Linear systems

Academic Year: (2022 / 2023) **Review date: 20-06-2022**

Department assigned to the subject: Signal and Communications Theory Department

Coordinating teacher: LÓPEZ SANTIAGO, JAVIER

Type: Electives ECTS Credits : 6.0

Year : Semester :

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Calculus II
Signals, Systems and Circuits

DESCRIPTION OF CONTENTS: PROGRAMME

BLOCK 0: Introduction
Unit 0. Review of Signals and Systems in the Time-Domain
BLOCK 1: The Fourier Transform of Continuous-Time Signals
Unit 1. Fourier Series Representation of Continuous-Time Periodic Signals
1.1. Introduction: Response of LTI Systems to Complex Exponentials
1.2. Fourier Series Representation of Continuous-Time Periodic Signals: Analysis and Synthesis Equations
1.3. Convergence
1.4. Properties of Continuous-Time Fourier Series. Examples
Unit 2. The Continuous-Time Fourier Transform
2.1. Introduction
2.2. The Continuous-Time Fourier Transform for Aperiodic Signals
2.3. The Continuous-Time Fourier Transform for Periodic Signals
2.4. Properties of the Continuous-Time Fourier Transform. Examples.
BLOCK 2. The Fourier Transform of Discrete-Time Signals
Unit 3. Fourier Series Representation of Discrete-Time Periodic Signals
3.1. Fourier Series Representation of Discrete-Time Periodic Signals: Analysis and Synthesis Equations
3.2. Properties of Discrete-Time Fourier Series. Comparison with the Continuous Case. Examples.
Unit 4. The Discrete-Time Fourier Transform
4.1. Introduction
4.2. The Discrete-Time Fourier Transform for Aperiodic Signals
4.3. The Discrete-Time Fourier Transform for Periodic Signals
4.4. Properties of the Continuous-Time Fourier Transform. Parseval¿s Theorem. Duality
Unit 5. Systems
5.1. Introduction
5.2. Frequency Response of Systems Characterized by Linear Constant-Coefficient Differential Equations
5.3. Frequency Response of Systems Characterized by Linear Constant-Coefficient Difference Equations
BLOCK 3. Sampling
Unit 6. Sampling in the Time-Domain
6.1. Introduction
6.2. The Sampling Theorem
6.3. Reconstruction of Continuous-Time Signals from Its Samples Using Interpolation
6.4. Discrete-Time Processing of Continuous-Time Signals
6.5. Decimation and Interpolation
Unit 7. Sampling in the Frequency-Domain: Discrete Fourier Transform
7.1. Introduction
7.2. Sampling of the Fourier Transform
7.3. Discrete Fourier Transform
7.4. Properties
BLOCK 4. The z-Transform
Unit 8. The z-Transform
8.1. Introduction
8.2. The z-Transform
8.3. The Region of Convergence. Properties

8.4. The Inverse z-Transform
8.5. Properties of the z-Transform
8.6. Evaluation of the Frequency Response from the Pole-Zero Plot
8.7. Analysis and Characterization of LTI Systems Using the z-Transform
8.8. Block Diagram Representation

LEARNING ACTIVITIES AND METHODOLOGY

AF1. THEORETICAL-PRACTICAL CLASSES. Knowledge and concepts students mustacquire. Receive course notes and will have basic reference texts.Students partake in exercises to resolve practical problems
AF2. TUTORING SESSIONS. Individualized attendance (individual tutoring) or in-group (group tutoring) for students with a teacher.Subjects with 6 credits have 4 hours of tutoring/ 100% on- site attendance.
AF3. STUDENT INDIVIDUAL WORK OR GROUP WORK.Subjects with 6 credits have 98 hours/0% on-site.
AF8. WORKSHOPS AND LABORATORY SESSIONS. Subjects with 3 credits have 4 hours with 100% on-site instruction. Subjects with 6 credits have 8 hours/100% on-site instruction.
AF9. FINAL EXAM. Global assessment of knowledge, skills and capacities acquired throughout the course. It entails 4 hours/100% on-site
AF8. WORKSHOPS AND LABORATORY SESSIONS. Subjects with 3 credits have 4 hours with 100% on-site instruction. Subjects with 6 credits have 8 hours/100% on-site instruction.
MD1. THEORY CLASS. Classroom presentations by the teacher with IT and audiovisual support in which the subject`s main concepts are developed, while providing material and bibliography to complement student learning
MD2. PRACTICAL CLASS. Resolution of practical cases and problem, posed by the teacher, and carried out individually or in a group
MD3. TUTORING SESSIONS. Individualized attendance (individual tutoring sessions) or in-group (group tutoring sessions) for students with teacher as tutor. Subjects with 6 credits have 4 hours of tutoring/100% on-site.
MD6. LABORATORY PRACTICAL SESSIONS. Applied/experimental learning/teaching in workshops and laboratories under the tutor's supervision.

ASSESSMENT SYSTEM

SE1. FINAL EXAM. Global assessment of knowledge, skills and capacities acquired throughout the course.The percentage of the evaluation varies for each subject between 50% and 0%.
SE2. CONTINUOUS EVALUATION. Assesses papers, projects, class presentations, debates, exercises, internships and workshops throughout the course.The percentage of the evaluation varies for each subject between 50% and 100% of the final grade.

% end-of-term-examination:	50
% of continuous assessment (assigments, laboratory, practicals…):	50

BASIC BIBLIOGRAPHY

- Alan V. Oppenheim, Alan S Willsky, Syed Hamid Nawab Signals and Systems, Prentice Hall, 1998

ADDITIONAL BIBLIOGRAPHY

- Alan V. Oppenheim Ronald W Schafer Discrete-time signal processing, Pearson Education, 2011