Applications of signal processing

Academic Year: (2019 / 2020) **Review date: 16/05/2019 13:53:29**

Department assigned to the subject:

Coordinating teacher: GONZALEZ SERRANO, FRANCISCO JAVIER

Type: Electives ECTS Credits : 6.0

Year : 1 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Basic courses on Digital Signal Processing

OBJECTIVES

BC9 Students should communicate their conclusions, knowledge and rationale to specialists and non-specialists in a clear and unambiguous way.
BC10 Students should have the learning skills to enable them to continue studying in a autonomous or self-directed way.
SC1 Ability to make critical analysis of technical and scientific documents in the field of Signal Processing and Communications.
SC3 Ability to produce original research work in some specific fields of Signal Processing, including its preparation as a presentation, and its oral exposition and defense.
SC4 Ability to apply the knowledge in mathematics, statistics and to different problems in signal acquisition, analysis, and processing, in communications, in bioengineering, etc...
SC7 Know and master basic and advanced signal processing techniques (predictive models, spectral analysis, array processing) and its application in different environments (communications, bioengineering, imaging).

DESCRIPTION OF CONTENTS: PROGRAMME

Unit 1: Signal Prediction: Time-Series models
- Linear Prediction: ARMA Models

Unit 2: Multidimensional Signal Processing
- Dimensionality Reduction: PCA, LDA, Autoencoders
- Array Processing

Unit 3: Selected Applications in Bioengineering, Communications and other sectors
* Signal Processing for Brain Computer Interfaces
* Acquisition: compress sensing
* Dimensionality Reduction: face recognition.
* ICA/Blind Source Separation.
* Signal Processing in the Encrypted Domain.

LEARNING ACTIVITIES AND METHODOLOGY

Activity Code	Activity	Hours	% Presential
AF1	Lectures and exercises	36	20
AF2	Laboratory	6	3,3
AF3	Supervision of Students	14	7,7
AF4	Team Work	24	0
AF5	Individual work	100	0

TEACHING METHODS
MD1: Classroom lectures, with the support of slide presentations, to provide the main concepts of the subject and the related bibliography.
MD2: Critical reading of recommended texts:

scientific and academic journal articles, conference proceedings, reports, and manuals, either for class discussion, or to extend and consolidate the knowledge of the subject.
MD3: Resolution, individually or in group, of practical cases, problems, etc.. proposed by the teacher.
MD4: Presentation and discussion of topics and practical cases related to the course syllabus.
MD5: Preparation, individually or in group, technical reports.

ASSESSMENT SYSTEM

% end-of-term-examination/test:	0
% of continuous assessment (assigments, laboratory, practicals…):	100

The work of the students will be evaluated with a continuous evaluation system, including problems and lab exercises, short exams, and technical reports (and oral presentations) on selected signal processing topics.
The precise scoring used for the ordinary exam will be the following:
1. Problems and Lab exercises: 20 %.
2. Short exams, performed individually at the end of each unit: 30 %. (PO: a, g)
3. Elaboration and oral presentation of technical reports on selected signal processing problems: 50 %

Those students who fail the ordinary assessment process will be given one additional opportunity at the end of the academic year. This exam will consist of a written exam, and its contribution to the final grade will be according to the UC3M normative.

BASIC BIBLIOGRAPHY

- Alessandro Piva and Stefan Katzenbeisser (Guest Editors) Signal Processing in the Encrypted Domain, EURASIP Journal on Information Security, Hindawi, 2007

- Francis Castanié (Editor) Spectral Analysis: Parametric and Non-Parametric Digital Methods, ISTE, 2006

- Peter J. Brockwell, Richard A. Davis Time Series: Theory and Methods, Springer, 28/04/2009

- Petre Stoica and Randolph Moses Spectral Analysis of Signals, PRENTICE HALL, Upper Saddle River, New Jersey, 2005

- Pierre Comon (Editor), Christian Jutten (Editor) Handbook of Blind Source Separation: Independent Component Analysis and Applications, Academic Press, March 8, 2010