

Mineral Resources

Programme Requirements:

Mineral Resources - MSc
<p>ES5303ES5305 (15 credits) and ES5304 (15 credits) and ES5300 (15 credits) and ES5301 (15 credits) and ES5013 (15 credits) and ES5302 (15 credits) and ES5009 (15 credits) and ES3003 (15 credits) and ES5099 (60 credits)</p> <p>If students have prior experience of the above modules, the following are suitable substitutes:</p> <p>ES3004 – Sedimentology and Stratigraphy ES3007 – Structure and Tectonics ES4007 – Petroleum Exploration and Geophysics ES5005 – Isotope Geochemistry ES5010 – Advanced Geochemistry</p>

Compulsory modules:

ES3003 GIS and Spatial Analysis for Earth Scientists				
SCOTCAT Credits:	15	SCQF Level 9	Semester	2
Academic year:	2018/9			
Planned timetable:	10.00 am - 1.00 pm Mon, Wed (lecture plus lab session) (Weeks 1 - 7)			
This module covers the principles behind, and practical application of digital spatial analysis in Earth Sciences. This includes the analysis of primary and secondary datasets, how to access and import a variety of data types, and the fundamentals of various spatial analytical methods including spatial statistics and modeling within a GIS environment. The module also prepares students for the correct presentation of maps and datasets in the dissertation proposal and thesis.				
Pre-requisite(s):	Before taking this module you must take ES3002			
Learning and teaching methods of delivery:	Weekly contact: 6 lectures and 14 practicals and support sessions (Weeks 1 - 7).			
Assessment pattern:	Coursework = 100%			
Re-assessment pattern:	2-hour Written Examination = 100%			
Module coordinator:	Dr C R Bates			
Module teaching staff:	Dr C Bates			

ES5009 Geodynamics				
SCOTCAT Credits:	15	SCQF Level 11	Semester	2
Academic year:	2018/9			
Planned timetable:	9.00 am - 10.00 am Tue and Wed; 9.00 am - 5.00 pm Fri (Weeks 2,5,9)			
<p>A study of the geodynamic evolution of Earth's crust since the Archaean, the evolution of convergent and divergent margins, and the relationships between deep Earth geodynamics, surficial tectonics, erosion, climate, and biosphere. The module investigates how fundamental geodynamic processes impact the rock record and contrasts geodynamic evolution in the Archaean, Proterozoic, Palaeozoic, Mesozoic and Cenozoic using a number of case studies. The module develops skills of geodynamic interpretation, use of numerical models, palaeogeographic and metadata analysis. Students will undertake an independent research project culminating in a manuscript-style report for continuous assessment; and there will be a final exam focusing on continental tectonics.</p>				
Anti-requisite(s)	You cannot take this module if you take ES4009			
Learning and teaching methods of delivery:	Weekly contact: 2 x 1-hour or 1 x 2-hour lectures (x 11 weeks) , plus 2 extended laboratory classes..			
Assessment pattern:	2-hour Written Examination = 50%, Coursework = 50%			
Re-assessment pattern:	2-hour Written Examination = 80%, Coursework = 20%, No Re-assessment if Coursework mark is <4			
Module coordinator:	Dr T D Raub			
Module teaching staff:	Dr T Raub, Dr R White			

ES5013 Advanced Petrogenesis				
SCOTCAT Credits:	15	SCQF Level 11	Semester	1
Academic year:	2018/9			
Planned timetable:	10.00 am Mon and Tue (lectures). 10.00 - 1.00 pm Wed or Fri (practicals)			
<p>Rocky planets, like Earth, comprise of a metallic core with a rocky mantle and crust topped with a gaseous atmosphere. The focus of this course is the genesis of the rocky mantle and crust ? termed the silicate Earth ? and it?s relationship to small-scale to planetary-wide processes. The silicate Earth primarily comprises igneous and metamorphic rocks. This module explores the nature of the magmatic and metamorphic processes that characterise the Earth from the immediate subsurface to the base of the mantle. We focus on the petrology and geochemistry of the minerals and rocks created, and the evolution of composition as a function of time and depth. Students completing this module will understand how magmatic systems operate from melting source, through ascent to the plumbing systems in the immediate subsurface. The response of the crust to dynamic changes in pressure and temperature will also be explained along with the methods used to determine these. The course will develop key skills in identifying rocks, interpreting geochemical data, and using geochemical and thermodynamic methods to unravel rock histories. Students will also be shown how these data can be used to understand any and all rocky bodies in the cosmos, from Earth to exoplanets.</p>				
Pre-requisite(s):	Before taking this module you must take ES3009			
Learning and teaching methods of delivery:	Weekly contact: 18 lectures, 15 hours of laboratory work, 18 hours of field-related study over the semester			
Assessment pattern:	2-hour Written Examination = 50%, 3-hour Practical Examination = 50%			
Re-assessment pattern:	2-hour Written Examination = 100%, No Re-assessment if Coursework mark is <4			
Module coordinator:	Prof A A Finch			
Module teaching staff:	Prof A Finch, Prof R White and Dr S Mikhail			

ES5300 Magmatic-related Ore Deposits				
SCOTCAT Credits:	15	SCQF Level 11	Semester	1
Academic year:	2018/9			
Planned timetable:	To be arranged.			
The module focuses on the geodynamic setting, age, geometry, and mineralogy of the principal metallic mineral deposits related to magmatic processes. The different deposit types are studied using a holistic (geology, structural, geochemistry, and geophysics) mineral system approach. Current genetic models of ore deposits related to magmatic processes are reviewed with an emphasis on the geological processes required to create them. Finally, a roadmap to mineral exploration for each type of ore deposit is discussed. Deposit types discussed include magmatic Ni-Cu, magmatic PGE-Cr, porphyry, epithermal, skarn, Rare Earth Element (REE) and iron oxide copper gold (IOCG). Laboratory exercises involve geological problem solving using a mineral exploration industry focus involving the examination of geological maps and representative suites of samples (thin sections and hand samples) from different types of metallic mineral deposits.				
Learning and teaching methods of delivery:	Weekly contact: 2 x 1-hour lectures (22 hours over 10 weeks), 3 x 1-hour seminars (x 2 weeks); 3-hour practical classes (x 4 weeks)			
Assessment pattern:	2-hour Written Examination = 50%, Practical Examination = 15%, Coursework = 35%			
Re-assessment pattern:	2-hour Written Examination = 80%, Existing Coursework = 20%			
Module coordinator:	Dr J Cloutier			
Module teaching staff:	Dr J Cloutier and Prof A Finch			

ES5301 Mineral Exploration				
SCOTCAT Credits:	15	SCQF Level 11	Semester	2
Academic year:	2018/9			
Planned timetable:	To be arranged.			
The purpose of this module is to learn basic concepts of mineral exploration that are used by the mineral exploration industry. The module is divided into three sections each focusing on different aspect of mineral exploration. Section 1 focuses on geochemical methods, section 2 on hyperspectral methods, and section 3 on geophysical methods. Each section discusses the theoretical background necessary to understand the different methods and introduces the different available analytical techniques, and highlights effective data acquisition. Finally, interpretation and application of datasets related to each method is conducted as practical exercises.				
Pre-requisite(s):	Student must have gained entrance to the mgeol or msc mineral resources			
Learning and teaching methods of delivery:	Weekly contact: 2 lectures (x 11 weeks), 1 practical (x 2 weeks)			
Assessment pattern:	Coursework = 50%, 2-hour Written Examination = 50%			
Re-assessment pattern:	2-hour Written Examination = 80%, grade derived from Previous Coursework = 20%			
Module coordinator:	Dr J Cloutier			
Module teaching staff:	Dr J Cloutier, Dr R Bates			

ES5302 Hydrothermal Ore Deposits

SCOTCAT Credits:	15	SCQF Level 11	Semester	2
Academic year:	2018/9			
Planned timetable:	To be arranged.			
The module focuses on the geodynamic setting, age, geometry, and mineralogy of the principal metallic mineral deposits related to hydrothermal processes. The different deposit types are studied using a holistic (geology, structural, geochemistry, and geophysics) mineral system approach. Current genetic models of ore deposits related to hydrothermal processes are reviewed with an emphasis on the geological processes required to create them. Finally, a roadmap to mineral exploration for each type of ore deposit taught is discussed. Deposit type discussed in the module includes orogenic gold, VMS, SEDEX, Mississippi Valley-type, unconformity-related uranium deposits, and sedimentary-hosted stratiform copper deposits. Laboratory exercises involve geological problem solving using a mineral exploration industry focus involving the examination of geological maps and representative suites of samples (thin sections and hand samples) from different types of metallic mineral deposits.				
Pre-requisite(s):	Student must have gained entrance to the mgeol or msc mineral resources programmes			
Learning and teaching methods of delivery:	Weekly contact: 2 lectures (x 11 weeks), 1 practical (x 3 weeks), 1 field trip			
Assessment pattern:	2-hour Written Examination = 50%, Coursework = 50%			
Re-assessment pattern:	2-hour Written Examination = 80%, Existing Coursework = 20%			
Module coordinator:	Dr J Cloutier			

ES5303 Applied Geological Mapping

SCOTCAT Credits:	15	SCQF Level 11	Semester	1
Academic year:	2018/9			
Planned timetable:	To be arranged			
This module aims to train students in applied geological field skills. The module focuses on creating and interpreting surface and underground maps, and drill core logs. Module assessment is based on the quality of field notebooks, maps, logs, and group participation.				
Learning and teaching methods of delivery:	Weekly contact: 2 hours of lectures (x 3 weeks), 12 hours of practicals (x 2 weeks) and 17.5 hours of fieldwork (x 4 weeks)			
Assessment pattern:	Coursework = 100%			
Re-assessment pattern:	No Re-assessment available			
Module coordinator:	Dr W McCarthy			
Module teaching staff:	Dr J Cloutier, Dr W McCarthy, Prof T Prave			

ES5304 3D Geological Modelling

SCOTCAT Credits:	15	SCQF Level 11	Semester	2
Academic year:	2018/9			
Availability restrictions:	Available only to students on the MGeol or Mineral Resources degrees			
Planned timetable:	To be arranged.			
This module aims to familiarise students with three-dimensional geological modelling using the industry-standard pieces of software. The module emphasises the creation, validation and interpretation of geological and structural models, as well as their use in mineral exploration and mineral resource estimation. Module assessment is based on the quality of three-dimensional models created and group participation.				
Learning and teaching methods of delivery:	Weekly contact: 3 hours of lectures (x 5 weeks), 3 hours of practical classes (x 5 weeks)			
Assessment pattern:	Coursework = 100%			
Re-assessment pattern:	No Re-assessment available			
Module coordinator:	Dr J Cloutier			
Module teaching staff:	Dr J Cloutier, Dr R Bates			

ES5305 Applied Geological Mapping				
SCOTCAT Credits:	30	SCQF Level 11	Semester	1
Academic year:	2018/9			
Availability restrictions:	Priority for the module will be given to the students enrolled in the MSc in Mineral Resources. Extra spaces will be allocated on a first-come-first-serve basis.			
Planned timetable:	To be confirmed			
This module aims to train students to use a suite of modern software packages and field tablet computers to conduct geological fieldwork. The module focuses on creating and interpreting surface and underground maps and drill core logs using computers, a skill that is not core at undergraduate level but is sought by employers in the mineral resource sector. Module assessment is based upon the reproducibility and organisation of field data (notes, logs and maps), the interpretation of these data, group participation and upon a series of technical reports.				
Learning and teaching methods of delivery:	Weekly contact: 1 lecture (x11 weeks), 1 lab (x11 weeks). Four field excursions, one of these is a single day trip, two are over night trips and one is a 5 day excursion. Some field excursions will be during the weekend			
Assessment pattern:	Coursework = 100%			
Re-assessment pattern:	No reassessment is offered			
Module coordinator:	Dr W McCarthy			
Module teaching staff:	Dr W McCarthy, Dr J Cloutier, Dr C Cousins			

ES5099 Research Project				
SCOTCAT Credits:	60	SCQF Level 11	Semester	Both
Academic year:	2018/9			
Planned timetable:	To be arranged.			
This module provides an opportunity to conduct independent research with an academic supervisor, usually within a research group. The research topic is defined by the student and can be chosen from research foci within the School. The research project will involve project formulation, a background literature review, proposal writing, and analytical design, as well as data integration and interpretation. The results are presented as oral presentations, as a poster as part of a conference, and in a dissertation.				
Learning and teaching methods of delivery:	Weekly contact: introductory lectures, presentations and supervisory meetings.			
Assessment pattern:	Coursework (10,000 word dissertation + other elements) = 100%			
Re-assessment pattern:	No Re-assessment available			
Module coordinator:	Dr P S Savage			
Module teaching staff:	TBC Module coordinator(s): Dr P Savage/Dr J Clouteier			

Possible alternative modules:

ES3004 Processes and Products in Sedimentary Systems				
SCOTCAT Credits:	15	SCQF Level 9	Semester	2
Academic year:	2018/9			
Planned timetable:	9.00 am - 10.00 am Tue - Thu (lectures), 2.00 - 5.00 pm Mon (practicals). 3 field days (9.00 am - 5.00 pm)			
This core module provides fundamental knowledge and training in describing, studying and interpreting sediments, sedimentary rocks and stratigraphic frameworks. The concepts and methodologies of process sedimentology, stratigraphy and sedimentary petrography will be taught, and training undertaken using fieldwork and practicals. The module serves as preparation for subsequent modules on related topics and for field-based modules, including Advanced Geological Mapping, the Research dissertation, and the fourth-year field course.				
Pre-requisite(s):	Before taking this module you must pass ES2001 and (pass ES2002 or pass ES2003)			
Learning and teaching methods of delivery:	Weekly contact: Weekly lectures and practicals averaging 6 hours per week plus field training			
Assessment pattern:	2-hour Written Examination = 50%, Coursework = 50%			
Re-assessment pattern:	2-hour Written Examination = 80%, Coursework = 20%, No Re-assessment if Coursework mark is <4			
Module coordinator:	Prof A R Prave			
Module teaching staff:	Prof T Prave, Dr C Rose			

ES4007 Petroleum Exploration and Geophysics				
SCOTCAT Credits:	15	SCQF Level 10	Semester	1
Academic year:	2018/9			
Planned timetable:	11.00 am - 1.00 pm Thu (lectures), 2.00 - 5.00 pm Thu (practicals)			
The fundamental concepts, techniques and practices of the hydrocarbon exploration industry are presented. Students will gain a thorough understanding of the geoscience of petroleum exploration, particularly using geophysical methods, and a working knowledge of modern concepts in oil and gas geology.				
Pre-requisite(s):	Before taking this module you must pass ES2001 and (pass ES2002 or pass ES2003)			
Learning and teaching methods of delivery:	Weekly contact: 18 lectures and 4 workshops, 2 practicals and support sessions (Weeks 1 - 10).			
Assessment pattern:	Coursework (Petrel Logging - 50%, Carbonate Workshop - 20%, Wireline Logging Workshop - 10%, North Sea Report - 20%) = 100%			
Re-assessment pattern:	Current Coursework (Petrel Logging) = 50%, Coursework = 50%, No Re-assessment if Coursework mark is <4			
Module coordinator:	Dr C R Bates			
Module teaching staff:	Dr R Bates			

ES5005 Isotope Geochemistry: Theory, Techniques, and Applications			
SCOTCAT Credits:	15	SCQF Level 11	Semester 1
Academic year:	2018/9		
Planned timetable:	To be arranged.		
Isotope geochemistry has grown over the last 50 years to become one of the most important fields in the Earth sciences. The growth in the importance of isotope geochemistry reflects its remarkable success in solving fundamental problems in mantle formation, ore genesis, hydrology, hydrocarbon formation, crustal evolution, planetary formation, geochemical cycles, hydrothermal circulation, ocean circulation, and climate and environmental change. In this module, we will explore the theory of isotopes and their fractionation, including kinetic, equilibrium, and Rayleigh fractionation. We will also use case studies and applications of isotopes to interesting problems across Earth Sciences including the evolution of the atmosphere, the formation of the solar system and planets, and climate and carbon cycle reconstructions. These case studies will introduce concepts such as clumped isotopes, isotope mass balance, mass independent fractionation, and radionuclide disequilibria.			
Pre-requisite(s):	Current bsc students should pass ES3008 or pass (ch1401, CH1402 and ch2501)		
Learning and teaching methods of delivery:	Weekly contact: 2 x2-hour lectures (x 5 weeks), 3-hour practical sessions (x 3 weeks)		
Assessment pattern:	2-hour Practical (Open Book) Examination = 50%, Coursework = 50%		
Re-assessment pattern:	2-hour Practical (Open Book) Examination = 80%, Coursework = 20%		
Module coordinator:	Dr A Burke		
Module teaching staff:	Dr A Burke, Dr P Savage, Dr A Zerkle		

ES5010 Advanced Geochemistry			
SCOTCAT Credits:	15	SCQF Level 11	Semester 2
Academic year:	2018/9		
Planned timetable:	To be arranged.		
The objective of this course is to provide students with skills in some of the more advanced topic in geochemistry that are not commonly discussed in introductory courses, including isotope geochronology, aqueous geochemical modeling, non-traditional stable isotopes and organic geochemistry. This selection of topics covers both theoretical and applied aspects in geochemical sciences with the aim of laying out potential avenues for future professional development.			
Pre-requisite(s):	Before taking this module you must take ES3008		
Learning and teaching methods of delivery:	Weekly contact: 1-hour lecture (x 10 weeks) 7 x 3-hour practical sessions and 1 x 2-hour session of group presentations over the semester.		
Assessment pattern:	Coursework = 100%		
Re-assessment pattern:	2-hour Written Examination = 80%, Coursework = 20%, No Re-assessment if Coursework mark is <4		
Module coordinator:	Dr E E Stueeken		
Module teaching staff:	Prof D Mark		

