Coastal Processes and Dynamics (250600)

General information

School:	ETSECCPB
Departments:	Departament d'Enginyeria Civil i Ambiental (DECA)
Credits:	5.0 ECTS
Programs:	MÀSTER UNIVERSITARI ERASMUS MUNDUS EN ENGINYERIA I GESTIÓ COSTANERA I MARÍTIMA, pla 2022 - (codi pla 1525), MÀSTER UNIVERSITARI ERASMUS MUNDUS EN ENGINYERIA I GESTIÓ COSTANERA I MARÍTIMA, pla 2013 - (codi pla 1090)
Course:	2023/2024

Main teaching language at each group

- Group 10Q2 English (Q2)

Faculty

Responsible faculty: Juan Pablo Sierra Pedrico

Teachers: Maria Liste Muñoz, Juan Pablo Sierra Pedrico

Generic objectives

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.

Skills

Specific skills

MetOcean main physical processes and their effects on the port and waterways infrastructure.

Numerical and laboratory modelling techniques.

Port planning and operation.

Environmental issues before and after construction of e.g. a port.

How climate change uncertainties can be managed to reduce risks when designing and operating resilient infrastructure.

Perform time and frequency domain analysis of MetOcean data to provide operational and design values.

Design navigational infrastructure with resilience and adaptation to climate change in mind.

Coastal hydrodynamics and processes.

Short-term and long-term wave climate.

Sediment transport and morphology.

Tidal currents.

Coastal and oceanographic numerical modelling.

Field campaigns and data treatment to evaluate problematic situations and plan/design solutions.

The basis behind climate change and its effect on the coast.

Design coastal interventions.

Understand and predict the impacts of coastal interventions.

Offer alternatives to hard coastal engineering.

Analyse and interpret collected field data in order to understand the physical drivers at short, mid and long-time or climatic scales.

Apply state-of-the-art wave, flow and morphological models.

Generic skills of subject

Design methods for ports, waterways and other coastal facilities.

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.

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.

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.

ECTS credits: total hours of student work

		Dedication	
		Hours	**Percent**
Supervised Learning	**Theory**	26.00	57.8%
	Assignments	9.00	20.0%
	Laboratory	10.00	22.2%

	Supervised activities	0.00	0.0%
Self-Learning		80.00	

Contents

Introduction

Dedication

3.0h. Theory

Description

Summary of the main processes and problems encountered in Coastal Engineering

Water wave mechanics

Dedication

4.0h. Theory + 2.0h. Assignments

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

Wave propagation

Dedication

8.0h. Theory + 3.0h. Assignments + 7.0h. Laboratory

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.

Other hydrodynamic processes

Dedication

5.0h. Theory + 2.0h. Assignments + 2.0h. Laboratory

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

Morphodynamic processes

Dedication

4.0h. Theory + 1.0h. Assignments + 1.0h. Laboratory

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

Climate change

Dedication

2.0h. Theory + 1.0h. Assignments

Description

Study of climate change and how it can affect coastal processes

Practical application of the theory explained in class

Activities

Grading rules (*)

(*) The evaluation calendar and grading rules will be approved before the start of the course.

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).

Test rules

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.

Office hours

Students will be attended by appointment

Basic bibliography

- J. Bosboom & M.J.F. Stive. **Coastal Dynamics**. Delft University of Technology. Delft, The Netherlands. 2021. ISBN 978-94-6366-370-0.
- L.H. Holthuijsen. **Waves in oceanic and coastal waters**. Cambridge University Press. Cambridge, UK. 2007. ISBN 978-0-521-86028-4.