Course guide
280827 - 280827 - Instrumentation and Modelling in Oceanographic Engineering

Last modified: 27/05/2024

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

Degree: MASTER'S DEGREE IN NAVAL AND OCEAN ENGINEERING (Syllabus 2017). (Optional subject).

Academic year: 2024 **ECTS Credits:** 5.0 **Languages:** Catalan, Spanish, English

LECTURER

Coordinating lecturer: MANUEL ESPINO INFANTES

Others: Segon quadrimestre:
MANUEL ESPINO INFANTES - MUENO
MANUEL GRIFOLL COLLS - MUENO

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Transversal:
CT3. TEAMWORK: Ability to work as a member of an interdisciplinary team, either as a member or performing management tasks, with the aim of contributing to projects pragmatically and sense of responsibility, assuming commitments considering the resources available.
CT4. EFFECTIVE USE OF INFORMATION RESOURCES: Manage the acquisition, structuring, analysis and visualization of data and information in the field of specialty, and critically evaluate the results of this management.
CT5. THIRD LANGUAGE Learning a third language, preferably English, with adequate oral and written and in line with the future needs of the graduates.

Basic:
CB6. Possess knowledge and understanding that provide a basis or opportunity be original in the development and / or application of ideas, often in a research context.
CB7. That the students can apply their knowledge and ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their study area.
CB8. Students should be able to integrate knowledge and handle the complexity of making judgments based on information that, being incomplete or limited, includes reflections on the responsibilities social and ethical linked to the application of their knowledge and judgments.
CB9. That students can communicate their conclusions and the knowledge and Latest rationale underpinning to specialists and non Specialty clearly and unambiguously.
CB10. Students must possess the learning skills that enable them continue studying in a way that will be largely self-directed or autonomous.

TEACHING METHODOLOGY

The subject is face-to-face in which a practice or a case study will be carried out weekly. In each session, the case study will be worked on based on a practice sheet in the computer room. The subect include prgramming in open source code and professional software.

LEARNING OBJECTIVES OF THE SUBJECT

The subject focuses on the acquisition of knowledge about instrumentation and modelling in the field of oceanographic engineering. The student will acquire knowledge about development of numerical models to reproduce and simulate processes in the ocean.

STUDY LOAD

Type	Hours	Percentage
Hours large group	45,0	36.00
Self study	80,0	64.00

Total learning time: 125 h

CONTENTS

Prac.1. Storm Surge simulation and modelling

Description:
Introduction to numerical modelling in oceanographic engineering. Explicit and implicit methods. Spatial discretization: finite differences and finite elements. Stability conditions. Case 1: Simulation of Oceanographic engineering processes: Storm Surge.

Full-or-part-time: 16h
Practical classes: 6h
Self study : 10h

Prac.2. Spiral Ekman modelling

Description:
Frictional layers in water column. Temporal discretization schemes. Boundary conditions. Ekman spiral and transport. Upwelling and coastal circulation. Case 2: Ekman spiral.

Full-or-part-time: 9h
Practical classes: 3h
Self study : 6h

Prac. 3. Modelling in Oceanographic Engineering: Long wave.

Description:
Euler equations and Airy Theory or finite wave theory. Simplifications for shallow water zones. Long wave equations. Case 3: Long wave equation.

Full-or-part-time: 17h
Practical classes: 6h
Self study : 11h

Prac. 4. Process simulation in ocean engineering: transport equation in 2D.

Description:
Transport equation: Advection, difussion and source term. Simplification for 1D and 2D cases. Peclet number. Initial conditions, boundary conditions and numerical stability. Lagrangean versus Eulerian perspectives. Case 4: Transport equation in 2D.

Full-or-part-time: 17h
Practical classes: 6h
Self study : 11h

Prac 5. Modeling in Oceanographic Engineering: The SWAN Wave Propagation Model

Description:
Waves generation and propagation. Difraction, refraction and shoaling. Elliptical models, energetic models, mean field models and Boussinseq models. Case 5: The SWAN wave propagation model.

Full-or-part-time: 17h
Practical classes: 6h
Self study : 11h

Prac. 6. Modeling in Oceanographic Engineering: the GNOME Pollutant Dispersion Model

Description:
Pollutants dispersion models. Associated processes: emulsification, dispersion and biodegradation. Skimmers and barrieres against oil spills. Case 6: the GNOME pollutant dispersion model.

Full-or-part-time: 16h
Practical classes: 6h
Self study : 10h

Prac. 7. Instrumentation: physical equipment + remote sensing (satellites, cameras, drones, etc.) and COPERNICUS products.

Description:
Instrumentation in oceanographic engineering: pressures, currents and hidrography. Satellital measurements: wind, currents, waves, etc. Cameras and drones used to identify plastics. COPERNICUS portal and sentinel program at the ESA.

Full-or-part-time: 9h
Theory classes: 3h
Self study : 6h

Prac. 8. Instrumentation: physical equipment, operation, visit to the laboratory

Description:
Micro-controllers and sensors. Optical sensors. Data transmission. Compact devices. Field measurements. Practice taking measurements "in situ". Laboratory visit.

Full-or-part-time: 8h
Theory classes: 3h
Self study : 5h

Prac. 9. Practical current measurement: launch of Lagrangian buoys and processing of results

Description:
Design of the measurement system of a lagrangean buoy. Ensambling and reception tests. Currents data storage and post-process. Current measurement practice: Lagrangean buoys launching and processing of the adquired data.

Full-or-part-time: 16h
Practical classes: 6h
Self study : 10h

GRADING SYSTEM

Students will be graded based on the marks obtained in the deliverables associated to the different practices made during the course.

BIBLIOGRAPHY

Basic:
- Kämpf, Jochen. Ocean modelling for beginners : using open-source software [on line]. Berlin: Springer, 2009 [Consultation: 01/09/2022]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=510888. ISBN 9783642008207.