Course guide
2500231 - GEA0231 - Decision Making Systems

Last modified: 01/10/2023

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

Degree: BACHELOR'S DEGREE IN ENVIRONMENTAL ENGINEERING (Syllabus 2020). (Compulsory subject).

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** Spanish

LECTURER

Coordinating lecturer: AGUSTÍ PÉREZ FOGUET

Others: AGUSTÍ PÉREZ FOGUET

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
14451. Apply the fundamental concepts of statistics and randomness of physical, social and economic phenomena, as well as uncertainty and decision-making techniques.
14457. Identify the fundamentals of structure theory, sustainable procedures for construction and dismantling of buildings and civil works; and describe the technology bases of the materials used in construction.
14460. Design and project treatment systems for purification and purification of water resources, and establish the basis for the management of waste generated, describe and assess desalination and reuse processes.
14461. Analyze, design, simulate and optimize processes and systems with environmental relevance, both natural and artificial, and their resolution techniques, as well as recognize techniques for analysis and evaluation of climate change.
14462. Design and project processes for the treatment of contaminated soils and aquifers.
14463. Prepare, implement, coordinate and evaluate urban and industrial solid waste management plans and resource recovery.
14464. Apply measures to prevent and control air quality, quantify noise pollution and its corrective measures and quantify odor emissions and corrective measures.

Generical:
14440. Identify, formulate and solve problems related to environmental engineering.
14441. Apply the functions of consulting, analysis, design, calculation, project, construction, maintenance, conservation and exploitation of any action in the territory in the field of environmental engineering.
14442. To use in any action in the territory proven methods and accredited technologies, in order to achieve the greatest efficiency respect for the environment and the protection of the safety and health of workers and users.
14443. Apply the necessary legislation during the professional practice of environmental engineering.
14444. Apply business management techniques and labor legislation.

TEACHING METHODOLOGY

The course consists of 2.3 hours per week of classroom activity (large size group) and 1.2 hours weekly with half the students (medium size group).

The 2.3 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 1.2 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.

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.

LEARNING OBJECTIVES OF THE SUBJECT

Professionals in environmental engineering will have to make complex decisions throughout their professional lives. A cross-sectional and at the same time global and inclusive perspective is necessary that provides future graduates with decision-making tools for their professional practice. A series of Cases with practical and real applications are presented.

1. Understand the mathematical programming tools for optimization processes (linear, integer, decision variables, Simplex method, conditions
optimality
2. Understand and apply decision-making techniques based on risk analysis, Markov chains, decision trees.
3. Evaluate the results for their application in studies of alternatives and strategic planning.

Decision Making Systems. Professionals in environmental engineering throughout their professional lives will have to make complex decisions. A cross-sectional and at the same time global and inclusive perspective is needed that provides future graduates with decision-making tools for their professional practice.
The course includes three conceptual modules (Optimization, Decision Making itself and Evaluation) and a series of Cases with real and practical applications.

STUDY LOAD

Type	Hours	Percentage
Hours medium group	15,0	10.00
Self study	90,0	60.00
Hours small group	15,0	10.00
Hours large group	30,0	20.00

Total learning time: 150 h

CONTENTS

Decision theory

Description:
Decision theory. Types of decisions.
Decision-making process. Modeling of the Decision Process. Simple Decision Scenario
Risk and uncertainty.
Multiple Decision Scenario: Influence Diagrams, Decision Trees.

Full-or-part-time: 28h 47m
Theory classes: 12h
Self study : 16h 47m

Mathematical programming

Description:
Continuous and integer mathematical programming.
Unrestricted optimization.
Linear optimization with linear constraints
Quadratic optimization with linear constraints

Full-or-part-time: 28h 47m
Theory classes: 12h
Self study : 16h 47m

Multi-criteria techniques

Description:
Composite indices and multidimensional measures
Pairwise comparisons.
Preferences and preorders.
Multiabritute utility.

Full-or-part-time: 28h 47m
Theory classes: 12h
Self study : 16h 47m

Applications

Description:
models of choice
study of alternatives
study of alternatives

Full-or-part-time: 57h 35m
Practical classes: 24h
Self study : 33h 35m

GRADING SYSTEM

The subject's grade is obtained from the continuous assessment grades and the corresponding laboratory and/or computer lab grades. Continuous assessment consists of carrying out different activities, both individual and group, of an additive and formative nature, carried out during the course (inside and outside the classroom). The qualification of teaching in the laboratory is the average of the activities of this type. The assessment tests consist of a part with questions about concepts associated with the learning objectives of the subject in terms of knowledge or understanding, and a set of application exercises. The course grade corresponds to 40% partial exam, 50% final exam and 10% course follow-up. Re-evaluation (RE) Criteria for qualification and admission to the re-evaluation (Re): Students suspended from the ordinary evaluation who have appeared regularly in the evaluation tests of the suspended subject will have the option to take a reassessment test in the period set in the academic calendar. Students who have already passed or students who are classified as not presented or who have not submitted all the exercises/problems (Pr) and assignments and reports (Tr) will not be able to take the revaluation test of a subject. reevaluation (RE) will consist of a single exam that covers all the content of the course. The maximum grade for the reassessment will be five (5.0) and the final grade for the course will be the highest grade between the continuous assessment and the reassessment exam, i.e. MAX(EO,RE). The non-attendance of a student called to the re-evaluation test, held in the fixed period, cannot give rise to the completion of another test with a later date. Extraordinary assessments will be carried out for those students who, due to accredited force majeure, have not been able to take any of the continuous assessment tests. These tests must be authorized by the corresponding head of studies, at the request of the teacher responsible for the subject, and will be carried out within the corresponding teaching period.

EXAMINATION RULES.

If one of the laboratory or continuous assessment activities is not carried out in the scheduled period, it will be considered as a zero score. The tests will be carried out individually, with test-type questions that can be theoretical or problem-type questions. The exams may include short questions to be developed by the students and exercises to be solved.

BIBLIOGRAPHY

Basic:

- Sànchez-Marrè, Miquel. Intelligent decision support systems [on line]. Cham: Springer, 2022Available on: https://link-springer-com.recursos.biblioteca.upc.edu/book/10.1007/978-3-030-87790-3. ISBN 9783030877903.
- Hersh, M.A. Mathematical modelling for sustainable development. Berlin: Springer-Verlag, 2006. ISBN 9783540242161.
- Figueira, José; Greco, Salvatore; Ehrogott, Matthias. Multiple Criteria Decision Analysis: State of the Art Surveys [on line]. 2nd ed. New York, NY: Springer, 2016 [Consultation: 05/10/2023]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=4414645. ISBN 9781493930944.
- Pratt, J. W., Raiffa, H., Schlaifer. Introduction to Statistical Decision Theory. Cambridge: MIT Press, 1994. ISBN 0262161443.