Signals and Systems

Academic Year: (2018 / 2019) **Review date: 10/05/2018 00:50:50**

Department assigned to the subject: Signal and Communications Theory Department

Coordinating teacher: MIGUEZ ARENAS, JOAQUIN

Type: Compulsory ECTS Credits : 6.0

Year : 2 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Calculus I
Calculus II

OBJECTIVES

The goal of the course is to provide the students with the theoretical and methodological knowledge necessary to work with continuous and discrete-time signals and LTI (linear and time-invariant) systems in the time and frequency domain.

Upon successful completion of the course a student will gain the following competences and skills.

Basic competences:
- CB1: assimilate knowledge in a field of study that starts from a high-school background and attains a level that, while still supported by advanced textbooks, also includes topics corresponding to the state of the art in the field.
- CB2: the student will be able to apply his knowledge in a professional environment and will gain the skills needed to construct arguments and advocate them, as well as to solve problems in the field of study.
- CB5: the student will develop the learning skills needed to undertake graduate education and enjoy a great extent of autonomy.

General competences:
- CG1: knowledge and skills needed to analyse and summarise fundamental problems in the field of data science and engineering, to solve these problems and communicate the solutions efficiently.
- CG2: knowledge of fundamental scientific and technical subjects that enable the student to learn new technologies and methodologies, as well as to gain the versatility of thought needed in order to adapt to new scenarios.

Specific competences:
- CE11: ability to analyse and process both digital and analog signals, both in time domain and frequency domain.

DESCRIPTION OF CONTENTS: PROGRAMME

This course introduces the basic tools of Fourier analysis of signals (both in continuous and discrete time), the analysis of linear systems and the representation of signals from their samples.

INTRODUCTION:
- Signals: properties and classification.
- Systems: properties and classification.
- Linear and time-invariant systems (LTI).

PART 1: Fourier series (FS) representation of periodic signals
- Response of LTI systems to complex exponentials.
- FS representation of continuous-time signals. Properties.

- FS representation of discrete-time signals. Properties.

PART 2: Fourier transform (FT)
- FT of signals in continuous time. Properties and examples.
- Linear systems characterised by ordinary differential equations.
- FT of discrete time signals. Properties and examples.
- Linear systems characterised by difference equations.

PART 3: Representation of signals from their samples
- The sampling theorem.
- Interpolation and decimation.
- Discrete-time processing of continuous-time signals.
- The discrete Fourier transform.

PART 4: Z Transform (ZT)
- The ZT.
- Region of convergence.
- Properties.
- Analysis of LTI systems.

ASSESSMENT SYSTEM

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

The final exam will determine 60% of the total course grade (6 points). (CB1, CG1, CG2, CE11)

Quizzes, homework and lab sessions will be used to award the remaining 4 points (40% of the final grade).

1. At the end of each unit or couple of units there will be a. The total maximum grade for these exercises will be 3 points. (CB1, CB2, CG1, CG2, CE11)

2. Laboratory sessions. There are 3 sessions, the total grade here is 1 point, which is evaluated in an additional lab session as an exam. This block is evaluated by an exam in the lab. (CB2, CB5, CE11).

The students need 3.5 out 10 points in the final exam to successfully pass the course.

BASIC BIBLIOGRAPHY

- Alan Oppenheim and Alan Willsky Signal and Systems, Prentice Hall, 1997

- B. . Lathi Linear Systems and Signals, Oxford University Press, 2005

- Hwei Hsu Signals and Systems, Schaum's Outlines, 2011