

## EARTH SCIENCES

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[www.earth.waikato.ac.nz](http://www.earth.waikato.ac.nz)

*An understanding of Earth sciences is vital if we are to sustainably manage the Earth's energy, water, mineral, soil and coastal resources. The Earth sciences are also the key to predicting and managing natural hazards such as floods, earthquakes, tsunami, landslides and volcanic eruptions. Earth Sciences at the University of Waikato include study of coastal and marine science, climate change, soil science, hydrology, volcanology, sedimentary geology and engineering geology. Our graduates in Earth Sciences go on to a diverse range of careers in environmental and resource management as well as research.*

The Department of Earth & Ocean Sciences is uniquely placed to offer a thorough grounding in all aspects of the Earth sciences. We are situated close to both North Island coasts, a short drive from the active Taupo Volcanic Zone, at the heart of the richest New Zealand farming region, and have New Zealand's longest river at our doorstep. The teaching programme in the Department provides an opportunity for students in their first year to develop a broad understanding of Earth's systems, and then in following years to increase the depth of their studies to include topics such as sedimentary geology, soil science and land management, hydrology and water resource management, meteorology, oceanography, volcanology, coastal marine science, engineering geology, georesource exploration, global environmental change, environmental monitoring and management, and natural hazards. Earth Sciences at Waikato includes and builds upon physical geography.

We offer a learning experience that goes beyond the laboratory and lecture room – out into the world.

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### CONTACTS FOR THE DEPARTMENT OF EARTH & OCEAN SCIENCES

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## Degrees

Earth Sciences is available as a major subject for the Bachelor of Science or Bachelor of Science (Technology) degrees. Earth Science papers are also part of the Environmental Sciences major and Environmental Planning major. The Department of Earth & Ocean Sciences offers papers at all levels of study, from undergraduate degrees, through to postgraduate and doctoral studies.

## Earth Sciences Major

General Structure of an Earth Sciences Major for the BSc and BSc(Tech) degrees			
<b>100 LEVEL</b>	ERTH103 15 points	ERTH104 15 points	<b>100 Level</b> – Prerequisites: ERTH103 Discovering Planet Earth and ERTH104 Earth and Ocean Environments.  <b>200 Level</b> – At least 60 points at 200 Level Earth Sciences.  <b>300 Level</b> – At least 60 points at 300 Level Earth Sciences.
<b>200 LEVEL</b>	ERTH2XX 20 points	ERTH2XX 20 Points	
<b>300 LEVEL</b>	ERTH3XX 20 points	ERTH3XX 20 points	

### Specialisations

Students may undertake the following specialisations for the BSc and BSc(Tech) major in Earth Sciences.

» Agribusiness	*
» Science International	page 157
» Te Pūtaiao me ngā take Māori	page 162

*\*Enrolment in this specialisation should be completed in consultation with both the Faculty of Science & Engineering and the Waikato Management School.*

### General Programmes

Students may undertake the following general programmes for the BSc or BSc(Tech) major in Earth Sciences.

» Coastal Science	page 78
» Earth Sciences and Geography	page 79
» Engineering Geology	page 81
» Environmental Engineering Science	page 82
» Hydrology and Water Resources	page 84
» Natural Hazards	page 85
» Sedimentary Geology and Tectonics	page 87
» Soil and Land Resources	page 88
» Volcanology	page 89

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## Choosing Papers

### Entry into Earth Sciences Papers

There are no formal prerequisites for admission to 100 Level Earth Sciences papers. You will, however, be best prepared if you have taken any of biology, chemistry or geography at least through to Year 12.

In some cases, we are able to relax the rules relating to prerequisites. If you would particularly like to take a paper for which you have not satisfied a specified requirement, please come and speak to the staff in the Department about possible options.

### Earth Sciences Major

To complete a major in Earth Sciences, students must complete 120 points above Level 100, including 60 points above Level 200 from compulsory Earth Sciences papers.

#### 100 Level – Papers are worth 15 points.

Students wishing to major in Earth Sciences or a related field should choose the two core papers.

#### *Prerequisites*

- » EARTH103A – Discovering Planet Earth
- » EARTH104B – Earth and Ocean Environments

#### 200 Level – Papers are worth either 10 or 20 points.

Choose at least 60 points at 200 Level in Earth Sciences papers.

#### 300 Level – Papers are worth either 10 or 20 points.

Choose at least 60 points at 300 Level in Earth Sciences papers.

The other papers needed to complete the requirements of the BSc and BSc(Tech) degrees may come from further optional papers in Earth Sciences, other science subjects or may even include a few papers from other faculties/schools of studies.

### Students not Intending to Major in Earth Sciences

If you are not majoring in Earth Sciences, please feel free to sample from our wide variety of papers. Generally, it will be easiest for you to take Earth sciences papers at 100 and 200 Levels, as these papers will be less affected by prerequisites.

### Timetable Clashes

Your selection of papers may depend on your timetable. You will not usually be permitted to take papers which have lecture clashes. Laboratory clashes can usually be resolved. You should contact the Department if you have a laboratory clash.

## Earth Sciences Papers

### 100 Level Papers

#### ERTH103-12A (HAM) – Discovering Planet Earth

15 Points

A lecture and laboratory paper that explores the Earth's interior and its dynamic interaction with the crust, including: the major rocks and minerals and their economic importance; interpreting the rock record and geologic maps; the geological time scale and fossils; rock deformation; plate tectonics; volcanism; earthquakes; the New Zealand geological environment. A one-day field trip will be run introducing students to aspects of Earth Sciences.

Lecturer(s): Professor Cam Nelson and Dr Adrian Pittari

Tutor(s): Natalie Miedema

Required book(s): S. Marshak *Earth: Portrait of a Planet 3rd ed* (Norton)

Recommended book(s): I. J. Graham (Chief ed.) *A continent on the move: New Zealand Geoscience into the 21st Century* (Geological Society of NZ).

Required reading: EARTH103 Study Guide 2012

Assessment: Internal assessment/examination ratio: 1 : 1

#### ERTH104-12B (HAM) – Earth and Ocean Environments

15 Points

A lecture and laboratory paper that explores the processes operating in the terrestrial and ocean environments, and the resulting deposits and landforms. Topics covered include oceanography; coastal hazards and climate change; the hydrological cycle; rivers and groundwater; glaciers; weathering; erosion and mass movement; and soil formation. A one-day field trip will be run introducing students to the physical environment of the Waikato-Raglan district.

Lecturer(s): Dr Megan Balks, Dr David Campbell and Dr Willem de Lange

Tutor(s): Natalie Miedema

Required book(s): S. Marshak *Earth: Portrait of a Planet 3rd ed* (Norton)

Required reading: EARTH104 Study Guide 2012

Assessment: Internal assessment/examination ratio: 1 : 1

#### ENVS101-12B (HAM) – Environmental Science

15 Points

For details refer to *Environmental Sciences ENVS101*.

### 200 Level Papers

#### ERTH221-12B (HAM) – Earth Materials and Processes

20 Points

In this paper the nature and significance of Earth materials are studied, and particularly the processes and products of volcanism and sedimentation. Students learn the methods of describing and identifying the common minerals and rocks of the Earth's crust. There is an emphasis on laboratory work which covers introductory crystallography, optical mineralogy using petrographic microscopes, igneous, metamorphic, and sedimentary petrography, grain-size analysis, and detrital mineralogy. These topics are supported by two lectures per week.

It is strongly advised that this paper is taken in conjunction with EARTH222. A background in first-year chemistry is advisable, but is not essential.

Lecturer(s): Dr Adrian Pittari and Professor Peter Kamp

Prerequisite(s): EARTH103 and one of EARTH104, ENVS101, GEOG103

Required book(s): Briggs *Optical Mineralogy* (supplied)

Recommended book(s): Blatt and Tracey *Petrology* (Freeman);  
Boggs Jr *Principles of Sedimentology and Stratigraphy* (Merrill)

Assessment: Internal assessment/examination ratio: 1 : 1

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### ERTH222-12A (HAM) – Stratigraphy and Tectonics

#### 20 Points

This paper teaches students field methods in Earth Sciences related to the description, mapping and structural interpretation of rock sequences underlying land surfaces. As such it is the principal paper at second-year level that gives students experience in fieldwork. Topics covered are stratigraphic procedures; field mapping and map interpretation; introduction to analysis of geological structures; report writing; and computer graphics for Earth science applications. There is a six-day field camp at Port Waikato, where students undertake various section descriptions and mapping exercises. This is followed by training in, and the completion of, a report on the fieldwork.

**Note(s):** *This paper has an enrolment limit of 45 students, due to field trip accommodation availability.*

**Lecturer(s):** Professor Peter Kamp, Associate Professor Roger Briggs and Dr Adrian Pittari  
**Prerequisite(s):** Either ERTH103 or ERTH104  
**Recommended book(s):** *Boggs Jr Principles of Sedimentology and Stratigraphy (Merrill); Prothero et al Sedimentary Geology – An Introduction to Sedimentary Rocks and Stratigraphy (Freeman)*  
**Assessment:** Internal assessment/examination ratio: 3 : 2

### ERTH233-12A (HAM) – Soils in the Landscape

#### 10 Points

This is an introductory paper on the nature and formation of soils and their place in the landscape, their classification, distribution pattern and use as a finite resource in New Zealand.

**Lecturer(s):** Professor David Lowe  
**Prerequisite(s):** Any two of ERTH103, ERTH104, ENVS101 or GEOG103  
**Restriction(s):** ERTH231  
**Required book(s):** *Clayden and Hewitt Horizon Notation for New Zealand Soils (Manaaki Whenua Press)*  
**Recommended book(s):** *Molloy Soils in the New Zealand Landscape 2nd ed (NZ Society of Soil Science)*  
**Assessment:** Internal assessment/examination ratio: 1 : 1

### ERTH234-12A (HAM) – Soil Properties and their Management

#### 10 Points

Introduction to physical, chemical, mineralogical, and biological properties of soils including analysis and interpretation using laboratory methods, and issues of soil quality, land degradation and sustainable management.

**Lecturer(s):** Associate Professor Louis Schipper  
**Prerequisite(s):** Any two of ERTH103, ERTH104, ENVS101 or GEOG103  
**Restriction(s):** ERTH231  
**Assessment:** Internal assessment/examination ratio: 1 : 1

**ERTH242-12B (HAM) – Oceanography***20 Points*

New Zealand has the fourth largest Exclusive Economic Zone in the world, which creates a demand for graduates with good understanding of oceanography. The paper is largely an introduction to physical oceanography and examines the nature and origin of the oceans; the currents, waves, and circulation patterns found in the oceans; and ocean/climate interactions such as ENSO events. Additional topics include paleoceanography; oceanographic instrumentation and technology; marine resources and management; productivity, energetics and fisheries; and oceanography of the New Zealand Exclusive Economic Zone.

This paper is suitable for all students with an interest in some aspect of marine sciences, and should provide a basic grounding in oceanography which is not normally available elsewhere in a single course until masters-level papers.

*Lecturer(s):* Dr Julia Mullarney, Dr Willem de Lange and Dr Karin Bryan

*Prerequisite(s):* Any two of EARTH103, EARTH104, ENV5101 or GEOG103

*Recommended book(s):* Garrison **Oceanography** 6th ed. (Tomson, Brooks & Pole);

Goff et al **The New Zealand Coast: Te Tai O Aotearoa** (Dunmore Press)

*Assessment:* Internal assessment/examination ratio: 1 : 1

**ERTH245-12A (HAM) – Weather and Climate***10 Points*

Introduction to atmospheric processes, including meteorology of the New Zealand region, precipitation processes, energy exchanges within the hydrosphere, and microclimatology, with emphasis on the role of water in climate processes.

*Lecturer(s):* Dr David Campbell

*Prerequisite(s):* Any two of EARTH103, EARTH104, ENV5101 or GEOG103

*Restriction(s):* EARTH241

*Assessment:* Internal assessment/examination ratio: 1 : 1

**ERTH246-12B (HAM) – Introduction to Hydrology***10 Points*

An introduction to the land component of the hydrological cycle and associated human modifications. Topics include introduction to groundwater, fluvial processes and landforms, catchment hydrology and hydro power evaluation.

*Lecturer(s):* Associate Professor Earl Bardsley

*Prerequisite(s):* Any two of EARTH103, EARTH104, ENV5101 or GEOG103

*Restriction(s):* EARTH241

*Assessment:* Internal assessment/examination ratio: 1 : 1

**ERTH251-12B (HAM) – Engineering Geomorphology***10 Points*

Introduction to the study of mass wasting processes on hillslopes: classification of mass wasting; processes of rock and soil slope failure and their recognition based on geomorphic evidence; nature and geomorphology of debris flows and debris avalanches; hazard assessment for slope failure. Field and laboratory work concentrates on basic mapping and surveying techniques, air photo interpretation and geomorphic map presentation, collection and description of soil profile logs.

*Lecturer(s):* Dr Vicki Moon

*Prerequisite(s):* Any two of EARTH103, EARTH104, ENV5101 or GEOG103

*Assessment:* Internal assessment/examination ratio: 1 : 1

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## ERTH284-12B (HAM) – Introduction to Environmental Monitoring

10 Points

This paper introduces students to aspects of environmental monitoring within the New Zealand resources management framework, including: principles of environmental monitoring as applied to a range of environments in the Waikato Region; sampling strategies; and data interpretation. Practical exercises concentrate on specific skills in the acquisition and interpretation of environmental data, including: undertaking field surveys; sampling of earth materials; sample management and analysis; report presentation and communication of results.

**Lecturer(s):** *Dr Vicki Moon, Dr Megan Balks and guest lecturers from Environment Waikato*

**Prerequisite(s):** *Any two of ENV5101, ERTH103, ERTH104 or GEOG103*

**Restriction(s):** *ENVP308*

**Assessment:** *Internal assessment/examination ratio: 1 : 1*

## 300 Level Papers

### ERTH311-12A/B/C (HAM) – Special Topics in Earth Sciences

20 Points

Each student is assigned a research project on which they are expected to spend at least 100 hours and write a written report. This paper is not normally part of an Earth Sciences major and is intended for top academic achievers. Admission is at the discretion of the chair of department, and will depend on the availability of a supervisor.

**Assessment:** *Internal assessment/examination ratio: 1 : 0*

### ERTH312-12A/B/C (HAM) Special Topics in Earth Sciences

10 Points

Each student is assigned a research project on which they are expected to spend at least 50 hours and then write a written report. This paper is not normally part of an Earth Sciences major. Admission is at the discretion of the chair of department and will depend on the availability of a supervisor.

**Assessment:** *Internal assessment/examination ratio: 1:0*

### ERTH321-12A (HAM) – Volcanology

20 Points

Volcanism is the fundamental geological process shaping our planet, one that provides abundant resources for society while also posing significant hazards. This paper explores the nature, dynamics and significance of all types of volcanoes and volcanic processes, and examines the magmatic systems that feed volcanoes. The first half of the paper focuses on physical volcanology, and topics covered include volcano geomorphology, lava flows, explosive eruption mechanisms, eruption plumes, pyroclastic fall and flow emplacement, and volcano monitoring. Practicals for this part of the paper include physical modelling and laboratory analysis of volcanic samples. The second half of the paper deals mainly with igneous petrology and how analysis of mineralogy, mineral textures, and geochemistry can be used to understand magmatic and volcanic processes.

The paper includes a two-day field trip to Taupo and Tongariro to examine some world-class volcanoes and volcanic deposits.

**Lecturer(s):** *Associate Professor Roger Briggs and Dr Adrian Pittari*

**Prerequisite(s):** *ERTH221 (ERTH222 is strongly recommended)*

**Assessment:** *Internal assessment/examination ratio: 3 : 2*

**ERTH322-12B (HAM) – Sedimentary and Petroleum Geology***20 Points*

This paper describes various types of sedimentary basins in terms of their plate tectonic setting, and looks at the different controls on sedimentation. It offers an integrated lecture-lab segment on principles and application of sequence stratigraphy which involves the interpretation of oil exploration acquired seismic reflection profiles. The concept of sedimentary facies is emphasised, particularly those criteria used for interpreting the depositional environments of ancient sedimentary rock sequences. New Zealand examples are used throughout the paper. Laboratory work includes facies analysis and mapping, microfossil analysis, thin-section petrography, X-ray diffraction techniques, and there is a three-day geology field trip to northern Taranaki, based at Awakino.

This paper leads on from ERTH221 and/or ERTH222 and it may be considered a partner to ERTH321.

*Lecturer(s):* Professor Peter Kamp/To be advised

*Prerequisite(s):* ERTH221 or ERTH222

*Recommended book(s):* *Boggs Jr Principles of Sedimentology and Stratigraphy* (Merrill); *James et al Facies Models – Response to Sea Level Change* (Geological Association of Canada); *Prothero et al Sedimentary Geology – An Introduction to Sedimentary Rocks and Stratigraphy* (Freeman)

*Assessment:* Internal assessment/examination ratio: 3 : 2

**ERTH333-12A (HAM) – Pedology and Land Evaluation***10 Points*

Soil genesis and spatial variability, quantitative soil survey and soil-landscape modelling, soil taxonomy, and the interpretation of soil and land data in a form applicable to land-use planning and management.

*Lecturer(s):* Professor David Lowe

*Prerequisite(s):* ERTH233

*Restriction(s):* ERTH331

*Recommended book(s):* *Schaetzl and Anderson Soils: Genesis and Geomorphology* (Cambridge University Press); *Milne et al Soil Description Handbook 2nd ed* (Manaaki Whenua Press)

*Assessment:* Internal assessment/examination ratio: 3 : 2

**ERTH334-12B (HAM) – Soil and Land Management***10 Points*

Analysis and interpretation of soil properties relating to land and environmental management, soil fertility, soil water management, land treatment of wastes, soil degradation and remediation, soil nitrogen and phosphorus cycling.

*Lecturer(s):* Associate Professor Louis Schipper and Dr Megan Balks

*Prerequisite(s):* ERTH234

*Restriction(s):* ERTH331

*Assessment:* Internal assessment/examination ratio: 3 : 2

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### ERTH343-12B (HAM) – Coastal Geomorphology and Management

#### 20 Points

The paper focuses on understanding of coastal processes, sediments and evolution of coastal landforms as a basis for coastal management. Topics covered include beach sediments and processes, coastal erosion, and littoral, tidal flats, tidal inlets, estuaries, dunes, rocky shorelines; semiquantitative methods for coastal hazard analysis and tidal inlet stability; coastal planning issues relating to the RMA (1991); sea level rise impacts, dredging and spoil dispersion, port and marina developments, and methods of coastal protection.

There will be a one-day field trip to examine aspects of coastal geomorphology processes and management.

*Lecturer(s):* Dr Willem de Lange and Dr Karin Bryan

*Prerequisite(s):* 40 points from 200 Level Earth Sciences or approved Geography papers

*Recommended books:* Komar **Beach processes and sedimentation** 2nd ed (Prentice-Hall) 1998; Middleton **Data analysis in the Earth Sciences using Matlab** (Prentice-Hall)

*Assessment:* Internal assessment/examination ratio: 3 : 2

### ERTH344-12A (HAM) – Coastal Oceanography and Engineering

#### 20 Points

This paper focuses on physical oceanography of the coastal zone. Topics include methodologies for quantifying processes and coastal responses; evaluation of design conditions for coastal engineering; and application of numerical models for simulating coastal processes. This paper, which follows on from ERTH242, includes a one-day field trip.

*Lecturer(s):* Dr Karin Bryan and Dr Julia Mullarney

*Prerequisite(s):* ERTH242 or ERTH245

*Recommended book(s):* Komar **Beach processes and sedimentation** 2nd ed (Prentice-Hall) 1998; Middleton **Data analysis in the Earth Sciences using Matlab** (Prentice-Hall)

*Assessment:* Internal assessment/examination ratio: 3 : 2

### ERTH345-12A (HAM) – Catchment Hydrology

#### 10 Points

Measurement, analysis and modelling of surface hydrological processes at the catchment scale, emphasizing precipitation, river flow, evaporation, interception loss and hillslope runoff processes.

*Lecturer(s):* Dr David Campbell

*Prerequisite(s):* ERTH245 or ERTH246

*Restriction(s):* ERTH341

*Assessment:* Internal assessment/examination ratio: 3 : 2

**ERTH346-12B (HAM) – Groundwater and Hydrological Analysis***10 Points*

Introduction to groundwater and simple models of hydrological processes. Topics include simulating catchment runoff, extreme flood events, optimal hydro power operation, and soil water budgets.

*Lecturer(s): Associate Professor Earl Bardsley*

*Prerequisite(s): ERTH246 or ERTH245*

*Restriction(s): ERTH341*

*Recommended book(s): Wainwright and Mulligan **Environmental Modelling** (Wiley) 2004*

*Assessment: Internal assessment/examination ratio: 3 : 2*

**ERTH352-12A (HAM) – Engineering Geology***10 Points*

An understanding of the nature and mechanics of soil instability is developed from an examination of slope erosion processes and the physical properties of earth materials. Strategies are discussed for mitigation and avoidance of hazards resulting from slope instability and associated erosion processes.

*Lecturer(s): Dr Vicki Moon*

*Prerequisite(s): ERTH251*

*Assessment: Internal assessment/examination ratio: 3 : 2*

**ERTH384-12B (HAM) – Advanced Environmental Monitoring***10 Points*

This paper has focus on detecting and quantifying change in the natural environment. A source-to-sea theme is included, with topics incorporating catchment hydrology, soil and land use patterns, sedimentation and nutrient inputs to estuaries. Techniques covered include simple modelling, statistical methods and field survey analysis.

*Lecturer(s): Dr Karin Bryan, Associate Professor Earl Bardsley and Dr Megan Balks*

*Prerequisite(s): ERTH284*

*Assessment: Internal assessment/examination ratio: 3 : 2*

**BSc(Tech) Work Placement Papers**

*For details refer to Work Placements.*

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## Earth Sciences General Programmes

**Note(s):** For descriptions of individual papers refer to the following subjects: BIOL Biological Sciences; CHEM Chemistry; ENEL Electronics; ENGG Engineering; ENMP Materials & Processing; ENME Mechanical Engineering; ENVS Environmental Sciences; EARTH Earth Sciences; PHYS Physics; PSYC Psychology. See also Biological Sciences general programmes. For papers with other subject codes refer to the University Calendar.

Students must complete any prerequisites for recommended papers.

### Coastal Science

This programme will suit students interested in the management and use of coastal resources for recreation or physical development. This programme has a narrower focus than the specialisation in marine science. It concentrates on the origin and behaviour of physical resources at the coast, but allows the student to explore the tourism potential and environmental management as well. This programme develops the necessary skills for graduate level studies in coastal marine science within Earth Sciences.

This general programme is for students undertaking a BSc or BSc(Tech) degree with a major in Earth Sciences. The following papers are recommended for students interested in coastal science:

#### Structure of the Coastal Science Programme

100 LEVEL	ERTH103 15 points	ERTH104 15 points	SCIENCE 15 points	SCIENCE 15 points	SCIENCE 15 points	SCIENCE 15 points	SCIENCE 15 points	ELECTIVE 15 points
200 LEVEL	ERTH242 20 points	ERTH245 10 points ERTH* 10 points	ERTH* 20 points	** 20 points	** 20 points	** 20 points	** 20 points	
300 LEVEL	ERTH343 20 points	ERTH344 20 points	ERTH*** 20 points	**** 20 points	**** 20 points			

#### 100 Level – Papers are worth 15 points.

- » EARTH103A – Discovering Planet Earth
- » EARTH104B – Earth and Ocean Environments

#### Recommended Science papers

- » BIOL102A – The Biology of Organisms
- » CHEM101A – Chemical Concepts
- » COMP123A/B/S – The Computing Experience
- » ENGG180A – Foundations of Engineering
- » ENVS101B – Environmental Science
- » PHYS103B – Physics for Scientists and Engineers 1
- » STAT111B – Statistics for Science or  
STAT121A/S – Introduction to Statistical Methods

#### Recommended elective paper

- » ANTH102B – New Zealand and the Pacific
- » GEOG103A – Resources and Environmental Sustainability
- » POLS105A – People and Policy

**200 Level – Papers are worth 20 points unless specified.**

- » ERTH242B – Oceanography
- » ERTH245A – Weather and Climate (10 points)

\*Choose at least 30 points from 200 Level Earth Sciences papers. Recommended papers:

- » ERTH221B – Earth Materials and Processes
- » ERTH222A – Stratigraphy and Tectonics
- » ERTH233A – Soils in the Landscape (10 points)
- » ERTH246B – Introduction to Hydrology (10 points)
- » ERTH251B – Engineering Geomorphology (10 points)

\*\*Choose a further 80 points at 200 Level. Recommended papers:

- » BIOL212A – Ecology
- » ENVP206B – Principles of Environmental Planning
- » GEOG219A – Māori Lands and Communities
- » GEOG224B – Tourism Environments
- » GEOG228A – Information Technology and Cartography

**300 Level – Papers are worth 20 points unless specified.**

- » ERTH343B – Coastal Geomorphology and Management
- » ERTH344A – Coastal Oceanography and Engineering

\*\*\*Choose at least 20 points from 300 Level Earth Sciences papers. Recommended papers:

- » ERTH322B – Sedimentary and Petroleum Geology
- » ERTH334B – Soil and Land Management (10 points)
- » ERTH345A – Catchment Hydrology (10 points)
- » ERTH352A – Engineering Geology (10 points)
- » ERTH384B – Advanced Environmental Monitoring (10 points)

\*\*\*\*Recommended papers:

- » BIOL314A – Marine Biology and Monitoring
- » GEOG306A – Disasters and Development
- » GEOG328B – Geographic Information Systems

**Earth Sciences and Geography**

There are excellent career prospects for graduates of this programme due to a growing demand for people with knowledge and skills in environmental planning, climate change, and water, coastal, soil and energy resource management.

This general programme is for students undertaking a BSc or BSc(Tech) degree with a major in Earth Sciences. For students who want to build on their physical geography studies, the following papers are recommended:

Structure of the Earth Sciences and Geography Programme							
<b>200 LEVEL</b>	ERTH103 15 points	ERTH104 15 points	SCIENCE 15 points	SCIENCE 15 points	SCIENCE 15 points	SCIENCE 15 points	GEOG103 15 points
<b>300 LEVEL</b>	ERTH284 10 points	ERTH*	ERTH*	ENVP206 20 points	GEOG228 20 points	*	
	ERTH* 10 points	20 points	20 points	20 points	20 points	20 points	
<b>300 LEVEL</b>	ERTH** 20 points	ERTH** 20 points	ERTH** 20 points	GEOG306 20 points	GEOG328 20 points	*** 20 points	

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## 100 Level – Papers are worth 15 points.

- » EARTH103A – Discovering Planet Earth
- » EARTH104B – Earth and Ocean Environments
- » GEOG103A – Resources and Environmental Sustainability

Choose a further 75 points from 100 Level Science papers. Recommended papers:

- » BIOL102A – The Biology of Organisms
- » CHEM101A – Chemical Concepts
- » COMP123A/B/S – The Computing Experience
- » ENVS101B – Environmental Science
- » STAT111B – Statistics for Science or
- » STAT121A/S – Introduction to Statistical Methods

## 200 Level – Papers are worth 20 points unless specified otherwise.

- » EARTH284B – Introduction to Environmental Monitoring (10 points)
- » ENVP206B – Principles of Environmental Planning
- » GEOG228A – Information Technology and Cartography

\*Choose a further 70 points from 200 Level Science papers, of which at least 50 points from 200 Level Earth Sciences. Recommended papers:

- » BIOL212A – Ecology
- » EARTH221B – Earth Materials and Processes
- » EARTH222A – Stratigraphy and Tectonics
- » EARTH233A – Soils in the Landscape (10 points)
- » EARTH234A – Soil Properties and their Management (10 points)
- » EARTH242B – Oceanography
- » EARTH245A – Weather and Climate (10 points)
- » EARTH246B – Introduction to Hydrology (10 points)
- » EARTH251B – Engineering Geomorphology (10 points)

## 300 Level – Papers are 20 points unless specified otherwise.

- » GEOG306A – Disasters and Development
- » GEOG328B – Geographic Information Systems

\*\*Choose 60 points from 300 Level Earth Sciences papers.

\*\*\*Choose 20 points from 200 or 300 Level Science papers.

## Engineering Geology

Graduates from this programme typically find employment in private consultancies where they undertake site investigations, assess landslide hazard and damage, and undertake design for slope stability. The following papers are recommended for students with an interest in engineering geology, undertaking a BSc or BSc(Tech) degree with a major in Earth Sciences.

Structure of the Engineering Geology Programme								
100 LEVEL	ERTH103 15 points	ERTH104 15 points	SCIENCE 15 points	SCIENCE 15 points	SCIENCE 15 points	SCIENCE 15 points	SCIENCE 15 points	ELECTIVE 15 points
200 LEVEL	ERTH221 20 points	ERTH222 20 points	ERTH246 10 points	ERTH233 10 points	*	*		
			ERTH251 10 points	ERTH234 10 points				
300 LEVEL	ERTH321 20 points	ERTH322 20 points	ERTH346 10 points	**	**	**		
			ERTH352 10 points	20 points	20 points	20 points		

### 100 Level – Papers are worth 15 points.

- » EARTH103A – Discovering Planet Earth
- » EARTH104B – Earth and Ocean Environments

Recommended 100 Level Science or elective papers. Choose 90 points from:

- » COMP123A/B/S – The Computing Experience
- » ENGG180A – Foundations of Engineering
- » ENMP102B – Introduction to Materials Science and Engineering
- » GEOG103A – Resources and Environmental Sustainability
- » MATH101A/B/C/D – Introduction to Calculus or MATH165A – General Mathematics
- » PHYS100A – Exploring Physics
- » STAT111B – Statistics for Science or
- » STAT121A/S – Introduction to Statistical Methods

### 200 Level – Papers are worth 20 points unless specified otherwise.

- » EARTH221B – Earth Materials and Processes
- » EARTH222A – Stratigraphy and Tectonics
- » EARTH233A – Soils in the Landscape (10 points)
- » EARTH234A – Soil Properties and their Management (10 points)
- » EARTH246B – Introduction to Hydrology (10 points)
- » EARTH251B – Engineering Geomorphology (10 points)

\*Choose a further 40 points from 200 Level Science or Geography papers. Recommended papers:

- » ENMP241B – Environmental Technology 1
- » EARTH242B – Oceanography
- » EARTH245A – Weather and Climate (10 points)
- » EARTH284B – Introduction to Environmental Monitoring (10 points)
- » GEOG228A – Information Technology and Cartography

# EARTH SCIENCES

**300 Level – Papers are worth 20 points unless specified otherwise.**

- » EARTH321A – Volcanology
- » EARTH322B – Sedimentary and Petroleum Geology
- » EARTH346B – Groundwater and Hydrological Analysis (10 points)
- » EARTH352A – Engineering Geology (10 points)

**\*\*Choose 60 points from 300 Level Science or Geography papers. Recommended papers:**

- » EARTH333A – Pedology and Land Evaluation (10 points)
- » EARTH334B – Soil and Land Management (10 points)
- » EARTH343B – Coastal Geomorphology and Management
- » EARTH344A – Coastal Oceanography and Engineering
- » EARTH345A – Catchment Hydrology (10 points)
- » EARTH384B – Advanced Environmental Monitoring (10 points)
- » GEOG328B – Geographic Information Systems

## Environmental Engineering Science

A significant proportion of Earth Sciences graduates now work closely with engineers and technologists. This programme provides students with a range of courses that develop an understanding of the physical environment and a range of skills that contribute to environmental engineering and technology, and will facilitate interactions with engineers.

This general programme is for students undertaking a BSc or BSc(Tech) degree with a major in Earth Sciences.

### Structure of the Environmental Engineering Science Programme

<b>100 LEVEL</b>	ERTH103 15 points	ERTH104 15 points	ENGG180 15 points	* 15 points	* 15 points	** 15 points	** 15 points	** 15 points
<b>200 LEVEL</b>	ERTH221 20 points	ERTH222 20 points	ERTH246 10 points ERTH251 10 points	ERTH242 20 points	*** 20 points	*** 20 points		
<b>300 LEVEL</b>	ERTH344 20 points	ERTH346 10 points ERTH**** 10 points	ERTH352 10 points ERTH384 10 points	**** 20 points	**** 20 points	**** 20 points		

**Note(s):** Students must complete any prerequisites for recommended papers.

**100 Level – Papers are worth 15 points.**

- » EARTH103A – Discovering Planet Earth
- » EARTH104B – Earth and Ocean Environments
- » ENGG180A – Foundations of Engineering

\*Choose at least 30 points from 100 Level Mathematics or Statistics or Computer Science papers. Recommended:

- » COMP103A/B – Introduction to Computer Science 1
- » MATH101A/B/C/D – Introduction to Calculus
- » MATH102A/B/C/D – Introduction to Algebra
- » MATH165A – General Mathematics  
(for those who don't meet prerequisites for MATH101 or MATH102)
- » STAT111B – Statistics for Science or  
STAT121A/S – Introduction to Statistical Methods

\*\*Choose at least 30 points from 100 Level Science papers. Recommended:

- » BIOL102A – The Biology of Organisms
- » CHEM101A – Chemical Concepts
- » COMP104B/S – Introduction to Computer Science 2
- » COMP123A/B/S – The Computing Experience
- » ENMP102B – Introduction to Materials Science and Engineering
- » ENVS101B – Environmental Science
- » PHYS103B – Physics for Scientists and Engineers 1

**200 Level – Papers are worth 20 points unless specified otherwise.**

- » EARTH221B – Earth Materials and Processes
- » EARTH222A – Stratigraphy and Tectonics
- » EARTH242B – Oceanography
- » EARTH246B – Introduction to Hydrology (10 points)
- » EARTH251B – Engineering Geomorphology (10 points)

\*\*\*Choose a further 40 points from 200 Level papers. Recommended:

- » ENGG282B – Engineering Design (10 points)
- » ENMP241B – Environmental Technology 1
- » ENMP282A – Science and Engineering Management A (10 points)
- » EARTH233A – Soils in the Landscape (10 points)
- » EARTH234A – Soil Properties and their Management (10 points)
- » EARTH245A – Weather and Climate (10 points)
- » EARTH284B – Introduction to Environmental Monitoring (10 points)
- » GEOG228A – Information Technology and Cartography
- » MATH251A – Multivariable Calculus (10 points)
- » MATH255B – Differential Equations (10 points)

# EARTH SCIENCES

## 300 Level – Papers are worth 20 points unless specified otherwise.

- » EARTH344A – Coastal Oceanography and Engineering
- » EARTH346B – Groundwater and Hydrological Analysis (10 points)
- » EARTH352A – Engineering Geology (10 points)
- » EARTH384B – Advanced Environmental Monitoring (10 points)

\*\*\*\*Choose a further 70 points from 300 Level papers, of which at least 10 points must be from Level 300 Earth Sciences papers. Recommended:

- » ENME340A – Computer Aided Engineering
- » ENMP341A – Environmental Technology 2
- » EARTH321A – Volcanology
- » EARTH322B – Sedimentary and Petroleum Geology
- » EARTH333A – Pedology and Land Evaluation (10 points)
- » EARTH334B – Soil and Land Management (10 points)
- » EARTH343B – Coastal Geomorphology and Management
- » EARTH345A – Catchment Hydrology (10 points)
- » GEOG328B – Geographic Information Systems

## Hydrology and Water Resources

This general programme is for students undertaking a BSc or BSc(Tech) degree with a major in Earth Sciences. For students interested in pursuing a career in water resources management and freshwater science, the following papers are recommended:

### Structure of the Hydrology and Water Resources Programme

100 LEVEL	ERTH103 15 points	ERTH104 15 points	BIOL102 15 points	ENVS101 15 points	STAT111 or STAT121 15 points	SCIENCE* 15 points	SCIENCE* 15 points	GEOG103 15 points
200 LEVEL	ERTH245 10 points	ERTH* 20 points	ERTH* 20 points	BIOL212 20 points	** 20 points	** 20 points		
	ERTH246 10 points							
300 LEVEL	ERTH345 10 points	ERTH384 10 points	ERTH** 20 points	BIOL313 20 points	*** 20 points	*** 20 points		
	ERTH346 10 points	ERTH** 10 points						

## 100 Level – Papers are worth 15 points.

- » BIOL102A – The Biology of Organisms
- » ENVS101B – Environmental Science
- » EARTH103A – Discovering Planet Earth
- » EARTH104B – Earth and Ocean Environments
- » GEOG103A – Resources and Environmental Sustainability
- » STAT111B – Statistics for Science or  
STAT121A/S – Introduction to Statistical Methods

\*Choose a further 30 points from 100 Level Science papers. Recommended:

- » CHEM101A – Chemical Concepts
- » COMP123A/B/S – The Computing Experience
- » MATH165A – General Mathematics
- » PHYS100A – Exploring Physics

**200 Level – Papers are worth 20 points unless specified.**

- » BIOL212A – Ecology
- » ERTH245A – Weather and Climate (10 points)
- » ERTH246B – Introduction to Hydrology (10 points)

\*\*Choose 40 points from 200 Level Earth Sciences papers and 40 points from 200 Level Science or Geography papers. Recommended:

- » CHEM261B – Geochemistry and Environmental Chemistry
- » ENMP241B – Environmental Technology 1
- » ERTH221B – Earth Materials and Processes
- » ERTH222A – Stratigraphy and Tectonics
- » ERTH233A – Soils in the Landscape (10 points)
- » ERTH234A – Soil Properties and their Management (10 points)
- » ERTH242B – Oceanography
- » ERTH251B – Engineering Geomorphology (10 points)
- » ERTH284B – Introduction to Environmental Monitoring (10 points)
- » GEOG228A – Information Technology and Cartography
- » STAT221A – Statistical Data Analysis

**300 Level – Papers are worth 20 points unless specified.**

- » BIOL313B – Applied Freshwater Ecology
- » ERTH345A – Catchment Hydrology (10 points)
- » ERTH346B – Groundwater and Hydrological Analysis (10 points)
- » ERTH384B – Advanced Environmental Monitoring (10 points)

\*\*Choose 30 points from 300 Level Earth Sciences papers.

\*\*\*Choose 40 points from 200 or 300 Level Science or Geography papers.

**Natural Hazards**

This programme of study will appeal to students interested in understanding the physical impacts of natural hazards and how they can be planned for and managed. Science graduates with a background in natural hazards are in demand by council and government agencies, research institutes and environmental consultancies.

This general programme is for students undertaking a BSc or BSc(Tech) degree with a major in Earth Sciences.

Structure of the Natural Hazards Programme								
300 LEVEL	ERTH103 15 points	ERTH104 15 points	ENVS101 15 points	SCIENCE 15 points	SCIENCE 15 points	SCIENCE 15 points	SCIENCE 15 points	GEOG103 15 points
200 LEVEL	ERTH251 10 points	ERTH* 20 points	ERTH* 20 points	GEOG228 20 points	SCIENCE ** 20 points	** 20 points		
300 LEVEL	ERTH343 20 points	ERTH346 10 points	ERTH384 10 points	ERTH*** 20 points	GEOG306 20 points	GEOG328 20 points		
		ERTH352 10 points	ERTH*** 10 points					

## EARTH SCIENCES

### 100 Level – Papers are worth 15 points.

- » ENV5101B – Environmental Science
- » EARTH103A – Discovering Planet Earth
- » EARTH104B – Earth and Ocean Environments
- » GEOG103A – Resources and Environmental Sustainability

Choose a further 60 points from Level 100 Science papers. Recommended:

- » CHEM101A – Chemical Concepts
- » COMP123A/B/S – The Computing Experience
- » MATH165A – General Mathematics
- » PHYS100A – Exploring Physics
- » PSYC102B – Social and Developmental Psychology
- » STAT111B – Statistics for Science or  
STAT121A/S – Introduction to Statistical Methods

### 200 Level – Papers are worth 20 points unless specified.

- » GEOG228A – Information Technology and Cartography
- » EARTH251B – Engineering Geomorphology (10 points)

\*Choose at least 50 points from 200 Level Earth Sciences papers. Recommended:

- » EARTH221B – Earth Materials and Processes
- » EARTH222A – Stratigraphy and Tectonics
- » EARTH233A – Soils in the Landscape (10 points)
- » EARTH234A – Soil Properties and Management (10 points)
- » EARTH242B – Oceanography
- » EARTH245A – Weather and Climate (10 points)
- » EARTH246B – Introduction to Hydrology (10 points)
- » EARTH284B – Introduction to Environmental Monitoring (10 points)

\*\*Choose a further 40 points from 200 Level Science or Geography papers.

Of the 40 points, 20 points must be science papers. Recommended:

- » ENVP206B – Principles of Environmental Planning
- » PSYC225A – Behavioural Psychology and Learning (10 points)
- » STAT221A – Statistical Data Analysis

### 300 Level – Papers are worth 20 points unless specified.

- » EARTH343B – Coastal Geomorphology and Management
- » EARTH346B – Groundwater and Hydrological Analysis (10 points)
- » EARTH352A – Engineering Geology (10 points)
- » EARTH384B – Advanced Environmental Monitoring (10 points)
- » GEOG306A – Disasters and Development
- » GEOG328B – Geographic Information Systems

\*\*\*Plus a further 30 points from 300 Level Earth Sciences papers. Recommended:

- » EARTH321A – Volcanology
- » EARTH334B – Soil and Land Management (10 points)
- » EARTH345A – Catchment Hydrology (10 points)

## Sedimentary Geology and Tectonics

This programme provides students with a strong foundation for a career within the geological sciences, petroleum exploration and consultancy industries. This general programme is for students undertaking a BSc or BSc(Tech) degree with a major in Earth Sciences.

### Structure of the Sedimentary Geology and Tectonics Programme

100 LEVEL	ERTH103 15 points	ERTH104 15 points	BIOL102 15 points	CHEM101 15 points	*	*	*	*
200 LEVEL	ERTH221 20 points	ERTH222 20 points	ERTH242 20 points	ERTH251 10 points ERTH** 10 points	CHEM261 20 points	**		
300 LEVEL	ERTH321 20 points	ERTH322 20 points	ERTH343 20 points	ERTH352 10 points ERTH*** 10 points	***	***		

#### 100 Level – Papers are worth 15 points.

- » BIOL102A – The Biology of Organisms
- » CHEM101A – Chemical Concepts
- » ERTH103A – Discovering Planet Earth
- » ERTH104B – Earth and Ocean Environments

\*Choose a further 60 points at 100 Level from:

- » CHEM102B – Chemical Change and Organic Compounds
- » COMP123A/B/S – The Computing Experience
- » ENGG180A – Foundations of Engineering
- » ENMP102B – Introduction to Material Science and Engineering
- » ENVS101B – Environmental Science
- » GEOG103A – Resources and Environmental Sustainability
- » MATH165A – General Mathematics
- » PHYS100A – Exploring Physics
- » PHYS103B – Physics for Scientists and Engineers 1
- » STAT111B – Statistics for Science or
- » STAT121A/S – Introduction to Statistical Methods

#### 200 Level – Papers are worth 20 points unless specified.

- » CHEM261B – Geochemistry and Environmental Chemistry
- » ERTH221B – Earth Materials and Processes
- » ERTH222A – Stratigraphy and Tectonics
- » ERTH242B – Oceanography
- » ERTH251B – Engineering Geomorphology (10 points)

\*\*Choose a further 30 points from the following:

- » BIOL212A – Ecology
- » CHEM204A – Analytical Chemistry and Instrumental Techniques
- » ENMP241B – Environmental Technology 1
- » ERTH233A – Soils in the Landscape (10 points)
- » ERTH234A – Soils Properties and their Management (10 points)
- » ERTH245A – Weather and Climate (10 points)
- » ERTH246B – Introduction to Hydrology (10 points)
- » GEOG228A – Information Technology and Cartography

# EARTH SCIENCES

**300 Level – Papers are worth 20 points unless specified.**

- » EARTH321A – Volcanology
- » EARTH322B – Sedimentary and Petroleum Geology
- » EARTH343B – Coastal Geomorphology and Management
- » EARTH352A – Engineering Geology (10 points)

\*\*\*Choose 50 points from 300 Level Science papers (including up to 20 points from Geography).

Recommended:

- » EARTH333A – Pedology and Land Evaluation (10 points)
- » EARTH334B – Soil and Land Management (10 points)
- » EARTH344A – Coastal Oceanography and Engineering
- » EARTH345A – Catchment Hydrology (10 points)
- » EARTH346B – Groundwater and Hydrological Analysis (10 points)
- » EARTH384B – Advanced Environmental Monitoring (10 points)
- » GEOG328B – Geographic Information Systems

## Soil and Land Resources

This general programme is for students undertaking a BSc or BSc(Tech) degree with a major in Earth Sciences.

### Structure of the Soil and Land Resources Programme

<b>100 LEVEL</b>	ERTH103 15 points	ERTH104 15 points	ENVS101 15 points	*	*	*	*	GEOG103 15 points
<b>200 LEVEL</b>	ERTH233 10 points ERTH234 10 points	ERTH** 20 points	ERTH** 20 points	**	**	**		
<b>300 LEVEL</b>	ERTH333 10 points ERTH334 10 points	ERTH*** 20 points	ERTH*** 20 points	***	***	***		

**100 Level – Papers are worth 15 points.**

- » ENVS101B – Environmental Science
- » EARTH103A – Discovering Planet Earth
- » EARTH104B – Earth and Ocean Environments
- » GEOG103A – Resources and Environmental Sustainability

\*Choose a further 60 points from 100 Level Science papers. Recommended:

- » BIOL102A – The Biology of Organisms
- » CHEM101A – Chemical Concepts
- » COMP123A/B/S – The Computing Experience
- » MATH165A – General Mathematics
- » STAT111B – Statistics for Science or  
STAT121A/S – Introduction to Statistical Methods

**200 Level – Papers are worth 20 points unless specified.**

- » ERTH233A – Soils in the Landscape (10 points)
- » ERTH234A – Soil Properties and their Management (10 points)

\*\*Choose at least 40 points from 200 Level Earth Sciences, plus up to 60 points from 200 Level Science (including up to 20 points from Geography).

Recommended Earth Sciences papers:

- » ERTH221B – Earth Materials and Processes
- » ERTH245A – Weather and Climate (10 points)
- » ERTH246B – Introduction to Hydrology (10 points)
- » ERTH251B – Engineering Geomorphology (10 points)
- » ERTH284B – Introduction to Environmental Monitoring (10 points)

Recommended Science and Geography papers:

- » BIOL212A – Ecology
- » CHEM261B – Geochemistry and Environmental Chemistry
- » GEOG228A – Information Technology and Cartography

**300 Level – Papers are worth 20 points unless specified.**

- » ERTH333A – Pedology and Land Evaluation (10 points)
- » ERTH334B – Soil and Land Management (10 points)

\*\*\*Choose at least 40 points from 300 Level Earth Sciences papers plus up to 60 points from 300 Level Science (including up to 20 points from Geography).

Recommended Earth Sciences papers:

- » ERTH345A – Catchment Hydrology (10 points)
- » ERTH346B – Groundwater and Hydrological Analysis (10 points)
- » ERTH352A – Engineering Geology (10 points)
- » ERTH384B – Advanced Environmental Monitoring (10 points)

Recommended Geography paper:

- » GEOG328B – Geographic Information Systems

**Volcanology**

This programme of study will appeal to students interested in understanding volcanic processes and products. This programme provides graduates with a strong foundation for a career within the geological sciences and research, environmental consultancy, and local authorities. This general programme is for students undertaking a BSc or BSc(Tech) degree with a major in Earth Sciences.

Structure of the Volcanology Programme								
100 LEVEL	ERTH103 15 points	ERTH104 15 points	CHEM101 15 points	PHYS100 15 points	*	*	*	*
200 LEVEL	ERTH221 20 points	ERTH222 20 points	ERTH2** 20 points	** 20 points	** 20 points	** 20 points		
300 LEVEL	ERTH321 20 points	ERTH322 20 points	ERTH352 and ERTH*** 20 points	*** 20 points	*** 20 points	*** 20 points		

# EARTH SCIENCES

## 100 Level – Papers are worth 15 points.

- » CHEM101A – Chemical Concepts
- » EARTH103A – Discovering Planet Earth
- » EARTH104B – Earth and Ocean Environments
- » PHYS100A – Exploring Physics
- \*Choose a further 60 points from:
  - » CHEM102B – Chemical Change and Organic Compounds
  - » COMP123A/B/S – The Computing Experience
  - » ENGG180A – Foundations of Engineering
  - » ENV5101B – Environmental Science
  - » GEOG103A – Resources and Environmental Sustainability
  - » MATH165A – General Mathematics
  - » PHYS103B – Physics for Scientists and Engineers 1
  - » STAT111B – Statistics for Science or
  - STAT121A/S – Introduction to Statistical Methods

## 200 Level – Papers are worth 20 points unless specified.

- » EARTH221B – Earth Materials and Processes
- » EARTH222A – Stratigraphy and Tectonics
- \*\*Choose 80 points from 200 Level Science papers, of which at least 20 points must be from 200 Level Earth Sciences papers. Up to 20 points from Geography may be included. Recommended:
  - » CHEM204A – Analytical Chemistry and Instrumental Techniques
  - » CHEM261B – Geochemistry and Environmental Chemistry
  - » EARTH233A – Soils in the Landscape (10 points)
  - » EARTH234A – Soils Properties and their Management (10 points)
  - » EARTH242B – Oceanography
  - » EARTH245A – Weather and Climate (10 points)
  - » EARTH246B – Introduction to Hydrology (10 points)
  - » EARTH251B – Engineering Geomorphology (10 points)
  - » GEOG228A – Information Technology and Cartography

## 300 Level – Papers are worth 20 points unless specified.

- » EARTH321A – Volcanology
- » EARTH322B – Sedimentary and Petroleum Geology
- » EARTH352A – Engineering Geology (10 points)
- \*\*\*Choose a further 70 points from 300 Level Science papers, of which at least 10 points must be from Earth Sciences papers. Up to 20 points from Geography may be included. Recommended:
  - » EARTH333A – Pedology and Land Evaluation (10 points)
  - » EARTH334B – Soil and Land Management (10 points)
  - » EARTH343B – Coastal Geomorphology and Management
  - » EARTH344A – Coastal Oceanography and Engineering
  - » EARTH345A – Catchment Hydrology (10 points)
  - » EARTH346B – Groundwater and Hydrological Analysis (10 points)
  - » EARTH384B – Advanced Environmental Monitoring (10 points)
  - » GEOG328B – Geographic Information Systems