Earth, Ocean and Ecological Sciences
Introduction to the Department of Earth, Ocean and Ecological Sciences

The past and future of the solid Earth, the oceans and life are all inexorably linked. In this Department, we research and teach about the solid Earth (Geology and Geophysics), about the seas and oceans (Oceanography), and how groups of organisms evolve and interact (Ecology and Marine Biology). Our work often crosses the boundaries between these areas, for instance addressing how the physics of ocean currents affects nutrient supply for marine organisms, and how climate change – registered in the isotopic composition of seawater – is recorded in the rocks which were formed in that seawater.

Study abroad

As part of your degree programme you may have the opportunity to study abroad. Studying abroad has huge personal and academic benefits, as well as giving you a head start in the graduate job market. Current opportunities for Ecology and Marine Biology students include Lund University, Sweden, through the Erasmus+ programme, as well as a number of our worldwide exchange partnerships including Australia and Canada. All Ecology and Marine Biology students undertake an independent study abroad visit. For Earth Sciences students, we offer both Geology and Geophysics degree programmes with a year in North America. Students on the F601 and FF68 programmes can apply to spend a semester at partner universities in Australia and New Zealand. Most of our Earth Sciences field courses are based abroad and many students choose to carry out their independent project work abroad. Ocean Sciences students can currently apply to study abroad with partner universities in Canada, North America and Australia. For more information, visit www.liverpool.ac.uk/goabroad

Year in China

The Year in China is the University of Liverpool’s exciting flagship programme enabling undergraduate students, from a huge range of departments, including Earth, Ocean and Ecological Sciences, the opportunity to spend one year at our sister university Xi’an Jiaotong-Liverpool University (XJTLU), following XJTLU’s BA China Studies degree classes. See www.liverpool.ac.uk/yearinchina for more information.
Why choose **Earth Sciences at Liverpool**?

Earth Sciences at Liverpool offers accredited degrees in geophysics, geology and physical geography that are highly valued by employers and will prepare you for a rewarding future career. Our interdisciplinary programmes will enable you to keep your degree options open so that you can specialise in the area that interests you.
Benefit from access to our world-class teaching facilities
Our award-winning, teaching laboratories are the most advanced in Europe and offer you an inspiring environment to learn in. You’ll be taught to confidently use state-of-the-art research and industry standard equipment during your degree.

Have confidence for the future with our accredited degree programmes
Our degree programmes are accredited by professional bodies, demonstrating that you have gained the skills necessary for a professional career in your chosen field, and enabling you to become professionally chartered. Geology degrees are recognised by the Geological Society of London and Geophysics degrees are recognised by the Institute of Physics. You will build the skills necessary for many areas of employment from environmental protection and consultancy, planning and conservation, through to the petroleum, geotechnical and mineral extraction industries and careers in scientific research or academia.

Keep your options open with our interdisciplinary programmes
Whichever programme you decide to study in Earth Sciences, we have world-class experts in geology, geophysics, marine biology and oceanography giving you the opportunity to take optional modules in a variety of disciplines.

Develop academically with support from our network of staff and access to research groups
You’ll join a Department with an excellent reputation for both teaching and research, providing you with a stimulating environment in which to study. You’ll be taught by research active staff, at the forefront of their chosen fields and this research-led teaching ensures that you’ll learn about cutting-edge science before it appears in textbooks.

You’ll also have the opportunity to undertake project work within the Department’s research groups.
**Fulfil your potential in a supportive environment**
Our excellent staff to student ratio means you will never be an anonymous student in an enormous class and you’ll have the opportunity to get to know all staff in the Department. You will have fortnightly tutorials with a member of academic staff in Years One and Two, and you will be assigned a personal tutor, who can offer guidance and support throughout your time at the University. We also have a very active Earth Sciences student society ‘The Herdman Society’, which runs academic and social events from guest lectures and fieldtrips to Gala dinners, symposiums and sports events.

**Complement your studies with extensive fieldwork opportunities**
Field classes are an important part of all our Earth Science degree programmes, allowing you to step out of the classroom and witness earth processes first hand, in a variety of locations. By the time you graduate, our extensive field training will have equipped you with the specific practical skills necessary for a career in the Earth Sciences, and you will have developed transferable life- skills and independent thinking.

**How you learn**
Teaching takes place through lectures, practicals, workshops, seminars, tutorials and fieldwork, with an emphasis on learning through doing. The award-winning Central Teaching Laboratories, provide a state-of-the-art facility for undergraduate practical work. Students value the learning opportunities provided by field classes, including the rapid and detailed feedback on performance.

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.

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I really enjoyed my time at Liverpool and I now work as an Environmental Consultant for EC Harris, where I use much of what I learned at Liverpool, particularly the skills gained through the fieldwork programme.

Mel Booth
Geology MESci (Hons)
Why choose Ocean Sciences at Liverpool?

The University of Liverpool is an ideal place to study ocean sciences, with the National Oceanography Centre on campus. You will be taught in a highly supportive environment by world-leading scientists who are passionate about their subject. You will learn new experimental skills in state-of-the-art, award-winning laboratories and during field work at sea. Our degrees are accredited by the Institute for Marine Engineering, Science and Technology. We will train you to become a scientist who can play a leading role in tackling some of the greatest challenges facing the world now and in the future.
Be inspired by our culture of research excellence in a friendly environment
You will be taught by world-class research-active staff working at the forefront of their fields. Research-led teaching ensures that you will learn about cutting-edge science before it is incorporated into textbooks. Project work, carried out within the research groups, will allow you to use research equipment and the latest techniques. All students have a personal tutor, who can offer guidance and support throughout your time at university. Our excellent staff to student ratio means you will never be an anonymous student and you’ll have the opportunity to get to know all ocean sciences staff. You will also benefit from interaction with scientists from the National Oceanography Centre (NOC) in Liverpool, which is located on the University campus. Scientists from NOC supervise research projects and teach on modules in Years Three and Four.

Develop as a scientist equipped to address global environmental problems
Our degree programmes are designed to produce scientists with a range of transferable skills, so you will develop the flexibility to go into either further scientific research, commercial or industrial work, or indeed any role that requires a high level of practical and analytical expertise. We train students to critically assess scientific hypotheses and concepts, and to construct suitable routes to solving novel problems. Training in analytical techniques to study the marine environment is provided in the award-winning Central Teaching Laboratories using state-of-the-art equipment.

Field work experience onshore and on-board research vessels will be provided in Years One to Three and during the Year Three project. Depending on the subject, these projects are supervised by world-leading experts and so you can tackle real environmental issues. Recent projects include using global ocean datasets to assess the spatial variation in sea level change, investigating the regional imprint of sea surface temperature changes, investigating the impact of oxygen minimum zones on deep sea benthic macro-faunal communities, and using simple models to investigate the impact of wind and storms on the physical structure and biology in the shelf seas.
**Ocean Sciences span across the traditional scientific disciplines**

We are the only university in the UK to train ocean science students in data management and modelling using industry standard software. Students are trained in Year Two, so they can apply these skills in their research project in Years Three and Four. We have been a world leader in oceanography for over 170 years and many world firsts happened here, including the first observatory to study sea level and the world’s first storm-surge prediction model – an updated version of which is still used by the UK Meteorological Office. In addition, methods for measuring essential ocean nutrients, such as phosphate and iron, were developed in Liverpool and are now used worldwide.

**How you learn**

Teaching takes place through lectures, practicals, workshops, seminars, tutorials and computer based learning, with an emphasis on learning through doing. The award-winning £23 million Central Teaching Laboratories provides a state-of-the-art facility for undergraduate practical work.

Students value the learning opportunities provided by field classes, including the rapid feedback on performance. You will typically receive at least 15 hours of formal teaching each week. Between 30 and 100 hours of fieldwork and hands-on activities are provided each year depending on the discipline.

A typical module might involve two or three one-hour lectures each week, and often a three-hour laboratory or computer-based practical as well. Tutorials typically involve groups of 4-7 students meeting with a member of staff at least every two weeks in Year One and Two. In Year Three, you will undertake an Honours project, which is a piece of independent research (field, laboratory or data analysis) on a topic of your choice, supervised by a member of staff. In Years Three and Four students meet with their project supervisor on a weekly or more frequent basis. As you progress through your degree, you will be increasingly challenged to engage with current debates, to think critically and to study independently.

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.

*With a programme focused so heavily on the water column I felt it was necessary to have a suitable resource base to take advantage of. With the National Oceanography Centre on campus, and the close proximity to the River Mersey and its docklands, Liverpool is the perfect place to study Ocean Sciences.*

Jonathan Payne
Ocean Sciences BSc (Hons)
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<td>Environmental change lecture</td>
<td>Life in a dynamic ocean lecture</td>
<td>Statistics for environmental sciences lecture</td>
<td>Library/independent study</td>
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<td>National oceanography centre seminar</td>
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**Why choose Ecology and Marine Biology at Liverpool?**

Liverpool has long led the way in teaching and research of these subjects. We were the first UK university to offer a degree in marine biology and our teaching staff includes world-leading academics in marine and terrestrial ecology, biodiversity and conservation. We are part of the School of Environmental Sciences so your studies will benefit from our shared links with ocean sciences, geography, earth sciences and the School of Life Sciences.
Be part of a group whose world-leading research is helping to tackle today’s greatest environmental challenges
Our research into the vulnerability of marine species and habitats to fishing, global climate change and coastal development is helping organisations such as the Department for Environment, Food and Rural Affairs, the Intergovernmental Panel on Climate Change and the International Council for the Exploration of the Sea to develop sustainable management plans.

Bring your studies to life with field teaching
Field teaching is at the centre of learning in all years, because it gives students a practical hands-on experience to gain an understanding of the natural environment that cannot be achieved in the classroom alone. Our residential field course locations currently include Pembrokeshire, Devon and the west coast and highlands of Scotland but we also regularly get out into the local area around North West England and North Wales.

Broaden your perspective by experiencing study overseas
All of our students organise and undertake an independent study visit overseas to a country of their choice. This gives you vital scientific work experience on a subject that interests you. You will also learn about the culture and biodiversity of another country and expand your network of contacts. An increasing number of our students take the chance to study abroad during their second year with one of our exchange partners in countries such as Australia, Canada, Malaysia and Sweden.

Benefit from our excellent facilities and partnerships
Our outstanding facilities include our custom-built remotely operated underwater vehicles (ROVs), long-term field study sites, and the Central Teaching Laboratories (CTL). Students use the CTL’s state-of-the-art facilities and equipment for practical work, field work and analytical skills such as Geographical Information Systems (GIS). Liverpool hosts the National Oceanography Centre (NOC) who contribute to research-led teaching. Local, national and international partners including World Museum Liverpool, RSPB and the Marine Biological Association help with field teaching and research projects.

Good to know:
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Earth, Ocean and Ecological Sciences
Year One undergraduates in 2016

1st
Liverpool was the first UK university to offer a degree in Marine Biology

100%
of our students said staff were good at explaining things (NSS 2016)

93%
of students are satisfied overall with their programme (NSS 2016)

Offers study abroad opportunities

Offers a Year in China
Thrive in our friendly and supportive atmosphere

From day one, you will study with fellow students from your programme, on modules designed specifically for you. Intensive field courses and projects will give you the opportunity to work closely with our award-winning academic staff. Throughout your studies, your personal tutor will guide and support you and help to prepare you for the next step in your career.

How you learn

Teaching strategies include a mix of lectures, tutorials, workshops, field classes, research vessel cruises, laboratory work, computer sessions, group projects and individual work under supervision. You will typically receive around 15 hours of formal teaching each week, as well as about 60 hours on residential field courses each year. You will study four modules per semester. A module might involve two one-hour lectures each week, and a laboratory or computer-based practical as well. Tutorials are an integral part of our approach, involving groups of 5-7 students meeting regularly with a member of academic staff to discuss study skills, careers, current research and topical issues.

As you progress through your degree, you are increasingly challenged to engage with current debates, to think critically and to study independently. You will do an ‘Honours Project’ throughout Year Three, which is a piece of independent research (field, lab or data analysis) on a topic of your choice, supervised by a member of academic staff. If you opt for the four-year integrated master’s programmes, you will spend 50% of your final year on a ‘master’s project’ working closely within a research group on an area which may well generate publishable results.

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.

There is a wide range of learning opportunities available. Whether this be in lectures, developing practical skills or going abroad to undertake work placements, there are always chances to get involved. My overseas placement has inspired me to take a different path within environmental sustainability, and I would now like to work closely with legislation and will be applying for positions within environment-related government agencies.

Ruby Temple-Long
Marine Biology BSc (Hons)
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<td>Ecology and conservation lecture</td>
<td>Practical skills for ecologists and marine biologists. All day lab session or field trip</td>
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<td>Ocean chemistry and life lecture</td>
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<td>Guild comedy night</td>
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Make yourself employable
As well as subject-specific skills, you will graduate with a wide range of transferrable skills. You will have experience of working independently and as a member of a team, with the opportunity also to be a team leader. You will have presented work in the form of reports, posters and oral presentations, and will have used a wide range of software and specialist equipment. You will have gained time-management and organisational skills from completing your independent project, and will be able to integrate large quantities of data from a wide range of sources and at a variety of scales to solve real-world problems.

Postgraduate opportunities
Many of our students go onto further study on master’s or PhD programmes in the UK and abroad.

Earth Sciences
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.

The majority of 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. The truly interdisciplinary nature of our degrees additionally makes graduates in the earth sciences highly sought after by other employment sectors.

Recent employers of our graduates
- Geological Surveys in the UK and abroad
- Hydrocarbon and support industries: ExxonMobil, BP, Shell, Geotrace, Geokinetics, Neftex, Robertson, Deloitte, CGG, Osiris, PGS

Work experience opportunities
Our students often successfully complete internships in industry during university vacations. Many of the academic staff in the Department have worked outside of academia and can provide support and guidance in finding a suitable placement.
I specialise in water management, investigating the causes of flooding, and possible solutions to flooding problems. I also design drainage schemes, create new water supplies, undertake hydrogeological assessments for quarry developments, assess the consequences of changes in land use and consider the impacts of construction and development on water bodies. All the fieldwork I did, the analytical methods I used, and the technical knowledge I acquired during my degree have been invaluable, and really aided my career.

Katie Burton  
Graduated with MESci Geology and Physical Geography  
(Now works as a Senior Environmental Consultant)
Ocean Sciences
Ocean scientists are in demand worldwide to understand how the oceans are warming, where sea level is rising, how the oceans are taking up carbon from the atmosphere, and how these changes are affecting plankton and marine life. Our degree programmes are designed to provide you with the skills to tackle these global environmental challenges. The vast majority of our recent graduates gained employment within a degree-related field or continued further within education and research after graduation.

Recent employers of our graduates
- British Oceanographic Data Centre
- Environment Agency
- Bermuda Institute of Ocean Sciences
- Lloyds (property insurance)
- Meteorological Office
- Arcus Renewable Energy Consulting Ltd
- VerdErg Connectors Limited.

Work experience opportunities
We have close links with the National Oceanography Centre and each year, the centre in Liverpool offers at least one competitive research placement for one year. The placement involves working closely with research scientists on new and on-going oceanographic projects and there are opportunities to go to sea on a research cruise. Additionally, we have competitive 5-10 week summer placements for students in Year Two/Year Three. These remunerated placements are great opportunities to gain practical experience and work on a specific research project guided by one of our academics.

Make yourself employable
Our research funding organisation, the Natural Environment Research Council (NERC), recently performed a study to identify critical skills gaps in the Environment sector, defined as the ‘parts of the UK that significantly rely on, or generate knowledge, concerned with the state and condition of the Earth’. The top six skills identified as being needed in the environment sector were computer modelling, multidisciplinarily data management, numeracy, communication and fieldwork.

Our degree programmes are designed to provide ocean sciences students with these skills through training in industry standard software for modelling and data management, development of quantitative and communication skills and opportunities for at-sea training throughout the degree programme. On graduating, you will be a highly employable ocean scientist ready to tackle global environmental challenges.

Postgraduate opportunities
More than 40% of our students go on to further study on master’s or PhD programmes in the UK and abroad. We offer postgraduate opportunities in Ocean Sciences via our four-year integrated master’s programme (F710), our MSc in Sea Level and a new NERC Doctoral Training Centre in partnership with the University of Manchester and the National Oceanography Centre.
Ecology and Marine Biology

Our graduates have a diverse range of careers, including media, environmental consultancy, administration, academia, teaching, local and national government and international banking. Recent graduates who have careers within the sector include fisheries observers, seabird research assistant, field assistant on mammal surveys, rangers and conducting environmental surveys for construction work. Many choose to continue their studies at master’s or PhD level on topics such as fish assemblages in mangroves, marine ecosystem responses to climate change and carbon sequestration in soils.

Recent employers of our graduates
- Joint Nature Conservation Committee (JNCC)
- United Utilities
- Fairbanks Environmental
- Earth and Marine Environmental Consultants
- Oceans Research
- Universities of Liverpool, Manchester and Southampton.

Work experience opportunities
The importance of work and volunteer experience is stressed to our students from Welcome Week onwards. We maintain an up-to-date list of organisations in the local area and further afield, who take on volunteers every year and opportunities exist within the School for work experience every summer. The overseas study visit is an opportunity for students to gain work experience overseas. We are part of a competitive placement scheme funded by the Natural Resources Wales (NRW) and each year our Year Two students can apply to spend a fully-funded year working with the CCW marine team.

Postgraduate opportunities
- MRes/MSc Conservation and Resource Management
- MSc Marine Planning and Management
- MSc Environmental Management
- PhDs funded through two NERC Doctoral Training Partnerships.

Make yourself employable
Essential transferable skills ranging from organisation and time management to communication, writing, presentations and numeracy are embedded throughout our programmes. There is a strong focus on preparation for future work including a ‘CV Masterclass’ from a recruitment industry professional, a programme of visits from recent graduates, dedicated careers fair and links to our accrediting bodies and learned societies such as the Marine Biological Association and British Ecological Society.

We encourage our students to gain niche skills through our relationships with specialist providers. These include Liverpool University Sub-Aqua Club for diving, Liverpool Animal Conservation Society, the Field Studies Council for species identification and OrcaWeb for marine mammal identification and survey techniques.

LivWiSE (Liverpool Women in Science and Engineering)
LivWiSE is a society for men and women to celebrate and promote women in science, technology, engineering, maths and medicine (STEM). They regularly host events and networking opportunities which are open to everyone interested in STEM. Find out more at www.liverpool.ac.uk/livwise, www.facebook.com/liverpoolWISE or Twitter @LivUniWiSE
# Degrees

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<td>Marine Biology with Oceanography BSc (Hons)</td>
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<tr>
<td>Mathematics with Ocean and Climate Sciences BSc (Hons)</td>
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<td>Earth Sciences entry route leading to BSc (Hons) (4-year route</td>
<td>F608</td>
<td>4 (1+3)</td>
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<td>including a Foundation Year at Carmel College)</td>
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<td>Biological Sciences leading to BSc (Hons) (4-year route including</td>
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<td>a Foundation Year at Carmel College)</td>
<td>C108</td>
<td>4 (1+3)</td>
<td>38</td>
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1 Foundation programmes have flexible entry requirements.

Contact E: degree@carmel.ac.uk for details.

See [www.liverpool.ac.uk/study/undergraduate/courses](http://www.liverpool.ac.uk/study/undergraduate/courses) for current entry requirements.
Conservation and Biodiversity BSc (Hons)
UCAS code: C192
Programme length: 3 years

Conservation and Biodiversity MEcol (Hons)
UCAS code: C180
Programme length: 4 years

Our planet's biodiversity is facing profound challenges which require a supply of skilled and qualified graduates in the environmental sector. Our programmes cover key ecological concepts and practical skills, with as much fieldwork as possible and an emphasis on applied science and conservation. Our four-year integrated master’s programme (C180) is designed to train high-performing students to the best possible standard to prepare them for PhD research and employment.

Programme in detail
Ecology is at the heart of our programme, with core concepts ranging from ecosystem structure and function to population dynamics. These fundamentals are complemented by applied modules such as Living with environmental change; Marine ecology; Evolution and Conservation biology and new computer technologies such as Geographical Information Systems.

You may also take modules from ocean sciences, geography and geology, including Hydrology; Oceans and climate; Soils; Climatology; Sustainability and Environmental change.

A major strength is the emphasis on practical and field-based work, with field work modules in all three years of the degree. Some students take summer modules with the Field Studies Council in field identification of organisms such as plants, amphibians and reptiles, and bats, developing further skills for environmental work.

Residential field courses visit Scotland and West Wales and you will make short visits to important ecosystems and sites affected by industry in Merseyside and the Northwest. There are opportunities for additional residential field courses at centres in the UK and overseas.

On C180 you will follow the BSc programme for the first three years and then, subject to performance, proceed to the final master's year. During this year you will focus on gaining additional research experience and an advanced understanding of ecology through specialist modules and a field course to the Highlands of Scotland.

Continued over...
C192 and C180 key modules

**Year One**

Core modules
- Ecology and conservation
- Ecology and the global environment
- Evolution
- Laboratory and field techniques
- Quantitative skills for ecology and marine biology
- Study skills.

Selected optional modules
- Animal biodiversity
- Applied genetic and molecular technologies
- Climate, atmosphere and oceans
- Introduction to marine biogeochemistry
- Living with environmental change
- Marine biology: life in the seas and oceans
- Marine ecosystems: diversity, processes and threats
- Molecules and cells.

**Year Two**

Core modules
- Biodiversity practical skills
- Ecology practical skills
- Population and community ecology
- Research skills
- Statistics for environmental scientists
- Understanding marine and terrestrial spatial ecology using GIS.

Selected optional modules
- Animal behaviour
- Changing environments
- Climatology
- Comparative animal physiology
- Evolutionary biology
- Marine ecophysiology, ecology and exploitation
- Marine pollution
- Soils, slopes and the environment.

Year Three

Core modules
- Advanced topics in ecology
- Contemporary issues in ecology and marine biology
- Honours project: ecology and environment/marine biology.

Selected optional modules
- Coastal environments: spatial and temporal change
- Conservation biology
- Current skills and topics in evolutionary biology
- Current topics in animal behaviour
- Integrative comparative animal physiology
- Marine ecology: theory and applications
- Science communication
- Surviving the marine environment: adaptation, behaviour and conservation.

**Year Four (C180 only)**

Core modules
- Advanced conservation biology
- Conservation and resource management field course
- Master’s project.

Selected optional modules
- Advanced ecology
- Advanced statistics for biological research
- Geographic information science
- Human impacts on environments
- Tackling environmental issues.

See pages 40-57 for module descriptions.
Geography and Oceanography BSc (Hons)  
UCAS code: FF78  
Programme length: 3 years

The way that the earth behaves as a system results from interactions between the land, the oceans and the atmosphere. Complex issues such as climate change, sea level rise and environmental pollution can only be fully understood if all the different facets of the earth’s behaviour are considered. While the ocean sciences deal with present day and future climate change scenarios, the link to physical geography provides an understanding of changes in climate over the last several thousand years to provide context for recent climate change. This was the first UK university programme to combine land, ocean and climate studies in an integrated programme of study.

Programme in detail  
Your training will cover core topics in oceanography, physical geography, geology and ecology as well as modules in IT and communication skills. There will be the opportunity to participate in field/project work throughout the course of your studies, as well as a full sea practical during your final year. Scientists from the National Oceanography Centre in Liverpool provide guest lectures and supervision of projects. Students without mathematics, physics or chemistry at A level are provided with remedial courses.

The degree in Geography and Oceanography at Liverpool is accredited by the Institute of Marine Engineering, Science and Technology.

Key modules  
Year One  
Core modules  
- Climate, atmosphere and oceans  
- Introduction to marine biogeochemistry  
- Living with environmental change  
- Study skills  
- Theory and laboratory experiments in earth surfaces processes.

Selected optional modules  
- Ecology and conservation  
- Environmental chemistry  
- Experiments in physical geography I  
- Introduction to sedimentary rocks and fossils  
- Marine ecosystems: diversity, processes and threats  
- Maths and physics for environmental scientists.

Year Two  
Core modules  
- Changing environments  
- Climatology  
- Geomorphology: ice, sea and air  
- Key skills for environmental data analysis  
- Life in a dynamic ocean  
- Oceanography of estuaries and shelf seas.

Selected optional modules  
- Catchment hydrology  
- Marine ecophysiology, ecology and exploitation  
- Marine pollution  
- Principles and theory in geography  
- Sampling the ocean  
- Sedimentary processes and sequences  
- Soils, slopes and the environment  
- Statistics for environmental scientists.

Year Three  
Core modules  
- Coastal environments: spatial and temporal change  
- Global carbon cycle  
- Marine sciences: special topics  
- Ocean dynamics  
- Ocean sciences research project  
- Sea practical.

Selected optional modules  
- Climate change: a critical review  
- Evolution, oceans and climate  
- Fluvial environments  
- Science communication.

See pages 40-57 for module descriptions.
Discover planet Earth: from natural hazards to natural resources, from the history of life to the history of the planet itself. You don’t need to have studied geology before and this programme can open the door to a career as a professional geologist in industries such as petroleum, mineral resources, engineering geology and environmental assessment. You will gain a thorough and highly practical training in modern geology, with a strong emphasis on fieldwork.

F601 shares the first two years with F600, with the final two years providing more advanced training in all aspects of geology. You choose from a wide range of applied and more academic modules to create your own pathway. Again, there is high level of field-based training designed specifically to give you skills in data analysis, synthesis, problem solving, research and reporting your results. Semester Two of Year Three can be spent abroad at a partner university in Australia or New Zealand.

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

Programme in detail (F600)

Your training will cover core topics including sedimentology, stratigraphy, fossils, volcanoes, minerals, metamorphism, structural geology, geological maps and plate tectonics, as well as comprehensive training in field geology, IT and communication skills.

In Years One and Two we provide core training in all key areas of Geology. In Year Three you can begin to tailor your degree by choosing a pathway to suit your career intentions. There are modules in applied topics such as engineering geology, geohazards, mineral deposits and petroleum geology or more research-oriented topics such as Rock deformation, Volcanology, and Petrology, as well as specialised areas like Geoarchaeology.

Options in ocean science, geography and geophysics are available. Current areas used for residential field classes include Spain, Dorset, Ireland and Wales. All students have at least one overseas field class.

In Year Three you will undertake an independent field project and dissertation, involving 35 days independent fieldwork either in the UK or abroad.

Key modules

Year One
Core modules
- Earth structure and plate tectonics
- Introduction to earth science and earth history
- Introduction to field geology (field classes)
- Introduction to sedimentary rocks and fossils
- Introduction to structural geology and geological maps
- Study skills.

Selected optional modules
- Climate, atmosphere and oceans
- Environmental chemistry
- Maths and physics for environmental scientists
- Theory and laboratory experiments in earth surfaces processes.

Year Two
Core modules
- Exploration geophysics
- Field mapping techniques (field class)
- Geohazards, georesources and sustainability
- Metamorphism and crustal evolution
- Minerals, magma and igneous geochemistry
- Research skills
- Sedimentary processes and sequences
- Structural geology and interpretation of geological maps.

Year Three
Core modules
Choose one of the following:
- Crust and mantle evolution and geodynamics (field class)

Or
- Petroleum geology and applied basin analysis (field class)
In addition to:
- Advanced geology field techniques (field class)
- Field project and dissertation.

**Selected optional modules**
- Advanced structural geology
- Crust and mantle evolution
- Earth structure and rock deformation
- Engineering geology and hydrogeology
- Environmental geophysics
- Evolutionary palaeobiology
- Geoarchaeology
- Mineral deposits in space and time (M level)
- Petroleum geology
- Science communication
- Seismology and geohazards
- Volcanology.

See pages 40-57 for module descriptions.

**Programme in detail (F601)**
In Years One and Two we provide core training in all key areas of geology. You will undertake an independent field-based project and complete a dissertation in Year Three. Modules specific to the four-year programme include **Volcanic processes; Mineral deposits;** and **Research methods.** Year Three and Four field classes visit Northern Spain and Tenerife. In Year Four, you will work within one of our research groups and complete a major geological research project.

This will involve development of research and communication skills through a project proposal, literature review, journal-style manuscript and conference-style talk. Results often get published in international journals.

There is scope for an industrial placement with organisations such as Shell, BP, Exxon- Mobil, Rio-Tinto, Anglo-American, the Environment Agency and the British Geological Survey. Many of our students successfully complete internships in industry between Years Three and Four.

This programme is recognised under the ‘Accreditation of Geoscience First Degree’ scheme of the Geological Society of London and is suitable for a professional career in geosciences.

**Key modules**

**Year One**
- Core modules
  - Same list as F600.
- Selected optional modules
  - Same list as F600.

**Year Two**
- Core modules
  - Same list as F600.

**Year Three**
- Core modules
  - Choose one of the following:
    - Crust and mantle evolution and geodynamics (field class)
    - Petroleum geology and applied basin analysis (field class)
    - Volcanology and volcanic processes (field class)
  - In addition to:
    - Advanced geology field techniques (field class)
    - Field project and dissertation.
- Selected optional modules
  - Advanced structural geology
  - Crust and mantle evolution
  - Earth structure and rock deformation
  - Engineering geology and hydrogeology
  - Environmental geophysics
  - Evolutionary palaeobiology
  - Geoarchaeology
  - Global carbon cycle
  - Mineral deposits in space and time (M level)
  - Petroleum geology
  - Science communication
  - Seismology and geohazards
  - Volcanology.
Year Four
Core modules
Choose one of the following:
● Applied basin analysis (field class)
Or
● Geodynamics (field class)
Or
● Volcanic processes (field class)
In addition to:
● Advanced geology project
● Research methods.

Selected optional modules
● Advanced structural geology (M level)
● Earth structure and rock deformation
● Engineering geology and hydrogeology (M level)
● Evolutionary palaeobiology
● Global carbon cycle
● Mineral deposits in space and time (M level)
● Petroleum geology (M level)
● Seismology and geohazards
● Volcanology.

See pages 40-57 for module descriptions.

Programme in detail
In Years One and Two we provide core training in all key areas of geology. After Year Three in North America, you can choose from modules specific to the four-year programme including Volcanic processes; Geohazards; Geodynamics and Rock deformation. Year Four field classes visit Northern Spain or Tenerife.

In Year Four, you will work within one of our research groups and complete a major geological research project. This will involve development of research and communication skills through a project proposal, literature review, journal-style manuscript and conference-style talk.

This programme is recognised under the 'Accreditation of Geoscience First Degree' scheme of the Geological Society of London and is suitable for a professional career in geosciences.

Key modules
Year One
Core modules
Same list as F600.

Selected optional modules
Same list as F600.

Year Two
Same list as F600.

Year Three
Core modules
Modules selected at North American partner university.

Year Four
Core modules
● Advanced geology project
● Research methods.

Choose one of the following:
● Applied basin analysis (field class)
● Geodynamics (field class)
● Volcanic processes (field class).

For up-to-date entry requirements and full module details see www.liverpool.ac.uk/study/undergraduate/courses
Selected optional modules
- Advanced structural geology (M level)
- Earth structure and rock deformation
- Engineering geology and hydrogeology (M level)
- Evolutionary palaeobiology
- Global carbon cycle
- Global geophysics
- Mineral deposits in space and time (M level)
- Petroleum geology (M level)
- Seismology and geohazards
- Volcanology.

See pages 40-57 for module descriptions.

**Geology and Geophysics MESci (Hons)**
**UCAS code: F641**
Programme length: 4 years

This four-year degree delivers advanced and rigorous training in both geophysics and geology, including a high proportion of field-based work, and fundamental training in physics and mathematics. Graduates benefit from a wide range of careers in geosciences, allowing (for example), allowing flexible career paths between geology and geophysics in a large company. Transfer to a geology degree is possible up to the end of Year One. This degree is accredited by the Geological Society of London, satisfying the requirements of Fellowship and Chartered Geologist status.

**Programme in detail**
You will cover core topics in geophysics, geology, physics and mathematics. Major features include training in practical geology and geophysics, exploration geophysics (particularly seismology), planetary-scale geophysics and geophysical inverse theory. Fieldwork currently involves field areas in Ireland, Wales, Tenerife, and Spain.

In Year Three, you will undertake an independent field mapping project and dissertation, either in the UK or abroad. In the final year you will work within one of our geophysical research groups to undertake a substantial research project, often producing research of publishable quality thus providing an ideal entry into further research degrees if desired.

**Key modules**

**Year One**
Core modules
- Earth structure and plate tectonics
- Introduction to field geology (field classes)
- Introduction to sedimentary rocks and fossils
- Introduction to structural geology and geological maps
- Mathematics for physicists I
- Mathematics for physicists II
- Newtonian dynamics
- Study skills.

**Year Two**
Core modules
- Dynamic stratigraphy
- Electromagnetism
- Exploration geophysics
- Field mapping techniques (field classes)
- Geophysical mathematics and potential theory
- Minerals, magma and igneous geochemistry
- Seismology and computing
- Structural geology and interpretation of geological maps.

Selected optional modules
- Deep earth mineralisation systems
- Magmatism and volcanic hazards.

**Year Three**
Core modules
- Advanced geology field techniques
- Environmental geophysics
- Exploration geophysics and signal processing
- Field project and dissertation
- Metamorphism and crustal evolution
- Quantitative tectonics
- Volcanoes, earthquakes and tsunami geophysics.
Year Four
- Geophysical data modelling
- Geophysical exploration techniques
- Geophysical project (M level).

Selected optional modules
- Advanced structural geology (M level)
- Evolutionary palaeobiology
- Mineral deposits in space and time
- Rock deformation.

See pages 40-57 for module descriptions.

Geology and Physical Geography BSc (Hons)
UCAS code: F6F8
Programme length: 3 years

Geology and Physical Geography MESci (Hons)
UCAS code: FF68
Programme length: 4 years

The earth surface system is dynamic and diverse, with changes driven by the interplay of physical, chemical, geological and biological processes in a wide range of environments. Drawing on the complementary expertise of staff in geology and physical geography, this integrated degree programme provides a clear view of the controlling processes that link landscape evolution with environmental change and natural events that impact human activity. Fieldwork in Years Two and Three at Liverpool is designed specifically for this degree programme integrating geology and geomorphology. Students have academic tutors from both disciplines in Years One and Two. Graduates from F6F8 (BSc) either gain employment directly or proceed to vocational MSc (such as Recent Environmental Change, Engineering Geology, Hydrogeology) or PhD degree programmes.

The first two years of FF68 (MESci) are shared with the BSc programme. The final two years provide a wider choice of taught modules and a comprehensive fieldwork programme. In addition, you have the opportunity to design and undertake a major individual research project that will provide you with skills in analysis, synthesis, problem solving, and reporting. The unique range of skills that MESci Geology and Physical Geography students develop make them attractive to employers in the geotechnical and resource exploration industries, as well as the environmental monitoring, surveying and planning sectors.

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

Programme in detail (F6F8)
Your training will include the comprehensive study of surface and near-surface processes, relevant to many industrial, engineering and environmental employment sectors. Years One and Two cover a wide range of geological and physical geography topics, allowing for greater choice in the final year. A research-based dissertation is undertaken in Year Three on a geological and/or geomorphological topic. A two-week field class to South Eastern Spain in Year Three has been designed exclusively for Geology and Physical Geography students, integrating all aspects of the degree.

Key modules

Year One
Core modules
- Experiments in physical geography I
- Introduction to earth science and earth history
- Introduction to field geology (field class)
- Introduction to sedimentary rocks and fossils
- Introduction to structural geology and geological maps
- Study skills
- Theory and laboratory experiments in earth surfaces processes.

For up-to-date entry requirements and full module details see www.liverpool.ac.uk/study/undergraduate/courses
Selected optional modules
- Earth structure and plate tectonics
- Environmental chemistry
- Living with environmental change
- Maths and physics for environmental scientists.

Year Two
Core modules
- Exploration geophysics
- Field mapping techniques (field class)
- Geomorphology: ice, sea and air
- Minerals, magmas and igneous geochemistry
- Research skills
- Sedimentary processes and sequences.

Selected optional modules
- Catchment hydrology
- Climatology
- Geohazards, georesources and sustainability
- Metamorphism and crustal evolution
- Quaternary environmental change
- Soils, slopes and the environment
- Structural geology and interpretation of geological maps.

Year Three
Core modules
- Field project and dissertation
- Fluvial environments
- Geodynamics of the Mediterranean (field class).

Selected optional modules
- Advanced structural geology
- Climate change: a critical review
- Coastal environments: spatial and temporal change
- Crust and mantle evolution
- Engineering geology and hydrogeology
- Evolutionary palaeobiology
- Geoarchaeology
- Human-environmental interactions
- Metamorphism and crustal evolution
- Mineral deposits in space and time (M level)
- Natural hazards and society
- Petroleum geology
- Science communication.

Programme in detail (FF68)
Your training will focus on practical and quantitative aspects of geological and geographical science through study of the interaction of surface and near surface processes on the earth.

Research-based dissertations on topics of your choice are undertaken in Years Three and Four on projects that are geological and/or geomorphological. Year Four includes the opportunity for additional field courses to Dorset (applied basin analysis) or Tenerife (volcanic processes).

Key modules
Year One
Core modules
Same list as F6F8.

Selected optional modules
Same list as F6F8.

Year Two
Core modules
Same list as F6F8.

Selected optional modules
Same list as F6F8.

Year Three
Core modules
Same list as F6F8.

Selected optional modules
Same list as F6F8.

Year Four
Core modules
Choose one of the following:
- Applied basin analysis (field class)
- Volcanic processes (field class)

In addition to:
- Advanced geology-physical geography project
- Research methods.

See pages 40-57 for module descriptions.
Selected optional modules
- Advanced structural geology (M level)
- Climate processes and variability
- Crust and mantle evolution
- Earth structure and rock deformation
- Engineering geology and hydrogeology
- Evolutionary palaeobiology
- Geoarchaeology
- Human impacts on environments
- Laboratory methods and techniques in environmental reconstructions
- Mineral deposits in space and time (M level)
- Petroleum geology
- Science communication
- Volcanology.

See pages 40-57 for module descriptions.

Key modules

Year One
Core modules
Same list as F641.

Year Two
Core modules
- Electromagnetism
- Environmental geophysics
- Exploration geophysics
- Field mapping techniques
- Geophysical mathematics and potential theory
- Minerals, magmas and volcanoes
- Seismology and computing.

Selected optional modules
- Deep earth mineralisation systems
- Dynamic stratigraphy
- Magmatism and volcanic hazards
- Metamorphism and crustal evolution.

Year Three
Core modules
- Exploration geophysics and signal processing
- Geophysical exploration techniques
- Geophysical project.

Selected optional modules
- Advanced structural geology
- Crust and mantle evolution
- Geoarchaeology
- Geophysical data modelling
- Metamorphism and crustal evolution
- Mineral deposits in space and time
- Planetary geophysics
- Quantitative tectonics
- Rock deformation
- Science communication
- Sedimentary processes and sequences
- Volcanoes, earthquakes and tsunami geophysics.

See pages 40-57 for module descriptions.

For up-to-date entry requirements and full module details see www.liverpool.ac.uk/study/undergraduate/courses
Geophysics (North America)  
MESci (Hons)  
UCAS code: F660  
Programme length: 4 years

The first two years of this four-year degree are shared with the F640 programme whilst the final two years provide more advanced training. Year Three will be spent at a sister department in North America or Australia, where you will have the opportunity to experience a different culture and learning environment, along with access to diverse subject areas. Current links include the University of Georgia; the University of Illinois at Urbana-Champaign; McGill University, Montreal, Canada; Toronto University in Canada and Monash University in Melbourne, Australia. The number of places available on this degree programme is limited. If you apply, but don’t achieve the required grades, you will be offered a place on either F641 or F640, provided you obtain the required grades for those programmes.

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

Programme in detail
The programme gives high level training in geophysics with supporting geology, and including fundamental university training in physics and mathematics. Major features include training in practical geophysics, exploration geophysics (particularly seismology), planetary scale geophysics and geophysical inverse theory.

In the final year you will work within one of our geophysical research groups to undertake a substantial research project, generally producing research of publishable quality thus providing an ideal entry into further research degrees if desired.

Key modules
Year One
Core modules
Same list as F641.

Year Two
Core modules
Same list as F640.

Selected optional modules
Same list as F640.

Year Three
Core modules
Modules selected at North American partner university.

Year Four
Core modules
- Geophysical exploration techniques
- Geophysical project (M level).

Selected optional modules
- Advanced structural geology (M level)
- Earth structure and rock deformation
- Exploration geophysics and signal processing
- Geophysical data modelling
- Mineral deposits in space and time (M level)
- Planetary geophysics (M level)
- Quantitative tectonics
- Seismology and geohazards
- Volcanoes, earthquakes and tsunami geophysics.

See pages 40-57 for module descriptions.
Geophysics (Physics) BSc (Hons)
UCAS code: F656
Programme length: 3 years

This programme provides training in the principles and practice of geophysics with an emphasis on pure and practical physics. High level training is given in geophysics with supporting physics, providing classical physics training to second year university level, and including university training in geology and mathematics. The programme is particularly strong for careers in geophysical data analysis, and research areas related to global geophysics and planetary science.

Transfer to a Physics degree is possible up to the end of Year One.

This degree is recognised by the Institute of Physics.

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

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.

Key modules
Year One
Core modules
- Earth structure and plate tectonics
- Foundations of modern physics
- Introduction to sedimentary rocks and fossils
- Mathematics for physicists I
- Mathematics for physicists II
- Newtonian dynamics
- Study skills
- Wave phenomena.

Year Two
Core modules
- Condensed matter physics
- Electromagnetism
- Environmental geophysics
- Exploration geophysics
- Geophysical mathematics and potential theory
- Quantum and atomic physics
- Seismology and computing
- Thermal physics.

Year Three
Core modules
- Exploration geophysics and signal processing
- Geophysical exploration techniques
- Geophysical project
- Quantitative tectonics
- Volcanoes, earthquakes and tsunami geophysics.

Selected optional modules
- Geophysical data modelling
- Nuclear and particle physics
- Ocean dynamics
- Planetary geophysics
- Science communication.

See pages 40-57 for module descriptions.

Marine Biology BSc (Hons)
UCAS code: C160
Programme length: 3 years

Marine Biology MMarBiol (Hons)
UCAS code: C161
Programme length: 4 years

From microscopic algae to giant whales, most of our planet’s life is found in the oceans. As a marine biologist, you will learn about the behaviour, physiology, and ecology of marine organisms, and how marine food webs are influenced by global warming and fisheries. We produce highly employable marine biologists, able to apply their knowledge and skills to fields including monitoring, pollution, conservation, and aquaculture.
Our four-year integrated master’s programme is designed to train high performing marine biologists to the best possible standard to prepare them for PhD research and employment.

**Programme in detail**
Modern marine biology requires a wide range of skills, from field work to data analysis. The first two years of study help you develop these core skills. There are week-long field courses in every year of study, including opportunities for boat work. Students currently make an independent overseas study visit in the summer of Year Two, for which past destinations include Australia, Tanzania, Ecuador and Iceland.

In Year Three, you will take advanced modules in your area of interest, and spend a large amount of time working on your independent research project. Recent projects include investigating physiological data on how cormorants stay warm while diving in frigid Arctic waters, building mathematical models of coral reefs, and looking at the impacts of a wind farm on benthic communities.

You can choose modules from the School of Life Sciences, ocean sciences, and geography in each year of study on topics such as climate change and ocean physics, population ecology, physiology, conservation, parasitology, microbiology, molecular biology and genetics.

Our degree is one of only a handful in the UK to be accredited by the Institute of Marine Engineering, Science and Technology (IMAREST).

**Key modules**

**Year One**

**Core modules**
- Evolution
- Laboratory and field techniques
- Marine biology: life in the seas and ocean
- Marine ecosystems: diversity, processes and threats
- Quantitative skills for ecology and marine biology
- Study skills.

**Selected optional modules**
- Applied genetic and molecular technologies
- Climate, atmosphere and oceans
- Ecology and conservation
- Ecology and the global environment
- Introduction to marine biogeochemistry
- Living with environmental change
- Microbiology
- Molecules and cells.

**Year Two**

**Core modules**
- Marine biology: Year Two field course
- Marine ecology field studies
- Marine ecophysiology, ecology and exploitation
- Research skills
- Statistics for environmental scientists.

**Selected optional modules**
- Animal behaviour
- Comparative animal physiology
- Evolutionary biology
- Life in a dynamic ocean
- Marine pollution
- Population and community ecology
- Understanding marine and terrestrial spatial ecology using GIS.

**Year Three**

**Core modules**
- Contemporary issues in ecology and marine biology
- Honours project: ecology and environment/ marine biology.

**Selected optional modules**
- Advanced topics in ecology
- Coastal environments: spatial and temporal change
- Conservation biology
- Current skills and topics in evolutionary biology
- Current topics in animal behaviour
- Integrative comparative animal physiology
- Marine ecology: theory and applications
- Marine planning theory and practice
- Science communication
- Surviving the marine environment: adaptation, behaviour and conservation.

Continued over...
Year Four (C161 only)
Core modules
- Advanced statistic for biological research
- Master’s project
- Mastering marine biology.

Selected optional modules
- Advanced conservation biology
- Advanced ecology
- Geographic information science
- Human impacts on environments
- Marine planning and management in action
- Tackling environmental issues.

See pages 40-57 for module descriptions.

Marine Biology with Oceanography BSc (Hons)
UCAS code: C1F7
Programme length: 3 years

Life first emerged in the ocean and has spread throughout this dynamic environment. The distribution, growth and success of marine organisms is affected by the interaction of biological, chemical and physical processes operating in the ocean. You will study the interaction between the biology of marine organisms, the composition and properties of seawater and the physical processes operating in the oceans. There is a strong emphasis on marine sustainability and ecosystem management, marine biogeochemistry, the climate system and numerical skills. Training at sea, in the field, and in the laboratory in Years One, Two and Three will provide you with the essential skills required to be a successful marine scientist including practical experience of data collection and processing, analysis and interpretation.

Programme in detail
Throughout the three-year programme, core modules in marine biology and ocean sciences will provide you with observational, analytical and numerical skills. You will also have a choice of optional modules from within the School of Environmental Science and the School of Life Sciences.

In the final year, you will take advanced modules in an area of interest, and spend a large amount of time working on a research project in either in marine biology, ocean sciences or a topic that combines the two disciplines. The degree in Marine Biology with Oceanography at Liverpool is accredited by the Institute of Marine Engineering, Science and Technology.

Key modules
Year One
Core modules
- Climate, atmosphere and oceans
- Introduction to marine biogeochemistry
- Laboratory and field techniques
- Marine biology: life in the seas and ocean
- Marine ecosystems: diversity, processes and threats
- Study skills.

Selected optional modules
Choose two of the following:
- Applied genetic and molecular technologies
- Ecology and conservation
- Ecology and the global environment
- Environmental chemistry
- Evolution and biodiversity
- Maths and physics for environmental scientists
- Microbiology
- Molecules and cells.

Year Two
Core modules
- Life in a dynamic ocean
- Marine biology field course
- Oceanography of estuaries and shelf seas
- Research skills.
Selected optional modules
Choose two of the following:
- Advanced techniques in zoology
- Human impacts on marine ecosystems
- Key skills for environmental data analysis
- Marine ecology field studies
- Marine pollution
- Sampling the ocean
- Statistics for environmental scientists.

Year Three
Core modules
Choose:
- Honours project: ecology and environment/marine biology
  OR
- Ocean sciences research project.
Choose:
- Marine biology: contemporary issues
  OR
- Sea practical AND Marine sciences: special topics.

Selected optional modules
Choose two of the following:
- Global carbon cycle
- Marine ecology: theory and applications
- Ocean dynamics
- Surviving the marine environment: adaptation, behaviour and conservation.
Choose one of the following:
- Advanced topics in animal behaviour
- Advanced topics in ecology
- Climate change: a critical review
- Coastal environments: spatial and temporal change
- Conservation biology
- Evolution
- Integrative comparative animal physiology.
See pages 40-57 for module descriptions.

Mathematics with Ocean and Climate Sciences BSc (Hons)
UCAS code: G1F7
Programme length: 3 years

Predicting climate and climate change is a major challenge facing the scientific community. The oceans regulate the climate of the planet through storing and transporting heat as well as modifying properties of the overlying atmosphere. Complex issues such as climate change and sea level rise can only be understood if the role of the ocean and atmosphere is fully appreciated. This degree provides an understanding of how the ocean and atmosphere operate in the climate system, as well as offering a strong grounding in mathematics.

It is offered in collaboration between the Department of Mathematics in the School of Physical Sciences and the internationally renowned National Oceanography Centre in Liverpool, providing excellent preparation for careers in computer modelling in oceanography, meteorology or environmental monitoring.

Programme in detail
You will acquire a broad knowledge of mathematics and the analytical and numerical techniques for solving problems, and the ability to apply those techniques with confidence. You will gain an understanding of how the climate system behaves, how the atmosphere and ocean transport heat, why jets and eddies emerge on a rotating planet, how tracers are transported and mixed, and how these processes affect the growth of phytoplankton.

The degree in Mathematics with Ocean and Climate Sciences at Liverpool is accredited by the Institute of Marine Engineering, Science and Technology.
Key modules

Year One
Core modules
- Calculus I
- Calculus II
- Climate, atmosphere and oceans
- Dynamic modelling
- Introduction to linear algebra
- Introduction to marine biogeochemistry
- Introduction to statistics
- Study skills.

Year Two
Core modules
- Introduction to the methods of applied mathematics
- Key skills for environmental data analysis
- Life in a dynamic ocean
- Oceanography of estuaries and shelf seas
- Ordinary differential equations
- Sampling the ocean
- Vector calculus with applications in fluid mechanics.

Selected optional modules
Choose one of the following:
- Classical mechanics
- Climatology
- Numerical methods.

Year Three
Core modules
- Further methods of applied mathematics
- Global carbon cycle
- Marine sciences: special topics
- Ocean dynamics
- Ocean sciences research project
- Sea practical.

Selected optional modules
Choose one of the following:
- Chaos and dynamical systems
- Climate change: a critical review
- Coastal environments: spatial and temporal change
- Population dynamics
- Science communication.

See pages 40-57 for module descriptions.

Ocean Sciences BSc (Hons)
UCAS code: F700
Programme length: 3 years

Ocean Sciences MOSci (Hons)
UCAS code: F710
Programme length: 4 years

The ocean plays a central role in the earth’s climate system by regulating the transfer of heat and carbon over the globe. The effect of the ocean can only be fully understood by addressing the fundamental physical and chemical processes operating in our environment. This degree route offers three distinct pathways in oceanography, physics or chemistry, combined with an understanding of the ocean and climate system.

Each pathway has its own mix of modules from the School of Environmental Sciences and School of Physical Sciences. Scientists from the National Oceanography Centre in Liverpool provide guest lectures and supervision of projects.

The four-year master’s programme, F710, will provide you with the high-level skills and knowledge required to work in a research environment and address the challenges in ocean science. There is a strong emphasis on numerical skills hands-on laboratory and fieldwork at sea and independent study.

You will have the opportunity to work with scientists from the National Oceanography Centre (Liverpool), who are international leaders in sea level science and shelf sea physics.

Programme in detail (F700)
On the oceanography pathway you will acquire a broad interdisciplinary understanding of the ocean environment from a physical, chemical and biological perspective. The oceanography route is suitable if you don’t have a strong background in mathematics, physics or chemistry as remedial courses are provided.

On the physics pathway you will acquire a strong grounding in physics together with applications to the atmosphere, ocean and climate system.

On the chemistry pathway you will acquire a strong grounding in chemistry and laboratory work, together with applications to the ocean.

For up-to-date entry requirements and full module details see www.liverpool.ac.uk/study/undergraduate/courses
Across this degree programme, you will gain an understanding of how the climate is changing, how the atmosphere and ocean transport heat and tracers over the globe, how nutrients and carbon are cycled over the globe, how plankton growth and fisheries are sustained, the effects of ocean acidification, and how life operates in a dynamic ocean.

This degree programme will focus on practical aspects of marine science and will provide grounding in ‘hands on’ quantitative studies of chemical and physical marine science. There will be the opportunity to participate in field/project work throughout the course of your studies, as well as a full sea practical using UK marine facilities during Year Three. You will undertake a major research project in your final year.

The degree in Ocean Sciences at Liverpool is accredited by the Institute of Marine Engineering, Science and Technology.

**Key modules**

**Year One**

Core modules
- Climate, atmosphere and oceans
- Introduction to marine biogeochemistry
- Study skills.

Oceanography route:
- Environmental chemistry
- Experiments in physical geography I
- Marine ecosystems: diversity, processes and threats
- Maths and physics for environmental scientists.

Physics route:
- Mathematics for physicists I
- Mathematics for physicists II
- Newtonian dynamics
- Thermal physics
- Wave phenomena.

Chemistry route:
- Introductory inorganic chemistry
- Introductory organic chemistry
- Introductory physical chemistry
- Introductory spectroscopy.

**Selected optional modules**

Students on the oceanography route choose one of the following:
- Ecology and conservation
- Introduction to sedimentary rocks and fossils
- Living with environmental change
- Marine biology: life in the seas and ocean
- Mathematics for physicists I and II.

**Year Two**

Core modules
- Oceanography route:
  - Climatology
  - Key skills for environmental data analysis
  - Life in a dynamic ocean
  - Marine pollution
  - Oceanography of estuaries and shelf seas
  - Sampling the ocean.

Physics route:
- Electromagnetism
- Key skills for environmental data analysis
- Life in a dynamic ocean
- Mathematics for physicists III
- Mathematics for physicists IV
- Oceanography of estuaries and shelf seas
- Sampling the ocean.

Chemistry route:
- Key skills for environmental data analysis
- Marine pollution
- Metals and metalloids of the P and D blocks
- Oceanography of estuaries and shelf seas
- Organic chemistry II
- Physical chemistry II
- Preparative chemistry: synthesis and characterisation
- Sampling the ocean.
Selected optional modules

Students on the oceanography route choose two of the following:
- Catchment hydrology
- Human impacts on marine ecosystems
- Marine biology practical skills
- Numerical methods
- Palaeobiology and evolution
- Sedimentary processes and depositional environments
- Statistics for environmental scientists
- Vector calculus with applications in fluid mechanics.

Students on the physics route choose one of the following:
- Climatology
- Condensed matter physics
- Marine pollution
- Nuclear and particle physics.

Year Three
Core modules
- Global carbon cycle
- Marine sciences: special topics
- Ocean dynamics
- Ocean sciences research project
- Sea practical.

Selected optional modules
Students on the oceanography route choose two of the following:
- Climate change: a critical review
- Coastal environments: spatial and temporal change
- Evolution, oceans and climate
- Science communication.

Students on the physics route choose two of the following:
- Advanced electromagnetism
- Climate change: a critical review
- Coastal environments: spatial and temporal change
- Nuclear physics
- Physics of life
- Science communication.

Students on the chemistry route choose two of the following:
- Chemical database skills
- Climate change: a critical review
- Coastal environments: spatial and temporal change
- Inorganic applications of group theory
- Inorganic chemistry III
- Life in a dynamic ocean
- Organic chemistry III
- Science communication.

See pages 40-57 for module descriptions.

Programme in detail (F710)
The first three years follow BSc (Hons) degree programmes offered in ocean sciences, with specific pathways in mathematics, chemistry, biology, physics, and geography. Semester One of Year Four is focused on developing your knowledge and skills in laboratory techniques and data analysis, writing and reviewing research ideas, and discussing current research issues in ocean science. Modules highlighting the interdisciplinary nature of ocean sciences are offered.

Training in Semester One will provide you with the skills to conduct an independent research project in Semester Two, which will be supervised by ocean scientists from the University and the National Oceanography Centre in Liverpool. This high-level training will prepare you with the critical thinking, communication and writing skills you will need to work in a research environment, as well as an awareness of the future challenges in ocean sciences.

The MOSci in Ocean Sciences at Liverpool is accredited by the Institute of Marine Engineering, Science and Technology.

For up-to-date entry requirements and full module details see www.liverpool.ac.uk/study/undergraduate/courses
Key modules
Years One, Two and Three
Core modules
You will take core and optional modules in Years One, Two and Three of the MOSci, selecting from a three-year Ocean Sciences degree programme, the choice depending on your interests and skills. You will select one of the following three-year Ocean Sciences degree programme routes:
F700 Ocean Sciences, either the oceanography, physics or chemistry route (see page 34)
FF78 Geography and Oceanography (see page 21)
C1F7 Marine Biology with Oceanography (see page 32)
G1F7 Mathematics with Ocean and Climate Sciences (see page 33).
Then you will follow the Year Four of the MOSci in Ocean Sciences as follows:

Year Four
Core modules
• From sampling to models in ocean biogeochemistry
• Integrated master’s research project
• Modelling processes in oceans and climate.

Selected optional modules
Choose one of the following:
• Advanced ecology: conserving resources
• Climate processes and variability
• Dynamic population modelling
• Human impacts on environments
• Politics of the environment
• Sea level and coastal flooding.
See pages 40-57 for module descriptions.

Earth Sciences entry route leading to BSc (Hons) (4-year route including a Foundation Year at Carmel College)

UCAS code: F608
Programme length: 4 (1+3) years

This programme provides a route into a number of BSc (Hons) degrees in earth or ocean sciences; it is especially suitable for students without a strong background in science. You will follow a Foundation Year at Carmel College (St Helens, nine miles from the University of Liverpool), where the class sizes are small and the standards of academic achievement high.

You will then follow one from:
• Geology (F600)
• Geology and Physical Geography (F6F8)
• Geophysics (Geology) (F640)
• Geophysics (Physics) (F656)
• Ocean Sciences (F700)
• Geography and Oceanography (FF78)
• Mathematics with Ocean and Climate Sciences (G1F7)
• Marine Biology with Oceanography (C1F7).

Programme in detail
Based at Carmel College, St Helens, about nine miles from the main University precinct. The College offers small class sizes and high standards of academic achievement. You will follow three foundation modules chosen from chemistry, mathematics, physics, biology or geography. Module choice depends on the programme you wish to follow after the Foundation Year.
Degrees offered with other departments

Environmental Science BSc (Hons)
UCAS code: F750
Programme length: 3 years

Our Environmental Science degree provides a wide breadth of study opportunities from across the School of Environmental Sciences. Our degree is designed to give you an understanding of both natural and human induced environmental problems. All of our modules centre on real world issues and application, such as food security, climate change, energy security, pollution and natural hazards.

In addition to bespoke environmental science classes, our degree allows you to choose from a range of modules in biology, ecology, physical geography, and earth, climate and ocean sciences, so that you can shape your degree to suit your particular areas of interest and career pathway.

Focusing on applied skills that are relevant to careers in environmental science, you will gain expertise in monitoring, modelling and managing the environment. From your first week to your final year, field classes and laboratory practicals are an integral part of your learning, and provide a firm grounding in the latest techniques and technologies in environmental science. You will learn through a combination of individual and group work, including practicals in our purpose built (£23 million) Central Teaching Laboratories.

In addition to making the most of Liverpool’s coastal location, you will have the opportunity to undertake fieldwork in locations such as Snowdonia, Pembrokeshire, Peak District, Portugal, Iceland and California.

For more information download the Environmental Science brochure from www.liverpool.ac.uk/study/undergraduate/courses/publications

Biological Sciences leading to BSc (Hons) (4-year route with Foundation Year at Carmel College)
UCAS code: C108
Programme length: 4 (1+3) years

Intended for adult learners or undergraduates who wish to take up biology but do not have the appropriate subject background, Biological Sciences offers a foundation year at nearby Carmel College.

This is not a programme in itself but acts as a springboard onto degree programmes in Ecology and Marine Biology. This deferred choice programme means that you have the flexibility and freedom to switch to your chosen degree after completing the foundation year (Year Zero). The aim of this programme is to make you an expert in one particular field with the ability to cross discipline boundaries, a highly attractive prospect to employers.

For more information download the Life Sciences brochure from www.liverpool.ac.uk/study/undergraduate/courses/publications

For up-to-date entry requirements and full module details see www.liverpool.ac.uk/study/undergraduate/courses
<table>
<thead>
<tr>
<th>Module title</th>
<th>Semester</th>
<th>Credit</th>
<th>Module description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animal biodiversity</td>
<td>2</td>
<td>15</td>
<td>Introduces the structure and function of the basic body plan of the major groups of animals.</td>
</tr>
<tr>
<td>Applied genetic and molecular technologies</td>
<td>2</td>
<td>15</td>
<td>Provides the knowledge and understanding of the structure of nucleic acids and how these molecules encode the properties of cells; the mechanisms that lead to inheritance in offspring; the basic techniques that are used to experimentally clone genes and analyse their structure and function; and the ethical implications of genetic and molecular technologies.</td>
</tr>
<tr>
<td>Calculus I</td>
<td>1</td>
<td>15</td>
<td>Introduces the basic ideas of differential and integral calculus, to develop the basic skills required to work with them and to apply these skills to a range of problems.</td>
</tr>
<tr>
<td>Calculus II</td>
<td>2</td>
<td>15</td>
<td>Discusses local behaviour of functions using Taylor's theorem.</td>
</tr>
<tr>
<td>Climate, atmosphere and oceans</td>
<td>1</td>
<td>15</td>
<td>Introduces the climate system, the atmosphere and ocean.</td>
</tr>
<tr>
<td>Dynamic modelling</td>
<td>2</td>
<td>15</td>
<td>Provides the basic methods for modelling mathematical topics in subjects like biology, engineering, physical sciences and social sciences.</td>
</tr>
<tr>
<td>Earth structure and plate tectonics</td>
<td>2</td>
<td>15</td>
<td>This module introduces the structure and composition of the earth, the earth's gravitational and magnetic fields, and dynamics within the deep earth.</td>
</tr>
<tr>
<td>Ecology and conservation</td>
<td>2</td>
<td>15</td>
<td>Introduces the complex and multifaceted nature of environmental issues and ecological science, particularly stressing the interrelationships between biophysical and human dimensions.</td>
</tr>
<tr>
<td>Ecology and the global environment</td>
<td>2</td>
<td>15</td>
<td>Describes the physical and chemical contexts of the biosphere, the cycling of important elements at different scales, the distribution of biomes and the ecosystem concept.</td>
</tr>
<tr>
<td>Environmental chemistry</td>
<td>2</td>
<td>15</td>
<td>The module allows you to obtain the basic chemistry to understand the chemical reactions and processes that are fundamental to the evolution of our planet generally, and of hydrosphere and the oceans in particular; develops a practical and numerate ability to quantify processes through worked examples given in the form of assessed homework exercises and workshops and develops self-learning by learning to look up concepts and examples in books and on the Web.</td>
</tr>
<tr>
<td>Evolution</td>
<td>1</td>
<td>15</td>
<td>The module introduces you to evolutionary concepts and theories; describes the genetic basis of evolutionary changes; describes interrelationships of life forms and biodiversity, by descriptions of specialised biological systems and develops knowledge and understanding of the subject and the ability to apply, evaluate and interpret this knowledge to solve problems in biology.</td>
</tr>
</tbody>
</table>

Please note: modules may not be available across all programmes, please check programme-specific module lists on pages 18-38.
<table>
<thead>
<tr>
<th>Module title</th>
<th>Semester</th>
<th>Credit</th>
<th>Module description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiments in physical geography I</td>
<td>1</td>
<td>15</td>
<td>This module provides a practical introduction to environmental processes, experimental design, reliable measurement, and data analysis. You will undertake 10 different experiments, each lasting a full day, using industry standard equipment in the University’s Central Teaching Laboratory.</td>
</tr>
<tr>
<td>Foundations of modern physics</td>
<td>2</td>
<td>15</td>
<td>This module will introduce the theory of special relativity and its experimental proofs. It will also introduce the concepts and the experimental foundations of quantum theory.</td>
</tr>
<tr>
<td>Introduction to earth sciences and earth history</td>
<td>1</td>
<td>15</td>
<td>Introduces you to a range of fundamental geological and geophysical concepts and analytical techniques.</td>
</tr>
<tr>
<td>Introduction to field geology</td>
<td>2</td>
<td>15</td>
<td>Introduces a range of geological field techniques, allowing you to become proficient in gathering observational data and interpreting your results.</td>
</tr>
<tr>
<td>Introduction to linear algebra</td>
<td>1</td>
<td>15</td>
<td>Introduces techniques of complex numbers and linear algebra, including equation solving, matrix arithmetic and the computation of eigenvalues and eigenvectors.</td>
</tr>
<tr>
<td>Introduction to marine biogeochemistry</td>
<td>2</td>
<td>15</td>
<td>This module introduces students to marine chemistry of the major and trace elements and demonstrates the dynamic relationship between the chemical environment and biological processes.</td>
</tr>
<tr>
<td>Introduction to sedimentary rocks and fossils</td>
<td>1</td>
<td>15</td>
<td>Provides an introduction to the study of sediments and sedimentary rocks and introduces the main groups of common fossil.</td>
</tr>
<tr>
<td>Introduction to statistics</td>
<td>2</td>
<td>15</td>
<td>Introduces topics in statistics and to describe and discuss basic statistical methods.</td>
</tr>
<tr>
<td>Introduction to structural geology and geological maps</td>
<td>2</td>
<td>15</td>
<td>Introduces small- and large-scale geological structures, the principles of stress and strain and stereographic projection techniques. You will be able to use synthetic and real topographic and geological maps to teach a basic understanding of geological maps as representations of geometry and stratigraphy.</td>
</tr>
<tr>
<td>Introductory inorganic chemistry</td>
<td>1</td>
<td>15</td>
<td>Gives you an understanding of the underlying principles of the chemistry of the main group elements and the importance of this chemistry in everyday life.</td>
</tr>
<tr>
<td>Introductory organic chemistry</td>
<td>1 and 2</td>
<td>30</td>
<td>Introduces the fundamental principles of organic chemistry, including nomenclature, structure and bonding, the basic principles of static and dynamic stereochemistry and reaction mechanisms. This module also introduces the basic techniques associated with practical synthetic chemistry.</td>
</tr>
<tr>
<td>Introductory physical chemistry</td>
<td>2</td>
<td>15</td>
<td>Equips you with an understanding of basic kinetics and thermodynamics as they relate to chemical reactions.</td>
</tr>
<tr>
<td>Introductory spectroscopy</td>
<td>1 and 2</td>
<td>15</td>
<td>Introduces modern spectroscopic methods in chemistry.</td>
</tr>
<tr>
<td>Laboratory and field techniques</td>
<td>2</td>
<td>15</td>
<td>This practical module provides training in a range of ecological skills in field work which have wide application to many fields of environmental science including modern biology, ecology and physical geography. Techniques taught include identification of plants and animals, communities and measurement of selected ecological processes.</td>
</tr>
</tbody>
</table>

Please note: modules may not be available across all programmes, please check programme-specific module lists on pages 18-38.
## Core and selected optional modules overview

### Year One (continued)

<table>
<thead>
<tr>
<th>Module title</th>
<th>Semester</th>
<th>Credit</th>
<th>Module description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living with environmental change</td>
<td>1</td>
<td>15</td>
<td>Introduces you to the ‘Grand Challenges’ facing society and what is being done to address them. <em>Living with environmental change</em> is a key interdisciplinary research theme currently being addressed worldwide – from tackling climate change and carbon emissions to promoting sustainable resource use and energy efficiency. This module gives you an introduction to these key areas of research.</td>
</tr>
<tr>
<td>Marine biology: life in the seas and oceans</td>
<td>1</td>
<td>15</td>
<td>This module is designed to deliver an introduction to the diversity of life in the marine environment. It considers the range of living organisms in the oceans from microscopic plants and bacteria to whales, and explores some of the diverse mechanisms living organisms have adopted in order to meet the challenge of survival in the marine environment.</td>
</tr>
<tr>
<td>Marine ecosystems: diversity, processes and threats</td>
<td>2</td>
<td>15</td>
<td>Introduces the diversity of ecosystem types in the marine environment and the various threats that they face.</td>
</tr>
<tr>
<td>Mathematics for physicists I</td>
<td>1</td>
<td>15</td>
<td>Provides a foundation for the mathematics required by physical scientists.</td>
</tr>
<tr>
<td>Mathematics for physicists II</td>
<td>2</td>
<td>15</td>
<td>Consolidates and extends the understanding of mathematics required for the physical sciences.</td>
</tr>
<tr>
<td>Maths and physics for environmental scientists</td>
<td>1</td>
<td>15</td>
<td>This module provides an understanding of the basic maths and physics relevant to processes in the atmosphere, ocean and solid earth. It is particularly aimed at students without A level maths or equivalent.</td>
</tr>
<tr>
<td>Microbiology</td>
<td>2</td>
<td>15</td>
<td>Describes how microbes play crucial roles in maintaining the natural environment; the role of microbes in disease processes and how the immune system protects against infections; and the roles of microbes in biotechnological processes.</td>
</tr>
<tr>
<td>Molecules and cells</td>
<td>1</td>
<td>15</td>
<td>Explores the basic of structure, composition and function of cells and core concepts relating to the organisation and specialisation of eukaryotes, prokaryotes and viruses.</td>
</tr>
<tr>
<td>Newtonian dynamics</td>
<td>1</td>
<td>15</td>
<td>This module covers the fundamental concepts and principles of classical mechanics together with an introduction to the study of fluids. The use of elementary vector algebra in the context of mechanics is also introduced.</td>
</tr>
<tr>
<td>Quantitative skills for ecology and marine biology</td>
<td>1</td>
<td>15</td>
<td>This module aims to prepare students for the quantitative aspects of other parts of their degree programme.</td>
</tr>
<tr>
<td>Study skills</td>
<td>1 and 2</td>
<td>30</td>
<td>Delivered through small group tutorials, you will develop key academic skills such as how to produce effective essays, oral presentations and posters. This module also helps you start to develop skills such as CV writing and internship applications, which are important for future employment beyond your studies.</td>
</tr>
</tbody>
</table>

*Please note:* modules may not be available across all programmes, please check programme-specific module lists on pages 18-38.
Module title | Semester | Credit | Module description
--- | --- | --- | ---
Theory and laboratory experiments in earth surfaces processes | 2 | 15 | The module uses a lecture and laboratory-based problem-solving approach to explore some of the fundamental physical and chemical processes underlying physical geography. It provides a foundation for environmental and physical geography modules in Years Two and Three. It also aims to provide training in careful observation, appropriate handing of liquid and solid samples, and correct use of analytical instruments. Throughout there is emphasis on quality control via replication and reference materials, and appropriate use of descriptive and inferential statistics.

Thermal physics | 1 | 15 | Develop an understanding of the kinetic theory of gases. Introduces the terminology, concepts and logical structure of basic thermodynamics as far as the second law.

Wave phenomena | 2 | 15 | An introduction to the fundamental concepts of wave phenomena which will highlight the many diverse areas of physics in which an understanding of waves is crucial. The module will cover reflection, transmission, and superposition of waves leading to the concepts of interference and diffraction. In addition, it will address lenses, optical instruments, and the basic principles of lasers.

Please note: modules may not be available across all programmes, please check programme-specific module lists on pages 18-38.

Core and selected optional modules overview

Year Two

Module title | Semester | Credit | Module description
--- | --- | --- | ---
Animal behaviour | 1 | 15 | Provides an introduction to the fundamental evolutionary principles that explain a wide range of animal behaviours.

Biodiversity practical skills | 1 | 7.5 | Develop the ability to map taxonomic and evolutionary relationships; construct and use keys for taxonomy; dissect and observe the morphology of specific organ systems and demonstrate knowledge and understanding of the subject and to apply, evaluate and interpret this knowledge to solve problems in biology.

Catchment hydrology | 1 | 15 | This module investigates the main hydrological processes operating in drainage catchments in terms of their measurement, operation and controlling factors. The module provides ‘hands-on’ experience of observing hydrology and of modelling hydrological systems, with an emphasis on applied learning.

Changing environment | 1 | 15 | In this module, you will learn how climate and human activities have shaped our landscape, from micro-to-macro-scale. You will learn how we can reconstruct climatic conditions, landscape and vegetation from the past.

Classical mechanics | 2 | 15 | Provides an awareness of the physical principles that can be applied to understand important features of classical (ie non-quantum) mechanical systems.

Please note: modules may not be available across all programmes, please check programme-specific module lists on pages 18-38.
## Core and selected optional modules overview

### Year Two (continued)

<table>
<thead>
<tr>
<th>Module title</th>
<th>Semester</th>
<th>Credit</th>
<th>Module description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climatology</td>
<td>2</td>
<td>15</td>
<td>Explores meteorological processes and analysis of climate records. It covers topics such as hurricanes, drought, flooding, monsoonal systems, and the construction and utilisation of climate records.</td>
</tr>
<tr>
<td>Comparative animal physiology</td>
<td>2</td>
<td>15</td>
<td>Develop the ability to describe the physiological problems encountered by animals in their natural environments, and how they are overcome; relate lifestyle and physiology to habitat and to potentially hostile environment; demonstrate understanding of how increasing complexity of bodily organisation can lead to greater levels of bodily homeostasis; explains how the lifestyles of animals and their independence from environmental disturbance are critically linked to the management of energy flow through their bodies and elucidate physiological mechanisms at all levels of organisation, in relation to energetics, temperature, respiration, osmoregulation, and nitrogen excretion.</td>
</tr>
<tr>
<td>Condensed matter physics</td>
<td>1</td>
<td>15</td>
<td>Develop concepts introduced in Year One and Year Two modules which relate to solids.</td>
</tr>
<tr>
<td>Earth structure and plate tectonics</td>
<td>1</td>
<td>15</td>
<td>Introduces the structure and composition of the earth’s gravitational and magnetic fields, and dynamics within the deep earth.</td>
</tr>
<tr>
<td>Ecology practical skills</td>
<td>2</td>
<td>7.5</td>
<td>This practical module will provide you with an opportunity to experience and gain familiarity with a range of scientific, practical techniques that are used to study the terrestrial environment and its biota. Particular emphasis will be placed on acquiring an understanding the applicability of a wide range of survey/analytical techniques, as well as their limitations, and also post-practical handling of data and report preparation.</td>
</tr>
<tr>
<td>Electromagnetism</td>
<td>1</td>
<td>15</td>
<td>This module will cover electrostatics, magnetostatics, circuit analysis, electromagnetism and Maxwell's equations. This will lead on to electromagnetic waves and the concepts of field theories in physics using electromagnetism as an example.</td>
</tr>
<tr>
<td>Environmental geophysics</td>
<td>2</td>
<td>15</td>
<td>This module aims to build on theory taught through practical application of methods previously taught. In addition, fundamentals of remote sensing will be taught. The module will equip you with experience in a range of geophysical methods, carrying out surveys and associated data analysis and interpretation. How the various methods can be integrated will also be explored.</td>
</tr>
<tr>
<td>Environmental sustainability</td>
<td>1</td>
<td>15</td>
<td>This module introduces current thinking in relation to sustainable development and locates environmental sustainability within this broader framework of ideas.</td>
</tr>
</tbody>
</table>

Please note: modules may not be available across all programmes, please check programme-specific module lists on pages 18-38.
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<tr>
<th>Module title</th>
<th>Semester</th>
<th>Credit</th>
<th>Module description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evolutionary biology</td>
<td>1</td>
<td>15</td>
<td>Provides a modern framework for understanding how organisms evolve and the major transitions in evolution.</td>
</tr>
<tr>
<td>Exploration geophysics</td>
<td>1</td>
<td>15</td>
<td>Enables you to gain an understanding in the basic principles and practise of exploration geophysics.</td>
</tr>
<tr>
<td>Field mapping techniques</td>
<td>2</td>
<td>15</td>
<td>Trains you in the techniques required to make geological and geomorphological maps.</td>
</tr>
<tr>
<td>Geohazards, georesources and sustainability</td>
<td>1</td>
<td>15</td>
<td>Examines diverse natural hazards and their mitigation, along with the sustainable use of natural resources.</td>
</tr>
<tr>
<td>Geomorphology: ice, sea and air</td>
<td>2</td>
<td>15</td>
<td>Examines fundamental processes operating in glacial, coastal and aeolian environments and by learning how modern landscapes are described, analysed and interpreted.</td>
</tr>
<tr>
<td>Geophysical mathematics and potential theory</td>
<td>1 and 2</td>
<td>15</td>
<td>Provides mathematical training required for geophysical research.</td>
</tr>
<tr>
<td>Introduction to the methods of applied mathematics</td>
<td>2</td>
<td>15</td>
<td>Provides a grounding in elementary approaches to solution of some of the standard partial differential equations encountered in the applications of mathematics.</td>
</tr>
<tr>
<td>Key skills for environmental data analysis</td>
<td>1</td>
<td>15</td>
<td>This module provides data analysis skills to interrogate ocean and climate data sets. You will learn how to use an industry standard computing package, MATLAB, to process and plot data sets and critically review them.</td>
</tr>
<tr>
<td>Life in a dynamic ocean</td>
<td>1</td>
<td>15</td>
<td>Gain an appreciation of how ecosystems in the ocean are intricately linked to their physical fluid environment.</td>
</tr>
<tr>
<td>Marine Biology Year Two field course</td>
<td>1</td>
<td>15</td>
<td>This module aims to increase students’ knowledge of how to sample and identify a broad range of taxonomic groups common to inshore and coastal ecosystems.</td>
</tr>
<tr>
<td>Marine Ecology field studies</td>
<td>2</td>
<td>15</td>
<td>This module aims to increase students’ knowledge of how to study a broad range of coastal habitats and species. It will build knowledge and confidence in the ability to go on and undertake both field-based and laboratory based marine ecological research in their careers going forward.</td>
</tr>
<tr>
<td>Marine ecophysiology, ecology and exploitation</td>
<td>2</td>
<td>15</td>
<td>Provides students with essential background in marine ecology, ecophysiology and resource exploitation required for study at higher levels. Students will also develop the ability to evaluate and critique the scientific literature, as well as the ability to draw in relevant information from multiple topic areas to address.</td>
</tr>
<tr>
<td>Marine pollution</td>
<td>1</td>
<td>15</td>
<td>Marine systems are currently changing under a variety of stressors. A global increase of temperatures and increase of carbon dioxide in the atmosphere are affecting the chemistry, physics and biology of the marine systems at unprecedented rates. These changes are expected to accentuate in the coming decades. Local anthropogenic stressors such as excess nutrients, plastic debris, metals, radionuclides and other emerging contaminants are also affecting our coastal waters and beyond. This module will thus focus on the current state of our seas in relation to the various stressors.</td>
</tr>
</tbody>
</table>

**Please note:** modules may not be available across all programmes, please check programme-specific module lists on pages 18-38.
## Core and selected optional modules overview

### Year Two (continued)

<table>
<thead>
<tr>
<th>Module title</th>
<th>Semester</th>
<th>Credit</th>
<th>Module description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mathematics for physicists III</strong></td>
<td>1</td>
<td>15</td>
<td>Reinforces students’ prior knowledge of mathematical techniques and introduces new mathematical techniques for physics modules.</td>
</tr>
<tr>
<td><strong>Mathematics for physicists IV</strong></td>
<td>2</td>
<td>15</td>
<td>Builds on Mathematics for physicists III.</td>
</tr>
<tr>
<td><strong>Metals and metalloids of the P and D blocks</strong></td>
<td>2</td>
<td>15</td>
<td>An introduction to the coordination and organometallic chemistry of 3D transition P and D blocks metals, and will encompass theory, physical methods and descriptive chemistry.</td>
</tr>
<tr>
<td><strong>Metamorphism and crustal evolution</strong></td>
<td>2</td>
<td>15</td>
<td>Introduces metamorphic rocks and the ways in which they form, to develop observational skills in relation to metamorphic rocks, and to show how they relate to other parts of geology. To convey the detailed techniques used for studying mineral assemblages in metamorphic rocks, to illustrate these in relation to contact and regional metamorphic case studies, and to discuss the large scale patterns of metamorphic rocks in terms of burial, erosion and overprinting.</td>
</tr>
<tr>
<td><strong>Minerals, magmas and igneous geochemistry</strong></td>
<td>1</td>
<td>15</td>
<td>Introduces the petrological microscope, volcanic hazards awareness and principles of risk mitigation and the main rock forming minerals. Examines the origins of Earth’s magmas, igneous rocks and volcanoes and the physical processes of the main types of volcanic activity and the associated hazards. Finally, the modules considers the physical and chemical properties of magmas, how compositions of magmas are changed, and how magma emplacement history is recorded in rock texture.</td>
</tr>
<tr>
<td><strong>Nuclear and particle physics</strong></td>
<td>2</td>
<td>15</td>
<td>Introduces Rutherford and related scattering; nuclear size, mass and decay modes; particle physics, including interactions, reactions and decay and to provide some applications and examples of nuclear physics.</td>
</tr>
<tr>
<td><strong>Numerical methods</strong></td>
<td>2</td>
<td>15</td>
<td>Provides an introduction to the main topics in numerical analysis and their relation to other branches of mathematics.</td>
</tr>
<tr>
<td><strong>Oceanography of estuaries and shelf seas</strong></td>
<td>2</td>
<td>15</td>
<td>This module covers the oceanographic concepts needed to understand how coastal seas work, reaching from within estuaries, out across the shelf sea and to the shelf edge. Topics covered include circulation and transports in estuaries, estuaries as sources of nutrients to the ocean, waves and tides in coastal seas, the links between the physics, the plankton and important fisheries, and the reasons for coastal seas being so different to the open ocean.</td>
</tr>
</tbody>
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<tr>
<th>Module title</th>
<th>Semester</th>
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</thead>
<tbody>
<tr>
<td>Ordinary differential equations</td>
<td>1</td>
<td>15</td>
<td>Familiarises students with basic ideas and fundamental techniques to solve ordinary differential equations.</td>
</tr>
<tr>
<td>Organic chemistry II</td>
<td>1</td>
<td>15</td>
<td>Introduces important carbon-carbon bond forming reactions within a mechanistic and synthetic framework, together with exposure to a selection of stereochemical issues.</td>
</tr>
<tr>
<td>Petroleum geology and applied basin analysis (field class)</td>
<td>1 and 2</td>
<td>15</td>
<td>Provides an appreciation of the geological controls on a basin-scale petroleum system (The Wessex basin, South England) and related significant economic issues in sedimentary basins.</td>
</tr>
<tr>
<td>Physical chemistry II</td>
<td>1 and 2</td>
<td>15</td>
<td>Explains the application of the 1st and 2nd laws of thermodynamics to chemical reactions.</td>
</tr>
<tr>
<td>Population and community ecology</td>
<td>2</td>
<td>15</td>
<td>Introduces the concepts and principles underlying the dynamic interactions between species within communities and populations.</td>
</tr>
<tr>
<td>Preparative chemistry: synthesis and characterisation</td>
<td>1</td>
<td>15</td>
<td>Presents a unified approach to the synthesis and characterisation of organic and inorganic compounds and will build on techniques introduced in the first year.</td>
</tr>
<tr>
<td>Principles and theory in geography</td>
<td>1</td>
<td>15</td>
<td>Develop a critical and reflexive sense of the nature of geography as a dynamic, plural and contested discipline.</td>
</tr>
<tr>
<td>Quantum and atomic physics</td>
<td>2</td>
<td>15</td>
<td>Develop an understanding of the role of wave functions, operators, eigenvalue equations, symmetries, compatibility/non-compatibility of observables and perturbation theory in quantum mechanical theory.</td>
</tr>
<tr>
<td>Research skills (Geoscience)</td>
<td>1 and 2</td>
<td>15</td>
<td>Delivered through a tutorial-based system alongside a lecture series this module develops keys skills in research design and implementation – including data collection techniques and analysis.</td>
</tr>
<tr>
<td>Sampling the ocean</td>
<td>2</td>
<td>15</td>
<td>Provides an understanding of the methods used to measure and analyse the physical, biological and chemical quantities in the ocean. You will gain hands on experience of sampling, sample processing and analysis during fieldwork.</td>
</tr>
<tr>
<td>Sedimentary processes and sequences</td>
<td>1</td>
<td>15</td>
<td>Addresses aspects of physical, chemical and biological processes of sedimentation in the context of the depositional settings in which they operate. To provide the necessary background for understanding the significance of structures and textures preserved in sedimentary rocks and the skills necessary to gather and analyse information that allows well constrained interpretations of depositional environments to be made in the rock record.</td>
</tr>
<tr>
<td>Seismology and computing</td>
<td>2</td>
<td>15</td>
<td>Gives an understanding of the fundamentals of theoretical and observational seismology. Introduces basic MATLAB programming and the ability to analyse various seismological data sets.</td>
</tr>
<tr>
<td>Soils, slopes and the environment</td>
<td>2</td>
<td>15</td>
<td>This module introduces pure and applied soil science. It covers themes such as components of soil, pedogenic processes, soil profiles, and soil classification.</td>
</tr>
</tbody>
</table>

Please note: modules may not be available across all programmes, please check programme-specific module lists on pages 18-38.
## Core and selected optional modules overview

### Year Two (continued)

<table>
<thead>
<tr>
<th>Module title</th>
<th>Semester</th>
<th>Credit</th>
<th>Module description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statistics for environmental scientists</td>
<td>1</td>
<td>15</td>
<td>Provides training in statistics for environmental scientists. It aims to give students an understanding of the statistical terms that appear in scientific papers and the media, and to enable you to be able to choose appropriate statistical tests, use statistical software, and summarise data using graphs, tables and numerical summaries. The module teaches the essential theory alongside the practical components.</td>
</tr>
<tr>
<td>Structural geology and interpretation of geological maps</td>
<td>2</td>
<td>15</td>
<td>Develop an understanding of the geometric, kinematic and temporal relationships between similar and dissimilar structures and of the role of finite strain in geological structures.</td>
</tr>
<tr>
<td>Thermal physics</td>
<td>1</td>
<td>15</td>
<td>Develop an understanding of the kinetic theory of gases. Introduces the terminology, concepts and logical structure of basic thermodynamics as far as the second law.</td>
</tr>
<tr>
<td>Understanding marine and terrestrial spatial ecology using GIS</td>
<td>2</td>
<td>15</td>
<td>Introduces the nature, operation and application of Geographical Information Systems (GIS) relevant to ecologists, environmental managers and marine biologists. Issues surrounding data and acquisition, integration and spatial analyses will be explored through practical work, whilst relevant applications in the three areas will be informed through the review of published material.</td>
</tr>
<tr>
<td>Vector calculus with applications in fluid mechanics</td>
<td>1</td>
<td>15</td>
<td>Provides an understanding of the various vector integrals, the operators div, grad and curl and the relations between them. Gives an appreciation of the many applications of vector calculus to physical situations. Provides an introduction to the subjects of fluid mechanics and electromagnetism.</td>
</tr>
</tbody>
</table>

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## Core and selected optional modules overview

### Year Three

<table>
<thead>
<tr>
<th>Module title</th>
<th>Semester</th>
<th>Credit</th>
<th>Module description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced electromagnetism</td>
<td>2</td>
<td>15</td>
<td>Builds on Year One and Two modules on electricity, magnetism and waves.</td>
</tr>
<tr>
<td>Advanced geology field techniques</td>
<td>1</td>
<td>15</td>
<td>This module develops your capability for detailed and sophisticated field analysis of sedimentary, igneous and metamorphic rocks in the field.</td>
</tr>
<tr>
<td>Advanced structural geology</td>
<td>2</td>
<td>15</td>
<td>Dynamic analysis of the mechanics of geological structures.</td>
</tr>
<tr>
<td>Advanced topics in ecology</td>
<td>1</td>
<td>15</td>
<td>Describes modern approaches to long-standing ecological issues.</td>
</tr>
<tr>
<td>Applied basin analysis</td>
<td>1 and 2</td>
<td>15</td>
<td>Provides an appreciation of the geological controls on a basin-scale petroleum system (the Wessex Basin, S England) and related significant economic issues in sedimentary basins.</td>
</tr>
<tr>
<td>Chaos and dynamical systems</td>
<td>2</td>
<td>15</td>
<td>Develop expertise in dynamical systems in general and study particular systems in detail.</td>
</tr>
<tr>
<td>Chemical database skills</td>
<td>1</td>
<td>7.5</td>
<td>Introduces chemical database skills and molecular modelling through lectures and computer based workshop sessions.</td>
</tr>
<tr>
<td>Climate change: a critical review</td>
<td>2</td>
<td>15</td>
<td>Provides you with the knowledge to evaluate the likely outcomes of climate change and climate variability over the next 100 years, to understand policy decisions at different levels, to obtain a critical understanding of climate predictions, and to understand the importance of reference to past and present climates.</td>
</tr>
<tr>
<td>Coastal environments: spatial and temporal change</td>
<td>1</td>
<td>15</td>
<td>Examines how coastal geomorphology, sedimentary and biological systems and socio-economic infrastructures will respond to changes in sea-level and climate.</td>
</tr>
<tr>
<td>Contemporary issues in ecology and marine biology</td>
<td>1 and 2</td>
<td>30</td>
<td>This module aims to develop a number of skills, attributes and experiences required by graduates in ecology and marine biology.</td>
</tr>
<tr>
<td>Conservation biology</td>
<td>1</td>
<td>15</td>
<td>Explores patterns of biodiversity and encourages you to critically evaluate the evidence that explains the demise of animal and plant species.</td>
</tr>
<tr>
<td>Crust and mantle evolution</td>
<td>2</td>
<td>15</td>
<td>Integrates understanding of large and small scale processes in crust and mantle evolution.</td>
</tr>
<tr>
<td>Crust and mantle evolution and geodynamics (field class)</td>
<td>2</td>
<td>15</td>
<td>In-depth appraisal of models concerned with orogenic evolution: structural, metamorphic, geophysical and sedimentological. NW Spain Variscan geotraverse as the case study. Particular emphasis concerns appreciation of interrelations of theoretical, experimental and observationally based modelling.</td>
</tr>
<tr>
<td>Current skills and topics in evolutionary biology</td>
<td>2</td>
<td>15</td>
<td>An exploration of current thinking in the field of evolution, with a focus on phenotypic plasticity and gene-environment interactions.</td>
</tr>
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</thead>
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<tr>
<td>Current topics in animal behaviour</td>
<td>2</td>
<td>15</td>
<td>Further develops the use of evolutionary theory to explain aspects of animal behaviour, including a focus on the adaptationist approach.</td>
</tr>
<tr>
<td>Earth structure and rock deformation</td>
<td>2</td>
<td>15</td>
<td>Provides an understanding of the principles and mechanisms of rock deformation throughout the crust, including the theory of homogeneous stress in two-dimensions, brittle fracture, rock friction, diffuse mass transfer and intracrystalline plastic flow.</td>
</tr>
<tr>
<td>Engineering geology and hydrogeology</td>
<td>1</td>
<td>15</td>
<td>Provides a sound theoretical framework from and within which the strategies, methods and procedures used in engineering geology can be developed and understood.</td>
</tr>
<tr>
<td>Environmental geophysics</td>
<td>2</td>
<td>15</td>
<td>This module aims to build on theory taught through practical application of methods previously taught. In addition, fundamentals of remote sensing will be taught. The module will equip you with experience in a range of geophysical methods, carrying out surveys and associated data analysis and interpretation. How the various methods can be integrated will also be explored.</td>
</tr>
<tr>
<td>Exploration geophysics and signal processing</td>
<td>1</td>
<td>15</td>
<td>Develop your ability to undertake signal processing and exploration seismology in an industrial or research environment.</td>
</tr>
<tr>
<td>Evolutionary palaeobiology</td>
<td>2</td>
<td>15</td>
<td>Introduces evolutionary theory and how fossils contribute to the study of evolution. Provides an overview of the most important events in the evolution of life on earth.</td>
</tr>
<tr>
<td>Field project and dissertation</td>
<td>1</td>
<td>30</td>
<td>You will complete an independent geological mapping project involving creation of a geological and/or geomorphological map, completion of a field and laboratory notebook and submission of a final dissertation together with a final map constructed from the field maps.</td>
</tr>
<tr>
<td>Fluvial environments</td>
<td>2</td>
<td>15</td>
<td>Examines the main components of the fluvial system, and develops an understanding of the dynamics and controls on water and sediment flux and how these produce different types of landforms.</td>
</tr>
<tr>
<td>Further methods of applied mathematics</td>
<td>1</td>
<td>15</td>
<td>Gives an insight into some specific methods for solving important types of ordinary differential equations. Provides a basic understanding of the Calculus of Variations and to illustrate the techniques using simple examples in a variety of areas in mathematics and physics.</td>
</tr>
<tr>
<td>Geoarchaeology</td>
<td>2</td>
<td>15</td>
<td>Provides an understanding the principles and methods of the application of the earth sciences in archaeological investigations.</td>
</tr>
<tr>
<td>Geodynamics of the Mediterranean</td>
<td>2</td>
<td>15</td>
<td>Explores the geodynamic synthesis of the sedimentary basin evolution from tectonic Mediterranean origins (basin-forming mechanisms) to F710 sedimentary sequences (basin-filling) to uplift (tectonic inversion) and dissection (erosion of basin-fill).</td>
</tr>
</tbody>
</table>

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</thead>
<tbody>
<tr>
<td>Geographies of energy and natural resources</td>
<td>2</td>
<td>15</td>
<td>Explores geographical approaches to energy and natural resources, including agriculture, energy, marine, and waste resources. It considers how technology, governance, and stewardship may offer solutions to these complex issues.</td>
</tr>
<tr>
<td>Geophysical exploration techniques</td>
<td>1</td>
<td>15</td>
<td>Provides an understanding of the application of geophysical theory to exploration and engineering targets and practical use and evaluation of geophysical instrumentation, data acquisition, processing and interpretation.</td>
</tr>
<tr>
<td>Geophysical data modelling</td>
<td>1</td>
<td>15</td>
<td>This module allows you to develop the ability to create geophysical models from data and gives you practical experience in inversion of mathematically linear problems, with knowledge of how to approach more general nonlinear problems. To also gain an understanding of the limitations of such models, and how they should be interpreted, with particular reference to model non-uniqueness and instability, optimisation theory, and its application to interpretation of geophysical models and time series analysis with non-Fourier methods.</td>
</tr>
<tr>
<td>Geophysical project</td>
<td>1 and 2</td>
<td>30</td>
<td>Provides research level training in a specific geophysical subject area.</td>
</tr>
<tr>
<td>Global carbon cycle</td>
<td>2</td>
<td>15</td>
<td>Develop a fundamental understanding of the cycling of carbon in the Earth system including the behaviour of carbon dioxide in the atmosphere, the transfer and storage of carbon on land and in the ocean and role of plants on land and in the sea on influencing the distribution of carbon.</td>
</tr>
<tr>
<td>Honours project: ecology and environment/marine biology</td>
<td>1 and 2</td>
<td>30</td>
<td>Provides individual experience in the planning, design and execution of a research project in a defined topic that may be based on laboratory work, field work, data analysis, or modelling.</td>
</tr>
<tr>
<td>Human-environmental interactions</td>
<td>1</td>
<td>15</td>
<td>This module aims to demonstrate and review how successful management of modern and future landscapes often requires a long time perspective.</td>
</tr>
<tr>
<td>Inorganic applications of group theory</td>
<td>2</td>
<td>7.5</td>
<td>Demonstrates the underlying importance of symmetry throughout Chemistry, with particular applications to spectroscopic selection rules and bonding.</td>
</tr>
<tr>
<td>Inorganic chemistry III</td>
<td>1</td>
<td>15</td>
<td>Gives an understanding of how ligand field and other factors help determine both the (Chemistry rate and the mechanism of ligand exchange route only) for a given metal ion.</td>
</tr>
<tr>
<td>Integrative comparative animal physiology</td>
<td>1</td>
<td>15</td>
<td>Develops your understanding of the physiological mechanisms that underpin adaptations to environmental conditions.</td>
</tr>
<tr>
<td>Life in a dynamic ocean</td>
<td>1</td>
<td>15</td>
<td>Gain an appreciation of how ecosystems in the ocean are intricately linked to their physical fluid environment.</td>
</tr>
<tr>
<td>Marine ecology: theory and applications</td>
<td>2</td>
<td>15</td>
<td>Develop the connections between ecological theory and the management of marine communities and ecosystems. The theory covered will mostly be concerned with the dynamics and diversity of communities and ecosystems.</td>
</tr>
<tr>
<td>Marine sciences: special topics</td>
<td>1 and 2</td>
<td>15</td>
<td>Introduces and discusses the most topical research issues in marine science, drawing on articles published in high profile journals such as Nature, Science and Nature Geoscience.</td>
</tr>
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</table>

Please note: modules may not be available across all programmes, please check programme-specific module lists on pages 18-38.
### Core and selected optional modules overview

#### Year Three (continued)

<table>
<thead>
<tr>
<th>Module title</th>
<th>Semester</th>
<th>Credit</th>
<th>Module description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metamorphism and crustal evolution</td>
<td>1</td>
<td>15</td>
<td>Introduces metamorphic rocks and the ways in which they form, to develop observational skills in relation to F660 metamorphic rocks, and to show how they relate to other parts of geology. To convey the detailed techniques used for studying mineral assemblages in metamorphic rocks, to illustrate these in relation to contact and regional metamorphic case studies, and to discuss the large scale patterns of metamorphic rocks in terms of burial, erosion and overprinting.</td>
</tr>
<tr>
<td>Mineral deposits in space and time</td>
<td>1</td>
<td>15</td>
<td>Provides an understanding of major types of mineral deposits through critical assessment of conceptual models of deposit forming processes.</td>
</tr>
<tr>
<td>Natural hazards and society</td>
<td>1</td>
<td>15</td>
<td>Provides an integrated perspective on a variety of natural hazards. It explores the different levels of impact on human societies, and the mitigation/adaptation strategies adopted before, during and after extreme natural events.</td>
</tr>
<tr>
<td>Nuclear and particle physics</td>
<td>2</td>
<td>15</td>
<td>Introduces Rutherford and related scattering; nuclear size, mass and decay modes; particle physics, including interactions, reactions and decay and to provide some applications and examples of nuclear physics.</td>
</tr>
<tr>
<td>Nuclear physics</td>
<td>1</td>
<td>7.5</td>
<td>This module will take a detailed look at the bulk properties of nuclei, nuclear instability, and nuclear interactions, together with nuclear structure models and electromagnetic nuclear properties.</td>
</tr>
<tr>
<td>Ocean dynamics</td>
<td>1</td>
<td>15</td>
<td>Develop your understanding of how physical processes operate in the ocean, including the open ocean and shelf seas, as well as how analogous phenomena in the atmosphere behave.</td>
</tr>
<tr>
<td>Ocean sciences research project</td>
<td>1 and 2</td>
<td>30</td>
<td>Develop skills in all aspects of research in ocean sciences via an in-depth individual project supervised by a member of academic staff or scientist from the National Oceanography Centre.</td>
</tr>
<tr>
<td>Organic chemistry III</td>
<td>1</td>
<td>15</td>
<td>Consolidates and extends Year Two knowledge of synthetic and physical organic chemistry, and introduce aspects of biological chemistry.</td>
</tr>
<tr>
<td>Petroleum geology</td>
<td>1</td>
<td>15</td>
<td>This module provides students with suitable background to the concepts used by the petroleum industry.</td>
</tr>
<tr>
<td>Petroleum geology and applied basin analysis (field class)</td>
<td>1 and 2</td>
<td>15</td>
<td>Provides an appreciation of the geological controls on a basin scale petroleum system (The Wessex basin, South England) and related significant economic issues in sedimentary basins.</td>
</tr>
<tr>
<td>Physics of life</td>
<td>2</td>
<td>7.5</td>
<td>Will explain the constraints on the physical forces which are necessary for life to evolve in the Universe. The module will describe the characteristics of life on earth, and cover the physical techniques used in the study biological systems. Topics include the molecular basis of life, the genetic code and the chirality of life, thermodynamic considerations and self-organisation in chemical systems.</td>
</tr>
</tbody>
</table>

**Please note:** modules may not be available across all programmes, please check programme-specific module lists on pages 18-38.
<table>
<thead>
<tr>
<th>Module title</th>
<th>Semester</th>
<th>Credit</th>
<th>Module description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planetary geophysics</td>
<td>2</td>
<td>15</td>
<td>Provides a detailed and comprehensive understanding of the structure, composition and dynamic behaviour of the Earth and an appreciation of the way multiple geophysical disciplines combine to contribute to our understanding of the Earth and solar system. Further, it provides awareness of research frontiers in the subject area and the activities underway to advance these.</td>
</tr>
<tr>
<td>Population dynamics</td>
<td>1</td>
<td>15</td>
<td>Provides a theoretical basis for the understanding of population ecology; explores classical models of population dynamics and basic techniques of qualitative analysis of mathematical models.</td>
</tr>
<tr>
<td>Quantitative tectonics</td>
<td>1</td>
<td>15</td>
<td>Explores lithospheric-scale active tectonics, and the ability to carry out mathematical calculations to understand and analyse tectonic processes.</td>
</tr>
<tr>
<td>Science communication</td>
<td>1 and 2</td>
<td>15</td>
<td>You will learn about science communication and then prepare and deliver practical science workshops to local schools (primary and secondary).</td>
</tr>
<tr>
<td>Sea practical</td>
<td>1</td>
<td>30</td>
<td>The aim of this module is to teach basic field skills in laboratory work and ship work.</td>
</tr>
<tr>
<td>Sedimentary processes and sequences</td>
<td>1</td>
<td>15</td>
<td>Addresses aspects of physical, chemical and biological processes of sedimentation in the context of the depositional settings in which they operate. To provide the necessary background for understanding the significance of structures and textures preserved in sedimentary rocks and the skills necessary to gather and analyse information that allows well constrained interpretations of depositional environments to be made in the rock record.</td>
</tr>
<tr>
<td>Seismology and computing</td>
<td>2</td>
<td>15</td>
<td>Provides an understanding of the fundamentals of theoretical and observational seismology.</td>
</tr>
<tr>
<td>Surviving the marine environment: adaptation,</td>
<td>1</td>
<td>15</td>
<td>Fosters a broad understanding of contemporary theory in behavioural ecology, evolutionary biology and conservation, with special reference to the marine environment, by providing: knowledge of adaptational and life history strategies used by animals during inter- and intraspecific competition; understanding of the evolutionary implications of gene flow in the marine environment and the variety of mechanisms that drive evolutionary processes, from individual adaptation to speciation and knowledge of how these issues relate to contemporary themes in conservation biology and experimental marine biology.</td>
</tr>
<tr>
<td>Volcanoes, earthquakes and tsunami geophysics</td>
<td>2</td>
<td>15</td>
<td>Provides you with a thorough understanding of the challenges and tsunami practices in collecting and analysing geophysical time series.</td>
</tr>
<tr>
<td>Volcanology</td>
<td>1</td>
<td>15</td>
<td>Introduces the nature of volcanoes, volcanic rocks and methods of volcanic monitoring.</td>
</tr>
<tr>
<td>Volcanology and volcanic processes (field class)</td>
<td>2</td>
<td>15</td>
<td>Examines and evaluates the state-of-the-art aspects of advanced modern volcanology, particularly where there has been recent innovation, controversy or popular concern. This involves field teaching for Geology (F601) students and study of a popular-science aspect for Geophysics students (F641 etc.)</td>
</tr>
</tbody>
</table>
## Core and selected optional modules overview

### Year Four

<table>
<thead>
<tr>
<th>Module title</th>
<th>Semester</th>
<th>Credit</th>
<th>Module description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced conservation biology</td>
<td>2</td>
<td>15</td>
<td>Develop an understanding of the strategies used in conservation planning, in situ, ex situ and from global to local through a series of case studies.</td>
</tr>
<tr>
<td>Advanced ecology</td>
<td>1</td>
<td>15</td>
<td>Provides you with a clear and critical appreciation of ecological theory, information on statistical methods appropriate to community ecology, the ability to use scientific rigour when critically assessing the options available for conservation action in any given case, the ability to present balanced and critical written accounts on scientific issues.</td>
</tr>
<tr>
<td>Advanced geology and geology-physical geography project</td>
<td>1 and 2</td>
<td>45</td>
<td>This is the master's level Independent research project. The module entails the production of a literature review paper relevant to each individual project; a talk to communicate the research undertaken to a mixed audience of UGs, PGTs, Postdocs and Academic staff; and the final dissertation in manuscript format.</td>
</tr>
<tr>
<td>Advanced statistics for biological research</td>
<td>1</td>
<td>15</td>
<td>Introduces analysis and techniques in the 'R' statistical environment, the industry standard for the biological sciences.</td>
</tr>
<tr>
<td>Advanced structural geology</td>
<td>2</td>
<td>15</td>
<td>Dynamic analysis of the mechanics of geological structures.</td>
</tr>
<tr>
<td>Applied basin analysis (field class)</td>
<td>1 and 2</td>
<td>15</td>
<td>Provides an appreciation of the geological controls on a basin-scale petroleum system (the Wessex Basin, S England) and related significant economic issues in sedimentary basins.</td>
</tr>
<tr>
<td>Climate processes and variability</td>
<td>2</td>
<td>15</td>
<td>Introduces techniques and major research themes in variations and drivers of the global climate system.</td>
</tr>
<tr>
<td>Conservation and resource management field course</td>
<td>1</td>
<td>15</td>
<td>A one-week field course to the Lake District where students will carry out an ecosystem assessment and evaluation using appropriate industry-recognised standards.</td>
</tr>
<tr>
<td>Crust and mantle evolution</td>
<td>2</td>
<td>15</td>
<td>Students gain an understanding of large and small scale processes in crust and mantle evolution.</td>
</tr>
<tr>
<td>Dynamic population modelling</td>
<td>1</td>
<td>15</td>
<td>Provides you with a working knowledge of how to apply numeric modelling techniques to biological problems. The module will introduce the modelling programme STELLA, as a relatively simple tool for numeric modelling. The module will focus on examples from aquatic and terrestrial food webs but the concepts and techniques examined will be applicable to a wide range of biological situations.</td>
</tr>
<tr>
<td>Earth structure and rock deformation</td>
<td>2</td>
<td>15</td>
<td>Provides an understanding of the principles and mechanisms of rock deformation throughout the crust, including the theory of homogeneous stress in two-dimensions, brittle fracture, rock friction, diffuse mass transfer and intracrystalline plastic flow.</td>
</tr>
<tr>
<td>Engineering geology and hydrogeology</td>
<td>1</td>
<td>15</td>
<td>Provides sound theoretical frameworks from and within which the strategies, methods and procedures used in engineering geology and hydrogeology can be developed and understood.</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>Module title</th>
<th>Semester</th>
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<th>Module description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evolutionary palaeobiology</td>
<td>2</td>
<td>15</td>
<td>Introduces evolutionary theory and how fossils contribute to the study of evolution. Provides an overview of the most important events in the evolution of life on earth.</td>
</tr>
<tr>
<td>Exploration geophysics and signal processing</td>
<td>1</td>
<td>15</td>
<td>Develops your ability to undertake signal processing and exploration seismology in an industrial or research environment.</td>
</tr>
<tr>
<td>From sampling to models in ocean biogeochemistry</td>
<td>1</td>
<td>15</td>
<td>Key biogeochemical concepts will be explored in laboratory and/or field experiments in order to appreciate how parameters, such as growth or nutrient uptake rates, are represented in biogeochemical models. Analyses will be performed using research-grade equipment and there will be a focus on experimental design and representation of natural variability and errors in models.</td>
</tr>
<tr>
<td>Geoarchaeology</td>
<td>2</td>
<td>15</td>
<td>Provides an understanding of the principles and methods of archaeological sciences in archaeological investigations.</td>
</tr>
<tr>
<td>Geodynamics (field class)</td>
<td>2</td>
<td>15</td>
<td>In-depth appraisal of models concerned with orogenic evolution: structural, metamorphic, geophysical and sedimentological. NW Spain Variscan geotraverse as the case study. Particular emphasis concerns appreciation of inter-relations of theoretical, experimental and observationally based modelling.</td>
</tr>
<tr>
<td>Geographic information science</td>
<td>1</td>
<td>15</td>
<td>Provides an understanding of how digital representations of the real world can be created within a GIS including the referencing of geographic features.</td>
</tr>
<tr>
<td>Geophysical data modelling</td>
<td>1</td>
<td>15</td>
<td>Develop the ability to create geophysical models from data and gives you practical experience in inversion of mathematically linear problems, with knowledge of how to approach more general nonlinear problems. Also offers an understanding of the limitations of such models, and how they should be interpreted, with particular reference to model non-uniqueness and instability, optimisation theory, and its application to interpretation of geophysical models and time series analysis with non-Fourier methods.</td>
</tr>
<tr>
<td>Geophysical exploration techniques</td>
<td>1</td>
<td>15</td>
<td>Provides an understanding of the application of geophysical theory to exploration and engineering targets and practical use and evaluation of geophysical instrumentation, data acquisition, processing and interpretation.</td>
</tr>
<tr>
<td>Geophysical project (M level)</td>
<td>1 and 2</td>
<td>30</td>
<td>Provides a research level training in a specific geophysical subject area.</td>
</tr>
<tr>
<td>Geophysical exploration techniques</td>
<td>1</td>
<td>15</td>
<td>Provides an understanding of the application of geophysical theory to exploration and engineering targets and practical use and evaluation of geophysical instrumentation, data acquisition, processing and interpretation.</td>
</tr>
<tr>
<td>Geophysical project (M level)</td>
<td>1 and 2</td>
<td>30</td>
<td>Provides a research level training in a specific geophysical subject area.</td>
</tr>
<tr>
<td>Global carbon cycle</td>
<td>2</td>
<td>15</td>
<td>Develop a fundamental understanding of the cycling of carbon in the Earth system including the behaviour of carbon dioxide in the atmosphere, the transfer and storage of carbon on land and in the ocean and role of plants on land and in the sea on influencing the distribution of carbon.</td>
</tr>
<tr>
<td>Human impacts on environments</td>
<td>1</td>
<td>15</td>
<td>Develop your thoughts and perspectives on a wide range of potential human impacts on the environment. This module uses a series of lectures/seminars in the early weeks of the course from a range of staff from across the school, providing different perspectives on human impacts in the environment within their specific discipline. The second part of the module requires you to identify and develop their own interests in a particular case study. This is then developed and the results of this work presented to the peer group and staff during a poster day.</td>
</tr>
</tbody>
</table>

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Continued over...
Core and selected optional modules overview

**Year Four (continued)**

<table>
<thead>
<tr>
<th>Module title</th>
<th>Semester</th>
<th>Credit</th>
<th>Module description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integrated master's research project</td>
<td>1 and 2</td>
<td>60</td>
<td>You will carry out an individual research project, building on the knowledge and skills acquired elsewhere in the programme. The project module consists of a literature review conducted during Semester One, followed by the research project through Semester Two.</td>
</tr>
<tr>
<td>Laboratory methods and techniques in environmental reconstructions</td>
<td>1</td>
<td>30</td>
<td>This module uses laboratory-based practical sessions; seminars and group discussions to: outline the principles of the application of radiometric, granulometric, rock magnetic, reconstructions bio and geochemical, and macro and microfossil analytical techniques to palaeoenvironmental reconstruction; to teach the practical laboratory measurement and analysis of the above and to introduce the theory and practice of methods of advanced data presentation and analysis.</td>
</tr>
<tr>
<td>Marine planning and management</td>
<td>2</td>
<td>15</td>
<td>You will apply marine planning and management concepts and techniques in a group project with an industry partner to simulate a planning exercise.</td>
</tr>
<tr>
<td>Master's project</td>
<td>1 and 2</td>
<td>60</td>
<td>An in-depth research project worth 50% of the master's year marks. Advanced training in research methods will be given as you work as active members of an academic research group.</td>
</tr>
<tr>
<td>Mastering marine biology</td>
<td>1 and 2</td>
<td>15</td>
<td>Student-led group sessions, supported by tutorials, allow students to further develop their research skills and interests in current topics in Marine Biology through a grant-writing exercise and extended essay.</td>
</tr>
<tr>
<td>Mineral deposits in space and time (M level)</td>
<td>1</td>
<td>15</td>
<td>Provides an understanding of major types of mineral deposits through critical assessment of conceptual models of deposit forming processes.</td>
</tr>
<tr>
<td>Modelling processes in oceans and climate</td>
<td>1</td>
<td>15</td>
<td>Develop skills to build simple numerical models to address ocean and climate problems, including mixing and cycling of nutrients in the water column and how carbon and heat are exchanges between the atmosphere and ocean.</td>
</tr>
<tr>
<td>Petroleum geology</td>
<td>1</td>
<td>15</td>
<td>Provides students with a suitable background to the concepts used by the petroleum industry.</td>
</tr>
<tr>
<td>Planetary geophysics (M level)</td>
<td>2</td>
<td>15</td>
<td>Provides a detailed and comprehensive understanding of the structure, composition and dynamic behaviour of the Earth and an appreciation of the way multiple geophysical disciplines combine to contribute to our understanding of the Earth and solar system.</td>
</tr>
<tr>
<td>Politics of the environment</td>
<td>1</td>
<td>15</td>
<td>Critically evaluates the political responses to the growing impact that environmental issues and the concept of sustainability are having on decision making at all levels of governance, (international, national and local).</td>
</tr>
<tr>
<td>Quantitative tectonics</td>
<td>1</td>
<td>15</td>
<td>Explores lithospheric-scale active tectonics, and the ability to carry out mathematical calculations to understand and analyse tectonic processes.</td>
</tr>
</tbody>
</table>

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<th>Credit</th>
<th>Module description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research methods</td>
<td>1</td>
<td>15</td>
<td>This module involves seminars and technique-related workshops, in which you acquire the necessary knowledge and skills related to scientific practice and communication. You will take a series of workshops to learn how to use various analytical techniques and interpret the data from these techniques, which will be used in your independent project.</td>
</tr>
<tr>
<td>Science communication</td>
<td>1 and 2</td>
<td>15</td>
<td>Provides key transferable skills to undergraduates such as communication, presentation, practical classroom skills and team work.</td>
</tr>
<tr>
<td>Sea level: and coastal flooding</td>
<td>1</td>
<td>15</td>
<td>What is sea level? How do we measure it? How and why does it vary? This module provides you with an understanding of the meaning of sea level, methods of measuring it, and the causes of its variations both in space and in time, from waves and tides to storm surges, ocean circulation and geophysical processes, on time scales of hours to multi-millennial periods. At the end, you will be equipped to critically read and assess the rapidly evolving literature on sea level variability, and to identify the cutting edge scientific questions.</td>
</tr>
<tr>
<td>Seismology and computing</td>
<td>2</td>
<td>15</td>
<td>Provides an understanding of the fundamentals of theoretical and observational seismology.</td>
</tr>
<tr>
<td>Tackling environmental issues</td>
<td>2</td>
<td>15</td>
<td>Enables students to develop the skills to research key environmental issues.</td>
</tr>
<tr>
<td>Volcanic processes (field class)</td>
<td>2</td>
<td>15</td>
<td>Examines and evaluates the state-of-the-art aspects of advanced modern volcanology, particularly where there has been recent innovation, controversy or popular concern. This involves field teaching for Geology (F601) students and study of a popular-science aspect for Geophysics students (F641 etc.).</td>
</tr>
<tr>
<td>Volcanoes, earthquakes and tsunami geophysics</td>
<td>2</td>
<td>15</td>
<td>Provides a thorough understanding of the challenges and tsunami practices in collecting and analysing geophysics geophysical time series.</td>
</tr>
<tr>
<td>Volcanology</td>
<td>1</td>
<td>15</td>
<td>Introduces the nature of volcanoes, volcanic rocks and methods of volcanic monitoring.</td>
</tr>
</tbody>
</table>

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