

30157 - Linear Systems

Syllabus Information

Academic year: 2024/25

Subject: 30157 - Linear Systems

Faculty / School: 179 - Centro Universitario de la Defensa - Zaragoza

Degree: 563 - Bachelor's Degree in Industrial Organisational Engineering

ECTS: 6.0

Year: 4

Semester: First semester

Subject type: Optional

Module:

1. General information

The subject Linear Systems makes students know and be able to analyse different aspects related to the linear systems that a typical communication system consists of.

Main goals:

- To describe the basic aspects of signals and systems analysis in continuous time.
- To characterize time invariant linear systems (LTI) in continuous time.
- To describe the properties of LTI.
- To perform the analysis of signals and systems in the frequency domain.
- To know the main analogical modulations.

2. Learning results

In order to successfully pass the subject, the students will have to show that they are able to:

1. Describe the basic aspects of signals and systems analysis, both in continuous and discrete time.
2. Characterize time invariant linear systems in continuous and discrete time.
3. Perform the convolution operation in discrete and continuous time.
4. Describe the properties of the convolution operator.
5. Describe the properties of time invariant linear systems.
6. Apply the Fourier transform in continuous and discrete time.
7. Perform signals and systems analysis in the transformed domain, and signal sampling.

3. Syllabus

The course will address the following topics:

1. INTRODUCTION TO SIGNALS AND SYSTEMS: Basic operations with signals, energy and power concepts and systems classification.
2. SPECTRAL ANALYSIS: Fourier series analysis for periodic signals, Fourier Transform and its properties, energy and power spectral densities, bandwidth.
3. SIGNAL TRANSMISSION: Transfer function, amplitude and phase functions. Filtering.
4. AMPLITUDE MODULATIONS: DSB modulation. SSB modulation. Demodulation of DSB and SSB. Modulation and demodulation of AM signals. Power ratios for pure tone modulations. Commutation modulators.
5. ANGLE MODULATIONS: Frequency and phase modulations for pure tones. The spectrum of a pure tone modulated with FM. Approximate bandwidth of FM signal. Frequency translation and multiplication. FM modulators and demodulators. Superheterodine receivers.

4. Academic activities

The methodology followed for the teaching-learning process is mainly based on:

- **Participatory master classes:** masterclasses exposing the main theoretical concepts of each topic, accompanied by practical examples and problem solving. The student will actively participate in their resolution.
- **Learning based on problem solving.**
- **Solving cooperative problems and flipped classroom.**
- **Assessment tests.**
- **Personalized attention** to the student through tutorials with the aim of reviewing and discussing the materials and topics presented in class.
- **Study and autonomous work** of the student.

5. Assessment system

FIRST CALL

The students will be evaluated through continuous assessment.

1. Midterm written exam of the lessons 1-3 of the subject (25%).
2. Final term written exam of the lessons 1 to 5 of the subject (35%).
3. Continuous assessments during all the semester with autonomous and group work (40%).

In the final mark of the continuous assessment (100%) all the assessment instruments carried out throughout the course will be taken into account.

In order to pass the subject, the average of the written exams must be equal to or greater than 5 and the student's final grade must be equal to or greater than 5 in the final mark of the continuous assessment.

Final Exam

The students who do not pass the subject by continuous assessment or who would like to improve their grades, will have the right to take the Final Exam, prevailing, in any case, the best of both grades. This Final Exam will be a single exam and will have the 100% weight in the final grade. To pass the subject, the student's final grade must be equal to or greater than 5.

SECOND CALL

Final Exam

The students who do not pass the subject in the first call may take the Final Exam for the second call. This Final Exam will be a single exam and will have the 100% weight in the final grade. To pass the subject, the student's final grade must be equal to or greater than 5.

Assesment system	Weight	LR-1	LR-2	LR-3	LR-4	LR-5	LR-6	LR-7
Midterm written exam (Lessons 1-3)	25%	x	x	x	x	x	x	x
Final term written exam (Lessons 1-5)	35%	x	x	x	x	x	x	x
Continuous assessments	40%	x	x	x	x	x	x	x

6. Sustainable Development Goals

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