

# Master of Science in Oil and Gas Innovation

## Programme Requirements

### Oil and Gas Innovation - MSc

ES5201 (15 credits) **and**  
15 credits from Module List: ES3008, ES4007, ES5005, ES5009 - ES5010, ES5012 **and**  
ES5299 (120 credits)

**Students must also take the following modules that are not delivered by St Andrews:**

Commercialising Innovation - 15 credits.

Entrepreneurial Leadership - 5 Credits.

Finance and Pitching for funding for a New Venture - 5 Credits.

Product Development - 5 Credits

## Compulsory modules:

### ES5201 Project Scoping

<b>SCOTCAT Credits:</b>	15	SCQF Level 11	<b>Semester:</b>	1
<b>Planned timetable:</b>	To be arranged.			
The module prepares students for the Oil and Gas Innovation project, by scoping a project informed by literature and market research, and in interaction with the academic supervisor and, where applicable, an industry partner. The aims of the module are to build the knowledge and understanding that allows an innovation opportunity to be identified with supporting literature review and market research, and to develop the intellectual skills required to design a project plan that will be undertaken in the Oil and Gas Innovation Project.				
<b>Programme module type:</b>	Compulsory for MSc in Oil and Gas innovation			
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 1 hour (x 10 weeks) with 14 hours of project scoping events and 4 hours of project plan review sessions.			
<b>Assessment pattern:</b>	Coursework = 100%			
<b>Module coordinator:</b>	Dr R Bates and Dr T Raub			
<b>Module teaching staff:</b>	Earth & Environmental Sciences staff			

## Earth & Environmental Sciences - Oil and Gas Innovation - 2017/8 - August 2017

ES5299 Project in Oil and Gas Innovation				
<b>SCOTCAT Credits:</b>	120	SCQF Level 11	<b>Semester:</b>	2
<b>Planned timetable:</b>	Supervisor meetings: 1 per week for 25 weeks			
<p>The module involves independent research on an Oil and Gas Innovation opportunity, which has been designed and approved during the Project Scoping module (ES5101). The independent project offers students the opportunity to apply the knowledge acquired during the taught components of the course and to deepen this knowledge by executing an Oil and Gas Innovation project and delivering a formal report. The work requires reference to, and integration of, the various taught elements, independent research (data collection, analysis, interpretation), together with a general knowledge of all aspects of innovation (including political, economic, social, technological, environmental and legal factors). Normally projects will involve working with an industry partner, and students may be based in industry for. Supervision will include a primary and secondary academic supervisor and an industry supervisor (when relevant).</p>				
<b>Programme module type:</b>	Compulsory for MSc in Oil and Gas Innovation			
<b>Pre-requisite(s):</b>	ES5201			
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 1 hour a week for 25 weeks.			
<b>Assessment pattern:</b>	Coursework = 100%			
<b>Module coordinator:</b>	Dr R Bates and Dr T Raub			
<b>Module teaching staff:</b>	Earth and Environmental Sciences staff			

### Optional modules (offered by St Andrews):

ES3008 Geochemistry				
<b>SCOTCAT Credits:</b>	15	SCQF Level 9	<b>Semester:</b>	1
<b>Planned timetable:</b>	10.00 am Tue and Thu (lectures), 2.00 - 5.00 Fri (practicals)			
<p>This module provides an introduction to geochemistry: the study of the abundance, distribution and circulation of the chemical elements in minerals, rocks, soils, water and the atmosphere. Geochemical tools are a powerful means to the study of geological, economic, and environmental problems.</p> <p>In the module we study the origin and distribution of the chemical elements in the Earth and solar system and review thermodynamics and kinetics as applied to Earth systems. We apply thermodynamics to make quantitative predictions regarding the outcome of chemical reactions associated with geological processes. We consider the behaviour of elements, mainly in low temperature environments. Material covered includes aqueous geochemistry and mineral precipitation and dissolution. We utilise geochemical tools to constrain changes in earth processes and climate, and to predict the impact of future change.</p>				
<b>Programme module type:</b>	Normally compulsory for Geochemistry Postgraduate Programmes (in some circumstances ES3011 may be substituted). Optional for MSc in Oil and Gas Innovation			
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 17 lectures, 15 hours of laboratory classes, 2 or more field classes over the semester.			
<b>Assessment pattern:</b>	2-hour Written Examination = 50%, Coursework = 50%			
<b>Module coordinator:</b>	Dr N Allison			
<b>Module teaching staff:</b>	Dr N Allison, Prof A Finch, Dr J Rae, Dr P Savage			

<b>ES4007 Petroleum Exploration and Geophysics</b>				
<b>SCOTCAT Credits:</b>	15	SCQF Level 10	<b>Semester:</b>	1
<b>Planned timetable:</b>	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.				
<b>Programme module type:</b>	Optional for MSc in Oil and Gas Innovation, Optional substitution for ES3003 for MSc in Mineral Resources			
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 17 lectures, 15 hours laboratory classes, field classes over the semester.			
<b>Assessment pattern:</b>	2-hour Written Examination = 50%, Coursework = 50%			
<b>Module coordinator:</b>	Dr R Bates			
<b>Module teaching staff:</b>	Dr R Bates			

<b>ES5005 Isotope Geochemistry: Theory, Techniques, and Applications</b>				
<b>SCOTCAT Credits:</b>	15	SCQF Level 11	<b>Semester:</b>	1
<b>Planned timetable:</b>	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 learn how isotope measurements are made, with an introduction to mass spectrometry methods, techniques, and analysis. The latter half of the course will be devoted to 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.				
<b>Programme module type:</b>	Compulsory for MSc in Geochemistry Optional for MSc in Oil and Gas Innovation			
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2-hour lectures (x 10 weeks), 3-hour practical sessions (x 3 weeks)			
<b>Assessment pattern:</b>	2-hour Practical (Open Book) Examination = 50%, Coursework = 50%			
<b>Module coordinator:</b>	Dr A Burke			
<b>Module teaching staff:</b>	Dr A Burke, Dr P Savage			

## Earth & Environmental Sciences - Oil and Gas Innovation - 2017/8 - August 2017

ES5009 Geodynamics				
<b>SCOTCAT Credits:</b>	15	SCQF Level 11	<b>Semester:</b>	2
<b>Planned timetable:</b>	9.00 am - 10.00 am Tue and Wed; 9.00 am - 5.00 pm Fri (Weeks 2,5,9)			
A study of the geodynamic evolution of Earth's crust since the Archaean, the evolution of convergent and divergent margins, and the relationships between tectonics, erosion and climate. The module contrasts geodynamic evolution in the Archaean, Proterozoic, Palaeozoic, Mesozoic and Cenozoic using a number of case studies, including examples visited in the field. The module develops skills of geodynamic interpretation, field observation, use of numerical models, report writing and oral presentation.				
<b>Programme module type:</b>	Compulsory for MSc in Mineral Resources Optional for MSc in Geochemistry Optional for MSc in Oil and Gas Innovation			
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2 x 1-hour lectures(x 11 weeks) , plus 2 extended laboratory classes, and 2 days in the field during the semester.			
<b>Assessment pattern:</b>	2-hour Written Examination = 50%, Coursework = 50%			
<b>Module coordinator:</b>	Dr R White			
<b>Module teaching staff:</b>	Dr T Raub, Dr R White			

ES5010 Advanced Geochemistry				
<b>SCOTCAT Credits:</b>	15	SCQF Level 11	<b>Semester:</b>	2
<b>Planned timetable:</b>	To be arranged.			
Many of the environmental challenges facing society revolve around the cycling of natural materials between fluid and solid phases. Some of the most fundamental aspects of Earth System development are investigated through geochemical methodologies that characterise and interrogate processes operating at the interface between the solid Earth and the fluid Earth. Further, the processes that concentrate many natural resources are a result of fluid-solid interactions that can be studied using organic and aqueous geochemistry. This module focuses on training in the state-of-the art techniques and methodologies that are tools that can be applied widely to address questions about environmental changes and chemistry in sediments and natural waters and, as well as utilisation and exploitation of hydrocarbon resources and Earth System evolution through time.				
<b>Programme module type:</b>	Compulsory for MSc in Geochemistry Optional for Oil and Gas Innovation			
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 1-hour lecture (x 10 weeks) 5 x 3-hour practical sessions and 1 x 8-hour session of project presentations over the semester.			
<b>Assessment pattern:</b>	Coursework = 100%			
<b>Module coordinator:</b>	Dr E Stüeken			
<b>Module teaching staff:</b>	Prof D Mark and Dr T Raub			

<b>ES5012 Biogeochemistry</b>				
<b>SCOTCAT Credits:</b>	15	SCQF Level 11	<b>Semester:</b>	2
<b>Planned timetable:</b>	To be arranged.			
<p>Earth's surface environment is tightly regulated by biogeochemical processes. The biosphere directly influences the composition of Earth's atmosphere, ocean chemistry, and global climate, through the cycling of nutrients and other elements. This module will examine the role of biogeochemical processes in controlling Earth surface chemistry, and their possible influence on deep Earth reservoirs. Emphasis will be placed on feedbacks between the geosphere, atmosphere, and biosphere over geologic time, and how these interactions have both contributed and responded to important transitions in Earth history (e.g., the Great Oxidation Event, global glaciations). We will also highlight current geochemical (e.g., stable isotope ratios) and numerical (e.g., modelling) techniques used to constrain these interactions in both modern and ancient (rock record) systems.</p>				
<b>Programme module type:</b>	Optional for MSc in Geochemistry and MSc in Oil and Gas Innovation			
<b>Pre-requisite(s):</b>	Normally ES3008			
<b>Learning and teaching methods and delivery:</b>	<b>Weekly contact:</b> 2 x 1-hour lectures and 3-hour practical sessions.			
<b>Assessment pattern:</b>	2-hour Written Examination = 40%, Coursework (including modelling exercises, literature review and project) = 60%			
<b>Module coordinator:</b>	Dr A Zerkle			
<b>Module teaching staff:</b>	Dr A Zerkle, Dr M Claire, Dr S Mikhail			

