

Academic Year: ( 2024 / 2025 )

Review date: 20-01-2025

Department assigned to the subject: Statistics Department

Coordinating teacher: GARCIA PORTUGUES, EDUARDO

Type: Electives ECTS Credits : 3.0

Year : Semester :

**REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)**

Statistics  
Calculus I and II

**LEARNING OUTCOMES**

CB1: Students have demonstrated possession and understanding of knowledge in an area of study that builds on the foundation of general secondary education, and is usually at a level that, while relying on advanced textbooks, also includes some aspects that involve knowledge from the cutting edge of their field of study

CB2: Students are able to apply their knowledge to their work or vocation in a professional manner and possess the competences usually demonstrated through the development and defence of arguments and problem solving within their field of study.

CG3: Knowledge of basic and technological subject areas which enable acquisition of new methods and technologies, as well as endowing the technical engineer with the versatility necessary to adapt to any new situation.

CG10: Ability to solve mathematical problems arising in engineering. Aptitude for applied knowledge in: linear algebra, geometry; differential geometry; differential and integral calculus; differential equations and partial derivatives; numerical methods; numerical algorithms; statistics and optimization.

RA1: Knowledge and Understanding. Knowledge and understanding of the general fundamentals of engineering, scientific and mathematical principles, as well as those of their branch or specialty, including some knowledge at the forefront of their field.

RA5: Applications. Graduates will have the ability to apply their knowledge and understanding to solve problems, conduct research, and design engineering devices or processes. These skills include knowledge, use and limitations of materials, computer models, process engineering, equipment, practical work, technical literature and information sources. They must be aware of all the implications of engineering practice: ethical, environmental, commercial and industrial.

**OBJECTIVES****\* General skills**

- Ability to apply knowledge of mathematics, statistics, computer science, and engineering as it applies to the fields of computer hardware and software.
- Ability to interpret data and results of experiments.
- Ability to independently acquire and apply required information related to statistical techniques with the aim of designing, monitoring, and managing computer systems.
- An ability to communicate effectively by oral, written, and graphical means, the results of statistical analysis.

**\* Specific skills**

- An ability to identify statistical problems of multivariate dimension, with special emphasis in telecommunication engineering.
- An ability to describe multivariate datasets.
- Knowledge of multivariate statistical models.
- An ability to solve statistical models for regression analysis, and ANOVA models, applied to real data

of telecommunication engineering.

- An ability to model time series data, estimate their parameters and apply it to real problems of signal processing and telecommunications.

## DESCRIPTION OF CONTENTS: PROGRAMME

1. Review of basic concepts
  - 1.1. Descriptive statistics
  - 1.2. Probability
  - 1.3. Random variables
  - 1.4. Probability models
  - 1.5. Fit of distributions
2. Point estimation
  - 2.1. Introduction to statistical inference: population and sample
  - 2.2. Sample statistics and their distribution
  - 2.3. Estimation and estimators
  - 2.4. Method of maximum likelihood
3. Confidence intervals and hypothesis testing
  - 3.1. Confidence intervals
  - 3.2. Parametric hypothesis tests
4. Comparison of populations
  - 4.1. Comparison of two means from independent samples
  - 4.2. Comparison of two means from paired samples
  - 4.3. Comparison of two proportions
  - 4.4. Comparison of two variances in normal populations
5. The linear regression model
  - 5.1. The simple regression model
  - 5.2. The multiple regression model
  - 5.3. Inference in the regression model

## LEARNING ACTIVITIES AND METHODOLOGY

The learning methodology consists of the following elements:

- Lecture lessons: presentation of the main concepts, with their justification and examples. The instructor will illustrate the methodologies with the computer and real or simulated data. Discussion of the concepts with the students. Discussion of the questions and doubts aroused during the self-learning process.
- Exercises lessons: lessons devoted to solving exercises in small groups.
- Laboratories: in a computer room, the students, in small groups, solve data analysis problems using a statistical package. Also, students use the computer to solve exercises and conceptual problems.

## ASSESSMENT SYSTEM

<b>% end-of-term-examination:</b>	40
<b>% of continuous assessment (assignments, laboratory, practicals...):</b>	60

The evaluation of the course will be based on a continuous evaluation by means of the development of a case study with MATLAB and a midterm exam of theoretical and practical contents.

The continuous evaluation mark will be calculated giving a 70% weight to the midterm exam and a 30% weight to the development of a case study with MATLAB.

If the continuous evaluation grade is above 5, the student does not need to take the final exam and his/her final mark will be equal to his/her continuous evaluation mark. If the continuous evaluation mark is below 5, the student must take a final exam that will consist of theoretical and practical problem-solving.

Final exam -- ordinary call

The student's final grade will be calculated giving a 60% weight to the continuous evaluation grade and

<b>% end-of-term-examination:</b>	40
<b>% of continuous assessment (assignments, laboratory, practicals...):</b>	60

a 40% weight to the final exam.

Final exam -- extraordinary call

The evaluation system in the extraordinary call will be the higher of the following two criteria:

- (a) 100% of the final exam.
- (b) 60% of the continuous evaluation grade + 40% of the final exam.

#### BASIC BIBLIOGRAPHY

- Montgomery, D. C. and Runger, G. C. Applied Statistics and Probability for Engineers, Wiley, 2007
- Peña, D. Fundamentos de Estadística, Alianza, 2001