Course guides
250562 - ESTADAMBIE - Environmental Statistics

Unit in charge: Barcelona School of Civil Engineering
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering.
Degree: BACHELOR'S DEGREE IN MARINE SCIENCE AND TECHNOLOGY (Syllabus 2018). (Compulsory subject).
Academic year: 2020  ECTS Credits: 6.0  Languages: Spanish, English

LECTURER

Coordinating lecturer: EUSEBIO JARAUTA BRAGULAT
Others: EUSEBIO JARAUTA BRAGULAT

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
13388. To know and apply the lexicon and concepts of the Marine Sciences and Technologies and other related fields.
13390. Establish a good practice in the integration of common numerical, laboratory and field techniques in the analysis of any problem related to the marine environment.
13394. Address the most relevant processes and their interactions related to their physical / chemical / biological / geological components, applying technical and scientific knowledge and criteria.
13403. Develop a conceptual framework to address the sustainability of the marine environment and the related socio-economic activities at different scales, explaining the effects of climate change.
13405. Carry out calculations, assessments, surveys and inspections in coastal and marine environments, as well as the corresponding technical documents.
13407. Apply the necessary tools to analyze the economic and legal aspects of human actions and the related impacts on the marine environment, including technical advice and representation of companies and administrations.

General:
13380. Develop a professional activity in the field of Marine Sciences and Technologies.
13381. Address in a comprehensive manner the analysis and preservation of the marine environment with sustainability criteria.

TEACHING METHODOLOGY

The course is taught during 4 hours a week of face-to-face classes in the classroom, throughout the twelve academic weeks of the semester.
The sessions are devoted to Theory (exposition of concepts and basic materials of the subject, illustrated with examples of application), Classroom practices (resolution of exercises and problems) and Laboratory Practices (realization of calculations with application software to the subject).
Supporting material is available to students through the ATENEA virtual campus.
LEARNING OBJECTIVES OF THE SUBJECT

In this subject the basic statistical concepts relevant to the natural and environmental sciences will be addressed to provide experience in the correct use and interpretation of the various statistical methods currently used in the analysis of natural data and numerical simulation data. Fundamental aspects of descriptive statistics, probability and transformation of random variables will be emphasized. Subsequently, data analysis tools, such as the central limit theorem, data distribution and hypotheses analysis, will be addressed.

1.- Perform data analyses of environmental process problems using computer tools.
2.- Perform multiple linear regression analyses using computer tools.
3.- Carry out simulations of data and transformations of random variables, as well as employing probability distributions common in Marine Sciences and make inferences about them.

This subject focuses on highlighting aspects related to the state of health of the marine environment, mainly oriented to two well differentiated but complementary aspects. On the one hand, the ecological, ecosystemic and environmental aspects, which will give the students a specific vision of the environmental problems present in the marine environment, produced by the use and exploitation of the resources that it provides.

On the other hand, this subject represents a transition of knowledge for students between the Extension of the subject of Basic Sciences, the subject of Applied Sciences and Techniques

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours medium group</td>
<td>15,0</td>
<td>10.00</td>
</tr>
<tr>
<td>Guided activities</td>
<td>6,0</td>
<td>4.00</td>
</tr>
<tr>
<td>Hours small group</td>
<td>15,0</td>
<td>10.00</td>
</tr>
<tr>
<td>Hours large group</td>
<td>30,0</td>
<td>20.00</td>
</tr>
<tr>
<td>Self study</td>
<td>84,0</td>
<td>56.00</td>
</tr>
</tbody>
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Total learning time: 150 h

CONTENTS

**Exploratory data analysis**

**Description:**
In this section, the statistical treatments to which the data obtained through observation or experimental techniques are subjected will be addressed.

In this section, the statistical treatments to which the data obtained through observation or by experimental techniques are submitted.

**Specific objectives:**
Students will be introduced to the basic concepts of statistics that allow to establish descriptors and comparisons between different data sets.

The basic concepts of the statisticians will be introduced to the students

**Full-or-part-time:** 14h 23m
Theory classes: 2h
Practical classes: 4h
Self study : 8h 23m
### Introduction to the Theory of Probability

**Description:**
Students are introduced on the concepts of probability
The students are introduced on the basic aspects of probability as a predictive technique.

**Specific objectives:**
Show the students
Show the students basic concepts of counting, permutations, combinations, probability of events, conditional probability, etc.

**Full-or-part-time:** 14h 23m
Theory classes: 2h
Practical classes: 4h
Self study : 8h 23m

### Random variables and probability distributions

**Description:**
Students are introduced to the basic aspects of random variables (continuous or discontinuous) as values affected by randomness.
Exercises of random variables and probability distributions

**Specific objectives:**
The students will be shown to work with random variables in a solid way by means of randomized experiments for their statistical treatment to establish functional relationships between the elements of a sample space (associated to an experiment) and real numbers.
Master random variables and probability distributions

**Full-or-part-time:** 16h 48m
Theory classes: 2h
Practical classes: 5h
Self study : 9h 48m

### Inference: sampling and estimation

**Description:**
Show students how to obtain statistical information about large populations through studies of samples with significant representation (subsamples), which allow a reliable study of the total population.
Show students how to obtain statistical information about large populations through studies of samples with significant representation (subsamples), which allow a reliable study of the total population.

**Specific objectives:**
Show the student selection techniques of samples with a smaller size and absence of bias.

Show the student selection techniques of samples with a smaller size and absence of bias.

**Full-or-part-time:** 26h 24m
Theory classes: 4h
Practical classes: 7h
Self study : 15h 24m
### Contrasts of hypothesis

**Description:**
Students will be shown the procedures to accept or reject a hypothesis that is issued about a parameter or any other characteristic of the population.
The students will be shown the procedures to accept or reject a hypothesis that is emitted on a parameter or any other characteristic of the population.

**Specific objectives:**
Students will be taught to formulate a hypothesis test on a population by formulating null hypotheses and alternative hypotheses of contrast. Special emphasis will be placed on the use of p-value to determine the likelihood and the risk of taking any of the proposed hypotheses as adequate.
The students will be taught to formulate a hypothesis test on a population by formulating the null hypotheses and the alternative contrast hypotheses. Special emphasis will be placed on the use of p-value to determine the likelihood and the risk of taking any of the hypotheses considered as adequate.

**Full-or-part-time:** 26h 24m
Theory classes: 4h
Practical classes: 7h
Self study : 15h 24m

### Simple linear regression

**Description:**
Introduction to linear regression
Linear regression exercises and problems

**Specific objectives:**
Know and apply linear regression methods
Know and apply linear regression

**Full-or-part-time:** 16h 48m
Theory classes: 2h
Practical classes: 5h
Self study : 9h 48m

### Introduction to Compositional Data

**Description:**
Introduction to CODA concepts and methods

**Specific objectives:**
Know and apply the concepts CODA

**Full-or-part-time:** 4h 48m
Theory classes: 2h
Self study : 2h 48m
## Computer Laboratory

**Description:**
Computer sessions

**Specific objectives:**
Show the students the computer tools to solve problems and practices

**Full-or-part-time:** 12h  
Laboratory classes: 5h  
Self study : 7h

## Evaluation

**Full-or-part-time:** 12h  
Laboratory classes: 5h  
Self study : 7h

## GRADING SYSTEM

There are two exams throughout the semester:  
* Partial Examination (EP); Weight = 50%  
* Final Exam (EF); Weight = 50%

If the arithmetic mean of the EP and EF exams exceeds the passed one (that is, it is greater than or equal to 5 points out of 10), the course is approved. Otherwise, the student must take the re-evaluation exam.

A Course Global Work is proposed, which is valued with a maximum of 2 points for adding to the overall grade of the course.

## 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:**