LINK TO SOTON MER WEBSITE

University of Southampton

SEMESTERS 1 & 3

COURSE	ECTS	TYPE
Introduction to Biological Oceanography	3.75	CSS1
Introduction to Chemical Oceanography	3.75	CSS1
Introduction to Marine Geology	3.75	CSS1
Introductory Physical Oceanography	3.75	CSS1
Applied and Marine Geophysics	7.5	OPT
Biogeochemical Cycles in the Earth System	7.5	OPT
Coastal Sediment Dynamics	7.5	OPT
Computational Data Analysis for Geophysicists and Ocean Scientists	7.5	OPT
Contemporary Topics in Ocean and Earth Sciences	7.5	OPT
Deep Sea Ecology	7.5	OPT
Geodynamics and Solid Earth Geophysics	7.5	OPT
Introductory Remote Sensing of the Oceans	7.5	OPT
Large-scale Ocean Processes	7.5	OPT
Marine Conservation and Policy	7.5	OPT
Marine GeoArchaeology	7.5	OPT
Microfossils, Environment and Time	7.5	OPT
Zooplankton Ecology and Processes	7.5	OPT

CSS1: Compulsory at Soton Semester 1

OPT: Optional at SOTON in both Semester 1 and Semester 3

NOTE: Some courses may be not offered every academic year

Course/Unit	Introduction to Biological Oceanography
MER Code	MER SOES 6013
ECTS	3.75
Level	Compulsory (Soton) - Semester 1
Semester	1
Timetable slot	To be advised
Teaching Staff	T Bibby (Coord.)
Synopsis	Introduction to general ecological principles relating to the ocean and description of the ocean environment.
Aims	• To provide a basic understanding of the biological processes in the water and how these are affected by the ambient physicochemical conditions.
Objectives At the end of the Unit, the student should:	• At the end of the unit you should be able to understand the biological oceanography of the pelagic ecosystem.
Key Skills Acquired At the end of the Unit, the student should be able to:	Know the biological processes in the pelagic environment of the world ocean to include: o Primary and secondary production o Recycling process o Open ocean, shelf and upwelling production

Programme/Syllabus	1. General ecological principles relating to the ocean and description of the ocean environment. 2. Physical factors influencing primary productivity. 3. Primary production. 4. Breakdown of organic material, and regeneration of nutrients. 5. Oxygen relationships and anoxic conditions. 6. Pelagic secondary production. 7. Food webs. 8. Importance of vertical flux of organics in water column, implications of vertical migration to such movement. 9. Behavioural and physiological problems associated with vertical migration in the water column. 10. Fisheries and upwelling, the biology of subtropical gyres and the Southern Ocean and long-term ocean time-series together with an introduction to modelling in biological oceanography.
Learning & Teaching	(18 hr; 52 hr personal work) • Lectures • Boat work
Bibliography	• The lecture material is summarised at blackboard.soton.ac.uk. Instructions for accessing this material will be given during the course. • Core text: Miller, C.B., 2004. Biological Oceanography, Blackwell Science Ltd. ISBN 0-632-05536-7.
Assessment	• Written examination (80%) • Short Boat Work Report (20%): A 2 page report based on biological measurements made during MSc boat work in Southampton Water.
Course Evaluation	By completion of University Unit Evaluation Questionnaire by students, annual assessment by Unit Co-ordinator.

Course/Unit	Introduction to Chemical Oceanography
MER Code	MER SOES 6015
ECTS	
Level	Compulsory (Soton) - Semester 1
Semester	1
Timetable slot	To be advised
Teaching Staff	MJ Cooper (Coord.); B Dickie
Synopsis	The Unit is designed for graduates in any science discipline, embarking on postgraduate studies in Ocean and Earth Science.
Aims	• To introduce the basic concepts used in chemical oceanography. • To provide basic knowledge of chemical processes in the ocean. • To provide a framework to undertake more advanced units, within SOES. • To introduce techniques and practical skills needed for oceanographic chemical sampling/analyses.
Objectives At the end of the Unit, the student should:	1. able to convert between the different units used in chemical oceanography; 2. familiar with the hydrological cycle and erosion processes 3. aware of the differences between river water and seawater and the reasons for the differences; 4. able to discuss the impact of mid-ocean ridge hydrothermal activity on ocean chemistry; 5. familiar with (non-)conservative elements and their behaviour in the oceans (e.g.: nutrients, major/minor elements, trace metals); 6. able to construct 2 box models; 7. aware of the behaviour of elements within estuaries; 8. familiar with the behaviour of dissolved gases in the ocean and their impact on ocean anoxia and carbonate chemistry; 9. able to describe the distribution of major sediment types in ocean basins and chemical controls of the observed distributions; 10. aware of the behaviour and importance of trace metals dissolved in seawater; 11. aware of some of the different chemical tracers used in oceanography; and 12. able to interpret an estuarine nutrient data set.
Key Skills Acquired At the end of the Unit, the student should be able to:	1. Ability to access chemical oceanography literature 2. Data handling and interpretation skills 3. Chemical oceanographic sampling techniques 4. Chemical laboratory techniques and safety

Programme/Syllabus	Chemical oceanography covers many facets of marine environmental science and a multitude of different spatial and temporal scales. Topics covered in this unit span from evolution of the ocean, to controls on chemical speciation in sea water and molecular diffusion processes. Chemical processes are essential in biological systems; they control the geology of the planet and they are key tracers utilised in understanding the physics of the ocean.
Learning & Teaching	• Lectures 18 hr • Boat work (half day) • Problem Sheets & Online tests (52 hr personal work)
Bibliography	• The lecture material is summarised at blackboard.soton.ac.uk. Instructions for accessing this material will be given during the course. • Online test: A test with multiple choice and single word answer questions will be available on the Blackboard site for students to give feedback on their knowledge and understanding of the first half of the course.
Assessment	• Written examination (80%):To test the understanding of the theoretical part of the course, through essay-type questions and also numerical problems. Learning Outcomes 1-11 • Short Practical Write Up (20%):A short data analysis exercise based on the practical work carried out during the boat work week. Learning Outcomes 1,3,7 & 12
Course Evaluation	By completion of University Unit Evaluation Questionnaire by students, annual assessment by Unit Co-ordinator.

Course/Unit	Introduction to Marine Geology
MER Code	MER SOES 6016
ECTS	3.75
Level	Compulsory (Soton) - Semester 1
Semester	1
Timetable slot	To be advised
Teaching Staff	L McNeill (Coord.) & J Davis
Synopsis	The module is designed for graduates in any science discipline embarking on postgraduate studies in Ocean and Earth Science.
Aims	• To give a broad outline of the geological evolution of the ocean basins. • To give a broad outline of the methods used presently to investigate the superficial and deep structural features of the sea bed.
Objectives At the end of the Unit, the student should:	1. have a solid grounding in marine geology; 2. understand the framework provided by Plate Tectonics; 3. describe sediments found in different water depths and settings, and understand the sedimentary processes leading to their deposition; 4. describe the main geological and geophysical techniques for observing the seabed and sub-seabed; and 5. understand the driving forces behind, consequences, and importance of sea-level changes in the geological record.
Key Skills Acquired At the end of the Unit, the student should be able to:	1. Generic skills: report writing, scientific writing 2. Subject specific skills: presentation and manipulation of data, e.g. seismic interpretation, use of sea-level curves.

Programme/Syllabus	• This module will cover: the inception of ocean basins; the role of mid-ocean ridges in basin-scale processes; structure and geological processes at continental margins; and sedimentary processes within the basins. • Methodologies covered will include: the principles and design considerations behind echo-sounder and side-scan sonar systems; seismic methods; gravity and magnetic measurements; and dating methods. • Emphasis will be placed on the present utilisation of these techniques, in both research led and economically led environments.
Learning & Teaching	• Lectures 24 hr • Boat practical • Practicals (2): seismic interpretation, sea-level change and sedimentology (48 hr perdosnalñ work)
Bibliography	Much of the material is summarised at blackboard.soton.ac.uk. Instructions for accessing this material will be given during the course.
Assessment	• Written examination (80%) To test the understanding of the theoretical part of the course, through essay-type questions and also numerical problems. Learning Outcomes 1-11 Learning outcomes 1-5 • Short Practical Write Up (20%):A short data analysis exercise based on the practical work carried out during the boat work week. Learning Outcomes 1,3,7 & 12
Course Evaluation	By completion of University Unit Evaluation Questionnaire by students, annual assessment by Unit Co-ordinator.

Course/Unit	Introductory Physical Oceanography
MER Code	R SOES 6014
ECTS	3.75
Level	Compulsory (Soton) - Semester 1
Semester	1
Timetable slot	To be advised
Teaching Staff	A Naveira Garabato (Coord.)
Synopsis	Topics covered will include: the physical properties of sea water; the dynamics of wind-driven ocean circulation; description of the thermohaline circulation; and the role of the ocean in climate variability.
Aims	• To provide an introduction to the physics of the ocean, including descriptive and dynamical oceanography; • To give an understanding of the processes that control the movement of water, heat and other properties.
Objectives At the end of the Unit, the student should:	1. understand the physical processes that control the distribution of water properties and the movement of those properties in the ocean. 2. understand the range of time- and space-scales that exist from small-scale mixing processes (sec, cm) to the global ocean circulation (1000 years, 10000 km).
Key Skills Acquired At the end of the Unit, the student should be able to:	1. Generic skills: team working at sea; report writing on fieldwork; time management; and problem solving. 2. Subject-specific skills: knowledge of ocean waves; practical skills in oceanographic data acquisition; presentation of raw data.

Programme/Syllabus	
Learning & Teaching	• Lectures: 18 • Practical sessions: 2 • Tutorials: 6 ; Personal work: 116 hr
Bibliography	• The lecture material is summarised at blackboard.soton.ac.uk. Instructions for accessing this material will be given during the course. • Recommended books: Pond, S. and G. L. Pickard: Introductory Dynamic Oceanography. Open University: Ocean Circulation - fewer equations, more illustrations; Stewart, R. H. Introduction to Physical Oceanography (available on Web, http://oceanworld.tamu.edu/home/course_book.htm) • Further Reading: Gill, A. E.: Atmosphere-Ocean Dynamics; Lacombe, H.: Cours D'Oceanographie Physique (for French readers)
Assessment	• Written examination (80%). To test the understanding of the theoretical part of the course, through essay-type questions and also numerical problems. Tests Learning Outcomes 1 & 2 • Boat work report (20%) Tests Learning Outcome 1 (and generic and subject key skills).
Course Evaluation	By completion of University Unit Evaluation Questionnaire by students, annual assessment by Unit Co-ordinator.

Course/Unit	Applied and Marine Geophysics
MER Code	MER SOES 6004
ECTS	7.5
Level	Optional
Semester	1 or 3
Timetable slot	To be advised
Teaching Staff	N. Harmon (Coord)
Synopsis	Topics central to applied geophysics in the marine environment: seismology; potential field methods; marine electromagnetic surveying; application of potential field theory to geophysical exploration; and controlled-source electromagnetic methods.
Aims	• To develop the principles of geophysical exploration, from a basic level to that of current practice in exploration industry, together with research applications.
Objectives At the end of the Unit, the student should:	1. explain the main techniques used in multi-channel seismic reflection data processing; 2. interpret and report on seismic reflection profiles; 3. describe limits to the resolution of seismic and potential field data and design a data acquisition and processing strategy for a given target; 4. explain aspects of how seismic reflection methods and electromagnetic methods are used to identify and optimise hydrocarbon; 5. understand the core theory and practice underlying electromagnetic exploration methods; and 6. process, analyze and interpret potential field and electromagnetic data, to infer subsurface structure
Key Skills Acquired At the end of the Unit, the student should be able to:	1. use computer programs to model gravity, magnetic and electromagnetic data; 2. report writing to summarise scientific findings; 3. interprete seismic reflection profiles; 4. use of ProMAX software, for the processing and analysis of seismic reflection data.

Programme/Syllabus	The module covers, at an advanced level, three topics that are central to applied geophysics in the marine environment. The first is reflection seismology; the second is potential field methods; and the third is marine electromagnetic surveying. • Seismology : basic seismic processing operations (including correlation, convolution, deconvolution, frequency filtering and migration). Applications of spectral analysis, using Fourier-based methods. Examples from hydrocarbon exploration and continental margin studies (seismic stratigraphy, methods of reservoir identification and 3D surveying). Practicals exercises: seismic processing and interpretation. • Application of potential field theory to geophysical studies with a particular emphasis on gravity and magnetic surveying. Advanced methods for anomaly separation and filtering, based upon spectral analysis and spatial derivatives. Computer modeling and analysis exercises. Marine and airborne surveying and data processing. • Controlled source electromagnetic methods, as applied in marine survey operations (theory and the fundamentals of data acquisition and processing). Computer-based practical exercises: modeling marine controlled source electromagnetic datasets, and examining the sensitivity of this type of data to resistivity anomalies in the sub-surface.
Learning & Teaching	(51 hr + 99 hr personal work) • Lectures • Laboratory classes
Bibliography	• Much of the lecture material is summarised at blackboard.soton.ac.uk. Instructions for accessing this material will be given during the course. • Core text: W. M. Telford, L. P. Geldart & R. E. Sheriff, Applied Geophysics, 2nd Edition (1990), Cambridge University Press • Background reading: P. Kearey, M. Brooks & I. Hill, An Introduction to Geophysical Exploration, 3rd Edition (2002), Blackwell; E. J. W. Jones, Marine Geophysics, 1999, Wiley
Assessment	• Theory examination (60%): The questions normally will require the integration of information from more than one part of the course. Tests Learning Outcomes 1,3,4,5 • Practical (20%): Seismic processing and interpretation exercises. Tests Learning Outcomes 1 & 2 • Practical (20%): Potential field or EM data exercises. Tests Learning Outcomes 5 and 6.
Course Evaluation	By completion of University Unit Evaluation Questionnaire by students, annual assessment by Unit Co-ordinator.

Course/Unit	Biogeochemical Cycles in the Earth System
MER Code	MER SOES 6007
ECTS	7.5
Level	Optional
Semester	1 or 3
Timetable slot	To be advised
Teaching Staff	T Tyrrell (Coord.)
Synopsis	This module examines at the operation of the Ocean as a biogeochemical entity within the larger Earth System. There is a strong focus on how the Earth System will respond to anthropogenic impacts and global change.
Aims	• To provide at an advanced level, an overview of the Earth System; in particular biogeochemical processes, feedbacks and fluxes. • To examine how this knowledge contributes to understanding the global cycles of important elements, including carbon. • To cover examples from the modern ocean and the geological record, considering timescales from seconds to millions of years.
Objectives At the end of the Unit, the student should:	1. Have the ability to critically read the primary literature, understand the techniques used, their assumptions and limitations; 2. Be able to assimilate and to synthesise and discuss Earth System processes and biogeochemical cycles; 3. Be able to understand how they may be regulated via negative feedbacks; 4. Be able to devise, construct and solve geochemical mass balances; 5. Be able to estimate residence times; 6. Be able to solve quantitative problems; 7. Be able to understand anthropogenic effects on ocean carbonate chemistry
Key Skills Acquired At the end of the Unit, the student should be able to:	1. address numeracy and Problem Solving; 2. acquire literature access skills and critical reading; and 3. obtain laboratory analysis of dissolved gases and data interpretation.

Programme/Syllabus	This module examines in greater depth the sources, sinks and cycles of chemical constituents in the Earth System, particularly the Ocean, with particular reference to: processes at the ocean boundaries; the role of particle fluxes and scavenging in removing and redistributing material; and the interactions of biological, geological, chemical and physical oceanographic phenomena (geochemical cycles of trace elements and major biogeochemical elements; major nutrient cycles and their homeostatic regulation). Particular focus is placed upon the ocean carbon cycle and ocean acidification. Processes at the ocean boundaries: coupling of the ocean and atmosphere as geochemical systems, fluxes of aerosols and gases; and the chemistry of hydrothermal systems. Practical sessions include computer modeling of nutrient and carbon cycles in the ocean , together with manipulation of spreadsheets to determine impact of fluxes on the ocean. On-line quizzes are used to permit consolidation of acquired skills
Learning & Teaching	(40 hr + 110 hr personal work) • Lectures and Laboratory classes • Reading assignments and Tutorial support A wide range of support can be provided for those students who have further or specific learning and teaching needs.
Bibliography	• The lecture material is summarised at blackboard.soton.ac.uk. Instructions for accessing this material will be given during the course.
Assessment	• Theory Examination (70%) Tests Learning Outcomes 1-7 • Computing Assignment (30%) Tests Learning Outcomes 2-7
Course Evaluation	By completion of University Unit Evaluation Questionnaire by students, annual assessment by Unit Co-ordinator.

Course/Unit	Coastal Sediment Dynamics
MER Code	MER SOES 3014
ECTS	7.5
Level	Optional
Semester	1 or 3
Timetable slot	To be advised
Teaching Staff	J. Dix (Coord.)
Synopsis	Principles of coastal sediment dynamics, in a quantitative manner. Flow properties, benthic boundary layer and resulting sediment responses, under waves and steady currents. Sediment transport algorithms and the resulting evolution of the bed.
Aims	• To define the basic concepts of sediment movement within coastal and inner continental shelf waters, and the processes that control this movement. • To define the methods, techniques and equipment used in the study and measurement of sediment transport within a coastal setting.
Objectives At the end of the Unit, the student should:	1. Define and describe flow structures under unidirectional and wave tidal induced currents, alone and in combination. 2. Have an understanding of the prediction of sediment transport rates and directions. 3. Have a broad knowledge of the terminology and expressions used in coastal sediment dynamics and, in some cases, their derivation. 4. Distinguish between non-cohesive and cohesive sediment dynamics and what technologies and theories would be appropriate to use to evaluate issues, in each case.
Key Skills Acquired At the end of the Unit, the student should be able to:	1. Problem Analysis and numerical computation 2. Written Communication 3. Ability to learn 4. Critical Analysis

Programme/Syllabus	• Fundamental principles of coastal sediment dynamics in a quantitative manner. • Flow properties, the benthic boundary layer, and resulting sediment responses under waves and steady tidal currents are summarised. • Sediment transport algorithms are described, and the resulting evolution of the bed defined.
Learning & Teaching	(26 hr + 124 hr personal work) • Lectures • Tests: Four, 1-hour tests will be given at regular intervals through the course. The results will be evaluated in class and feedback given rapidly for misconceptions and deficiencies in learning
Bibliography	• Blackboard: Much of the lecture material is summarized at blackboard.soton.ac.uk. Instructions for accessing this material will be given during the course.
Assessment	• Written Examination (50%) Tests Learning Outcomes 1-2. • In-class Tests (50%) Tests Learning Outcomes 3- 4.
Course Evaluation	By completion of University Unit Evaluation Questionnaire by students, annual assessment by Unit Co-ordinator.

Course/Unit	**Computational Data Analysis** for Geophysicists and Ocean Scientists
MER Code	MER SOES6025
ECTS	7.5
Level	Optional
Semester	1 or 3
Timetable slot	To be advised
Teaching Staff	T. Tyrrell (Coord.)
Synopsis	This module will present a variety of different types of geophysical, oceanographic and remote sensing data and will explore methods for processing, analysing and modelling using MATLAB
Aims	• To provide students with a basic understanding of the mathematical methods used in the processing, analysis and modelling of a diverse range of geophysical and oceanographic data. • To provide the skills required to implement analysis methods in your own computer programs, including statistical analysis, spectral analysis and filtering.
Objectives At the end of the Unit, the student should:	1. Programming skills; 2. Report writing. 3. Data manipulation including the identification of noise and filtering
Key Skills Acquired At the end of the Unit, the student should be able to:	1. Analyse data using a variety of statistical and processing techniques, with an understanding of the relative merits of each technique, when and where to apply them, and any potential pitfalls in their use. 2. Implement mathematical algorithms in MATLAB programs. 3. Produce a quantifiable interpretation of data and present it in an informative manner.

Programme/Syllabus	The module will introduce statistical analysis, curve fitting and the interpolation of data. The analysis of data in the frequency domain using the Fourier Transform will be covered with applications to filtering in 1-D and 2-D. The fundamentals of computer programming will be taught in practical sessions using MATLAB and will involve implementing the techniques covered in the lectures. The course will include optimal methods for the display of data. Practical sessions: will exemplify the theory. Practical sessions will be computer-based exercises used to illustrate the concepts covered in the formal lectures. Computer practical sessions will use the software package MATLAB.
Learning & Teaching	• Lectures: 22 • Practical sessions: 2 • Personal work: 46 hr (A wide range of support can be provided for those students who have further or specific learning and teaching needs.)
Bibliography	Blackboard: The lecture material is summarized at blackboard.soton.ac.uk. Instructions for accessing this material will be given during the course. Illustrated handout materials will complement most lectures. Where relevant, lecturers' own research experience in the appropriate fields is brought into the lecturing sessions. References to the applicable chapter of course text and/or relevant journal articles are provided to complement some of the lectures.
Assessment	• Computing exercises 1&2 (2 x 30%): Write simple MATLAB programs to analyse and plot oceanographic and geophysical datasets. Tests Learning Outcomes (TLOs): 1, 2 and 3. • Mini project (40%): Write a substantial MATLAB program, or a number of smaller programs, to process and analyse one or more datasets. Interpret the results and present these in a written report including the analysis methods applied. TLOs: 1, 2, and 3.
Course Evaluation	By completion of University Unit Evaluation Questionnaire by students, annual assessment by Unit Co-ordinator.

Course/Unit	Contemporary Topics in Ocean and Earth Sciences
MER Code	MER SOES 6001
ECTS	7.5
Level	Optional
Semester	1 or 3
Timetable slot	To be advised
Teaching Staff	C. Hauton/ A. Naveria Garabato (Coords.)
Synopsis	An opportunity to be guided into the key literature on a variety of important contemporary topics at the forefront of Earth Science, Oceanography, Marine Biology, Marine Science Policy and Law and Marine Environmental and Resource Management.
Aims	• To provide an opportunity for you to be guided into the key literature on a variety of important contemporary topics at the forefront of Earth Science, Oceanography, Marine Biology, Marine Science Policy and Law and Marine Environmental and Resource Management.
Objectives At the end of the Unit, the student should:	1. synthesise a body of knowledge on a given subject 2. critically assess the scientific literature on a wide range of topics 3. make public oral presentations on the findings of current research 4. write critical syntheses of knowledge for a given subject in a scientifically-cogent style
Key Skills Acquired At the end of the Unit, the student should be able to:	1. Write scientific texts 2. Present scientific results 3. Understand scientific research

Programme/Syllabus	• The student will select three key topics from a list of options in his/her specialist area. • The student will be required to write a critical review and make a short oral presentation on each of your selected topics at weekly or fortnightly seminars. • Much of the learning will be through independent reading. The breadth of subject coverage is intended to broaden and deepen the student's knowledge of topical issues in his/her specialist area, as well as to develop scientific writing and presentation skills.
Learning & Teaching	• Seminars will be led by a variety of staff members with expertise in a range of important contemporary topics. • Reading will be guided by staff members, but much of the learning will be through independent reading and study by students, who will also give oral presentations at seminar-style classes. • The programme will consist of 12 two-hour seminars. • Supplementary material: Geophysics Seminar, NOCS Seminar programmes and WUN Seminars.
Bibliography	• Blackboard: the lecture material is summarized at blackboard.soton.ac.uk. Instructions for accessing this material will be given during the course.
Assessment	• Written reports (70%): Two reports on a topic which you will be expected to review, identify key scientific issues at stake and summarise arguments on both sides. You will be expected to form your own opinion on the matter. Each report should not be more than 5000 words. Tests Learning Outcomes 1,2,4 • Oral presentations (30%): Two x 10 minute presentations at seminar style gatherings, on a key-note topic. Tests Learning Outcomes 1,2,3
Course Evaluation	By completion of University Unit Evaluation Questionnaire by students, annual assessment by Unit Co-ordinator.

Course/Unit	Deep Sea Ecology
MER Code	MER SOES 6008
ECTS	7.5
Level	Optional
Semester	1 or 3
Timetable slot	To be advised
Teaching Staff	J. Copley (Coord.)
Synopsis	The course explores all aspects of the physical environment of the deep sea, including vents, considering the fauna of the deep sea within this framework.
Aims	• To give a detailed knowledge of the oceanography of the deep sea, the largest single ecosystem on Earth. • To introduce students to a variety of aspects of the physical and chemical environment. • To examine the distributions of fauna in different types of deep sea environments.
Objectives At the end of the Unit, the student should:	1. Determine those factors that are of physico-chemical significance in the deep sea; 2. Understand how these factors affect process in the animal communities; 3. Recognise a variety of ecological variables and their consequences in the deep sea including species diversity, biomass and zonation; and 4. Appreciate the latest research in deep-sea oceanography.
Key Skills Acquired At the end of the Unit, the student should be able to:	1. get aacquinted with nowledge of the largest environment on Earth.

Programme/Syllabus	The deep-sea occupies at least 50% of the surface of the globe. The original concept was that the deep sea was a tranquil environment, with little variation in its dominant physico-chemical and biological variables. In the last 20 years this paradigm has been challenged and we now know that the deep sea can be a highly dynamic environment, in which there are benthic storms and seasonal processes. There is also high species diversity. The original concept was that the system was heterotrophic but, with the discovery of hydrothermal vents and cold seeps, we have environments in which the basis of life is chemical energy, rather than sunlight.
Learning & Teaching	(26 hr + 124 hr personal work) 1. Lectures 2. Seminar series: a series of seminars will be delivered by guest speakers covering topics at the forefront of deep sea ecology. 3. Tutorial support
Bibliography	• Blackboard: the lecture material is summarized at blackboard.soton.ac.uk. Instructions for accessing this material will be given during the course.
Assessment	• Written Examination (75%) . Tests Learning Outcomes 1-4 • Coursework (25%) An analysis of a video of the East Pacific hydrothermal vents. Tests Learning Outcomes 2 and 3.
Course Evaluation	By completion of University Unit Evaluation Questionnaire by students, annual assessment by Unit Co-ordinator.

Course/Unit	Geodynamics and Solid Earth Geophysics
MER Code	MER SOES6037
ECTS	7.5
Level	Optional
Semester	1 or 3
Timetable slot	To be advised
Teaching Staff	N Harmon (Coord)
Synopsis	Topics include seismology, heat flow, geomagnetism and paleomagnetism, with a particular focus on the geometry, kinematics and dynamics of plate motion. Simple models of lithosphere rheology are developed and applied to case studies.
Aims	
Objectives At the end of the Unit, the student should:	.1. Understand the quantitative aspects of plate tectonics. 2. Understand the geomagnetic field and the principles of palaeomagnetism as they apply to plate tectonics. 3. Achieve practical experience of the application of elastic plate bending theory and heat conduction equations. 4. Be aware of the research methods in use in various aspects of solid Earth geophysics. 5. Describe the limitations and simplifications of plate tectonic theory. 6. Demonstrate an advanced understanding of the concept of the lithosphere. 7. Appreciate the principles of terrestrial heat flow. 8. Understand and know how to apply elastic plate bending theory. 9. Comprehend the characteristics of active plate boundaries. 10. Understand the importance of seismology in determining the interior structure of the Earth. 11. Understand the constraints on features around the core-mantle boundary
Key Skills Acquired At the end of the Unit, the student should be able to:	1. To determine earthquake parameters from teleseismic data. 2. To interpret first motion from seismograms and determine focal mechanisms. 3. To interpret palaeomagnetic data in terms of large-scale plate motions.

Programme/Syllabus	Formal lectures: will provide the underlying theory to kinematics, dynamics, seismology, crustal seismics and heatflow. An outline of each lecture is provided prior to start of a lecture or on website/in manual. Each lecture systematically covers the main concepts and topics. Where relevant, lecturers' own research experience in the appropriate fields is brought into the lecturing sessions. References to the applicable chapter of course text and/or other relevant journal articles are provided as essential reading for each lecture. Practical classes: will exemplify the theory and develop your practical skills in the analysis of plate kinematic and geodynamic data.
Learning & Teaching	Teaching (55 hr + 95 hr personal work) • Lectures • Practical sessions • Tutorial support A wide range of support can be provided for those students who have further or specific learning and teaching needs.
Bibliography	• Blackboard: the lecture material is summarized at blackboard.soton.ac.uk. Instructions for accessing this material will be given during the course.
Assessment	• Summative Assessment (100%) .
Course Evaluation	By completion of University Unit Evaluation Questionnaire by students, annual assessment by Unit Co-ordinator.

Course/Unit	Introductory Remote Sensing of the Oceans
MER Code	MER SOES 6017
ECTS	7.5
Level	Optional
Semester	1 or 3
Timetable slot	To be advised
Teaching Staff	S. Henson (Coord.)
Synopsis	Introduction at Masters level to the ways in which remote sensing from satellites is used in oceanography.
Aims	• To provide an overview of how the ocean can be observed and measured remotely using sensors on Earth orbiting satellites. • To provide an understanding of the role of remotely-sensed data in the study of the oceans
Objectives At the end of the Unit, the student should:	1. Acquire a new Perspective: grasp what is special about the view of the ocean provided from satellites, to enhance your knowledge of the ocean; 2. Methodology: understand the main methods of ocean remote sensing and the ocean properties that can be measured; 3. Importance in Ocean Science: discover some of the specific ways in which satellite ocean data make unique contributions to ocean science; 4. Wider Applications: find out how satellite ocean data are being applied for the benefit of human activity in the ocean; and 5. Acquire image handling skills: learn how to acquire, enhance, present and apply satellite image data in scientific and educational contexts.
Key Skills Acquired At the end of the Unit, the student should be able to:	1. Communication: scientific writing. 2. Information technology: image processing; manipulation and evaluation of satellite datasets acquired from the Internet. 3. Working in teams.

Programme/Syllabus	Topics to be covered include: • Basic principles: Introductory lectures on remote sensing methods, coupled with a practical introduction to image processing self paced on-line introductory tutorials. • Sea surface temperature: Method of infra-red and passive microwave remote sensing, detection of clouds and removal of atmospheric contamination, studies of ocean eddies and fronts, monitoring of global temperature patterns. • Ocean colour: Measuring chlorophyll and suspended sediment concentration from water colour as detected from aircraft and satellites. • Imaging Radar: How satellite synthetic aperture radars "see" the ocean and ocean information in radar images. Methods include, altimeters plus: Ocean topography winds and waves measured globally from satellites. • Earth observation systems: Global programmes, synergy between different types of data. • Lecture material is reinforced by computer practicals using remote sensing data.
Learning & Teaching	(47 hr: 103 hr personal work) • Lectures • Practicals: interactive computer-based practical work with image data, contained in a modular programme. (A wide range of support can be provided for those students who have further or specific learning and teaching needs)
Bibliography	• Blackboard: The lecture material is summarized at blackboard.soton.ac.uk. Instructions for accessing this material will be given during the course.
Assessment	• Group Presentation (10%) . Tests Learning Outcomes 1-5 • In class test (30%) Tests Learning Outcomes 1, 2, 3, 4 • Practial assignment (60%). Tests Learning Outcomes 1-5
Course Evaluation	By completion of University Unit Evaluation Questionnaire by students, annual assessment by Unit Co-ordinator.

Course/Unit	Large-scale Ocean Processes
MER Code	MER SOES 6005
ECTS	7.5
Level	Optional
Semester	1 or 3
Timetable slot	To be advised
Teaching Staff	B. Marsh (Coord.)
Synopsis	Introduction to the physical processes, both deep ocean and ocean margins. Processes which give rise to ocean circulation. Global processes (tides, wind, buoyancy forcing) and their influence on deep ocean and ocean margins.
Aims	• To provide an introduction to the dynamics of the deep ocean and ocean margins. • To explore and quantify the processes which give rise to ocean circulation. • To explore and quantify the links between ocean circulation and climate.
Objectives At the end of the Unit, the student should:	1. understand the dynamical approach to physical oceanography. 2. understand the mathematical formalism of dynamical ocean models. 3. interpret the mathematical results from dynamical ocean models. 4. quantify these results for the ocean circulation. 5. have an appreciation of the physical interactions between the deep ocean, the atmosphere and the shelf seas and their relation to global processes.
Key Skills Acquired At the end of the Unit, the student should be able to:	1. Develop numerical and mathematical skills. 2. Have a working knowledge of mathematical models and techniques. 3. Application of mathematical methods to ocean circulation. 4. Use of MATLAB, to analyse and interpret ocean data.

Programme/Syllabus	• The module will explore the processes which give rise to ocean circulation and how recent observations (e.g. World Ocean Circulation Experiment) are providing new insights into how the system works. • The module will include global processes (tides, wind, buoyancy forcing) and how these processes have markedly different influences on the deep ocean and on ocean margins. For example, the deep ocean is governed mainly by geostrophic flow, whilst the shelf seas are influenced strongly by frictional processes. • The global ocean circulation: its causes, its measurement and its role in the climate system will be explored.
Learning & Teaching	Teaching (41 hr + 109 hr personal work) • Lectures • MATLAB sessions • Practical sessions • Tutorial support
Bibliography	• Blackboard: The lecture material is summarized at blackboard.soton.ac.uk. Instructions for accessing this material will be given during the course.
Assessment	• Written examination (60%)Tests Learning Outcomes 1-5 • Course work (20%) Two computer based assessments: one Hydrographic practical • Data analysis practical (20%) Tests Learning Outcomes 1-5
Course Evaluation	By completion of University Unit Evaluation Questionnaire by students, annual assessment by Unit Co-ordinator.

Course/Unit	Marine Conservation and Policy
MER Code	MER SOES 6076
ECTS	7.5
Level	Optional
Semester	1 or 3
Timetable slot	To be advised
Teaching Staff	J. Godbold (Coord)
Synopsis	This module will cover a range of issues surrounding marine conservation and policy, split into three sections We will initially focus on the causes and consequences of the current biodiversity concerns, and concentrate on the socio-economic aspects and monitoring of marine exploitation, tracking of animal products and illegal trade.
Aims	
Objectives At the end of the Unit, the student should:	1. Summarise the main issues affecting global biodiversity and its socio-economic value. 2. Explain the main techniques and their effectiveness involved in biodiversity monitoring and tracking. 3. Describe contemporary UK and international conservation issues and have an understanding of the development of both conservation policy and biodiversity policies. 4. Understand and discuss potential conflicts of interest in management approaches between people, species and habitats.
Key Skills Acquired At the end of the Unit, the student should be able to:	1. To describe and apply population models for projections of biodiversity futures to improve conservation outcomes. 2. To develop, write and present a policy brief to inform non-specialists on research that may be important for the development of UK marine conservation strategies and policies.

Programme/Syllabus	Introduction and analysis of the central aspects of marine biodiversity conservation, the importance of population models for predicting and improving conservation outcomes and will investigate and discuss the main techniques and their effectiveness involved in biodiversity monitoring and tracking, including issues surrounding illegal wildlife trade, harvesting and invasive species. Understanding of the scientific processes which underpinning conservation and management, focussing in particular on marine biodiversity, threats to biodiversity and how it can be preserved. Threats for marine biodiversity: habitat loss and fragmentation, climate change, invasive species, over-exploitation, and pollution. Socio-economic trade-offs and potential conflicts between conservation, habitat use and exploitation of marine resources. Socio-economic facets of marine exploitation, including national and international legislative frameworks associated with marine exploitation, management and conservation. Case Studies: Research led examples, presentations from guest speakers e.g. local conservation trusts and the Southern IFCA will provide a wide breadth of perspectives, allowing discussion and debate on issues surrounding conservation, human use of habitats and exploitation of marine resources. Practical sessions: 1) Communicating science to decision makers and managers I: developing a policy brief. 2) Projecting population futures: use of population models for predicting conservation outcomes. 3) Communicating science to decision makers and managers II: presentation of policy brief, implications for conservation and management. Fieldtrips: 1) Studland: MPA under development - management and policy issues. 2) Poole Harbour: fisheries management and conservation designations
Learning & Teaching	Lectures 22 Fieldwork 12 Practical classes and workshops 6 Independent Study 110
Bibliography	• Blackboard: The lecture material is summarised at blackboard.soton.ac.uk. Instructions for accessing this material will be given during the course.
Assessment	• Policy brief (100%)
Course Evaluation	By completion of University Unit Evaluation Questionnaire by students, annual assessment by Unit Co-ordinator.

Course/Unit	Marine GeoArchaeology
MER Code	MER SOES 6061
ECTS	7.5
Level	Optional
Semester	1 or 3
Timetable slot	To be advised
Teaching Staff	J Dix (Coord.)
Synopsis	The module covers aspects of the marine environment, formation processes and marine geophysical prospection techniques. It includes a short (three day maximum) field programme is to provide the acquisition from inter-tidal and/or marine locations.
Aims	• To provide an understanding of what approaches are used by academia and the commercial sector to investigate the geoarchaeological record. • To provide the students with the skills set to be able to undertake a full geoarchaeological assessment of a marine or coastal site (from desk based analysis to field based data – acquisition, processing and interpretation. • To provide an understanding of how marine and coastal environments impact and/or enhance the archaeological record.
Objectives At the end of the Unit, the student should:	1. Plan and execute a geoarchaeological assessment of coastal or full marine archaeological site; 2. Be able to acquire, analyse and evaluate a wide range of archaeological, geological and oceanographic data including (heritage records; in situ and remotely (Lidar) acquired topographic data; bathymetric and some sub-surface seismic data; hydrodynamic data; hand auger sediment and faunal samples; 3. Place local site studies in both regional and global contexts; 4. Have a full appreciation of the key issues in marine geoarchaeology in terms of both submerged landscape studies and archaeologically specific site dynamics; 5. Have confidence in orally presenting in extended format integrated archaeological and earth science material; and 6. Write a full geoarchaeological report of a field site to English Heritage standards.
Key Skills Acquired At the end of the Unit, the student should be able to:	• Carry out team working; report writing; oral presentations; time management (generic skills) • get acquitance of the knowldge of all of the key topics covered (subject-specific skills).

Programme/Syllabus	
Learning & Teaching	(47 hr: 103 hr personal work) • Lectures • Practicals: 6 x 3 h (4 on GIS, one on particle size analysis and one on core data interpretation using Rockworks. • Field sessions: 3 sessions in the field or on boat. Support: is provided by staff and/or postgraduate demonstrators where appropriate. Including one surgery session where questions to facilitate the field report can be answered.
Bibliography	• Blackboard: The lecture material is summarised at blackboard.soton.ac.uk. Instructions for accessing this material will be given during the course.
Assessment	• Presentations (25%) A 20 minute oral presentation, assessed by academic staff. Tests All Learning Outcomes • 5000 Word Geoarchaeological Field Report (75%) Tests All Learning Outcomes.
Course Evaluation	By completion of University Unit Evaluation Questionnaire by students, annual assessment by Unit Co-ordinator.

Course/Unit	**Microfossils, Environment and Time**
MER Code	MER SOES 6022
ECTS	7.5
Level	Optional
Semester	1 or 3
Timetable slot	To be advised
Teaching Staff	S. Bohaty (Coord.)
Synopsis	General introduction to the various groups of microfossils. Alongside their morphology and taxonomy, you will learn how certain groups can be used for the solution of geological problems, or for hydrocarbon exploration.
Aims	• To give a general introduction to the various groups of microfossils, detailing their morphology, taxonomy, biology, and ecology. • To show how certain microfossil groups can be used in an applied manner for the solution of geological problems (such as biostratigraphy, palaeoecology, palaeoceanographic interpretation, proxies for climatic change, etc.). • To detail some of the industrial applications of microfossils, particularly those related to hydrocarbon exploration. • To provide a basic introduction to microfossil extraction/preparation methods. • To demonstrate the utility of various microfossil groups in hydrocarbon exploration (source rock analyses, thermal maturity studies, etc.). • To undertake an investigative exercise based on a hydrocarbon exploration borehole core.
Objectives At the end of the Unit, the student should:	1. assign a microfossil to its major taxonomic group (e.g. foram, ostracod, dinoflagellate, spore, pollen, etc.). 2. be aware of, and to recognise, the main morphological and compositional features which allow assignation of an individual fossil to each group. 3. draw basic stratigraphic conclusions about microfossil assemblages (e.g. age of rock unit, correlations, etc.). 4. deduce palaeoecological and/or palaeoceanographic interpretations from different assemblages of microfossils. 5. understand the applicability of particular microfossil groups to particular lithologies and particular geological time periods. 6. determine which microfossil groups are most applicable to the solution of a variety of particular geological problems.
Key Skills Acquired At the end of the Unit, the student should be able to:	• Utilise stereo binocular, transmitted and reflected light microscopes; use of scanning electron microscope; and report writing (generic skills). • acquire practical experience of microfossil identification to species level; compilation, utilisation and interpretation of biostratigraphic and palaeoenvironmental information; an appreciation of how to prepare and mount micropalaeontological samples for observation, and the safety precautions necessary to observe during such preparations; to have developed a background knowledge of micropalaeontological literature sources (subject-specific skills).

Programme/Syllabus	• Introduction to the various microfossils groups and detail their utility as important indicators of past environments, by examining the ecology of living microplankton taxa and extrapolating this to the fossil record (palaeoecology, palaeoceanography). • Applicability of different microfossil groups in providing both relative time-scales (through zonal schemes) and biostratigraphic correlation will be detailed, as will the role of certain microfossils in understanding evolutionary processes (particularly in groups such as land plants). • Microplankton as agents of global environmental change will also be investigated, especially with regard to fluxes of CaCO3 and C and, hence, to CO2 in the atmosphere. • Microfossil groups which form mineralised skeletons (calcareous, siliceous, phosphatic) and the organic-walled microfossils (known as palynomorphs). • Web based assessments: 2 web-based assessments will be run at specified times in NOCS Computer Cluster (dates in the timetable). These will be based on the Geodata Unit's WebQuiz programme, and guidance in answering the form of the questions will be provided. Tests learning outcomes 1-6 • Practical exercises & demonstrations: A series of practical exercises and demonstrations of material will be set during the course. Tests learning outcomes 1-6. Attendance at practical classes is expected, as some of these may form the basis of questions in the web assessments, the written exam and the practical exam. • A guided tour of the micropalaeontological laboratory facilities will be conducted, in addition to the opportunity to have hands-on experience of using the Scanning Electron Microscope for observation of microfossils. Tests learning outcomes 1-2
Learning & Teaching	(35 hr + 115 hr personal work) • Lectures, • Tutorial support and Seminar Guest Lectures
Bibliography	• Blackboard: The lecture material is summarized at blackboard.soton.ac.uk. Instructions for accessing this material will be given during the course.
Assessment	• Theory Examination (40%) Tests Learning Outcomes 3-6 • Practical Examination (60%) Two in class practical examinations. Tests learning outcomes 1-6.
Course Evaluation	By completion of University Unit Evaluation Questionnaire by students, annual assessment by Unit Co-ordinator.

Course/Unit	Zooplankton Ecology and Processes
MER Code	MER SOES 6009
ECTS	7.5
Level	Optional
Semester	1 or 3
Timetable slot	To be advised
Teaching Staff	C. Lucas (Coord.)
Synopsis	The module will assess the role of zooplankton in the global marine ecosystem.
Aims	• To establish the role of zooplankton in the pelagic and global marine community and to introduce holo- and meroplankton biodiversity. • To introduce the biological and non-biological factors which regulate community structure from the meso- to microscale. • To review the technologies available to sample the community in the field and to introduce procedures of laboratory analysis of abundance and biomass. • To establish the impact of zooplankton in the 'economy' of pelagic trophic web; introducing the impact of zooplankton grazing, zooplankton as predators, 'alternative' food resources; to review the methods available the assess feeding; zooplankton metabolic responses. • To review zooplankton reproduction and life cycle strategies and the methods available to estimate zooplankton production; to review zooplankton 'models'. • To introduce the responses of zooplankton to water mass movements; tidal advection and behavioural/physiological methods to avoid displacement; meroplankton settlement behaviour; diurnal vertical migration and its impact on the individual and the community. • To review the use of zooplankton as indicators of water mass movement; global climate change and pollution. • To assess the commercial importance of zooplankton.
Objectives At the end of the Unit, the student should:	1. appreciate the role of zooplankton in marine ecosystems and recognise the diversity of mero- and holplankton, and be able to identify the common species of temperate water zooplankton; 2. appreciate the factors that regulate the distribution patterns of zooplankton and be able the assess the methodologies available to design an effective field sampling programme; 3. understand the role of zooplankton in the pelagic trophic web and be able to appreciate the constraints in measuring zooplankton feeding in the laboratory and the field and structuring the energetic budget of individual zooplankters; 4. appreciate the methods available to estimate zooplankton secondary production, and the nature of the raw data required for the calculations; 5. appreciate the behavioural and physiological response employed by zooplankton to counter tidal advection/population dispersal and to undertake 24hr diurnal vertical migration; 6. assess the role of zooplankton as indicators of a range of environmental change; 7. design and conduct experiments on live zooplankton; 8. use a range of library information services, to aid production of well structured written reports.
Key Skills Acquired At the end of the Unit, the student should be able to:	1. Generic: Small groups ~ boatwork and laboratory practical programme. Individual assessment of data quality, presentation of written reports, library information retrieval and critical analysis of literature. 2. Subject-based: Boatwork and practical laboratory skills in zooplankton taxonomy and experimentation. Interrogation, analysis and presentation of raw data. Knowledge of zooplankton subject area.

Programme/Syllabus	Biological and non-biological forcing-factors structuring biodiversity, community and population patterns from the meso- to the microscale. Methods of conducting and analysing field sampling programmes. The position of zooplankton in the 'economy' of the pelagic ecosystem: (a) feeding and reproductive strategies of a range of zooplankton types; (b) make-up of zooplankton energy budgets; and (c) methods for the estimation and modelling of zooplankton secondary production. Responses of individual zooplankters to their environment (factors regulating tidal advection, larval settlement and the implications of diurnal vertical migration). The zooplankton as biological indicators of water mass movement, global climate change and pollution. The potential of zooplankton as a commercial resource. Practical classes: the diversity of mero- and holoplankton forms and formal taxonomic identification of temperate water species. Measure and analyze the impact of zooplankton grazing pressure, in relation to the quantity, quality and species composition of available diet.
Learning & Teaching	(28 hr + 122 hr personal work) • Lectures: 22 • Student reportk • Practical sessions • Boatwork • Revision support
Bibliography	• Blackboard: The lecture material is summarized at blackboard.soton.ac.uk. Instructions for accessing this material will be given during the course.
Assessment	• Theory Examination (75%) A 2½ hour written examination paper, choice of three questions from six to be answered. Tests learning outcomes 1-6 & 8 • Two online tests (25%) Tests learning outcomes 1, 3, 7 & 8.
Course Evaluation	By completion of University Unit Evaluation Questionnaire by students, annual assessment by Unit Co-ordinator.