Statistics

Academic Year: (2022 / 2023) **Review date: 24-05-2022**

Department assigned to the subject: Statistics Department

Coordinating teacher: DELGADO GOMEZ, DAVID

Type: Basic Core ECTS Credits : 6.0

Year : 1 Semester : 2

Branch of knowledge: Social Sciences and Law

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Calculus I
Algebra

OBJECTIVES

By the end of this subject, students will be able to have:
1. knowledge and understanding of the statistic principles underlying their branch of engineering;
2. the ability to apply their knowledge and understanding to identify, formulate and solve statistic problems using established methods;
3. the ability to apply their knowledge and understanding to analyse engineering products, processes and methods;
4. an understanding of statistics methodologies, and an ability to use them.
5. the ability to select and use appropriate statistic tools and methods;
6. the ability to combine theory and practice to solve engineering problems;
7. an understanding of applicable statistic techniques and methods, and of their limitations;

DESCRIPTION OF CONTENTS: PROGRAMME

Topics:
1. Descriptive Statistics
1.1 Qualitative and Quantitative data.
1.2 Univariate Descriptive Statistics.
1.2.1 Summary of data using frequency tables.
1.2.2 Graphical representation of data.
Graphical representation for qualitative data:
Bar chart, pie chart, Pareto diagram.
Graphical representation for quantitative data:
Histograms, frequency polygons, boxplots.
1.2.3 Analytical measures for data summary.
Measures of central tendency: Average, median and mode.
Measures of variability: Variance, Coefficient of Variation, Median, Quartiles and Percentiles.
Other Measures: Skewness and kurtosis.
1.3 Descriptive statistics for two variables.
Scatter plots. Covariance and correlation.

2. Probability
2.1 Introduction to the concept of probability:
Equiprobability and Laplace rule.
Frequentist approach and law of large numbers.

2.2 Events and operations with events.

Event definition. Venn diagrams. Union, Intersection and complementary events.

2.3 Definition and properties of the probability.
2.4 Independence and conditional probability.
2.5 law of total probability.
2.6 Bayes Theorem.

3. Random variables and probability models

3.1 Definition of random variable (discrete / continuous) and properties. Probability function, density function.
3.2 Expectation and variance of discrete and continuous random variables.
3.3 Distribution function.
3.4 Probability Models for discrete random variables. Bernoulli, Binomial.
3.5 Probability Models for continuous random variables. The normal distribution. The central limit theorem.
4. Statistical Inference
4.1 Introduction to statistical inference.
Population and sample. Distribution of the sample mean.
4.2 Confidence intervals for the sample mean.
5. Hypothesis Testing
5.1 Population and sample (review).
5.2 Null hypothesis and alternative hypothesis.
5.3 Hypothesis testing for the mean, proportion and variance of one population.
5.4 Hypothesis testing for two populations: Difference of means and proportions.

6. Quality control
6.1 Introduction to quality control
6.2 Control charts for variables. Control charts for the mean and range. Process capability.
6.3 Control charts for attributes. P and np control charts.

7. Regression
7.1 Introduction to linear regression.
7.2 Simple regression.
Hypothesis.
Estimation of parameters. Significance and interpretation
Diagnosis.
7.3 Multiple regression.
Hypothesis.
Estimation of parameters, significance and interpretation
Diagnosis
Multicollinearity
7.4 Regression with qualitative variables (dichotomous / polytomous).

LEARNING ACTIVITIES AND METHODOLOGY

- Lecture: 2,5 ECTS
- Problem solving sessions (in small groups): 1,5 ECTS
- Computes sessions (consistent of individual work out of the classroom with programmed tutorial sessions) 1,5 ECTS
- Evaluation sessions (continuos evaluation, some of them at computes laboratories): 0,5 ECTS

ASSESSMENT SYSTEM

The grade for the course is obtained by giving a 50% weight to the continuous evaluation and another 50% to the final exam. It is necessary to obtain a minimum grade of 5 in the final exam.

The continuous evaluation grade (50% of the final grade) is obtained through a practical exam. In order to take this exam, it is mandatory to have visualized at least 90% of the SPOC video-classes and to have obtained a score higher than 5 in the SPOC exercises within the period established for each module.

For the extraordinary exam, students who have not taken the continuous evaluation will be evaluated according to the University rules.

% end-of-term-examination:	50
% of continuous assessment (assigments, laboratory, practicals…):	50

BASIC BIBLIOGRAPHY

- PEREZ, C. "Estadística práctica con Statgraphics", 2000.
- PEÑA, D. Y ROMO, J. "Introducción a la Estadística para las Ciencias Sociales", McGraw-Hill.