Universidad Zaragoza

Academic Year/course: 2024/25

30312 - Digital Signal Processing

Syllabus Information

Academic year: 2024/25
Subject: 30312 - Digital Signal Processing
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 330 - Complementos de formación Máster/Doctorado
438 - Bachelor's Degree in Telecommunications Technology and Services Engineering
581 - Bachelor's Degree in Telecommunications Technology and Services Engineering
ECTS: 6.0
Year: 330 - Complementos de formación Máster/Doctorado: XX
581 - Bachelor's Degree in Telecommunications Technology and Services Engineering: 2
438 - Bachelor's Degree in Telecommunications Technology and Services Engineering: 2

Semester: Second semester
Subject type: 581 - Compulsory
438 - Compulsory
330 - ENG/Complementos de Formación
Module:

1. General information

The objective of the subject is to provide the student with the basic methodologies for the analysis and synthesis of the most common digital signal processing systems. The emphasis is on the practical implementation of the systems, including the case of real-time systems, and especially considering the efficiency of the implementation. The fundamental application of these systems is in communications and signal conditioning systems.

2. Learning results

- To know the representation and frequency characterization of signals and systems, as well as their fundamental properties.
- To know the process of sampling a signal in continuous time as well as its reconstruction from samples taken at regular intervals, both from the point of view of the time domain and from the point of view of frequency. Understand the concept of aliasing.
- To know the representation and characterization of signals and systems in the Z-transformed domain, as well as their fundamental properties.
- Describe the block diagram of a real-time digital signal processing system listing the significant parameters of each block.
- Define the basic structures of discrete-time systems. IIR infinite impulse response structures, FIR finite impulse response structures.
- Define and describe correctly a digital filter, its fundamental applications and differentiate the types of digital filters according to their frequency response characteristics.
- Define a multi-rate system, consider the solution to sampling rate change problems, and apply rational sampling rate change to the solution of problems.
- Teamwork.

3. Syllabus

1. Digital signal processing: introduction

2. Frequency representation of discrete signals
   - Discrete-time Fourier transform
   - Discrete Fourier Transform (DFT)
   - Implementation and applications

3. Sampling, reconstruction and multirate systems
   - Sampling and reconstruction of analog signals
   - Changing the sampling frequency
   - Multirate systems: applications

4. Transformed systems analysis
   - Z-transform

- Transfer function
- Frequency response
- Special systems

5. Digital filter design

- Ideal and real filters
- Design of linear phase FIR filters
- IIR filter design

4. Academic activities

Participatory lectures 40 hours

Theoretical-practical sessions in which the contents of the course are explained.

Problem solving and case studies: 10 hours

Classroom resolution of examples and problems associated with the syllabus.

Laboratory practices: 10 hours

Laboratory sessions to reinforce concepts and examples of application of the theory, with scientific software and electronic instrumentation.

Teaching assignments: 24 hours

Elaboration of previous studies and final questionnaires of the laboratory sessions, as well as evaluable works to be carried out in teams.

Personal study: 60 hours

Assessment tests. 6 hours

This course is *English Language Friendly*, which means that: the course syllabus is also available in English; the study and class materials are in English; the faculty is willing to conduct office hours in English; and students are allowed to take their assessments in English.

5. Assessment system

The subject will be assessed by the continuous assessment system by means of the following activities:

Official exam (60%). Written exam with a score from 0 to 10 points. A minimum score of 4.5 points in the final exam is required to pass the subject.

Team work deliverable tasks (20%). Scoring from 0 to 10 points. The quality of the material delivered (problem solutions, reports, source code) during the development of the course will be valued in the different tasks that will be raised periodically for teamwork. For each activity, the established delivery date must be respected. Students who do not take or do not pass these assessment activities will have the possibility of taking an alternative test on the same date as the final exam.

Laboratory practice work (20%). Scoring from 0 to 10 points. Both the attitude and aptitude observed in the development of the laboratory sessions and the quality of the documentation requested in this regard will be taken into account : previous studies and final questionnaire of each practical session. Students who do not take or do not pass these assessment activities will have the possibility of taking an alternative test on the same date as the final exam.

6. Sustainable Development Goals

8 - Decent Work and Economic Growth
9 - Industry, Innovation and Infrastructure