

## 29708 - Statistics

### Syllabus Information

**Academic year:** 2023/24

**Subject:** 29708 - Statistics

**Faculty / School:** 110 - Escuela de Ingeniería y Arquitectura

**Degree:** 434 - Bachelor's Degree in Mechanical Engineering

**ECTS:** 6.0

**Year:** 1

**Semester:** 434-First semester o Second semester

107-Second semester

**Subject type:** Basic Education

**Module:**

### 1. General information

This subject covers aspects of data collection, presentation, analysis and processing, as well as Probability, Statistical Inference and Optimization, modeling real situations in the presence of uncertainty. The final objective is that the student integrates the knowledge acquired in the subject in the formative context of the degree and that they are self-sufficient in the use of statistical techniques that may be useful in the professional practice of the mechanical engineer. All the training provided by this subject contributes transversally to AGENDA 2030 and SDGs, training the student for its development and management. Students are advised to study the subject constantly throughout the whole term.

### 2. Learning results

#### 2.1 Competencies

Specific competencies:

C12: Ability to solve mathematical problems that may arise in engineering. Ability to apply knowledge of Statistics and Optimization.

Generic competencies:

C4: Ability to solve problems and make decisions with initiative, creativity and critical thinking.

C5: Ability to communicate and transmit knowledge, skills and abilities in Spanish.

#### 2.2- Learning Results

Apply data processing and analysis techniques.

Know the fundamental concepts, applications and results of probability.

Understand the concepts of unidimensional and multidimensional random variables.

Master the modeling of engineering environments under stochastic nature by means of random variables and their applications in uncertainty situations.

Know the sampling and estimation techniques.

Know how to use statistical hypothesis testing and its application in decision making.

Ability to prepare, understand and critique reports based on statistical analysis.

Ability to identify and formulate optimization problems.

#### 2.3- Importance of learning results

This subject teaches the basic principles of decision making in the presence of uncertainty. Students develop competencies to address real problems and to work with real data and learn to recognize and handle models that serve to solve different situations in the presence of randomness.

A mechanical engineer must regularly handle information from databases and must be able to make decisions based on the analysis of this information. Decision-making requires an exploratory treatment of the data as well as hypothesis testing, which makes statistical techniques essential.

Students learn to pose and solve simple optimization problems.

In addition, students work in groups and with real data, so they also develop team collaboration skills in solving real problems.

### 3. Syllabus

Module 1: Exploratory data analysis in the computer laboratory.

Module 2: Probability distribution models.

Module 3: Sampling, estimation and hypothesis testing.

Module 4: Introduction to optimization.

Contents of the Computer Laboratory Internships:

One-dimensional descriptive statistics.

Two-dimensional descriptive statistics: Regression and correlation.

Probability distributions of discrete and continuous random variables.

Confidence intervals: means, variances and proportions.

Contrasts of equality of means, variances and proportions. Calculation of the p-value.

Goodness-of-fit test. Contingency tables.

Optimization.

#### **4. Academic activities**

The planning of the sessions will be in accordance with the academic calendar and schedules established by the center.

The 6 credits of the subject are divided into 3 ECTS taught to the whole group in which there will be presentations of the theory and examples that motivate its usefulness in the field of Engineering; and 3 ECTS in small groups aimed at developing skills for the approach and resolution of problems that resemble real situations. Half of these last 3 credits will take place in the computer classroom.

#### **5. Assessment system**

1. A test during the teaching period of Module 2.

2. A test of Module 3.

3. A test on the contents developed in the practical classes in the Computer Laboratory.

4. A Statistical Report applying various statistical techniques seen and to be carried out prior to the official call.

Students who do not take test 1 must take it in the official exam of the subject.

The percentage of the final grade for test 1 is 40% and for each of the three remaining tests is 20%. To pass the 60% that tests 1 and 2 represent, the student must obtain at least 4 points (out of 10) in each of them and a minimum weighted average of 4.5 points (out of 10).

In order to pass the 40% that tests 3 and 4 represent, the student must obtain at least 4 points (out of 10) in each of them and an average of at least 5 points (out of 10).

To pass the subject, the student must obtain a final grade of at least 5 points, out of 10.

The overall assessment test will consist of tests equivalent to tests 1, 2, 3 and 4.