Advanced signal processing

Academic Year: (2023 / 2024)

Department assigned to the subject: Signal and Communications Theory Department

Coordinating teacher: RAMIREZ GARCIA, DAVID

Type: Electives ECTS Credits : 6.0

Year : 1 Semester : 1

### REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN) STUDENTS ARE EXPECTED TO HAVE COMPLETED

The student should have basic knowledge of

- probability theory and statistics
- 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 advanced techniques of:

- Random signals analysis
- Estimation
- Detection

#### DESCRIPTION OF CONTENTS: PROGRAMME DESCRIPTION OF CONTENTS: PROGRAMME

- · Parameter estimation
  - Method of moments
  - Maximum likelihood
  - Bayesian estimation
- · Signal Estimation
  - MMSE estimation
  - Linear estimation and prediction
  - Optimal and adaptive filtering
- · Hypothesis testing
  - Wald tests
  - Likelihood ratio methods
  - Bayesian tests

# LEARNING ACTIVITIES AND METHODOLOGY

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The course is imparted in specific rooms and laboratories for the Master Program. It will include:

- Lectures for the presentation, development and analysis of the contents of the course.
- Practical sessions for the resolution of individual problems and practical projects in the laboratory.
- A project for each part of the course.
- Seminars for discussion with reduced groups of students

## ASSESSMENT SYSTEM

- SE1 Participation in class
- SE2 Individual or team works made during the course
- SE3 Final exam

Review date: 19-04-2023

Evaluation systems	Minimum weighting (%)	Maximum	Maximum Weighting	
SE1	0	20		
SE2	0	100		
SE3	0	60		
% end-of-term-examination:			30	
% of continuous assessment (assigments, laboratory, practicals):			70	

# % of continuous assessment (assigments, laboratory, practicals...):

## **BASIC BIBLIOGRAPHY**

- Murphy, K.P. Machine Leaning. A probabilistic perspective, MIT Press, 2012
- C. P. Robert, G. Casella Monte Carlo Statistical Methods, Springer, 2004

- H. Stark, J. W. Woods Probability and Random Processes with Applications to Signal Processing, Prentice Hall, 2002

- L. Wasserman All of Statistics, Springer, 2013
- Poor, V An Introduction to Signal Detection and Estimation, Springer, 1994

### ADDITIONAL BIBLIOGRAPHY

- Barber, D Bayesian Reasoning and Machine Learning, Cambridge University Press, 2012
- Bishop, C.M. Pattern Recognition and Machine Learning, Springer, 2006