Environmental Modelling (250461)

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	2025/26

Main teaching language at each group

- Group 11Q2 Catalan (Q2)
- Group 12Q2 Catalan (Q2)

Faculty

Responsible Faculty: Marc Berenguer Ferrer
Faculty: Marc Berenguer Ferrer, Xinyu Li, Daniel Sempere Torres

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.

Specialization course in Environmental Engineering and Sustainability in which knowledge in specific competences of the Master in Road, Channel and Port Engineering is intensified. It has knowledge at the level of specialization in environmental modeling that should allow developing and applying advanced level techniques and methodologies. Knows contents of specialization at master level in the area of environmental modeling and relates them to innovation in the field of engineering. Acquires capabilities to integrate environmental requirements in the practice of engineering and in the process of technological and social innovation. It models complex environmental processes in which infrastructures or services intervene from the analysis of observed data of environmental variables.

Competencies

Especific

The ability to plan, evaluate and regulate the use of surface water and groundwater resources.
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

Introduction. Approaches. Environmental modelling
Basics of probability and statistics

Environmental models

Typologies, structure and formulations.
Phases of modeling and model development
Practical application
Modeling of environmental complexity.
Analysis of an environmental modelling example
Environmental models

Data analysis and statistics

Descriptive statistics. Confidence interval. Hypothesis test. Transformations, Prediction intervals, Correlation.
Practical application

Calibration and parameter estimation

Calibration of environmental models
Regression models. Analysis of variance. Practical application

Model evaluation

Match and association analysis. Quality measures
Verification and validation.
Practical application
Simulation. Sensibility and uncertainty
Practical application

Teaching Methodology

The subject is carried out in sessions of 3h, usually divided into 2 parts: One of theory and one of practice.

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 grade of the subject is divided into 30% of course exercises, 30% of the analysis of scientific paper and 40% of the final control.

Test Rules

If an activity is not carried out according to the guidelines, it will be marked as zero.

Office Hours

Thursday from 2 pm-4pm.

Bibliography

Basic

- Holzbecher, E. Environmental modeling: using MATLAB. 2nd ed. Berlin ; New York: Springer, 2012. ISBN 9783642220425.
- Wainwright, J.; Mulligan, M. Environmental modelling: finding simplicity in complexity. 2nd ed. Chichester, UK: Wiley, 2013. ISBN 9781118366103.
- Smith, J.; Smith, P. Introduction to environmental modelling. Oxford: Oxford University Press, 2007. ISBN 9780199272068.

Complementary

- Kottegoda, N.T.; Rosso, R. Applied statistics for civil and environmental engineers. Second Edition. Oxford: Wiley?Blackwell, 2008. ISBN 978-1-4051-7917-1.
- Morgan, R.K. Environmental impact assessment: a methodological perspective. Dordrecht: Kluwer Acabemic, 1998. ISBN 0412730006.
- Ross, S.M. Introduction to probability and statistics for engineers and scientists. 5th ed. Oxford: Academic Press, 2014. ISBN 9780123948113.
- Berthouex, P.M.; Brown, L.C. Statistics for environmental engineers. 2nd ed. Boca Raton: Lewis, 2002. ISBN 1566705924.