Course guides
250442 - MODPRDECOP - Models for Decision Making and Optimisation in Engineering

Last modified: 04/11/2015

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

Degree: **Academic year:** 2015 **ECTS Credits:** 5.0
Languages: English

LECTURER

Coordinating lecturer: PEDRO DIEZ MEJIA

Others: MARINO ARROYO BALAGUER, PEDRO DIEZ MEJIA

TEACHING METHODOLOGY

The course consists of 1,8 hours per week of classroom activity (large size group) and 0,8 hours weekly with half the students (medium size group).

The 1,8 hours in the large size groups are devoted to theoretical lectures, in which the teacher presents the basic concepts and topics of the subject, shows examples and solves exercises.

The 0,8 hours in the medium size groups 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.

The rest of weekly hours devoted to laboratory practice.

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.

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.

STUDY LOAD

Type	Hours	Percentage
Theory classes	19,5	15.59
Laboratory classes	9,8	7.83
Guided activities	6,0	4.80
Self study	80,0	63.95
Practical classes	9,8	7.83

Total learning time: 125.1 h

CONTENTS

Stochastic modeling

Description:
Elements in a decision making scheme: Decision Maker, Actions, Random States, Utility, Optimization Criterion. A priori schemes. A posteriori schemes. Probabilistic description of an experiment.

Bayes' updating. Pre-posterior schemes.
Applications of decision schemes.

Full-or-part-time: 21 h
Theory classes: 6h
Laboratory classes: 3h
Self study : 12h 36m

Statistical learning

Description:
Algebraic SVD
Principal Components Analysis (PCA) and Karhunen-Loève theorem
Multidimensional Scaling (MDS)
Nonlinear dimensionality reduction

Full-or-part-time: 28 h
Theory classes: 3h
Practical classes: 6h
Laboratory classes: 3h
Self study : 16h 47m

Simulation

Description:
Monte-Carlo sampling and Stochastic FEM
Reduced order modeling

Full-or-part-time: 14 h
Theory classes: 3h
Laboratory classes: 3h
Self study : 8h 23m

Optimization

Description:
Duality
Optimal location of nodes in (electricity) grids
Maximum entropy models for operations research

Full-or-part-time: 21 h
Theory classes: 3h
Laboratory classes: 6h
Self study : 12h 36m

Project presentations

Full-or-part-time: 7 h
Laboratory classes: 3h
Self study : 4h 11m

GRADING SYSTEM

The mark of the course is obtained from the ratings of continuous assessment and their corresponding laboratories and/or classroom computers.

Continuous assessment consist in several activities, both individually and in group, of additive and training characteristics, carried out during the year (both in and out of the classroom).

The teachings of the laboratory grade is the average in such activities.

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.

EXAMINATION RULES.

Failure to perform a laboratory or continuous assessment activity in the scheduled period will result in a mark of zero in that activity.

BIBLIOGRAPHY

Basic:

- Lee, John A., Verleysen, Michel. Nonlinear Dimensionality Reduction. Springer, 2007. ISBN 978-0-387-39350-6.
- Roger G. Ghanem, Pol D. Spanos. Stochastic Finite Elements: A Spectral Approach. Courier Dover Publications, 2001.