Geophysics (Geology) BSc (Hons)

COURSE DETAILS

- A level requirements: ABB
- UCAS code: F640
- Study mode: Full-time
- Length: 3 years

KEY DATES

- Apply by: 31 January 2024
- Starts: 23 September 2024

Course overview

Discover how planet Earth works and how we use physics to image its static and dynamic subsurface, from inner core to crust.

INTRODUCTION

This programme provides training in the principles and practice of geophysics with an emphasis on pure and practical physics.

The programme covers core topics in geology, geophysics and physics, plus a choice of advanced modules in geophysics. Major features include training in practical/applied geophysics, exploration geophysics (particularly seismology), planetary-scale geophysics and geophysical inverse theory.

This degree provides high-level training in geophysics with supporting geology, and includes fundamental university training in physics and mathematics. You don't need to have studied geology before, and this degree therefore opens up a range of careers in geoscience. The programme provides particularly strong opportunities for careers in interpretation and processing of geophysical data (environmental, engineering, and exploration geophysics), and research areas related to geological applications.

Fieldwork currently involves field areas in Wales, Spain and Tenerife. You will work within one of our research groups to undertake a significant geophysical research project in your final year. This provides excellent training in research methodology for an academic or industrial research career.

Upon completion of your first year, it is possible to transfer to a Geology degree at the end of year one.

A number of the School's degree programmes involve laboratory and field work. Fieldwork is carried out in various locations, ranging from inner city to coastal and mountainous environments. We consider applications from prospective disabled students on the same basis as all other students, and reasonable adjustments will be considered to address barriers to access.

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WHAT YOU'LL LEARN

- Sedimentary rocks and fossils
- Geoscience and earth history
- Earth structure and plate tectonics
- Structural geology
- Field mapping techniques
- Seismology and computing
- Signal processing and seismic analysis

ACCREDITATION

This degree is accredited by the Geological Society of London, satisfying the requirements of Fellowship and Chartered Geologist status.

Course content

Discover what you'll learn, what you'll study, and how you'll be taught and assessed.

YEAR ONE

A strong feature of year one is the acquisition of fundamental skills in maths, geology and geoscience, supported by an integrated approach to transferable skills conveyed through the tutorial system.

Fieldwork involves:

- 1 day in North England (Autumn)
- 8 days in Pembrokeshire (Easter)

COMPULSORY MODULES

STUDY SKILLS AND GIS (EARTH SCIENCE) (ENVS101)

Credits: 15 / Semester: whole session

This module introduces students to the key skills necessary to succeed on a University Earth Science course. It does this via a series of lectures, workshops and tutorials, together with a geology fieldwork day and attendance at departmental seminars and talks. The lectures, towards the start of the first semester, cover academic integrity, exam skills, employability and 2D/3D visualisation. Tailored workshops cover Geographical Information Systems (GIS), Word, Excel and programming skills. Small-group (typically 4 to 8 students) tutorials are run by academic staff and cover essay writing (including assessment), careers and employability. Academic tutors undertake personal development planning (careers and module selection advice) with each tutee.

SEDIMENTARY ROCKS AND FOSSILS (ENVS118)

Credits: 15 / Semester: semester 1

This module provides a basic introduction to sedimentology and palaeontology. Students learn about the origin of sediment, sedimentary processes and structures and the ways in which sediments are converted into solid rock. The course outlines the importance of sedimentary rocks for hydrocarbons, water and as construction materials. Students learn how to describe and interpret sedimentary deposits.

The palaeontology component introduces students to the major fossil groups and to the ways in which organisms can be preserved as fossils. It covers the importance of fossils for the study of evolution, environmental change and earth history. Students learn how to describe fossils and how observations contribute to a broader understanding.

Students will be assessed by means of two practical tests and a theory examination.

MATHEMATICS FOR PHYSICISTS I (PHYS107)

Credits: 15 / Semester: semester 1

This module aims to provide all students with a common foundation in mathematics, necessary for studying the physical sciences and maths courses in later semesters. All topics will begin "from the ground up" by revising ideas which may be familiar from A-level before building on these concepts. In particular, the basic principles of differentiation and integration will be practised, before extending to functions of more than one variable. Basic matrix manipulation will be covered as well as vector algebra and an understanding of eigenvectors and eigenvalues.

INTRODUCTION TO FIELD GEOLOGY (ENVS109)

Credits: 15 / Semester: semester 2

This field module provides a basic training in field techniques and gives students practical experience working with a wide range of rock types and tectonic structures to solve geological problems. Students gain experience in recording field data and use their own data to interpret geological processes and environments. The module is assessed by means of an individual fieldwork portfolio and a group synthesis poster completed after the field class.

EARTH STRUCTURE AND PLATE TECTONICS (ENVS112)

Credits: 15 / Semester: semester 2

This module provides an introduction to the Earth and aims to teach students about the structure and composition of the Earth, the Earth’s gravitational and magnetic fields, and dynamics within the deep Earth; the physics of Earth material and the geological time scale; and plate tectonics. The course is delivered through a combination of lectures and practicals. Students are assessed through a combination of coursework and a final exam.

INTRODUCTION TO STRUCTURAL GEOLOGY AND GEOLOGICAL MAPS (ENVS156)

Credits: 15 / Semester: semester 2

This module introduces a key subject within Earth Sciences, Structural Geology and Geological Mapping. In this module you will be introduced to geological structures from the micro to the mountain scale, and receive training in the geometrical techniques used to document and analyse them. You will also learn the basic principles of stress and strain which underpin a number of advanced Earth Science subjects and skills used in industry and research. Finally, the module will provide training in how to read and understand geological maps, and train your 3D visualisation skills by learning how to create geological cross-sections from maps, and how to stereographically plot 3D geological data. A combination of virtual lectures, practical skill development sessions, discussion sessions, and directed reading will help you navigate this important Earth Sciences topic. You will be assessed on the development of your practical skills through an end-of-semester open book practical exam, and you will write an individual research paper on a specific topic in structural geology.

MATHEMATICS FOR PHYSICS II (PHYS108)

Credits: 15 / Semester: semester 2

This module introduces some of the mathematical techniques used in physics. For example, differential equations, PDE's, integral vector calculus and series are discussed. The ideas are first presented in lectures and then the put into practice in problems classes, with support from demonstrators and the module lecturer. When you have finished this module, you should: Be familiar with methods for solving first and second order differential equations in one variable. Be familiar with methods for solving partial differential equations and applications. Have a basic knowledge of integral vector calculus. Have a basic understanding of Fourier series and transforms.

EARTH MATERIALS (ENVS185)

Credits: 15 / Semester: semester 1

This module will introduce and develop understanding of rock-forming minerals and critical raw materials in terms of their environments of formation, occurrence, and abundance. The module will focus on exploring the uses and societal significance of a range of Earth materials, especially those critical to sustainable and renewable energy resources and various societal infrastructure. The key practical skills of mineral description, identification and interpretation will be developed and applied throughout the module to equip students with appropriate skills for many later geoscience modules and for future employment.

Programme details and modules listed are illustrative only and subject to change.

YEAR TWO

In year two, students build on their skill set through further modules in geology, while building on fundamental physics and mathematics. A strong feature of year two is the introduction of geophysics modules in applied geophysics and seismology.

Fieldwork involves:

- 15 days Geological Mapping Training in Spain (Easter)

COMPULSORY MODULES

GEOPHYSICAL MATHEMATICS AND POTENTIAL THEORY (ENVS201)

Credits: 15 / Semester: whole session

This module re-enforces and develops mathematical skills from first year level, up to and including solving partial differentiation. Many topics are covered in a short time – the aim is for students to be familiar with the methods and with fluency in application being a bonus. The second half of the module applies the mathematical methods to the development of potential theory, particularly for studying gravity and magnetism in both cartesian and spherical (planetary) geometry. The module is delivered through lectures and practical sessions, with a series of regular coursework assessments throughout the module.

APPLIED GEOPHYSICS (ENVS216)

Credits: 15 / Semester: semester 1

This module provides an introduction to the principles and application of all the main geophysical methods used for exploration purposes. These methods include seismic refraction, seismic reflection, electrical methods, ground penetrating radar, gravity and magnetics. Case studies will be used to highlight the application of these methods at a range of scales from shallow to deep to small to large, highlighting their uses within archaeology, engineering and geology. The module concludes with a synthesis of methods and how to approach site investigation. The module is delivered through lectures and problem sessions and is based on continuous assessment from set homework assignments or problem sheets and a final exam.

DYNAMICS AND RELATIVITY (PHYS101)

Credits: 15 / Semester: semester 1

The module provides an overview of Newtonian mechanics, continuing on from A-level courses. This includes: Newton's laws of motion in linear and rotational circumstances, gravitation and Kepler's laws of planetary motion. The theory of Relativity is then introduced, starting from a historical context, through Einstein's postulates, leading to the Lorentz transformations.

EARTH AND ENVIRONMENTAL DATA SCIENCE (ENVS229)

Credits: 15 / Semester: semester 2

This module introduces students to fundamentals of Earth and environmental data science. Students will become familiar with methods used to collate and computationally analyse a variety of Earth Science data. After introducing programming basics, students will then start to write code to analyse and simulate Earth processes that model their datasets. By the end of the module, students are expected to have a broad overview of the ways in which data science is applied in the study of the Earth and environment.

ENVIRONMENTAL GEOPHYSICS (ENVS258)

Credits: 15 / Semester: semester 2

This module builds on the theory taught in Exploration Geophysics (ENVS216), by introducing a large amount of practical experience, data analysis and interpretation. Fieldwork will be run using input from industry professionals from RSK. The module will introduce principles of remote sensing, and give practical experience in GIS, electrical methods, seismics, ground penetrating radar, gravity and magnetics. Attention will be paid to how these different methods can be integrated to give a thorough understanding of a study site. The module will be assessed through a combination of continuous assessment such as short reports.

FIELD MAPPING TECHNIQUES (ENVS293)

Credits: 15 / Semester: semester 2

This module is a residential field class in which students learn various techniques required to assess the 3D geological evolution of an area. Training entails mapping exercises at different scales, designed to develop abilities to visualise geology and geomorphology in 3D, and to analyse and synthesise discrete observations to build a full four-dimensional model that includes the deep-time geological history of the area. Mapping techniques also include notebook construction, to complement any geological or geomorphological map, generalised vertical sections and lithostratigraphy, and the construction of cross-sections for 3D visualisation. These are all skills that are highly regarded and often required by geoscience employers, and this field class also provides the students with several skills required for final year independent research projects. Supervision of all mapping and technical exercises is designed to encourage increasingly independent work as students' skills develop. Group work develops the individual's ability to work effectively in a team. Assessment takes place during the field class exercise.

OPTIONAL MODULES

METAMORPHISM AND CRUSTAL EVOLUTION (ENVS212)

Credits: 15 / Semester: semester 2

Building on previous study of mineralogy, igneous and structural geology, this module provides students with a foundation in the subject of metamorphism. From how and why atoms move around to form new minerals, through the textures of metamorphic rocks in hand specimen and how to interpret them, to the large-scale plate tectonic phenomena that drive everything. Delivery involves a combination of interactive lectures and practical sessions. Practicals involve thin section work, hand specimen examination, calculations and the study of geological maps. Metamorphic geology plays a pivotal role in unravelling the story of the Caledonides of Britain and Ireland, as it does in unravelling the history of the entire Earth. Students are assessed during term in using practical skills (thin section drawing, calculations, use of various graphical and pictorial techniques) and through a final theory exam in knowledge and understanding of the subject.

SEDIMENTARY PROCESSES AND DEPOSITIONAL ENVIRONMENTS (ENVS219)

Credits: 15 / Semester: semester 1

Sedimentary successions are the only archive from which we can accurately decode the Earth's past. Using physical, chemical and biological information we can reconstruct past climates, tectonics and depositional environments. This module teaches the fundamental principles of interpreting sedimentary stratigraphy and develops students' abilities to recognise sedimentary textures and use them to interpret ancient depositional environments.

VOLCANOLOGY AND GEOHAZARDS (ENVS284)

Credits: 15 / Semester: semester 1

This module comprises a series of lectures, seminars and practical classes to facilitate students constructing their own learning in the fields of volcanology and geohazards. Lectures and guided reading present the scientific, societal, economic and political aspects of volcanic hazards within the wider geohazard context. These themes are then explored further through illustrative case studies, guest seminars and practical exercises.

Programme details and modules listed are illustrative only and subject to change.

YEAR THREE

In Year Three, students focus on advanced Geophysics, with core modules in seismic analysis, and applied geophysics (fieldwork). Optional modules in a range of geophysics modules include topics in global geophysics and geodynamics, data modelling, and earthquake and volcano seismology. Students also undertake a field, laboratory or computer-based geophysics research project for the duration of their final year.
Fieldwork:

- 10 days on the Isle of Man.

COMPULSORY MODULES

SIGNAL PROCESSING AND SEISMIC ANALYSIS (ENVS343)

Credits: 15 / Semester: semester 1

This module will provide an introduction the fundamentals of signal processing and seismic interpretation. The module is taught through a combination of Lectures, practical examples during computer-based practical sessions, and self-directed learning. Assessment for the module includes a conference style presentation on the analysis and interpretation of a real-world seismic dataset and a final exam. Successful students will develop understanding of the fundamental concepts and theory of signal processing. They will become familiar with modern seismic data analysis workflows, including correcting and enhancing data, leading to a final geologic interpretation.

GEOPHYSICAL PROJECT (ENVS300)

Credits: 30 / Semester: whole session

A pinnacle of your degree, this module will embed you withinan active research group where you will undertake an individual and unique geophysical research project over the course of an academic year. The results of your analyses may well constitute an original scientific finding forming part of a future peer-reviewed paper appearing in an international publication. In addition to developing specific and general research skills, you will gain invaluable experience in communicating your topic and findings in both an oral and written format.

GEOPHYSICS FIELD SCHOOL (ENVS362)

Credits: 15 / Semester: semester 2

This module is a practical introduction to a range of techniques in exploration and environmental geophysics, and their application in industry and research. The students receive field-based (or online, where necessary) training in geophysical techniques, including seismic, gravity, magnetic, and electrical methods. During the entire duration of the field class the students will work in teams and will be required to undertake a geophysical survey. The students will benefit from being exposed to problem solving and a workflow analogous to working for a major exploration or geophysical engineering company.

OPTIONAL MODULES

GLOBAL GEOPHYSICS AND GEODYNAMICS (ENVS398)

Credits: 15 / Semester: semester 2

This module returns to the broad subject areas covered in "ENVS112 – Earth Structure and Plate Tectonics" but has a stronger quantitative and research skills focus. It will cover advanced topics in plate tectonics, global mantle and core geodynamics, Earth and planetary history and lithospheric-scale processes. A strong emphasis is placed on physical interactions between the primary layers of Earth leading to an integrational understanding of Earth's dynamics and evolution.

APPLIED EARTHQUAKE AND VOLCANO SEISMOLOGY (ENVS388)

Credits: 15 / Semester: semester 2

This module provides introduction to the fundamentals of applied seismology and essential training for students interested in academic or government careers in seismology. The course mainly deals with the analysis and interpretation of seismic data using arrays and networks of seismometers to constrain complex geological processes in tectonic and volcanic settings, and to evaluate earthquake and volcanic hazards. The course is research-led and provides a learning experience that reflects the process of creating knowledge through activities that mirrors modern research practices. Content will be delivered through a combination of traditional class-based lectures, research seminars and computer-based sessions. The students will have an opportunity to work with real-world seismic data, and will learn and apply state-of-the-art techniques used in operational settings for seismic and volcano monitoring.

GEOPHYSICAL DATA MODELLING (ENVS386)

Credits: 15 / Semester: semester 1

Geophysics talks are full of exciting colour figures showing the interior of the Earth. But are these pictures real? At best, they are only a simplified mathematical parameterisation of the true Earth; at worst they can be misleading or plain wrong. This module provides the tools to construct such models by mathematical modelling of geophysical observations, but perhaps even more importantly, shows how such models can be interpreted, and provides understanding of their limitations. Mathematical foundations are given with sections on matrix analysis, optimisation theory and statistics, before going on to show how these are applied to geophysical problems. The concept of non-uniqueness is central – almost all geophysical modules require the estimation of an infinite (continuous) system from only finite data. Error estimation is considered in detail, in particular the reasons why most error estimates are close to worthless! Detailed examples are presented from all areas of geophysics, with a project to generate a model of the magnetic field of the planet Neptune. Examples also extend to modern developments, including links to Big Data and Machine Learning.

OCEAN DYNAMICS (ENVS332)

Credits: 15 / Semester: semester 1

Ocean dynamics addresses how the ocean and atmosphere circulate. Fundamental questions are addressed, such as how heat, salt, and dissolved substances are transported, how jets and weather systems emerge on our planet, why there are western boundary currents in the ocean, and how seafloor topography shapes the ocean circulation. Students will improve their understanding of how the ocean and atmosphere behave, including comparing the importance of different physical processes in the climate system. The module is delivered via lectures and formative workshops to gain skills at problem solving. There is significant mathematical content, requiring familiarity with calculus and algebra. The module is assessed through two online tests and an essay.

SIMULATING ENVIRONMENTAL SYSTEMS (ENVS397)

Credits: 15 / Semester: semester 2

This module will teach students to write and use simple numerical forward models of environmental systems, including geomorphic, geophysical, oceanographic and ecological models. Successful students will develop important transferrable coding and numeracy skills through a series of lectures, seminars and practical work. The module will be assessed through practical work only, with formative feedback throughout to help develop the necessary skills.

ENGINEERING GEOLOGY AND HYDROGEOLOGY (ENVS338)

Credits: 15 / Semester: semester 1

This module provides the basic principles of engineering geology and hydrogeology. The applications of these principles are illustrated using selected examples and emphasis is placed on the interaction between them and their control on the mechanical stability of natural systems. By necessity predictions must be quantitative but, in order to develop understanding, a strongly graphical approach has been adopted in this module. The applications of engineering geology and hydrogeology will be highlighted using a field-based case study: the Mam Tor landslip. Engineering geology and hydrogeology are two important sources of employment and this module provides an opportunity to experience the scope and nature of these subjects. A combination of lectures, directed reading, laboratory work and fieldwork are used to deliver the module. Twelve lectures will be supported by six laboratory based practicals. It will be assessed using a report of the field investigation and an examination.

Programme details and modules listed are illustrative only and subject to change.

HOW YOU'LL LEARN

You will typically receive 15-20 hours of formal teaching each week, and complete between 50 and 100 days of residential fieldwork over the course of their programme. In years three and four you will carry out independent research projects on a topic and location of your choice. All projects are supervised by a member of staff who will meet with you on a weekly, or more frequent, basis.

A number of the School's degree programmes involve laboratory and field work. The field work is carried out in various locations, ranging from inner city to coastal and mountainous environments. We consider applications from prospective students with disabilities on the same basis as all other students, and reasonable adjustments will be considered to address barriers to access.

HOW YOU'RE ASSESSED

Assessment matches the learning objectives for each module and may take the form of written exams, practical laboratory and computer examinations, coursework submissions in the form of essays, scientific papers, briefing notes or lab/field notebooks, reports and portfolios, oral and poster presentations and contributions to group projects, and problem-solving exercises. Assessment is via tasks that mirror those graduate students are likely to undertake working as professional geoscientists. For example, generating and interpreting quantitative spatial data, with appropriate consideration of inherent uncertainty, is a key task and necessary skill for professional environmental geoscientists, and this skill is developed and assessed on several programme modules, especially field and lab-based modules. As well as being authentic in terms of the underlying purpose of the assessed task, assessment tasks are also authentic in terms of format, intended audience, resources used, and collaborative team elements. For example, team-based environmental assessment work with professional format delivery appropriate for presentation to management-level colleagues using state-of-the-art field, lab or IT resources is central to assessments in field classes.

LIVERPOOL HALLMARKS

We have a distinctive approach to education, the Liverpool Curriculum Framework, which focuses on research-connected teaching, active learning, and authentic assessment to ensure our students graduate as digitally fluent and confident global citizens.

Careers and employability

There has never been a better time to study Earth sciences. Many of the fundamental questions of our times will be answered by geoscientists, as we seek to provide sustainable resources for the world's population, as well as predict and mitigate climate change and natural hazards by building a better understanding of the planet on which we live.

Our recent graduates have gained employment within a degree-related field or continued within further education after graduation. We have close links with geoscience and environmental industries ensuring that our degrees properly equip you for future employment.

RECENT EMPLOYERS

- Geological Surveys in the UK and abroad
- Hydrocarbon and support industries: ExxonMobil, BP, Shell, Geotrace, Geokinetics, Neftex, Robertson, Deloitte, CGG, Osiris, PGS
- Engineering and environmental consultancies: The Environment Agency, Environmental Resources Management, URS Corporation, Caulmert Ltd, VerdErg Renewables, RSK Geophysics, RSK Environment, Geomaterials, Fugro
- Mining and related industries: Gold Fields, Rio Tinto, Cliffs Natural Resources, Geological Solutions, Hanson Aggregate Marine Ltd, Aggregate Industries.

89.5% **OF ENVIRONMENTAL SCIENCES STUDENTS ARE IN WORK AND/OR FURTHER STUDY 15 MONTHS AFTER GRADUATION.**

Discover Uni, 2018-19.

Fees and funding

Your tuition fees, funding your studies, and other costs to consider.

TUITION FEES

UK fees (applies to Channel Islands, Isle of Man and Republic of Ireland)	
Full-time place, per year	£9,250

International fees	
Full-time place, per year	£27,200

Fees are correct for the academic year 2024/25

Tuition fees cover the cost of your teaching and assessment, operating facilities such as libraries, IT equipment, and access to academic and personal support. Learn more about tuition fees, funding and student finance.

ADDITIONAL COSTS

We understand that budgeting for your time at university is important, and we want to make sure you understand any course-related costs that are not covered by your tuition fee. This includes costs for a lab coat, geological field kit, and sustenance during compulsory field trips.

Find out more about the additional study costs that may apply to this course.

SCHOLARSHIPS AND BURSARIES

We offer a range of scholarships and bursaries to provide tuition fee discounts and help with living expenses while at university.

Check out our Undergraduate Global Advancement Scholarship. This offers a tuition fee discount of up to £5,000 for eligible students starting an undergraduate degree from September 2024. There's also the Liverpool Bursary which is worth £2,000 per year for eligible students.

Discover our full range of undergraduate scholarships and bursaries

Entry requirements

The qualifications and exam results you'll need to apply for this course.

Your qualification	Requirements About our typical entry requirements
A levels	ABB Applicants with the Extended Project Qualification (EPQ) are eligible for a reduction in grade requirements. For this course, the offer is **BBB** with **A** in the EPQ. You may automatically qualify for reduced entry requirements through our contextual offers scheme. If you don't meet the entry requirements, you may be able to complete a foundation year which would allow you to progress to this course. Available foundation years: • Earth Sciences entry route leading to BSc (Hons) (4 year route including a Foundation Year at Carmel College) • Physical Sciences entry route leading to BSc (Hons) (4 year route including a Foundation Year at Carmel College)
GCSE	4/C in English and 4/C in Mathematics
Subject requirements	Mathematics and Physics A level. For applicants from England: For science A levels that include the separately graded practical endorsement, a "Pass" is required.
International Baccalaureate	33 points with no score less than 4, inc. Higher Level Mathematics and Physics
Irish Leaving Certificate	H1, H2, H2, H2, H3, H3 including H2 or above in Mathematics and Physics
Scottish Higher/Advanced	Not accepted without Advanced Highers at ABB including Maths and Physics

Your qualification	**Requirements** About our typical entry requirements
Higher	
Welsh Baccalaureate Advanced	Acceptable at grade B including Mathematics and Physics A Levels with grades AB
Access	Considered if taking a relevant subject. 45 Level 3 credits in graded units, including 30 at Distinction and a further 15 with at least Merit. 15 Distinctions are required in each of Mathematics and Physics. GCSE English and Mathematics grade C/4 or above also required.
International qualifications	Many countries have a different education system to that of the UK, meaning your qualifications may not meet our entry requirements. Completing your Foundation Certificate, such as that offered by the University of Liverpool International College, means you're guaranteed a place on your chosen course.

ALTERNATIVE ENTRY REQUIREMENTS

- If your qualification isn't listed here, or you're taking a combination of qualifications, contact us for advice
- Applications from mature students are welcome.

THE ORIGINAL REDBRICK