Course guide
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: 2022 ECTS Credits: 6.0 Languages: English

LECTURER

Coordinating lecturer: JOSE LUIS DIAZ BARRERO
Others: JOSE LUIS DIAZ BARRERO

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.

Generical:
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 subject is taught in 4 hours a week of face-to-face classes in the classroom or online (as agreed by the competent governing bodies) throughout the school weeks of the semester established by the academic calendar of the School.
The sessions are devoted to Theory (exposition of the basic concepts and materials of the subject, illustrated with application examples), Classroom Practices (solving exercises and problems) and Laboratory Practices (carrying out calculations with application software for the subject).
Support material is used that is made available to students through the virtual campus ATENEA.

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

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>
</table>

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:** 16h 48m
Theory classes: 3h
Practical classes: 4h
Self study : 9h 48m

### 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:** 21h 36m
Theory classes: 4h
Practical classes: 5h
Self study : 12h 36m

### 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:** 19h 12m
Theory classes: 4h
Practical classes: 4h
Self study : 11h 12m
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 another 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: 21h 36m
Theory classes: 4h
Practical classes: 5h
Self study: 12h 36m

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: 19h 12m
Theory classes: 3h
Practical classes: 5h
Self study: 11h 12m

Computer Laboratory

Description:
Computer sessions

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

Full-or-part-time: 19h 12m
Laboratory classes: 8h
Self study: 11h 12m

Evaluation

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

Two exams are held throughout the semester: *EP1 = Partial Exam 1, weight = 50% of the grade for the subject. *EP2 = Partial Exam 2, weight = 50% of the grade for the subject. If the grade obtained (EP1 + EP2) / 2 exceeds the approved one, that is, it is greater than or equal to 5 points out of 10, then the subject is approved per course. Otherwise, you have to go to the reevaluation exam. Class activities are taken into account, with a maximum supplement of 5% on the grade for the subject. A Course Work is proposed, of a voluntary nature, whose qualification can suppose an improvement of up to 15% of the qualification of the subject. It is done in groups of maximum 4 people.

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: