Course guide
2500215 - GEA0215 - Statistics

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: 2022  ECTS Credits: 6.0  Languages: Spanish

LECTURER

Coordinating lecturer: AGUSTÍ PÉREZ FOGUET
Others: JOSE LUIS DIAZ BARRERO, AGUSTÍ PÉREZ FOGUET

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
14445. Recognize the biological bases and foundations of the plant and animal field in engineering: notions of genetics, biochemistry and metabolism, physiology, organisms and environment, population dynamics, flows of matter and energy and changes in ecosystems, biodiversity, principles of the kinetics of microbial growth and reactor theory.
14447. Obtain basic knowledge about the use and programming of computers, operating systems, databases and basic numerical calculation and applied to engineering.
14451. Apply the fundamental concepts of statistics and randomness of physical, social and economic phenomena, as well as uncertainty and decision-making techniques.
14452. Enhance the capacity of spatial vision and identify the techniques of graphic representation, topography, photogrammetry, cartography, remote sensing and Geographic Information systems.
14453. Describe and apply the techniques of analysis of physical, chemical and biological parameters; Integrate the experimental evidence found in field and / or laboratory data with the theoretical knowledge and interpret its results.
14454. Formulate the principles of fluid mechanics and the fundamentals of continuous medium mechanics.
14455. Identify the concepts and technical aspects linked to the conduit systems, both in pressure and in free sheet and apply them to the water supply transport networks; pumping systems; unit networks; separative networks; Avenues prevention systems in urban areas and analysis of tools for the recovery of altered river and coastal spaces.
14456. Describe the processes linked to the water cycle: atmospheric circulation and rain formation; rain transformation into runoff; and apply them to surface and underground hydrology associated with avenues risk, surface water pollution, aquifer management and groundwater pollution.

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.

TEACHING METHODOLOGY

The subject consists of 3 hours a week of face-to-face classes in the classroom (large group) and 1 hour a week with half of the students (medium group). They dedicate to theoretical classes 3 hours in big group, in which the profesorado exposes the concepts and basic materials of the matter, presents examples and realizes exercises. 1 hour (middle group) is devoted to solving problems with greater interaction with students and to laboratory practices. Practical exercises are carried out in order to consolidate general and specific learning objectives. Support material is used in the format of a detailed teaching plan through the ATENEA virtual campus: contents, programming of assessment and guided learning activities and bibliography. Specific software (R) is used.

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

Knowledge is provided for data analysis, representation and treatment, as well as for solving uncertainty and statistical problems and their application to scientific-technological subjects, as well as applied technological ones.

1. Perform data analysis of environmental engineering problems using computer tools that use the techniques studied.
2. Perform multiple linear regression analysis using computer programs.
3. Perform data simulations and transformation of random variables, as well as the study of probability distributions.

Statistics. Knowledge will be raised for data analysis, representation and treatment, as well as for solving statistical and uncertainty problems and its application to scientific-technological subjects, as well as applied technological.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Self study</td>
<td>84,0</td>
<td>56.00</td>
</tr>
<tr>
<td>Hours medium group</td>
<td>15,0</td>
<td>10.00</td>
</tr>
<tr>
<td>Hours small 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 large group</td>
<td>30,0</td>
<td>20.00</td>
</tr>
</tbody>
</table>

Total learning time: 150 h

CONTENTS

Obtaining data

Description:
Obtaining data from environmental monitoring portals. Types of variables.

Specific objectives:
Obtaining data with the computer

Full-or-part-time: 2h 24m
Theory classes: 1h
Self study: 1h 24m

Data exploration

Description:
Exploratory data analysis
Location and dispersion. Averages, variability, quantiles and extremes.
Representation of the staggered sample distribution. Histograms.
Representation. Calculation and interpretation of the correlation.
Linear adjustment and prediction. Cyclic and polynomial trend

Full-or-part-time: 12h
Theory classes: 5h
Self study: 7h
Probabilistic models

Description:
Definition and properties of elementary probability.
Uniform distribution, Bernoulli, binomial, geometric, hypergeometric. Fish
Uniform, exponential, gamma and beta distribution. Central limit theorem and normal distribution. Extreme asymptotic models.
Problems on probability models
Punctual processes in time (Bernoulli and Poisson). Return periods

Full-or-part-time: 48h
Theory classes: 14h
Practical classes: 6h
Self study: 28h

Parameter estimation

Description:
Properties of estimators.
Examples of estimation
Parameter estimation problems

Full-or-part-time: 19h 12m
Theory classes: 4h
Practical classes: 4h
Self study: 11h 12m

Hypothesis testing

Description:
Decision rules. Type I and II errors. Power.
Contrasts on mean and variance of normal populations. Distributions t, chi2, F, p-value.
Problems on hypothesis testing

Full-or-part-time: 24h
Theory classes: 4h
Practical classes: 6h
Self study: 14h

Linear regression and applications

Description:
Linear regression model and its extensions Hypothesis tests.
Multiple regression. ANOVA. Use of factors.

Full-or-part-time: 9h 36m
Theory classes: 4h
Self study: 5h 36m
**Evaluation**

**Description:**
Practices on regression

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

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**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.

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**BIBLIOGRAPHY**

**Basic:**

**Complementary:**