Coastal Engineering and Management (250432)

General Information

School	ETSECCPB
Departments	Departament d'Enginyeria Civil i Ambiental (DECA)
Credits	5.0 ECTS
Programs	MÀSTER UNIVERSITARI EN ENGINYERIA DE CAMINS, CANALS I PORTS (pla 2012) MÀSTER UNIVERSITARI EN ENGINYERIA DE CAMINS, CANALS I PORTS (pla 2012) PARS: ENGINYER/A DE CAMINS, CANALS I PORTS (pla 2022)
Course	2024/25

Main teaching language at each group

- Group 10ES2 Spanish (Q2)

Faculty

Responsible Faculty: Jose Antonio Jimenez Quintana
Faculty: Manuel Espino Infantes, Jose Antonio Jimenez Quintana

Objectives of Education

Specialization subject in which knowledge on specific competences is intensified.

Knowledge and skills at specialization level that permit the development and application of techniques and methodologies at advanced level.

Contents of specialization at master level related to research or innovation in the field of engineering.

The objective of this course is to train students in the fields of dynamics, water quality and sediment transport in coastal areas, as well as in engineering and management activities in that area.

In particular, it is intended that students acquire an advanced knowledge of the agents and processes that act in the coastal zone (coastal dynamics, water quality and sediment transport). This training will focus mainly on training the student in the quantification of the processes which present the main methods, models and estimation techniques, emphasizing the range of application and validity.

Competencies

Especific

Knowledge of and the ability to understand dynamic phenomena of the coastal ocean and atmosphere and respond to problems encountered in port and coastal areas, including the environmental impact of coastal interventions. The ability to analyse and plan maritime works.

Transversal

ENTREPRENEURSHIP AND INNOVATION: Being aware of and understanding the mechanisms on which scientific research is based, as well as the mechanisms and instruments for transferring results among socio-economic agents involved in research, development and innovation processes.

SUSTAINABILITY AND SOCIAL COMMITMENT: Being aware of and understanding the complexity of the economic and social phenomena typical of a welfare society, and being able to relate social welfare to globalisation and sustainability and to use technique, technology, economics and sustainability in a balanced and compatible manner.
TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

Total hours of student work

		Hours	Percentage
Supervised Learning	Large group	25.5 h	56.67 %
	Medium group	9.75 h	21.67 %
	Laboratory classes	9.75 h	21.67 %
	Guided Activities	0.0 h	0.00 %
Self Study		80.0 h	

Contents

introduction

Presentation and course structure.
The coastal area. Delimitation and components.
Applications, resources, ecosystem functions and services. Processes, responses, pressures, impacts and issues in the coastal zone

Specific Objectives

Approach of the course objectives and course development. Concepts of time and space scales to define processes, problems and solutions.
Basic types of coastal problems.
Sustainability.

Hydrodynamic modeling in coastal environments

Basics waves. Spectral wave models. Waves in coastal areas. Introduction to SWAN model
Practical exercises with computer about the SWAN model
Types of currents at sea. Observation and representation of oceanographic variables. Modeling ocean currents. Examples of Operational Oceanography.

Specific Objectives

To familiarize students with the mathematical description of waves costaneras relevant from the perspective of civil engineering
To familiarize students with the model of wave generation and propagation SWAN
To familiarize students with the mathematical description and numerical ocean currents relevant from the perspective of civil engineering.

Dispersion of pollutants in coastal areas and estuaries

Molecular and turbulent diffusion.
Dispersion in coastal and estuarine areas.
Numerical models and field measurements

Statistics spills.
Physical and chemical characteristics of oil.
Environmental conditions.
Processes and algorithms.

Spills submarines.
Dispersants.
Models and applications

Work experience with GNOME and ADIOS models from NOAA

Specific Objectives

Study of the physical and mathematical models related to the dispersion and transport of pollutants in the coastal zone
To familiarize the student with the problematic of oil spills at sea and the subsequent arrival of fuel stains on the coast, driven by currents, waves and wind.
To familiarize students with oil spill models GNOME and ADIOS from NOAA

Evaluation

Sediment transport and coastal evolution

Initiation of motion.
Transport mechanism
Issues and actions typical in the coastal area based on an approach from the mechanics of transport
Storm -induced erosion and inundation
Models to assess the coastal response under storms
Proceedings before the impact of coastal storms

Design and impact of coastal works and activities

Problems induced by alongshore gradients in sediment transport.
Forcing terms
Evaluation of gradient evolution.
Models in plant evolution.

Solving coastaline problems induced by alongshore gradients in sediment transportong the coast
Detached breakwaters.
Artificial beaches.
Seawalls

Design of solutions for a long-term erosive coastline

Planning and management of the coastal system

Integrated Coastal Zone Management.
Coastal vulnerability to erosion and flooding.
Coastal vulnerability to toxic dumping.
Climate change and coastal adaptation

Activities

Tutored course work

Directed course work where students in groups, apply the tools presented during the course to a real problem in the coastal zone. This work will be presented in public in front of the class at the end of the course. You will also need to write a report covering the aspects of the oral presentation and any additional detail to show more understanding reached by the group in carrying out their work.

Dedication

6h

Teaching Methodology

The course consists of 3 hours per week of classroom activity

2,2 hours are devoted to theoretical lectures, in which the teacher presents the basic concepts and topics of the subject, shows examples and solves exercises.

0,8 hours 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.

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.

Although most of the sessions will be given in the language indicated, sessions supported by other occasional guest experts may be held in other languages.

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 qualifications of the tutored course work (30%) and two specific evaluation tests (35% each one).

Course work is directed to develop a coastal engineering analysis to a real problem of the Spanish coast. Requires teamwork, preparation of a written report and a final presentation in front of the class.

Specific evaluation tests consist of a part with questions on concepts associated with the learning objectives of the course in terms of knowledge or understanding, and a set of application exercises.

Test Rules

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Marks will range between 10 (maximum score) to 0 (minimum score)

The specific evaluation test will give approximate equal weight to the conceptual questions and to the application exercises. The tutores course work will be evaluated from the written report and the oral presentation. Different marks may be given to different members of the team, based on their respective contributions to the team work.

Office Hours

Wednesday 14:00 to 15:00
Anytime from 08:00 until 16:00 upon request and after confirmation

Bibliography

Basic

- Cur/Ciria. Manual on the use of rock in coastal and shoreline engineering. Gouda/Londres: Ciria Special publication, 1991.
- Dean, R.G. Beach nourishment: theory and practice. New Jersey: World Scientific Press, 2002. ISBN 9810215479.
- Dean, R.G; Dalrymple, R.A. Coastal Processes with Engineering Applications. Cambridge: Cambridge University Press, 2002. ISBN 0521495350.
- Herbich, J.B. (Ed.). Handbook of coastal engineering. New York: McGraw Hill, 2000. ISBN 0071344020.
- Kamphuis, J.W. Introduction to coastal engineering and management. 2nd ed. Singapore: World Scientific, 2010. ISBN 9789812834843.
- Kay, R.; Alder, J. Coastal planning and management. 2nd ed. Oxon: Taylor & Francis, 2005. ISBN 0415317738.
- Komar, P.D. Beach processes and sedimentation. 2nd ed. Upper Saddle River, N.J: Prentice Hall, 1998. ISBN 0137549385.

- Pilarczyck, K.W. (ed.). Dikes and revetments: design, maintenance and safety assessment. Rotterdam: A.A.Balkema, 1998. ISBN 9054104554.
- Soulsby, R. Dynamics of marine sands: a manual for practical applications. London: Thomas Telford, 1997. ISBN 072772584X.
- Morang, A. [et al.]. Coastal engineering manual. Washington: US Army Corps of Engineers, 2003.
- Vermaat, J.; Bouwer, L.; Turner, K.; Solomons, W. (Eds.). Managing European coasts: past, present, and future. Berlin: Springer, 2005. ISBN 3540234543.
- Holthuijsen, L.H. Waves in oceanic and coastal waters. Cambridge: Cambridge University Press, 2007. ISBN 9780521860284.
- Lewis, R. Dispersion in estuaries and coastal waters. Chochester [etc.]: John Wiley and Sons, 1997. ISBN 0471961620.
- Clark, M.M. Transport modeling for environmental engineers and scientists. 2nd ed. New York: John Wiley & Sons, 2009. ISBN 9780470260722.
- Doerffer, J.W. Oil spill response in the marine environment. Oxford: Pergamon Press, 1992. ISBN 0800410006.

Complementary

- Barragán, J.M. Las áreas litorales de España: del análisis geográfico a la gestión integrada. Barcelona: Ariel, 2004. ISBN 8434480700.
- Costas. Madrid: Boletín Oficial del Estado, 1994.
- Clark, J.R. Coastal zone management handbook. Boca Raton: Lewis Publishers, 1996. ISBN 1566700922.
- Gestión integrada de las zonas costeras en España. Madrid: Ministerio de Medio Ambiente. Dirección General de Costas de la Secretaría General para el Territorio y la Biodiversidad, 2006.
- Herbich, J.B. Handbook of dredging engineering. 2nd ed. New York: McGraw Hill, 2000. ISBN 0071343067.
- DPTOP, Generalitat de Catalunya. Pla director urbanístic del sistema costaner de Catalunya. Barcelona: Generalitat de Catalunya, Departament de Política Territorial i Obres Públiques, 2006. ISBN 8439371926.
- Kim, Y.C. Handbook of coastal and ocean engineering. Hackensack ; London: World Scientifc, 2010. ISBN 9789812819291.
- McFadden, L.; Nicholls, R.J.; Penning-Rowsell, E. (Eds.). Managing coastal vulnerability. Elsevier. Amsterdam: Elsevier, 200. ISBN 9780080447032.
- Turner, R.K.; Bateman, I.J.; Adger, W.N. Economics of coastal and water resources: valuing environmental functions. Dordrecht ; Boston: Kluwer Academic Publishers, 2001. ISBN 0792365046.
- Wright, D.J.; Bartlett, D.J. Marine and coastal geographical information systems. London: Taylor & Francis, 2000. ISBN 0748408703.
- Tolmazin, D. Elements of dynamic oceanography. London: Chapman & Hall, 1985. ISBN 0412532301.
- Knauss, J.A.; Garfield, N. Introduction to physical oceanography. 3rd ed. Long Grove, Illinois: Waveland Press, Inc., 2017. ISBN 9781478632504.
- Martin, J.L.; McCutcheon, S.C. Hydrodynamics and transport for water quality modeling. Boca Raton (Calif.): Lewis Publishers, 1999. ISBN 0873716124.
- Dyer, K.R. Estuaries: a physical introduction. Chischester: John Wiley, 1997. ISBN 0471974706.
- Kennish, M.J. Practical handbook of estuarine and marine pollution. Boca Raton: CRC Press, 1997. ISBN 0849384249.