WACOMA 2nd SEMESTER TEACHING MODULES - UNIVERSITY OF CADIZ - SPAIN

MANDATORY BLOCKS (2 ECTS MODULES)

Student selects 6 ECTS from each of 3 different blocks (= 18 ECTS)

BLOCK 1: Chemical Analysis of Water Quality, CHIM 01 (3 modules = 6 ECTS)

Module Title	**Professor**
Weight of evidence: Assessment of chemical contamination in aquatic environments	Roberta Guerra

Summary of Course Content

Weight of Evidence refers to integration of data generated from multidisciplinary environmental studies involving multiple, independent Line of Evidence, which typically comprise both chemical and biological measurements. It is a determination related to possible ecological impacts based on multiple Line of Evidence.

Weight of Evidence assessments provide three types of information:

1. Relative certainty of adverse environmental effects due to stressors;
2. Possible causation;
3. Key uncertainties that, if resolved, will improve management decision-making.

Module Title	**Professor**
Chemical and ecotoxicological guidelines for management of dredged materials in open waters	Mª Gemma Albendín García

Summary of Course Content

The content of this module intends to apply the methodology used for the integration of different LOEs for the evaluation and management of sediment and dredging material. It will be studied the advantages and disadvantages associated with the incorporation of sediment toxicity bioassays and new early warning measures (biomarkers) in the evaluation and management of dredging material. In the same way, the legal context of the management of dredging material in Spain and in other countries will be analyzed

1. Life cycle of sediments. Sustainability and management.
2. Legal framework of sediment management. Sediment quality guidelines and action levels. Technologies and strategies for waste management and dredging material.
3. Sediment management: Criteria, considerations and management options.

Module Title	**Professor**
Sensitive tools for the assessment of environmental and human risk	María Laura Martín Díaz

Summary of Course Content

The content of this module addresses the acquirement of the knowledge related to biomonitoring environmentally polluted areas using biomarkers of exposure, effect and susceptibility, in order to be included as early warning tools in environmental/human risk assessment. Together with this main aim, the use of different biomonitoring species will be analysed as sentinel species in laboratory and field ecotoxicological studies.

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Module Title Environmental assessment and management of accidental spill in littoral ecosystems	**Professor** Carmen Morales Caselles
Summary of Course Content This course is designed to introduce students to the different steps that follow an oil spill in a natural environment: from the detection to the contingency actions with a special focus on the diagnostic tools to identify the impacts of hydrocarbon contamination in the marine and coastal environment. 1. Oil spills in sea preparedness and responsiveness 2. Diagnostic tools to identify the impacts of hydrocarbon contamination in the marine and coastal environment 3. Case studies and practical approaches	

Module Title Tools for hazard assessment of chemical and complex environmental media	**Professor** Julián Blasco Pablo A. Lara Martín
Summary of Course Content This course has as main subjects: ✓ Introduction to contamination in aquatic settings; ✓ Organic legacy and emerging contaminants; ✓ Metal and metalloids legacy substances; ✓ Metal and metal oxide nanoparticles; ✓ Environmentally relevant physicochemical properties of contaminants; ✓ Environmental processes involved in the partitioning and degradation of chemicals; ✓ Equilibrium Criterion (EQC) models	

BLOCK 2: Ecotoxicological evaluation of Risk in Water and Coastal Management, BIO07 (3 modules = 6 ECTS)

Module Title	**Professor**
Ecotoxicity tests in Risk Assessment	María Laura Martín Díaz

Summary of Course Content

Toxicity tests have been carried out for a variety of purposes, from establishing sediment and water quality standards (eg, defining safety limits or acceptable concentrations of a pollutant), or monitoring their effects from various types of effluents, especially when they contain a complex mixture of chemicals whose precise composition is unknown. The main aim of this module is to involve the students in the acquirement of ecotoxicology concepts as a tool for environmental monitoring, and concretely, learn the most used methodologies worldwide for lethal and sublethal toxicity assessment of environmental stress agents.

1. Introduction to basic techniques based on biological/ecological response measures for environmental quality assessment
2. Introduction to basic ecotoxicological techniques under laboratory conditions: toxicity bioassays with equinoderms, bivalves and fish.
3. Techniques for environmental risk assessment calculation: Predictive no effect concentrations.

Module Title	**Professor**
Bioaccumulation and bioavailability: keys for quality ecosystems	Julián Blasco Miriam Hampel

Summary of Course Content

Theoretical lectures will be given to introduce to basic and advanced concepts of bioavailability and bioaccumulation in with special emphasis on marine environments. Introduction to biomarker approaches for biomonitoring. After the theoretical lectures, the students will be asked to implement these concepts in a practical site specific environment of their choice analyzing existing contamination problems and proposing monitoring strategies for risk assessment. This work will be discussed in a workshop carried out with the students. Where they present their projects in an open session in order to assess the possibility to be developed in a real context.

Module Title	**Professor**
Integrated tools to determine environmental quality	María Laura Martín Díaz

Summary of Course Content

The course is based on:

- ✓ Design and application of an integrated methodology for the evaluation of environmental quality.
- ✓ Interpretation and analysis of a data set that contains values related with contamination and toxicity;
- ✓ Integration of different Lines Of Evidence (LOE). Principal Component Analysis;
- ✓ Determine the pollution index of contaminated areas and environmental quality guidelines;
- ✓ Propose a protocol of use of Environmental Quality guidelines for an integrated coastal area management.

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Module Title Integrative assessment of sediment quality in aquatic ecosystems	**Professor** Sokratis Papaspyrou Ignacio Moreno Garrido
Summary of Course Content The objective of this course is to provide students the essential knowledge background to understand the necessity of a multidisciplinary approach to sediment ecotoxicology and the tools to perform and analyse different toxicity tests in this ecological compartment. ✓ Introduction: Rationale of sediment integrative toxicity assessment; ✓ Sampling strategies and sample conservation and treatment; ✓ Chemical characterization of sediments; ✓ Benthic organisms and standard sediment bioassay species; ✓ Bioavailability, bioaccumulation and biomagnifications; ✓ Identifying ecological stress: in vitro vs. in situ bioassays; classical approaches and new insights; ✓ Practical design of an avoidance tool to measure toxicity using aquatic invertebrates (rotifers, artemia or both).	

Module Title General methodology to assess quality of coastal ecosystems	**Professor** María Laura Martín Díaz
Summary of Course Content The main subjects of this course are: 1. Introduction to basic techniques based on biological / ecological response measures for environmental quality assessment; 2. Introduction to basic ecotoxicological techniques under laboratory conditions: toxicity bioassays with equinoderms, bivalves and fish; 3. Techniques for environmental risk assessment calculation: Predictive no effect concentrations.	

BLOCK 3: Geochemistry, GEO08 (3 modules = 6 ECTS)

Module Title	**Professor**
Basis for sediments and dredged material management	Enrico Dinelli

Summary of Course Content

In this short module will be focused on the basic principles required for dregded materials management providing a short overview of the methods to characterize these materials, both in the field and in the laboratory. Special attention will be given to the sediment quality guidelines and the regulatory requirements. In the final section there will be examples of management scenario: disposal, reuse, intervention.

Module Title	**Professor**
Coastal land subsidence effects on freshwater resources and flood risk	Clara Armaroli

Summary of Course Content

The course will include a first part with the definition of the issue (freshwater systems – ground and superficial freshwater – and land subsidence; definition of storms; definition of risk and impacts; methods to evaluate the impact of storms). Then the case study of the Emilia-Romagna region will be presented with several examples. A special focus will be on management plans and actions related to the mitigation of the effect of land subsidence, to present both positive and negative examples. The Po delta area will be finally presented as a further example of one of the largest delta in the world and how human impact has caused different problems to the sedimentary system of the delta and surrounding areas, especially caused by land subsidence.

Module Title	**Professor**
Coastal Flooding Hazards	Laura Del Río Rodríguez

Summary of Course Content

This module focuses on the natural processes (Tsunamis, Storm surges, Tidal flooding, Flooding in estuarine environments, Coastal subsidence, etc.) that can produce flooding of coastal lowlands. The main objective is that the students understand the main characteristics of these processes, their occurrence and general dynamics, as well as some basic procedures for coastal flooding hazard assessment and risk management.

Module Title	**Professor**
Hydro-meteorological hazards and risks at coastal zones	Óscar Ferreira

Summary of Course Content

This course has as main objectives:

- ✓ Understanding the natural processes responsible for the existence of hydro-meteo coastal hazards;
- ✓ Identify the temporal and spatial scales of action of these processes;
- ✓ Systematize and apply indicators used in coastal risks.

- ✓ Develop representative risk mapping in coastal areas by including hazard and exposure/consequence.

Content:

a) Synthesis of concepts of hazard versus risk. Concepts on mitigation, protection and adaptation. Examples for coastal areas.
b) Characterization of hydro-meteorological coastal hazards: shoreline retreat, storm induced coastal erosion, overwash and flooding.
c) Involved processes and their scales (time and space).
d) Coastal hazard indicators.
e) Cartography and representation of coastal risks, including hazard and exposure/consequence.

Module Title Land reclamation and drainage effect and feedback with water freshening and salinization	**Professor** Paolo Ciavola

Summary of Course Content

The course will include a first part with the definition of the processes in estuarine, deltaic and lagoon environments (estuarine circulation; type of estuaries; type of deltas; coastal lagoons; type of reclamation; construction of drainage systems of canals; stratigraphy of terrains in reclaimed areas). Then the case study of the Emilia-Romagna region will be presented with examples from the Po Delta and the Comacchio lagoon. The case study of the Humber Estuary (UK) will be discussed to assess how reclamation has changed circulation if water masses during the last 200 years. Finally, the Scheldte Estuary (NL) will be examined considering undergoing mitigation activities like managed retreat and polder recreation.

Module Title Quarrying and mining activities impacts on water quality	**Professor** Jose Miguel Nieto Liñán M. Dolores Basallote Sánchez

Summary of Course Content

This module describes the case of river basin management in catchment areas with sulphide or coal mining. The module deals with water characterization, assessment and remediation of freshwater bodies affected by Acid Mine Drainage (AMD).

Content:

- ✓ Exploitation and processing of mineral resources
- ✓ Sulphide oxidation and Acid Mine Drainage formation
- ✓ Prediction of acid mine drainage
- ✓ Treatment and monitoring strategies for AMD
- ✓ Case study (field trip): Metal pollution in the Tinto and Odiel rivers

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INTEGRATIVE BLOCKS (2 ECTS MODULES)

Student selects 6 ECTS from 2 different blocks (= 12 ECTS)

BLOCK 4: Environmental Legislation, IUS10 (3 modules = 6 ECTS)

Module Title Marine Strategy Directive Framework	**Professor** Sebastian Diaz Ribes
Summary of Course Content Analysis of the EU policy Marine Strategy Directive Framework Marine Strategy Directive Framework European Maritime Region classification. Process of Marine Strategy which was: a.- Initial assessment of environmental status in each member state waters. b.- The meaning of Good Environmental Status (GES) in each area. c.-Targets and indicators designed to show whether a member state is achieving GES. d.- Monitoring program to measure progress towards GES. e.- Program of measures designed to achieve or maintain GES	

Module Title Conflict resolution	**Professor** María del Mar Martín Aragón
Summary of Course Content This module is conducted to provide the students not just a broad knowledge about disputes (at large) and its different ways of resolutions, but also a general picture about the current water conflicts and its status. The main idea is to give the students the tools and acquaintances to make them able to analyze a water conflict and suggest a successful dispute resolution method. 1. Introduction to conflicts and disputes 2. Conflict resolution strategies 3. Conflicts around water 4. International resources on water conflict resolution 5. Case Law and case Studies	

Module Title Communication Science	**Professor** Sokratis Papaspyrou
Summary of Course Content Presentations and posters are some of the principle means for scientists to show their work to the scientific community, funding agencies, future employers and the general public. Although these forms of communication are an integral part of scientific work, many scientists never receive proper training. As a result, too often, unattractive and overloaded scientific presentations confuse the audience and pass-by unnoticed. The course will provide to the students some basic and advanced skills in science communication. Students will be introduced to modern theories of communication and the latest trends in design and presentations with hands-on exercises.	

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Module Title Beach nourishment as a management tool	**Professor** Juan José Muñoz Pérez
Summary of Course Content Causes of erosion are presented and possible solutions are commented. Beach nourishment versus groin construction is discussed in detail. ✓ Introduction about Shallow water characteristics (Wave climate, wave breaking, sediment transport,etc.); ✓ Beach morphodynamics (equilibrium profile, submerged bars, sand size); ✓ Flood level (inverted barometer effect, run up, surf beat); ✓ Pros and cons of Beach nourishment (dredging, methodology, maintenance cost) versus Groin construction.	

Module Title Integrated management of wetlands and harbors	**Professor** Javier García Onetti
Summary of Course Content The course is divided in: 1. Introduction to port coastal areas. Importance and particularities of the maritime-port sector and relationship with the integrated and ecosystem based approach. Ecosystem services in port coastal areas. Background and new frameworks; 2. Analysis of port systems from a socio-ecological perspective. Multidimensional influence, identifying its positive and negative impacts. Delimitation and characterization of socio-ecological port systems. Real examples and exercises; 3. International initiatives for the environmental management of port systems. Group exercise: selection and analysis of port systems around the world with a socio-ecological perspective. Management considerations.	

Module Title Coastal Cities Planning Guidelines	**Professor** María De Andrés García Javier García Sanabria
Summary of Course Content 1. Introduction to urban coastal areas. Study of the coastal cities of the world. Relationship with coastal and marine ecosystems; 2. Integrated Coastal Zone Management initiatives in urban areas. Ecosystem services and ecosystem based management in coastal urban areas; 3. Group exercise: New initiatives for ecosystem based management in coastal urban areas.	

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Module Title The Water Framework Directive	**Professor** Sebastian Diaz Ribes
Summary of Course Content ✓ To know the importance of the Water Framework Directive which had changed the water management in all member states of the European Unión, putting aquatic ecology at the base of management decisions. Contents of the Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy and the effect in EU countries policies/ Study 12 Water Notes/Implementation and States collaboration platform. Case Study and contact with relevant responsible public bodies.	

Module Title Sustainable development UN: Goal 6 and Goal 14	**Professor** Sebastian Diaz Ribes
Summary of Course Content General UN Sustainable Development Policy. Goals 6 and 14 impacts. Marine Pollution and Water management. Reports of development and scenarios in 2.020 and 2.030 Maritime Industry and public management effects.	

Module Title Conventions (RAMSAR, Regional Seas, OSPAR, HELQOM, UNEP)	**Professor** Sebastian Diaz Ribes
Summary of Course Content Architecture of the International Conventions under the U.N. umbrella and environment protection. Structure and relationship between several Conventions and their contents. Theoretical contents of each Convention Countries related to each Convention. Development of the Conventions, such as the Barcelona Convention, Rotterdam, Brussels and Stockholm Convention. Practical examples about the Convention Execution, such as visits to the National Areas near the University, and introduction to the responsible staff of the RAMSAR Convention. Case study of ship demolition and waste transboundary matters. Students will also be involved in searching about the Convention implications in their own countries.	

BLOCK 5: Biology of aquatic organisms, BIO01 (3 modules = 6 ECTS)

Module Title	**Professor**
Microbial potential for the attenuation of contaminants in coastal ecosystems and bioremediation	Alfonso Corzo Sokratis Papaspyrou Emilio Garcia Robledo

Summary of Course Content

The course is intended to highlight the problems pollutants cause and reasons for their persistence in the environment and to demonstrate the role that microbial communities play in the clean-up of organic and inorganic compounds that are either accidentally or deliberately released into the environment. The different metabolic abilities of microbes to degrade or transform pollutants as well as the various bioremediation strategies based on the use of different groups of microorganisms will be covered. The advantages and disadvantages of using bioremediation will be made clear.

Module Title	**Professor**
Invasive Alien Species	Ignacio Hernández

Summary of Course Content

Invasive Alien Species is a WACOMA course aiming at providing knowledge on the causes and consequences of the introduction of organisms to geographical areas outside their native range, as well as monitoring and mitigating strategies. Invasive alien species are recognized as one of most serious threats to biodiversity, and thus to ecosystem services, human health and livelihood. Interest in this topic has exponentially increased among ecologists, environmental managers and policy makers during the last years. How organisms move around the world, why some species become invasive, the ecological and economic impacts, and the management of alien species are key questions that will be examined in the Invasive Alien Species WACOMA modules. The module will consist of four units, beginning with a general overview and history of invasions science and finishing with examples of real management/eradication of invasive species, covering all the stages of the invasion process, from their introduction to the ecological and economic impacts.

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Module Title Biological tools for coastal management	**Professor** Ignacio Hernández Emilio García Carmen Morales Gonzalo Muñoz Daniel González

Summary of Course Content

To understand how the study of organisms from different trophic levels and their interactions can be used as management tools in coastal ecosystems. Special focus will be given to the processes underlying the ecosystem services provided by the coastal areas and how they can be integrated into decision-making. The module also will provide guidelines about how the biological tools are essential under an ecosystem-based management approach in coastal areas and beyond.

I. Biological tools in environmental regulatory frameworks: monitoring and assessment elements.

II. Organisms and biological processes as indicators of the status of the coastal ecosystem.

a. Algae and microbes as biological indicators of eutrophication processes.
b. Marine organisms as indicators of environmental health: ecotoxicology and food web assessments as management tools

III. - Ecosystem services and biodiversity: practical applications for the coastal management.

Module Title Remote Sensing: algal blooms	**Professor** Irene Laiz

Summary of Course Content

Understanding the basis of Remote Sensing applied to Earth Observation with theory and computer workshops:

- ✓ Introduction;
- ✓ Ocean Colour;
- ✓ Sensors;
- ✓ Ocean Colour Remote Sensing Techniques;
- ✓ Applications.

Module Title Integrated water resources and natural areas management in the coastal zone	**Professor** Adolfo Chica Alfredo Fernández

Summary of Course Content

- ✓ To learn the marine and coastal protected areas management plans.
- ✓ To study zoning techniques for coastal and marine protected areas.
- ✓ To teach students how to analyse natural coastal zones dynamics through geographic information.

The course is divided in:

Lectures: Approach to coastal and marine protected areas; Planning and management of coastal and marine protected areas; Zoning techniques for coastal and marine protected areas.

Data analysis: Use of GIS as a practical tool to work with data needed in natural zones investigation, in order to model marine and coastal environment.

BLOCK 6: Environmental Impact and Management, FIS07 (3 modules = 6 ECTS)

Module Title Modeling physical-biological processes	**Professor** Ana Machado Irene Laiz

Summary of Course Content

The main objectives of this course are to teach students the basic principles of

- ✓ Ocean circulation numerical modelling
- ✓ Biogeochemical modelling
- ✓ Physical-biological coupled models

1. Introduction to ocean circulation models:
   - Earth system models (ESM)
   - Oceanic General Circulation Models (OGCM)
   - Regional Ocean Models
   - Coastal Ocean Models
2. Introduction to the modelling of marine ecosystems:
   - Chemical-biological processes
   - Simple plankton models for the ocean: the NPZD Fasham model
   - Complex ecosystem models: The Biogeochemical Flux Model (BFM)
3. Physical-biological coupled models

Module Title Climate change and extreme events effects on flood hazard	**Professor** Theocharis Plomaritis

Summary of Course Content

This course has as main objectives:

- ✓ Familiarise with the different climate change scenarios used by the IPCC
- ✓ Understand how the natural processes responsible for the coastal flooding hazards could be altered under climate change conditions;
- ✓ Identify the temporal and spatial variability of these changes on a global scale;
- ✓ Understand the complexity of multi-hazard processes and how different climate change agents can affect them.
- ✓ Develop the ability to understand the statistical nature of climate change prediction and how these can affect the hazard predictions.

a) Definition of climate change and what the different IPCC scenarios represent.
b) Identify the natural processes that are affected by the climate change and how they vary on a global and regional scale
c) Study how the above changes affect the coastal flooding hazard.
d) Discuss how hazards are translated into risk and which are the possible solution/measures using the concepts of mitigation, protection and adaptation

Module Title	**Professor**
Techniques for the diagnosis on ICZM process	Vera Semeoshenkova

Summary of Course Content

Introduction to methodology of integrated coastal management. Conflict resolution and management (with a reference to the White Sea region): Typology of coastal conflicts. Different tools for conflict resolution. Analysis of potential conflicts (construction of conflict matrix). Specificity of communication conflicts. Public participations. Indicators methods: Compression of information. Indicators and indexes. DPSIR framework Integrated assessment of natural quality of coastal zone subject to recourse using and rehabilitation needs (with reference on coastal zone of the Russian Federation). Analysis of impact of coastal resources using on environment and social-economical sphere: Resource impact matrixes (with reference to the White Sea region), SWOT – analysis (example of St. Petersburg), Methodology of risk management: ISO 31000. Example of natural disaster risk management related to sea level oscillations. Example of risk management of oil spills due to ship incidents from point of development of new port facilities in the Eastern Gulf of Finland (the Baltic Sea). Maritime Spatial Planning (with reference to the Baltic Sea): Review of Marine Spatial Planning at the Baltic Sea. VASAB principals of marine spatial planning. Getting of competence related to application of practical tools in ICM developing process.

This module is oriented to integrated coastal management (ICM) and is related with application of different tools that can be used for coastal developing planning and decision making processes. It has strong links with coastal conflict resolution processes, use of Indicator's methods, Marine Spatial Planning (MSP), coastal zone integrated monitoring and risk management. Risk management is studied with use of two examples: risks of extreme sea level oscillations (storm surges, tsunami) and risks of oil spills.

Module Title	**Professor**
Salt marshes for flood risk management strategies	Gloria Peralta

Summary of Course Content

The Purpose of this module is:

- ✓ To acknowledge the role of coastal salt marshes on coastal protection.
- ✓ To learn about the services that provides the MI-SAFE package to evaluate the potential role of natural coastal salt marshes on flood risk management and training on the use of the MI-SAFE viewer.

The course is articulated in:

• Ecosystem services of vegetated coastal habitats;
• Coastal protection services of salt marshes;
• The FAST project and the MI-SAFE package;
• Study cases: using the MI-SAFE viewer to evaluate potential role of salt marshes on coastal protection.

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Module Title Complex satellite monitoring of coastal zones	**Professor** Jesús Gómez Enri

Summary of Course Content

The Purpose of this module is:

- ✓ Understanding the basis of Remote Sensing applied to Earth Observation:
- ✓ Introduction
- ✓ Electromagnetic Radiation
- ✓ Useful concepts in Remote Sensing
- ✓ Ocean Remote Sensing techniques
- ✓ Applications (satellite monitoring of coastal zones)

Theory:

a) Introduction
b) Electromagnetic Radiation
c) Useful concepts in Remote Sensing
d) Ocean Remote Sensing techniques
e) Applications (satellite monitoring of coastal zones)

Computer workshops

a) Bilko: Introduction to Bilko. Basic principles of satellite image analysis.
b) Bilko: Practical lesson related to the monitoring of coastal zones.

Module Title Coastal & marine areas: managing complex systems	**Professor** Javier García Sanabria

Summary of Course Content

1. Introduction to integrated coastal and marine management as a complex issue. Singularities of coastal and marine areas. Frameworks and methodologies (the Spyglass model, the Decalogue of management, the orders of outcomes, the public policy cycle). Key issues: policy and strategy, participation, coordination, institutions, instruments, information and communication, formation and training, education, and resources. Exercise: Debate on Governance;
2. The international context for Marine Spatial Planning: the United Nations and the European Maritime Policy. The new Directive of Marine Spatial Planning. Cases of study from international, national, regional and local scales of management. Practical simulation exercise: planning a coastal-marine area;
3. Applying lessons learned. Group exercise: designing an integrated management initiative. Oral presentations.

Module Title Natural hazards (SENDAI)	**Professor** Sebastian Diaz Ribes
Summary of Course Content The Sendai Framework Convention aims at reducing the risk of disaster and losses in lives, livelihoods, health and in economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries. The course contents include: ✓ Special key point in the voluntary incorporation of states. ✓ Seven Global Targets. ✓ Four priorities for actions. ✓ Implementation policies and measurements.	

Module Title Remote Sensing (part I): management applications	**Professor** Jesús Gómez Enri
Summary of Course Content Understanding the basis of Remote Sensing applied to Earth Observation with theory and computer workshops: ✓ Introduction; ✓ Electromagnetic Radiation; ✓ Useful concepts in Remote Sensing; ✓ Ocean Remote Sensing techniques; ✓ Applications.	

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COMPLEMENT TO 54 ECTS, if required in the student's plan
Student selects a maximum of 12 ECTS

BLOCK: LANGUAGE AND SCIENTIFIC SKILLS (MAX 12 ECTS). 2ND YEAR

Module Title Proposal writing	**Professor** Julián Blasco Miriam Hampel

Summary of Course Content

This course has as main objectives:

- ✓ To learn how to design and write a international research project
- ✓ Identification of appropriate international partners and consortium building
- ✓ Elaborate a risk evaluation plan at different levels (management, experimental, etc) and to propose alternative options as contingency and mitigation plans.
- ✓ To present and defend the projects at a panel composed by the students and teachers
- ✓ To evaluate a project according to EU evaluation process guidelines.

Content:

- ➢ Introduction to different international funding tools
- ➢ EU H2020 strategy and workplan
- ➢ Marie Curie actions IF
- ➢ Writing a proposal
- ➢ Project presentation

Module Title Scientific paper writing	**Professor** Pablo Lara, Alfredo Izquierdo

Summary of Course Content

The content of this module addresses the acquirement of the knowledge related to scientific paper writing. The module addresses to teach the student to write scientific manuscripts, evaluate the impact factor of the scientific journal and face a review and submission of manuscripts.

- ✓ Search for scientific abstracts, scientific publications, etc: Databases;
- ✓ Writing scientific articles and reviews;
- ✓ Preparation of master thesis;
- ✓ Authors' guide and presentation of an article for evaluation and publication;
- ✓ 5. Types of journals and impact indexes

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Module Title Literature review	**Professor** Irene Laiz José Antonio López López

Summary of Course Content

The main objectives of this module are as follows:

- ✓ Learn how to read scientific literature (research papers and /or technical documents) in a comprehensive way and how to identify the central ideas.
- ✓ Learn how to extract relevant information from a scientific text
- ✓ Learn how to summarize the contents of a scientific document for (a) the scientific community and (b) the general public.

Content:

1. How to screen a scientific document.
2. Understanding the document's approach.
3. First reading.
4. Thorough reading: understanding the full story.
5. Summarizing the key contents: (a) for a scientific public, and (b) for the general public.

Module Title Data bank searching	**Professor** Jesús Fernández García

Summary of Course Content

The objectives of this module are:

- ✓ To give an overview of the information resources offered by the Library for the MSc thematic area.
- ✓ To teach different ways and strategies to search scientific documents using electronic resources. Both multidisciplinary and specialized resources will be shown.
- ✓ To introduce students to the Mendeley Reference Manager.
- ✓ To teach students how to use the Mendeley Reference Manager as a tool to efficiently collect, sort and use bibliographic references.

Module Title Further Language skills	**Professor** Irene Laiz Jose Antonio López-López

Summary of Course Content

The main subjects of this course are:

- ✓ Compilation of main keywords, including: risk, hazard, exposure, consequence, vulnerability, susceptibility, exposure, resilience, flood, erosion, bioaccumulation, biomagnification, vulnerability of natural ecosystems, integrated coastal management, climate change, sea level rise, sea water intrusion, pollutants, water resources, socio-economic indicators, stakeholder, etc.
- ✓ Examples of concepts within the right context (i.e., to distinguish between risk and hazard, or between bioaccumulation and biomagnification);
- ✓ Solution of a case study;
- ✓ Oral presentation of topics related to selected keywords using a proper scientific language in the context of the master;
- ✓ Discussion about water and coastal management topics defending a point of view.

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Module Title Data management and interpretation	**Professor** Gloria Peralta

Summary of Course Content

The Purpose or Aims:

- ✓ To understand the importance of organizing scientific data as interoperable databases for wide-spreading knowledge generation.
- ✓ To learn organizing scientific databases and spreadsheet tools to summarize scientific information.

Content:

- Open source database structure.
- Types of variables and use of categorical ones for processing information.
- Spreadsheet tools for basic database processing.
- • Study cases: working with scientific data.

Module Title Geomatics and GIS	**Professor** Alfredo Fernández

Summary of Course Content

The Purpose of the module is to teach students to analyse the spread of pollutants in marine environment.

The course is divided in:

Lectures: Describe use of GIS as a practical tool for modeling marine environment along with data needed in marine environmental investigation, in order to show hydrodynamics of coastal circulation patterns in Cadiz Bay through numerical simulations.

Data analysis: Pollution dynamics in Andalusian fishing grounds

Module Title Fieldwork skills	**Professor** Sokratis Papaspyrou Theocharis Plomaritis José Antonio López López

Summary of Course Content

The objective of this course is to familiarise students with the idea of a multidisciplinary approach to the study of the marine environment and provide them with the background knowledge and tools to be able to design an integrated sampling campaign, collect the appropriate samples, and process and analyse oceanographic data.

Furthermore, this course aims to:

- ✓ Familiarise students with the different field work techniques across disciplines
- ✓ Understanding the complexity of multidisciplinary sampling strategies
- ✓ Identify the temporal and spatial variability of physical, geological, biological and chemical variables.