# 29708 - Statistics

**Información del Plan Docente**

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| **Academic Year** | 2016/17 |
| **Academic center** | 110 - Escuela de Ingeniería y Arquitectura |
| **Degree** | 434 - Bachelor's Degree in Mechanical Engineering |
| **ECTS** | 6.0 |
| **Course** | 1 |
| **Period** | Half-yearly |
| **Subject Type** | Basic Education |
| **Module** | --- |

## 1.Basic info

## 1.1.Recommendations to take this course

## 1.2.Activities and key dates for the course

## 2.Initiation

## 2.1.Learning outcomes that define the subject

## 2.2.Introduction

## 3.Context and competences

## 3.1.Goals

## 3.2.Context and meaning of the subject in the degree

## 3.3.Competences

## 3.4.Importance of learning outcomes

## 4.Evaluation

## 5.Activities and resources

## 5.1.General methodological presentation

## 5.2.Learning activities

## 5.3.Program

**Modules**

Module 1: Exploratory data analysis in computer laboratory.

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Module 2: Models of probability distribution.

Module 3: Sampling, estimation and hypothesis tests.

Module 4: Introduction to Optimization.

Module 1: Exploratory Data Analysis

Descriptive statistics

Basic concepts. Types of variables.

Data organization. Frequency table.

Graphic descriptions of a variable.

Numerical descriptions of a variable. Box-plot.

Bidimensional distributions. Bidimensional table.

Marginal and conditional distributions.

Measures of association. Regression and correlation.

Module 2: Models of probability distribution

Basic concepts. Sample space and events, algebra of events. Random and deterministic experiments.

Interpretations of probability.

Kolmogorov axiomatic definition.

Conditional probability. Independence of events.

Partition of a sample space, law of total probability and Bayes theorem.

Reliability of systems.

Random variables

Definition of random variable. Classification.

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Discrete random variable, probability function, distribution function.

Continuous random variable, density function, distribution function.

Expectation of a random variable and of a function of a random variable.

Basic properties of expectation and variance

Moments of a random variable.

Other measures of central tendency and dispersion.

Chebyshev inequality.

Main discrete distributions: Bernoulli, binomial, Poisson, geometric, hypergeometric.

Main continuous distributions: uniform, exponential, normal.

Reproductivity of random variables.

Poisson process: relationship to exponential distribution.

Approximations between random variables.

Two-dimensional distributions. Calculation of expectations and variances of a linear combination of independent random variables.

Module 3: Sampling, estimation and hypothesis tests

Sampling and Estimation

Introduction. Basic concepts associated with sampling distributions in normal populations: chi-square, Student's t, F.

Distributions important statistical sampling: Central Limit Theorem and Fisher theorem.

Confidence interval estimation. Intervals for means, variances and proportions. Calculation of the minimum sample size.

Hypothesis tests: null and alternative hypothesis, level of significance.

Relationship between confidence intervals and hypothesis tests.

Calculating the p-value.

Hypothesis testing for means, variances and proportions.

Chi-square and tests of contingency tables.

Module 4: Introduction to Optimization

Optimization problems

Decision variables, objective function and constraints.

Linear programming problems: graphic resolution.

**Contents of Practical classes in computer laboratory**

* Uni-dimensional descriptive statistics.

* Instructions for implementation of the Statistical Report.

* Two-dimensional Descriptive Statistics. Regression and correlation.

* Probability distributions of discrete and continuous random variables.

* Test goodness of fit.

* Hypothesis testing for means, variances and proportions.

* Introduction to Optimization.

## 5.4.Planning and scheduling

## 5.5.Bibliography and recomended resources