



## Course guides

# 250461 - MODAMB - Environmental Modelling

**Last modified:** 06/10/2020

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

**Degree:** MASTER'S DEGREE IN CIVIL ENGINEERING (PROFESSIONAL TRACK) (Syllabus 2012). (Optional subject).  
MASTER'S DEGREE IN CIVIL ENGINEERING (PROFESSIONAL TRACK) (Syllabus 2012). (Optional subject).

**Academic year:** 2020    **ECTS Credits:** 5.0    **Languages:** Catalan, English, Spanish

### LECTURER

---

**Coordinating lecturer:** AGUSTÍ PÉREZ FOGUET

**Others:** MARC BERENGUER FERRER, AGUSTÍ PÉREZ FOGUET

### DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

---

**Specific:**

8231. The ability to plan, evaluate and regulate the use of surface water and groundwater resources.

8233. 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:**

8559. 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.

8560. 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.

8561. 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.

### TEACHING METHODOLOGY

---

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

## LEARNING OBJECTIVES OF THE SUBJECT

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.

## STUDY LOAD

| Type               | Hours | Percentage |
|--------------------|-------|------------|
| Practical classes  | 9,8   | 13.63      |
| Laboratory classes | 9,8   | 13.63      |
| Guided activities  | 6,0   | 8.34       |
| Self study         | 26,8  | 37.27      |
| Theory classes     | 19,5  | 27.12      |

**Total learning time:** 71.9 h

## CONTENTS

### Environmental engineering

**Description:**

Introduction. Approaches Public health. Environmental science and technology Ecological engineering.

**Full-or-part-time:** 7h 11m

Theory classes: 3h

Self study : 4h 11m

### Environmental models

**Description:**

Typologies, structure and formulations.

Phases of modeling and model development

A1

Modeling of environmental complexity.

A2

**Full-or-part-time:** 21h 36m

Theory classes: 6h

Practical classes: 2h

Laboratory classes: 1h

Self study : 12h 36m



### Data analysis and statistics

**Description:**

Descriptive statistics. Confidence interval. Hypothesis test. Transformations, Prediction intervals, Correlation.  
A1

**Full-or-part-time:** 14h 23m

Practical classes: 4h

Laboratory classes: 2h

Self study : 8h 23m

### Calibration and parameter estimation

**Description:**

Regression models. Analysis of variance.  
Practical application

**Full-or-part-time:** 7h 11m

Theory classes: 1h 30m

Laboratory classes: 1h 30m

Self study : 4h 11m

### Model evaluation

**Description:**

Match and association analysis. Quality measures  
Verification and validation.  
Simulation. Sensibility and uncertainty  
A1

**Full-or-part-time:** 21h 36m

Theory classes: 6h

Practical classes: 3h

Self study : 12h 36m

### Decision making. Environmental impact.

**Description:**

Introduction to decision making  
Environmental impact studies.  
Environmental planning

**Full-or-part-time:** 7h 11m

Theory classes: 3h

Self study : 4h 11m



### Risk and emergency

**Description:**

Risk analysis  
Ecotoxicity models  
Environmental emergencies

**Full-or-part-time:** 7h 11m

Theory classes: 3h

Self study : 4h 11m

### Overview

**Full-or-part-time:** 7h 11m

Laboratory classes: 3h

Self study : 4h 11m

## GRADING SYSTEM

The grade of the subject is divided into 30% of the A1 activity carried out throughout the course, 30% of oral group work A2, 30% of the final control of exploitation and 10% follow-up of the course.

## EXAMINATION RULES.

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

## BIBLIOGRAPHY

**Basic:**

- Berthouex, P.M.; Brown, L.C. Statistics for environmental engineers. 2nd ed. Boca Raton: Lewis, 2002. ISBN 1566705924.
- Holzbecher, E. Environmental modeling: using MATLAB [on line]. 2nd ed. Berlin ; New York: Springer, 2012 [Consultation: 05/02/2020]. Available on: <https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=885105>. ISBN 9783642220425.
- Jørgensen, S.E.; Fath, B.D. Fundamentals of ecological modelling: Applications in Environmental Management and Research. 4th ed. Elsevier, 2011. ISBN 9780444535689.
- Kottegoda, N.T.; Rosso, R. Applied statistics for civil and environmental engineers [on line]. Second Edition. Oxford: Wiley?Blackwell, 2008 [Consultation: 28/10/2020]. Available on: <https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=428240>. ISBN 978-1-4051-7917-1.
- Mitsch, W.J.; Jørgensen, S.E. Ecological engineering and ecosystem restoration. Hoboken, NJ: John Wiley & Sons, 2004. ISBN 047133264X.
- Ross, S.M. Introduction to probability and statistics for engineers and scientists. 5th ed. Oxford: Academic Press, 2014. ISBN 9780123948113.
- Smith, J.; Smith, P. Introduction to environmental modelling. Oxford: Oxford University Press, 2007. ISBN 9780199272068.
- Ugarte, M.D.; Militino, A.F.; Arnholt, A.T. Probability and statistics with R. Second Edition. Boca Raton: Taylor and Francis Group, 2016. ISBN 978-1466504394.
- Vesilind, P.A.; Morgan, S.M.; Heine, L.G. Introduction to environmental engineering. 3rd ed. Stamford, Connecticut: Cengage Learning, 2010. ISBN 9780495295853.
- Wainwright, J.; Mulligan, M. Environmental modelling: finding simplicity in complexity [on line]. 2nd ed. Chichester, UK: Wiley, 2013 [Consultation: 05/02/2020]. Available on: <https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=1116174>. ISBN 9781118366103.

**Complementary:**

- Schnelle, K.B.; Dey, P.R. Atmospheric dispersion modeling compliance guide. New York: McGraw-Hill, 2000. ISBN 0070580596.



- Weiner, R.F.; Matthews, R.A. Environmental engineering [on line]. 4th ed. Amsterdam: Butterworth-Heinemann, 2003 [Consultation: 09/11/2020]. Available on: <https://www.sciencedirect.com/science/book/9780750672948>. ISBN 9780750672948.
- Nemerow, N.L ... [et al.]. Environmental engineering. 6th ed. Hoboken: Wiley, 2009. ISBN 9780470083055.
- Morgan, R.K. Environmental impact assessment: a methodological perspective. Dordrecht: Kluwer Academic, 1998. ISBN 0412730006.
- Manahan, S.E. Environmental science and technology: a sustainable approach to green science and technology. 2nd ed. Boca Raton: CRC/Taylor & Francis, 2007. ISBN 0849395127.
- Jurin, R.R.; Roush, D.; Danter, J. Environmental communication: skills and principles for natural resource managers, scientists and engineers. 2nd ed. Dordrecht ; London: Springer, 2010. ISBN 9789048139866.