DEGREE CURRICULUM

SIGNALS AND SYSTEMS

Coordination: CLARIA SANCHO, FRANCISCO

Academic year 2021-22

SIGNALS AND SYSTEMS 2021-22

Subject's general information

<table>
<tr><td>Subject name</td><td>SIGNALS AND SYSTEMS</td></tr>
<tr><td>Code</td><td>102121</td></tr>
<tr><td>Semester</td><td>1st Q(SEMESTER) CONTINUED EVALUATION</td></tr>
<tr><td>Typology</td><td>
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<tr><th>Degree</th><th>Course</th><th>Character</th><th>Modality</th></tr>
<tr><td>Bachelor's Degree in Automation and Industrial Electronic Engineering</td><td>3</td><td>COMPULSORY</td><td>Attendance-based</td></tr>
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<tr><td>Course number of credits (ECTS)</td><td>6</td></tr>
<tr><td>Type of activity, credits, and groups</td><td>
<table>
<tr><th>Activity type</th><th>PRALAB</th><th>PRAULA</th><th>TEORIA</th></tr>
<tr><th>Number of credits</th><td>0.4</td><td>2.6</td><td>3</td></tr>
<tr><th>Number of groups</th><td>2</td><td>1</td><td>1</td></tr>
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<tr><td>Coordination</td><td>CLARIA SANCHO, FRANCISCO</td></tr>
<tr><td>Department</td><td>COMPUTER SCIENCE AND INDUSTRIAL ENGINEERING</td></tr>
<tr><td>Teaching load distribution between lectures and independent student work</td><td>(40%) 60 h classroom or online
(60%) 90 h autonomous work</td></tr>
<tr><td>Important information on data processing</td><td>Consult this link for more information.</td></tr>
<tr><td>Language</td><td>Spanish</td></tr>
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SIGNALS AND SYSTEMS 2021-22

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
CLARIA SANCHO, FRANCISCO	francisco.claria@udl.cat	6,4	

Subject's extra information

This subject is imparted during the first semester of third year.
This subject aims is to provide students with ability to analyze, simulate and design systems in which input signals are processed or cause these systems to respond interacting with the physical environment. This is to familiarize students with some of the tools and / or basic methodologies of signal processing such as spectral analysis, convolution and correlation, signal sampling, filtering, and an introduction to analog and pulse modulation.
The concepts that brings this subject, in general, are often new to the student and assimilate them requires significant dedication and study time. These concepts are basic to understand subjects such as modeling and control systems, content that will be in other subjects.

Learning objectives

Objectives

- Understand the concept of convolution of two signals and their extent in analysis, design and systems simulation.
- Understand the spectral meaning of the Fourier Transform and its reach in signal processing.
- Relate correlation and convolution.
- Understand the relationship between sampling time and spectrum of a signal.
- Distinguish and choices in a system, the possibility of processing time or processing in frequency.
- Relate the expressions in time and frequency of these systems.

Competences

Cross-disciplinary competences approved by the Comissió Plenària dels Graus d'Enginyeria Industrial, Enginyeria Informàtica i Enginyeria de l'Edificació, gathered 16 Juny 2008.

- **EPS2.** Capacity to gather and interpret relevant data, within the area of study, to judge and think about relevant subjects of social, scientific and ethical nature.
- **EPS6.** Capacity for analysis and synthesis.

Specific competences that students should acquire, according ORDRE CIN/351/2009, 9 of febrer.

- **GEEIA20.** Knowledge of the principles and applications of analogical electronics.
- **GEEIA21.** Knowledge of the principles and applications of digital electronics and microprocessors.
- **GEEIA22.** Applied knowledge of power electronics.
- **GEEIA23.** Applied knowledge of electronic instrumentation.
- **GEEIA24.** Ability to design analog, digital and power electronic systems.

Subject contents

SIGNALS AND SYSTEMS 2021-22

CHAPTER 1

1 SIGNALS AND FOURIER ANALYSIS

- 1.1 INTRODUCTION
- 1.2 SIGNALS
- 1.3 APPROXIMATION OF A FUNCTION BY A SET OF ORTHONORMAL FUNCTIONS.
- 1.4 FOURIER SERIES EXPANSION

CHAPTER 2

2 FOURIER TRANSFORM AND ITS APPLICATION

- 2.1 FOURIER TRANSFORM
- 2.2 CONVOLVING TWO SIGNALS
- 2.3 FOURIER TRANSFORMS OF SOME FEATURES OF INTEREST
- 2.4 PROPERTIES OF THE FOURIER TRANSFORM
- 2.5 PROPOSALS EXERCISES

CHAPTER 3

3 SPECTRAL DENSITY AND CORRELATION

- 3.1 ENERGY OF A SIGNAL
- 3.2 SPECTRAL DENSITY OF ENERGY
- 3.3 POWER SPECTRAL DENSITY
- 3.4 CORRELATION OF TWO FINITE ENERGY SIGNALS
- 3.5 CORRELATION OF TWO FINITE MEAN POWER SIGNALS
- 3.6 HILBERT TRANSFORM AND ANALYTIC SIGNAL
- 3.7 SAMPLING THEOREM
- 3.8 DISCRETE FOURIER TRANSFORM
- 3.9 DISCRETE CONVOLUTION AND CORRELATION

CHAPTER 4

4 ANALOGICAL MODULATIONS

- 4.1 MODULATIONS
- 4.2 ANALOGICAL MODULATIONS OF AMPLITUDE
- 4.3. ANGULAR ANALOGICAL MODULATIONS

CHAPTER 5

5. PULSE MODULATIONS

5.1 INTRODUCTION

5.2 ANALOGICAL PULSE MODULATIONS

5.3 CODED PULSE MODULATION

Methodology

Master class: In the master classes the contents of the subject are presented orally by a professor without the active participation of students

Problem-based learning: Problem-based learning is used as a method of promoting the learning from selected problems of real life.

Classroom practices: Let you apply and configure a practical level, the theory of a field of knowledge in a particular context.

Development plan

Week	Metodologi	Agenda	Classroom	Autonomous work
1-2	Master class Problem-based learning	SIGNALS AND FOURIER ANALYSIS	8	12
3-5	Master class Problem-based learning	FOURIER TRANSFORM AND ITS APPLICATION	12	18
6	Master class Problem-based learning	SPECTRAL DENSITY AND CORRELATION	4	6
7-8	Master class Problem-based learning	HILBERT TRANSFORM AND ANALYTIC SIGNAL SAMPLING THEOREM	8	12
9-11	Master class Problem-based learning	ANALOGICAL MODULATIONS OF AMPLITUDE	12	18
12-14	Master class Problem-based learning	ANGULAR ANALOGICAL MODULATIONS PULSE MODULATIONS	12	18

Evaluation

Evaluation Method

During the semester, there shall be four assessments in the form of two written tests and two papers that account for the study and the work done in the labs. These documents will have a maximum score of 1 point each and not considered any improvement threshold. The two written tests will be held on dates determined by the EPS for this purpose.

In this course, by its nature, has little sense to evaluate parts of avoiding your stuff previous contents. Thus, each written test will be on all the stuff that has been given so far.

The first written test will have a maximum score of 3 points and be considered approved if the score is greater than or equal to 1.5 points. The second written test will have a maximum score of 5 points and will be considered approved if the score is greater than or equal to 2.5 points.

As the material is cumulative in each written test, if the second test is passed, then the first test will be compensated if the latter has not been surpassed, with half its maximum score (1.5 points).

> -The total score is the sum of the notes of the 4 reviews. **(This is the first of the two possible pathways of qualifications that are contemplated)**.
>
> -If the second written test you get a lower score to 2.5 points, you must use the recovery activity, to be performed on the date set by the EPS. The written test will have a valuation recovery maximum 8 points and be deemed to have been passed if you get a note added to the laboratory practice notes and document preparation practices study is greater than or equal to 5 points. (**This is the second pathway**)

In addition:

Any person enrolled in this course, which has been submitted to the second written test, whether it was surpassed or not, there may be a recovery test to increase the final grade. If the second test was successful the final qualification will never be lower than it would have obtained for the first approach.

Bibliography

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C. Sidney Burrus, James H. McClellan, Alan V. Oppenheim, Thomas W. Parks, Ronals W. Schafer, Hans W. Schuessler.

1997 Ed. Prentice Hall.

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John G. Proakis, Dimitris G. Manolakis

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Ashok Ambardar

2002 Ed. Tomson.

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F.G. Stremler.

1993 Ed. Adison-Wesley Iberoamericana.

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Samir S. Soliman, Mandyan D. Srinath

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A. Bruce Carlson.

1975 Ed. Mc.Graw-Hill.

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B.P. Lathi.

1974 Ed. Limusa.

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Athanasios Papoulis.

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1989. Ed. Alianza Editorial

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