Course guide
250568 - CONMARORTI - Marine Pollution. Sources, Transport and Impacts

Unit in charge: Barcelona School of Civil Engineering
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering.
Degree: BACHELOR'S DEGREE IN MARINE SCIENCE AND TECHNOLOGY (Syllabus 2018). (Compulsory subject).
Academic year: 2022  ECTS Credits: 6.0  Languages: Catalan

LECTURER
Coordinating lecturer: ENRICA UGGETTI
Others: MARC MESTRES RIDGE, ANTONIO ORTIZ RUIZ, ENRICA UGGETTI

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
13388. To know and apply the lexicon and concepts of the Marine Sciences and Technologies and other related fields.
13390. Establish a good practice in the integration of common numerical, laboratory and field techniques in the analysis of any problem related to the marine environment.
13394. Address the most relevant processes and their interactions related to their physical / chemical / biological / geological components, applying technical and scientific knowledge and criteria.
13395. To set, evaluate and propose solutions to the different conflicts of use and exploitation in the marine and coastal environment resources based on scientific and technical criteria.
13397. Carry out environmental impact, management and protection studies of the marine environment and adjacent coastal areas, including the corresponding infrastructures and their related impacts.
13403. Develop a conceptual framework to address the sustainability of the marine environment and the related socio-economic activities at different scales, explaining the effects of climate change.
13406. Write technical reports and disseminate knowledge about the different components of the marine system, considering the applicable legal framework.
13407. Apply the necessary tools to analyze the economic and legal aspects of human actions and the related impacts on the marine environment, including technical advice and representation of companies and administrations.

General:
13380. Develop a professional activity in the field of Marine Sciences and Technologies.
13381. Address in a comprehensive manner the analysis and preservation of the marine environment with sustainability criteria.
13382. Apply state-of-the-art methods and techniques in oceanography and marine climate, jointly covering the physical, chemical, geological and biological aspects.
13385. Apply knowledge and academic experience to the biotic and abiotic resources of the marine environment, explaining their interactions with the socio-economic activities that take place in it.
TEACHING METHODOLOGY

The course consists of 2.3 hours per week of classroom activity (large size group) and 1.2 hours weekly with half the students (medium size group).

The 2.3 hours in the large size groups are devoted to theoretical lectures, in which the teacher presents the basic concepts and topics of the subject, shows examples and solves exercises.

The 1.2 hours in the medium size groups is devoted to solving practical problems with greater interaction with the students. The objective of these practical exercises is to consolidate the general and specific learning objectives.

The rest of weekly hours devoted to laboratory practice.

Support material in the form of a detailed teaching plan is provided using the virtual campus ATENEA: content, program of learning and assessment activities conducted and literature.

LEARNING OBJECTIVES OF THE SUBJECT

In this subject, the concept of Environmental Impact in the Marine Environment (in particular, coastal and estuarine waters), its affectation by anthropogenic pollutants (fluvial, urban, port, etc.) and their influence on Water Quality will be addressed. Emphasis will be placed on the main sources of pollution, types of pollutants, and physical-chemical processes involved in their transport. The concepts underlying Fick’s laws and their application to the modeling of pollutant dispersion will be reviewed.

1.- Know the different sources and processes of pollution transfer to the marine environment, as well as the main types of pollutants.
2.- Understand the different transport mechanisms, physical and non-physical, of polluting substances in the sea.
3.- Understand the potential impact of pollution on the marine and coastal system, including the biological and physical components.

This is where students are expected to obtain a vision of real environmental problems in the marine environment from a perspective that combines, on the one hand, chemistry and biology, as well as the mathematical techniques to address these problems (Marine Ecology, Ecosystems and Productive Processes) and, on the other, the tools of chemistry, biology and physics (Marine Pollution, Origin, Transport and Impacts), which are needed to solve common problems in coastal and platform waters.

This subject also includes applied techniques in the visualization, interpretation and resolution of the problems addressed in this same subject.

This course will address the concepts of Environmental Impact on the Marine Environment (in particular, coastal and estuarine waters) and their impact on pollutants of anthropogenic origin (river, urban, port, etc.) and the impact on Water Quality. Emphasis will be placed on the main sources of pollution, types of pollutants, and the physicochemical processes involved in their transport. The concepts underlying Fick’s laws and their application to modeling the dispersion of pollutants will be reviewed. 1.- To identify the different sources and processes of transfer to the marine environment, as well as the main types of pollutants. 2.- To distinguish the different mechanisms of transport, physical and non-physical, of polluting substances in the sea. 3.- To predict the potential impact of pollution on the marine and coastal system, including biological and physical components. In this subject it is where students are sought to obtain a vision of real environmental problems in the marine environment from a perspective that combines, on the one hand, chemistry and biology, as well as mathematical techniques to address these problems (Ecology Marine, Ecosystems and Productive Processes) and on the other, the tools of chemistry, biology and physics (Marine Pollution. Origin, Transport and Impacts), which are needed to solve common problems in coastal and platform waters. This subject also includes techniques applied in the visualization, interpretation and resolution of the problems addressed in this same subject.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Hours large group</td>
<td>30,0</td>
<td>20.00</td>
</tr>
<tr>
<td>Hours small group</td>
<td>15,0</td>
<td>10.00</td>
</tr>
<tr>
<td>Guided activities</td>
<td>6,0</td>
<td>4.00</td>
</tr>
<tr>
<td>Self study</td>
<td>84,0</td>
<td>56.00</td>
</tr>
<tr>
<td>Hours medium group</td>
<td>15,0</td>
<td>10.00</td>
</tr>
</tbody>
</table>
Total learning time: 150 h

CONTENTS

Physical mechanisms of transport

Description:
The physical processes that contribute to the transport of pollution in the sea at different scales will be presented, and taking into account the particularities of the source (e.g., marine outfalls) and of the environment (e.g., coastal zone)

Specific objectives:
Know the physical mechanisms that contribute to reduce the concentration of pollutants Know the relative importance of the different mechanisms (orders of magnitude) Know the specific transport mechanisms for particular cases

Full-or-part-time: 28h 47m
Theory classes: 8h
Practical classes: 4h
Self study: 16h 47m

Cycle of C, N and P.

Description:
The definition of marine pollution will be introduced, and its main sources and the characteristics that determine its behavior in the marine environment will be seen. Emphasis will be placed on the biogeochemical cycles of carbon, nitrogen and phosphorus

Specific objectives:
Knowing what constitutes marine pollution Knowing the main sources and types of pollution in the sea Knowing the main biogeochemical cycles that take place at sea

Full-or-part-time: 4h 48m
Theory classes: 2h
Self study: 2h 48m
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Urban wastewater pollution

Description:
The marine pollution due to urban waste water spills will be analyzed. The main types of organic and inorganic contamination will be presented, as well as the role of wastewater treatment plants.

Specific objectives:
Understand the particularities of marine pollution by waste water Knowing their main types of pollution (organic and inorganic)
Knowing the role of sewage plants to reduce this type of pollution

Full-or-part-time: 14h 23m
Theory classes: 6h
Self study: 8h 23m

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Theory classes: 6h
Self study: 8h 23m
Microbial contamination

Description:
It will present all the problems associated with microbial contamination, including the definition of indicator microorganisms and the microbiological decay process. It will analyze how it affects the quality of the beaches, and how it is acted to reduce the impact.

Specific objectives:
Knowing what microbial contamination is and what generates it
Knowing what the process of microbiological decay is, and how it can be characterized
Knowing how it affects the quality of water on the beaches

Full-or-part-time: 9h 36m
Theory classes: 4h
Self study : 5h 36m

Other types of pollution

Description:
Laboratory analysis will be carried out of the main water quality parameters we have seen in the previous classes
Visit to a wastewater treatment plant
A puzzle-type dynamic will be carried out on the reading of scientific articles
Other types of pollution present in the marine environment, their characteristics, their impacts, and how to prevent them will be introduced. Persistent compounds, heavy metals, hydrocarbons and / or plastics will be analyzed

Specific objectives:
Learn to measure the main water quality parameters
Learn about other types of marine pollution and their particularities. Know how to prevent, avoid or reduce pollution by these substances

Full-or-part-time: 52h 48m
Theory classes: 12h
Laboratory classes: 10h
Self study : 30h 48m
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Theory classes: 12h
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Self study : 30h 48m

Eutrophication

Description:
The concept, causes and effects of water eutrophication, as well as measures to prevent it, will be introduced.

Specific objectives:
Knowing what is and what are the causes of the eutrophication of water bodies Know what measures can be applied to avoid eutrophication Know what impacts is eutrophication on the aquatic environment

Full-or-part-time: 4h 48m
Theory classes: 2h
Self study : 2h 48m
### Agricultural drainage waters pollution

**Description:**
The main polluting substances from agricultural drainage waters, as well as their impact on the marine environment and techniques to minimize it, will be introduced

**Specific objectives:**
Knowing the impact of agricultural waters on the marine environment Knowing methodologies to reduce the impact

**Full-or-part-time:** 9h 36m  
Theory classes: 4h  
Self study: 5h 36m

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### Numerical modeling of the dispersion

**Description:**
The basic concepts of numerical modeling, as well as different types of models, their fields of application, and their reliability (validation, calibration, limitations, ...) will be presented. Examples will be analyzed, and applied to realistic cases.

**Specific objectives:**
Know the basic types of dispersion models, and know the applicability and limitations. Know how to apply different dispersion models to example cases, making a critical evaluation of the results.

**Full-or-part-time:** 19h 12m  
Theory classes: 2h  
Practical classes: 6h  
Self study: 11h 12m
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Self study: 11h 12m

GRADING SYSTEM

The mark of the course is obtained from the ratings of continuous assessment and their corresponding laboratories and/or classroom computers.

Continuous assessment consist in several activities, both individually and in group, of additive and training characteristics, carried out during the year (both in and out of the classroom).

The teachings of the laboratory grade is the average in such activities.

The evaluation tests consist of a part with questions about concepts associated with the learning objectives of the course with regard to knowledge or understanding, and a part with a set of application exercises.

BIBLIOGRAPHY

Basic:

Complementary: