

Academic Year: ( 2023 / 2024 )

Review date: 13-04-2023

Department assigned to the subject: Signal and Communications Theory Department

Coordinating teacher: CID SUEIRO, JESUS

Type: Compulsory ECTS Credits : 6.0

Year : 2 Semester : 2

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

Probability and data analysis  
Introduction to statistical modeling  
Signals and systems  
Linear algebra

**OBJECTIVES**

The main objective of this course is that the student is able to extract relevant information contained in the signals under study with the aid of statistical signal processing tools. To achieve this, the student will study the main techniques of:

- Random signals analysis
- Estimation
- Detection

**DESCRIPTION OF CONTENTS: PROGRAMME**

This course introduces the fundamental tools for the estimation, detection, and prediction of discrete-time random signals

**INTRODUCTION and FOUNDATIONS:**

- Detection and estimation
- Calculus, probability, and linear systems

**PART 1: Stochastic processes**

- Introduction and examples
- First and second order statistics
- Stationarity and ergodicity
- Power spectral density

**PART 2: Estimation theory**

- Parameter estimation
- Bayesian estimation
- Time series
- Filtering, prediction and smoothing
- Power spectral density estimation

**PART 3: Detection theory**

- Introduction and examples
- Performance metrics for detectors
- Detector design
- Sequential detection

**LEARNING ACTIVITIES AND METHODOLOGY**

AF1: THEORETICAL-PRACTICAL CLASSES. They will present the knowledge that students should acquire. They will receive the class notes and will have basic texts of reference to facilitate the follow-up of the classes and the development of the subsequent work. Exercises, practical problems on the part of the student will be solved and workshops and evaluation test will be held to acquire the necessary skills.

AF2: Updated to allegation

AF3: INDIVIDUAL OR GROUP WORK OF THE STUDENT.

AF9: FINAL EXAM. In which the knowledge, skills and abilities acquired throughout the course will be assessed globally.

MD1: CLASS THEORY. Exhibitions in the teacher's class with support of computer and audiovisual media, in which the main concepts of the subject are developed and the materials and bibliography are provided to complement the students' learning.

MD2: LABS. Resolution of practical cases, problems, etc. raised by the teacher individually or in groups.

MD3: STUDENT CONSULTATION. Individualized assistance or in group to students by the teacher.

#### ASSESSMENT SYSTEM

SE1: FINAL EXAMINATION In which the knowledge, skills and abilities acquired throughout the course will be assessed globally.

SE2: CONTINUOUS ASSESSMENT. At the end of some course chapters, there will be one midterm exam with one or several exercises that will be solved in class.

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

- H. L. Van Trees Detection, Estimation and Modulation Theory (vol. 1), Wiley, 1968
- Louis L. Scharf Statistical signal processing, Addison-Wesley.
- R. O. Duda, P. E. Hart, D. G. Stork Pattern Classification, Wiley , 2001
- S. Haykin Adaptive Filter Theory, Prentice-Hall, 2002
- Steven M. Kay Fundamentals of Statistical Signal Processing (vols. 1 and 2), Prentice Hall.