Course guide
250COD011 - 250COD011 - Data-Driven Project Laboratory

Last modified: 15/06/2026

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

Degree: MASTER'S DEGREE IN COMPUTATIONAL AND DATA-ASSISTED ENGINEERING (Syllabus 2026). (Compulsory subject).

Academic year: 2026 **ECTS Credits:** 5.0 **Languages:** English

LECTURER

Coordinating lecturer: Aguirre Font, Miquel

Others: Aguirre Font, Miquel
Cornejo Velázquez, Alejandro
Giacomini, Matteo

TEACHING METHODOLOGY

The course combines:
- Hands-on sessions using computational tools
- Applied projects
- Independent student work

LEARNING OBJECTIVES OF THE SUBJECT

This course will reinforce, via practical projects in data science, the knowledge and skills acquired in the Q1 courses Applied statistics & uncertainty quantification and continuum mechanics and the Q2 courses Machine learning & artificial intelligence and Optimization. The projects will be motivated by real-life engineering or science projects which, in many cases, may use knowledge and tools obtained in the remaining, computational-mechanics-based courses. The students will carry out a total of 4 projects.

STUDY LOAD

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

Total learning time: 125 h

CONTENTS

Project I. Advanced statistics and uncertainty quantification.

Description:
Using advanced statistics and uncertainty quantification for real-world data. Implement a simple machine learning model for decision-making.

Full-or-part-time: 19h
Guided activities: 7h
Self study : 12h

Project II. Automatic constitutive model discovery.

Description:
By using optimization techniques, automatically learn the parameters of a phenomenological constitutive model for fracture mechanics.

Full-or-part-time: 19h
Guided activities: 7h
Self study : 12h

Project III. Real time computational modelling using machine learning.

Description:
Creating a machine learning based surrogate model for real time simulation in computational mechanics.

Full-or-part-time: 38h
Guided activities: 14h
Self study : 24h

Project IV. Physics-informed neural networks.

Description:
Project IV. Developing a Physics-Informed neural network for modelling hyperelasticity.

Full-or-part-time: 38h
Guided activities: 14h
Self study : 24h

Evaluation session.

Description:
Evaluation session.

Full-or-part-time: 11h
Guided activities: 3h
Self study : 8h

GRADING SYSTEM

- Practical assignments: 90%
- Participation and activities: 10%

BIBLIOGRAPHY

Basic:

- Lee, John .A.; Verleysen, Michel. Nonlinear dimensionality reduction. New York: Springer, 2007. ISBN 9780387393506.
- Bishop, Christopher M. Pattern recognition and machine learning. New York: Springer, 2006. ISBN 0387310738.