Course guide
250MEA002 - 250MEA002 - Ecological Engineering

Last modified: 30/06/2024

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). (Compulsory subject).

Academic year: 2024 **ECTS Credits:** 5.0 **Languages:** Spanish, English

LECTURER

Coordinating lecturer: JAUME PUIGAGUT JUAREZ

Others: JOAN DE PABLO RIBAS, JAUME PUIGAGUT JUAREZ

TEACHING METHODOLOGY

The course is organized in sessions (3 hours/session). General estructure of each session is that of 2 hors theory + 1 hour numerical exercises (as long as the theory is enough to address the numerical exercises).

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

.Ecological engineering encompasses the knowledge required to restore the ecological value of ecosistems afected by human beings and also develop new ecosystems with both human and ecological value. Specific objectives of the course are:

1) Understand the relation between biotic and abiotic factors within an ecosystem.
2) To know the most common parameters that define the quality of an ecosystem, before and after the restoration.
3) To know most common techniques and procedure of the restoration of ecosystems
4) To learn how to numerical estimate some of the most common parameters that define the quality of and ecosystem
5) To know the most common numerical tools (biological indexes) that are used to estimate and follow the quality of an ecosystem

STUDY LOAD

Type	Hours	Percentage
Hours small group	9,8	7.83
Hours large group	25,5	20.38
Hours medium group	9,8	7.83
Self study	80,0	63.95

Total learning time: 125.1 h

CONTENTS

Session 1. The work environment of ecological engineering: terms and concepts

Description:
Definition of concepts linked to Ecological Engineering. Concepts and definitions of ecology terms. Relationship between the physical/chemical environment and the biological environment. The great biogeochemical cycles. Relationship between bioavailability and contamination.

Full-or-part-time: 3h
Theory classes: 3h

Session 2. Techniques for improving teamwork, oral and written communication. Essential elements to choose a good case study.

Description:
The most common methods to improve the ability to transmit oral knowledge will be seen, how to organize a presentation, how to write scientific texts and how to choose a good practical case to present a good example of ecosystem restoration situations

Full-or-part-time: 3h
Theory classes: 2h
Guided activities: 1h

Session 3. Methods and techniques of restoration

Description:
The methodologies for analyzing a degraded ecosystem situation will be addressed and what are the steps to follow to return the ecosystem function

Full-or-part-time: 3h
Guided activities: 3h

Session 4. Parameters of quality in ecosystems

Description:
The methodology for determining the parameters that define the quality of an ecosystem will be defined and evaluated

Full-or-part-time: 3h
Theory classes: 3h

Session 5. Calculation and estimation of the quality parameters of an ecosystem

Description:
Calculation of diversity, biomass and temporal evolution of ecological successions in ecosystems. We will see the diversity equations and their calculation, the determination or estimation of the population abundance based on volumetric relationship equations with the biomass and the statistical potential equations to, based on the measurement of the normal diameter, estimate biomass photosynthetic Markov chains (matrix statistical calculation) will be used to determine the evolution of the communities of an ecosystem over time

Full-or-part-time: 3h
Theory classes: 2h
Guided activities: 1h

Session 6. Population ecology models applied to ecosystem monitoring

Description:
Application of the logistic model of population ecology with the variant of constant exploitation or exploitation with constant effort for the determination of human aggression in aquatic ecosystems

Full-or-part-time: 3h
Theory classes: 2h
Guided activities: 1h

Session 7. The use and application of biosensors for monitoring an ecosystem

Description:
Biosensors will be used to determine biomass and microbial activity in terrestrial and aquatic systems. Data processing and model formulation

Full-or-part-time: 3h
Theory classes: 2h
Guided activities: 1h

Session 8. Biological indexes

Description:
Biological indices as a numerical tool for monitoring the quality of aquatic and terrestrial ecosystems. Several biological indices will be seen and applied to the monitoring and determination of the quality of an aquatic ecosystem (BMWP and SBI) and a terrestrial system

Full-or-part-time: 3h
Theory classes: 2h
Guided activities: 1h

Sessión 9. Exam

Description:
Exam on theoretical and numerical concepts of Ecological Engineering

Full-or-part-time: 3h
Theory classes: 3h

Session 10 and 11. Presentation of case-study 1.

Description:
Oral defense of a case study of the monitoring and evaluation of the environmental restoration of a freshwater or saltwater ecosystem

Full-or-part-time: 6h
Theory classes: 3h
Laboratory classes: 3h

Session 12,13,14 and 15. Oral defense of experimental data

Description:
Oral presentation of the experimental data provided by the teaching staff on which strategy is best to condition a degraded soil. Analysis of soil quality production of terrestrial biomass

Full-or-part-time: 12h
Theory classes: 3h
Laboratory classes: 9h

GRADING SYSTEM

The rating of the course is based on the rating of each of tasks that encompasses the continuous evaluation. More precisely, the evaluation tasks are: 1) 4 activities based on the oral defense of 41 case-study on the restoration of a either a freshwater ecosystem or a marine ecosystems (15% of the overall course rating); 2) writting of a scientific paper (15% of overall rating) and an oral presentation (15% of overall ratin) of the experimental data provided by the professors on the health recovery of an unhealthy soil; 3) Report on the most applied techniques for optimising either oral or writting skills communication; and 4) exam tha evaluates the numerical and teoretical concepts of the course (40% of the overall rating of the course). The exam consists of 10 short questions and 2 numerical exercises.

EXAMINATION RULES.

The evaluated activities are compulsory. Not presenting any of the four activities will result in failing the course.

BIBLIOGRAPHY

Basic:
- Piñol, J.; Martínez-Vilalta, J. Ecologia con números: una introducción a la ecología con problemas y ejercicios de simulación. Barcelona: Lynx, 2006. ISBN 8496553019.
- Margalef i López, R. Ecología. 5a ed. Barcelona: Planeta, 1992. ISBN 8432045802.
- Schlesinger, W.H.; Bernhardt, E.S. Biogeochemistry: an analysis of global change. 4th ed. London: Academic Press, 2020. ISBN 9780128146088.