# Course guide
# 250MEA014 - 250MEA014 - Digitalization and Artificial Intelligence

**Last modified:** 05/06/2025

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

**Degree:** MASTER'S DEGREE IN ENVIRONMENTAL ENGINEERING (Syllabus 2024). (Optional subject).

**Academic year:** 2025 **ECTS Credits:** 5.0 **Languages:** Spanish

## LECTURER

**Coordinating lecturer:** AGUSTÍ PÉREZ FOGUET

**Others:** AGUSTÍ PÉREZ FOGUET
Diez Mejia, Pedro

## TEACHING METHODOLOGY

Theoretical classes are devoted to exposing the concepts and basic materials of the subject, presenting examples and carrying out exercises.

Guided activities are carried out to consolidate general and specific learning objectives.

Support material is used in the format of a detailed teaching plan through the ATENEA virtual campus:
contents, programming of assessment and guided learning activities and bibliography.

Most sessions will be taught in the language indicated in the guide. Some sessions or materials used may be in other languages.

## LEARNING OBJECTIVES OF THE SUBJECT

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## STUDY LOAD

| Type | Hours | Percentage |
|---|---|---|
| Self study | 80,0 | 64.00 |
| Hours large group | 35,0 | 28.00 |
| Hours small group | 10,0 | 8.00 |

**Total learning time:** 125 h

## CONTENTS

### Introduction

**Description:**
Context. Artificial intelligence. Programming techniques and environments.
Environmental measurements. Spatial and temporal precision.
Random variable. Bayes' theorem. Descriptive statistics. Multivariate distributions.

**Full-or-part-time:** 25h
Theory classes: 6h
Practical classes: 3h
Self study : 16h

### Cluster, factor, and Bayesian network analysis

**Description:**

Cluster analysis.
Principal component analysis.
Factor analysis.
Bayesian networks. Influence diagrams.
Case study. Air quality.

**Full-or-part-time:** 50h
Theory classes: 14h 30m
Practical classes: 3h 30m
Self study : 32h

### Regression, neural networks and surrogate models

**Description:**
Multiple linear regression. Vector linear regression.
Logistic regression.
Bayesian regression.
Artificial neural networks.
Surrogate models. Kriging.
Case study. Water quality.

**Full-or-part-time:** 50h
Theory classes: 14h 30m
Practical classes: 3h 30m
Self study : 32h

## GRADING SYSTEM

The mark of the course is obtained from the ratings of continuous assessment. Continuous assessment consist in two activities and two written exam. Each part counts the 25% of the course.
The evaluation tests consist of a part with questions about concepts associated with the learning objectives of the course with regard to knowledge or understanding, and a part with a set of application exercises, including computing programming, results discussions, and oral and written presentation in predefined formats.

## EXAMINATION RULES.

Failure to perform a continuous assessment activity in the scheduled period will result in a mark of zero in that activity.
The group activities can be qualified considering individual contributions.

## BIBLIOGRAPHY

**Basic:**
- Hersh, M.A. Mathematical modelling for sustainable development. Berlin: Springer, 2006. ISBN 9783540242161.
- Kjærulff, U.B.; Madsen, A.L. Bayesian networks and influence diagrams: a guide to construction and analysis [on line]. Second edition. New York: Springer Science+Business Media, 2014 [Consultation: 17/09/2024]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=1030496. ISBN 9781461451044.
- Greco, S.; Ehrogott, M.; Figueira, J.R. Multiple criteria decision analysis: state of the art surveys: volume 1 and 2 [on line]. 2nd ed. New York: Springer, 2016 [Consultation: 17/09/2024]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=4414645. ISBN 9781493930944.
- Ugarte, M.D.; Militino, A.F.; Arnholt, A.T. Probability and statistics with R. Second Edition. Boca Raton: CRC Press, Taylor & Francis Group, 2016. ISBN 9781466504394.
- Sànchez-Marrè, M. Intelligent decision support systems [on line]. 1a ed. Cham: Springer International Publishing, 2022 [Consultation: 17/09/2024]. Available on: https://link-springer-com.recursos.biblioteca.upc.edu/book/10.1007/978-3-030-87790-3. ISBN 9783030877903.