 is recommended.

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

Description: Topics include the 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 the role of ice-sheets, Antarctic mass balance and 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: Weekly written reports of practical work of up to 500 words each during semester (35%); written assignments totalling up to 3000 words due during semester (10%); a 3-hour written examination in the examination period (55%).

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)

Note: Students enrolled in combined engineering/science courses will receive 100-level science credit for this subject.

Credit points: 12.5

Coordinator: To be advised

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. Case studies on the origin and effects of catastrophic events such as earthquakes, sea level changes, flooding and land movements will be integrated with other case studies involving the cognisance of geology used in road building, the Channel Tunnel, flood/tidal control, underground water and mining.

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.

Assessment: A written assignment of 3000 words due at the end of semester (20%); a 2-hour laboratory-based practical examination towards the end of semester (50%); a 2-hour written examination in the examination period (30%).