Statistical Signal Processing

Academic Year: (2018 / 2019)   **Review date: 07-05-2018**

Department assigned to the subject: Signal and Communications Theory Department

Coordinating teacher: GOMEZ VERDEJO, VANESSA

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

OBJECTIVES

CB1: Students have demonstrated to possess and understand knowledge in an area of ¿¿study that starts from the base of general secondary education, and is usually found at a level that, although supported by advanced textbooks, also includes some aspects that they imply knowledge coming from the vanguard of their field of study.
CB2: Students know how to apply their knowledge to their work or vocation in a professional manner and have the skills that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of ¿¿study
CE1: Ability to solve mathematical problems that may arise in engineering and data science. Ability to apply knowledge about: algebra; geometry; differential and integral calculation; numerical methods; numerical algorithm; statistics and optimization.
CE12: Ability to model, predict, filter and smooth random signals and noise processes
CG1: Adequate knowledge and skills to analyze and synthesize basic problems related to engineering and data science, solve them and communicate them efficiently.
CG2: Knowledge of basic scientific and technical subjects that enable the learning of new methods and technologies, as well as providing a great versatility to adapt to new situations.
CG4: Ability to solve technological, computer, mathematical and statistical problems that may arise in engineering and data science.
CG5: Ability to solve mathematically formulated problems applied to diverse subjects, using numerical algorithms and computational techniques.

RA1 Have acquired advanced knowledge and demonstrated an understanding of the theoretical and practical aspects and the methodology of work in the field of science and data engineering with a depth that reaches the forefront of knowledge

DESCRIPTION OF CONTENTS: PROGRAMME

This course introduces the fundamental tools for the estimation, detection, tracking and prediction of random signals, both in continuous and discrete
time. Model assessment, comparison and classification are also addressed from the same perspective.
INTRODUCTION and FOUNDATIONS:
· Random signals
· Detection and estimation
· Time series and dynamical systems
· Probability and stochastic processes
· Random signals in discrete and continuous time (Sampling)

PART 1: Detection theory
· Signal detection and classification.
· Model comparison and classification.

PART 2: Estimation theory
· Parameter estimation.
· Bayesian estimation.
· Time series.
· Filtering, prediction and smoothing.
· Model assessment.

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: PRACTICES. Resolution of practical cases, problems, etc. raised by the teacher individually or in groups.
MD3: TUTORIALS. Individualized assistance (individual tutorials) or group (collective tutorials) 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 EVALUATION. In it, work, presentations, debates, exhibitions in class, exercises, practices and work in the workshops throughout the course will be evaluated.

% end-of-term-examination:	60
% of continuous assessment (assigments, laboratory, practicals…):	40

BASIC BIBLIOGRAPHY

- H. L. Van Trees Detection, Estimation and Modulation Theory (vol. 1), Wiley, 1968

- R. O. Duda, P. E. Hart, D. G. Stork Pattern Classification, Wiley , 2001

- S. Haykin Adaptive Filter Theory, Prentice-Hall, 2002