Academic Year/course: 2023/24

30157 - Linear Systems

Syllabus Information

Academic year: 2023/24
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 aims to provide the student with the knowledge and ability to analyse various aspects related to linear systems that appear in a typical communications system

Main objectives:

- To introduce the basic aspects of signal and system analysis in continuous time.
- To characterize linear time invariant (LTI) systems.
- To describe the properties of the systems (LTI).
- To analyse signals and systems in the frequency domain.
- To know the main analogy modulations.

These approaches and objectives are aligned with the following Sustainable Development Goals (SDGs) of the United Nations Agenda 2030 (https://www.un.org/sustainabledevelopment/es/), in such a way that the acquisition of the learning results of the subject provides training and competence to contribute to some extent to their achievement: Goal 9.

2. Learning results

In order to pass this subject, the students shall demonstrate they has acquired the following results:

1. Describe the basics of signal and system analysis, both in continuous time and in discreet time.
2. Describe the characterization of linear and invariant 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 linear and time invariant systems.
6. Apply the Fourier transform of signals in continuous and discrete time.
7. Perform analysis of signals and systems in the transformed and sampled domain.

3. Syllabus

1. INTRODUCTION TO SIGNALS AND SYSTEMS: basic operations with signals, concepts of energy and power, and classification of systems.

2. SPECTRAL ANALYSIS: Fourier series development of periodic signals, Fourier transform and its properties, spectral energy and power density, bandwidth concept.

3. SIGNAL TRANSMISSION: Transfer function, amplitude and phase functions. Filtering.

4. AMPLITUDE MODULATIONS: DSB modulation. SSB modulation. Demodulation of DSB and SSB signals. AM modulation and demodulation. Power ratios of single tone modulations. Switching modulators.

5. ANGULAR MODULATIONS: Single tone frequency and phase modulation. Signal spectrum FM modulated by a tone.

Approximate bandwidth of an FM signal. Translation and multiplication at frequency. FM modulator circuits. FM demodulator circuits. Super heterodyne receptors.

4. Academic activities

The methodology followed for the teaching-learning process that has been designed for this subject is based on :

- **Participative lectures:** presentation of the theoretical contents of the subject accompanied of practical examples and problem solving. The student will actively participate in their resolution.
- **Learning based on autonomous problem solving.**
- **Resolution of group exercises** and **flipped classroom.**
- **Assessment tests**.
- **Personalized attention** to the student through tutorials in order to review the materials and topics presented in class.
- **Autonomous study** and **work** of the student.

5. Assessment system

FIRST CALL

The student will be able to pass the subject by the <u>continuous evaluation</u> procedure. To do this they will need to demonstrate that they have achieved the intended learning results through the following assessment activities:

1. Midterm written test on topics 1-3 of the subject (30%).

2. Midterm written test on topics 4 and 5 of the subject (30%).

3. Practices and exercises to be handed in by the students (40%).

The final continuous assessment grade (100%) will be calculated according to the specific weight of each continuous assessment test . To pass the subject, the student must obtain a grade higher or equal to 4 in each of the two written tests and a final grade higher or equal to 5 in the final continuous evaluation grade.

<u>Overall test</u>

Students who do not pass the subject by continuous evaluation or who would like to improve their grade, will have the right to take the overall test, prevailing, in any case, the best of the grades obtained . This global test will be a single exam and will have a 100% weight in the final grade. To pass the subject, the student must obtain a final grade greater than or equal to 5.

SECOND CALL

<u>Overall test</u>

Students who do not pass the subject in the first exam may sit for an overall exam.

This global test will be a single exam and will have a 100% weight in the final grade. To pass the subject, the student must obtain a final grade greater than or equal to 5.

Weighting Instrument	Evaluation	RA-1	RA-2	RA-3	RA-4	RA-5	RA-6	RA-7
Midterm exam (Topics 1-3)	30%	x	x	x	x	x	x	x
Midterm exam (Topics 4-5)	30%	x	x	x	x	x	x	x
Practices and Exercises to be submitted	40%	x	x	x	x	x	x	x