SUBJECT TEACHING GUIDE

G287 - Signals and Systems

Degree in Telecommunication Technologies Engineering

Academic year 2023-2024

1. IDENTIFYING DATA					
Degree	Degree in Telecommunication Technologies Engineering			Type and Year	Core. Year 1
Faculty	School of Industrial Engineering and Telecommunications				
Discipline	Subject Area: Linear Circuits and Systems Basic Training Module				
Course unit title and code	G287 - Signals and Systems				
Number of ECTS credits allocated	6	Term		Semester based (2)	
Web	https://personales.unican.es/domingom/SyS				
Language of instruction	Spanish	English Friendly	No	Mode of delivery	Face-to-face

Department	DPTO. INGENIERIA DE COMUNICACIONES
Name of lecturer	MARTA DOMINGO GRACIA
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Other lecturers	JESUS RAMON PEREZ LOPEZ

3.1 LEARNING OUTCOMES
- Be able to identify signals and systems attending to their nature.
- Understand the relationship between discrete-time and continuous-time domains.
- Identify and apply basic properties of signals and systems.
- Analyze and characterize Linear Time Invariant systems and their properties.
- Be able to represent time domain signals using unit impulses as basis functions and develop the convolution-sum and the convolution integral representation of LTI systems.
- Be able to represent signals in the Fourier domain using complex exponentials as basis functions.
- Apply Fourier representation and their properties to LTI systems.
- To know and apply the sampling concept to signals recovery.
- Be able to apply the Laplace and z transforms to analyze and characterize continuous and discrete LTI systems.
- Apply Laplace and z transforms to solve differential and difference equations with initial conditions.

4. OBJECTIVES
Identify signals as functions carrying information and a system as a process in which signals are transformed. Be able to analyze signals and systems in both the time and frequency domains.

6. COURSE ORGANIZATION	
CONTENTS	
1	Signals and systems: Continuous-time and discrete-time signals. Transformations of the independent variable. Basic signals: exponential and sinusoidal signals, the unit step and the unit impulse functions. Basic system properties.
2	Linear time-invariant systems: Convolution: impulse response representation for LTI systems. Properties of LTI systems. Other representations of LTI systems.
3	Fourier Analysis: Fourier Series representation of continuous-time periodic signals (FS). Fourier series representation of discrete-time periodic signals (DTFS). Representation of continuous-time aperiodic signals, the continuous-time Fourier transform (FT). Representation of discrete-time aperiodic signals, the discrete-time Fourier transform (DTFT). Fourier representation properties. The Fourier transform for periodic signals.
4	Applications of Fourier representations: Frequency response of LTI systems. Sampling and reconstruction of continuous-time signals from their samples. Application to communication systems
5	The Laplace transform: The bilateral Laplace transform. The region of convergence for Laplace transform. The inverse Laplace transform. LTI systems analysis characterized by linear constant-coefficient differential equations. Analysis and characterization of LTI systems. The unilateral Laplace transform. Solving differential equations with initial conditions.
6	The z-transform. Fourier transform and z-transform relationship. The region of convergence for the z-transform. The inverse z-transform. Analysis and characterization of discrete-time LTI systems using z-transforms. LTI systems characterized by linear constant-coefficient differential equations.

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Final Exam (PF)	Written exam	Yes	Yes	60,00
Midterm exam. Blocks 1-2 (PI)	Written exam	No	Yes	15,00
Evaluation of Proposed questions and problems (AE)	Others	No	No	10,00
Classroom work (TA)	Others	No	No	5,00
Computer based exercices (PLO)	Laboratory evaluation	No	No	10,00
TOTAL				100,00

Observations

An evaluation exam will take place at the end of block 2. Even if you pass the partial exams, the contents will be included in the final exam.
The proposed non presential activities will be evaluated (individual and group work on problem solving). Classroom activities will only be evaluated in the case that at least 50% of attendance has been completed.
Computer labs are mandatory for all enrolled students. The evaluation of simulation labs will make up 10% of the overall grade.
In order to pass the subject, it will be necessary to obtain a weighted grade equal or greater than 5 points out of 10. The overall grade will be calculated by:
Final Grade: MAX[(0.10*PLO + 0.10*AE + 0.05*TA + 0.15*PI + 0.60*PF); (0.90*PF + 0.10*PLO)]
In case the grade obtained in the final test is lower than 4 out of 10, the subject will be failed and the overall grade will be obtained using:
Final grade [MIN{4.90; (0.10*PLO + 0.10*AE +0.05*TA+ 0.15*PI + 0.60*PF)}
In the extraordinary call, all contents will be evaluated in a final test that will make up 90% of the overall grade. Computer labs will make up the remaining 10% of the overall grade.

Observations for part-time students

The same rules will apply for part-time and full-time students.

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

Alan V. Oppenheim, Alan S. Willsky, S. Hamid, "Signals and Systems" 2ed, Prentice-Hall

Simon Haykin, Barry Van Veen, "Signals and Systems", 2ed, Wiley