Course guide
250600 - DINPROCOS - Coastal Processes and Dynamics

Last modified: 22/05/2024

Unit in charge: Barcelona School of Civil Engineering
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering.

Degree: **Academic year:** 2024 **ECTS Credits:** 5.0
Languages: English

LECTURER

Coordinating lecturer: JUAN PABLO SIERRA PEDRICO

Others: MARIA LISTE MUÑOZ, JUAN PABLO SIERRA PEDRICO

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
17488. MetOcean main physical processes and their effects on the port and waterways infrastructure.
17489. Numerical and laboratory modelling techniques.
17492. Port planning and operation.
17493. Environmental issues before and after construction of e.g. a port.
17495. How climate change uncertainties can be managed to reduce risks when designing and operating resilient infrastructure.
17496. Perform time and frequency domain analysis of MetOcean data to provide operational and design values.
17497. Design navigational infrastructure with resilience and adaptation to climate change in mind.
17500. Coastal hydrodynamics and processes.
17501. Short-term and long-term wave climate.
17502. Sediment transport and morphology.
17503. Tidal currents.
17504. Coastal and oceanographic numerical modelling.
17507. Field campaigns and data treatment to evaluate problematic situations and plan/design solutions.
17509. The basis behind climate change and its effect on the coast.
17511. Design coastal interventions.
17512. Understand and predict the impacts of coastal interventions.
17513. Offer alternatives to hard coastal engineering.
17514. Analyse and interpret collected field data in order to understand the physical drivers at short, mid and long-time or climatic scales.
17515. Apply state-of-the-art wave, flow and morphological models.

Generical:
17480. Design methods for ports, waterways and other coastal facilities.
17484. Develop knowledge and understanding of the coastal environment at an advanced level, applying classic (hard and soft) coastal engineering complemented with building with nature concepts, with ability to analyse, evaluate, assess and synthesis of data and information from different sources with contemporary techniques and technologies.
17485. Handle engineering problems dealing with waves, currents, their interactions, their effects on the coastline and man-made interventions, spanning from short (storms) to decadal scales, to incorporate the climate change dimension.
17486. Propose creative and innovative solutions by themselves or as a work group for current and future problems by enhancing their own interpersonal understanding, work as a team and oral and written communication skills.

TEACHING METHODOLOGY

The course consists of 3 hours per week of classroom activity. Part of the time is devoted to theoretical lectures, in which the professor presents the basic concepts and topics of the subject, shows examples and solves exercises.

Part of the time is dedicated 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.

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

This course surveys coastal processes that determine its dynamical response and associated processes that shape coastlines. The primary focus is on the natural forcing and driving terms, their relation to the sediment transport and bed processes. Lecture topics examine linear and non-linear wave theories, hydrodynamics; surf-zone circulation; fluid-sediment interactions and larger scale morphodynamics.

STUDY LOAD

Type	Hours	Percentage
Hours small group	9,8	7.83
Self study	80,0	63.95
Hours medium group	9,8	7.83
Hours large group	25,5	20.38

Total learning time: 125.1 h

CONTENTS

Introduction

Description:
Summary of the main processes and problems encountered in Coastal Engineering

Full-or-part-time: 7h 11m
Theory classes: 3h
Self study : 4h 11m

Water wave mechanics

Description:
Description of the main wave theories
Practical exercise in which some of the wave theories presented in class are applied
Study of short and long term irregular waves. Wave by wave analysis, spectral analysis, mean wave climate and extreme wave climate.
Practical exercise where theory previously explained is applied

Full-or-part-time: 14h 23m
Theory classes: 4h
Practical classes: 2h
Self study : 8h 23m

Wave propagation

Description:
Description of the main processes that affect waves when they propagates towards the coast
Practical application of the theory described in class
Study of the processes taking place in the surf zone.
Practical exercise where the theory explained in class is applied
Study of the different types of wave propagation models that exist
Explanation of the SWAN numerical wave propagation model and its practical application.

Full-or-part-time: 43h 12m
Theory classes: 8h
Practical classes: 3h
Laboratory classes: 7h
Self study : 25h 12m

Other hydrodynamic processes

Description:
Description of the main types of long waves that exist
Practical application of the theory studied in class.
Description of the current generating factors and the characteristics of the numerical models that model them
Application of the theory explained in class

Full-or-part-time: 21h 36m
Theory classes: 5h
Practical classes: 2h
Laboratory classes: 2h
Self study : 12h 36m

Morphodynamic processes

Description:
Theory related to sediment transport in coastal areas
Application of the theory explained in class
Description of the characteristics of coastal morphodynamic models
Practical application of the theory explained in class

Full-or-part-time: 14h 23m
Theory classes: 4h
Practical classes: 1h
Laboratory classes: 1h
Self study : 8h 23m

Climate change

Description:
Study of climate change and how it can affect coastal processes
Practical application of the theory explained in class

Full-or-part-time: 7h 11m
Theory classes: 2h
Practical classes: 1h
Self study : 4h 11m

GRADING SYSTEM

The mark of the course is obtained from the ratings of continuous assessment, which consists of several practical exercises, carried out during the year (both in and out of the classroom).

BIBLIOGRAPHY

Basic:
- Bosboom, J.; Stive, M.J.F. Coastal Dynamics [on line]. Delft, The Netherlands: Delft University of Technology, 2023 [Consultation: 24/05/2024]. Available on: https://textbooks.open.tudelft.nl/textbooks/catalog/view/37/92/383. ISBN 978-94-6366-370-0.
- Holthuijsen, Leo H. Waves in oceanic and coastal waters. Cambridge: Cambridge University Press, 2007. ISBN 9780521860284.