M.Sc. Course in Environmental Oceanography

The Geology Department of the University of Patras, offers a three semester (1 ½ years) curriculum of high level lectures, seminars, laboratory practicals and field training in Environmental Oceanography.

The course is designed to meet the growing international demand internationally, for scientists and engineers who are well enough equipped to fully understand marine processes and solve marine environmental problems related to human activity.

Furthermore, the M.Sc aims are to (i) broaden student awareness of the economic potential of the ocean, (ii) provide theoretical and practical training for enhancing the student skills necessary to effectively manage the marine environment and (iii) provide graduates with the appropriate experience for developing policies and making decisions for the sustainable exploration of marine resources.

In the 1st and 2nd semester the students follow advance lectures and seminars in the following subjects:

**SEMESTER A**
- Marine Geology and its application to coastal and offshore infrastructures
- The use of statistics in environmental marine Sciences
- Marine pollution and control
- Climate changes during late Quaternary and their impact on human cultural evolution

**SEMESTER B**
- Satellite imagery and GIS
- Operational Oceanography
- Integrated coastal zone management and sustainable development
- Exploration, conservation and management of our marine natural and cultural heritage
MODULES OBJECTIVES AND CONTENT

MARINE GEOLOGY AND ITS APPLICATION TO COASTAL AND OFFSHORE INFRASTRUCTURES

OBJECTIVES

The module introduces the students to: (i) the natural forces that operates in the seas and how these forces affect the operation of the infrastructures, (ii) the state of art strategies and practices to avoid and mitigate any risks imposed on the infrastructure or impact on the marine environment and (iii) planning and design of the infrastructures according to the EU directives and UN recommendations for the protection of the marine environment.

CONTENT

Offshore environmental hazards

Guidelines for site investigation methodologies and tools

State of the art field surveying methodologies and tools

Oceanographic, geological and geotechnical conditions prevailing in the Mediterranean Sea

Case studies

OPERATIONAL OCEANOGRAPHY

OBJECTIVES

This module presents the students with the current state of the art in Operational Oceanography for predicting and assessing the state of the ocean and the surrounding enclosed seas, estuaries, fjords and gulfs. The module also: (i) introduces the student to the essential measurements, tools and methods used in operational oceanography and (ii) teaches them how to use this knowledge for improving safety at seas, enabling the sustainable exploration of ocean resources, supporting safe and essential efficient offshore energy related activities and mitigating the effect of environmental hazards and pollution to the society.

MODULE CONTENT

How to plan and carry out an oceanographic survey

Water column observing and monitoring techniques

1. Profiling in the water column by vertically lowering instruments packages from a stationary vessel:
   - Temperature, salinity, density measurement
   - DO₂, pH, Eh

2. Under way towed instrument packages with the above mentioned sensors
3 Drifting buoys at pre-determined depths

To analyze and interpret oceanographic data

Current measurements using current meters and ADCP’s fixed in the seabed or the in the hull of a vessel

Preparing Oceanographic maps with the use of GIS

MARINE POLLUTION AND CONTROL

OBJECTIVES

This module introduces the students to the bio-geo-chemical processes operating in the marine environment. Furthermore, the module teaches the student to: (i) the essential measurements, tools and methods used in environmental oceanography for sampling and monitoring the marine environment and (ii) experience and skills in laboratory analytical techniques

MODULE CONTENT

Pollution and pollutants

Oxygen budget

Eutrophication

Physico-chemical and biological behaviour of pollutant in the sea

Impact of pollutants in the marine environment, case studies

Oceanographic and geological criteria for outfall site selection

Oceanographic and geological criteria for dumping solid wastes

Radioactive wastes and disposal

Pollution assessment methods and studies

INTEGRATED COASTAL ZONE MANAGEMENT AND SUSTAINABLE DEVELOPMENT

OBJECTIVES

This module introduces the students to: (i) the long and short term changes that occur in the coastal environment, which are induced by natural forces but also by human intervention, (ii) the importance of the coastal zone to societal well-fare and (iii) the concept of the sustainable management of the of the coastal zone

MODULE CONTENT

The coastal environment (cliffs, beaches, deltas, estuaries, fjords)
Physical factors affecting coastal landscape
Waves and tides
The influence of sea-level changes on the coastal geomorphology
The use of remote sensing in the monitoring and management of the coastal environment
Physical properties, hydraulic behaviour and transport of sediments
Coastal engineering techniques for studying beach erosion
Coastal sediment budget
People and coasts, current coastal issues

INTEGRATED MANAGEMENT OF THE COASTAL NATURAL AND CULTURAL HERITAGE

OBJECTIVES
The syllabus introduces the students to: (i) the concepts of natural (geological, biological) and cultural heritage valorization, protection, and conservation for a sustainable development of the coastal zone (ii) the importance of mapping the natural and cultural heritage to the legislation of a national/European for the sustainable management of the coastal zone and (iii) the methodologies and tools used in the mapping and valorization of the natural and cultural resources

MODULE CONTENT
Geomorphology and habitats
Human-induced threats to benthic habitats
Habitat classification systems
Statistical analysis for the quantification
Characteristics Mediterranean habitats
Principals of marine archaeology
Methodologies and tools for mapping geo-habitat and underwater archaeological features (harbours), wrecks and reconstruction of archaeological landscape

LABORATORY PRACTICALS
The laboratory practicals include training and development of practical skills in:
Marine geophysical surveying for site investigation, mapping geological hazards, submerged archaeological sites and wrecks and finally, benthic habitats

Geotechnical surveying for the study of physical and mechanical properties of the marine sediments and slope stability evaluation

Oceanographic instrumentation and data processing methodologies

Chemical analytical instrumentation and data processing methodologies

Palaeoclimatic analysis methodologies

FIELD WORK

At the end of the second and third semester the students will experience in surveying at sea for a minimum period of five days and learn how to plan an oceanographic survey and to operate a variety of tool systems for acquiring data for the mapping of the water column and the seafloor.

RESEARCH PROJECT

The research project, which starts in the 2nd semester and is completed in the 3rd semester, may be a desk-study, a laboratory study or field work based

The research project involves the student in undertaking research in either marine geophysical and geotechnical surveying or hydrographic surveying, and in palaeoclimatological studies.