

Academic Year of Degree: 2025/26

23965 - Signals and Systems II

Teaching Guide Information

Academic Course: 2025/26

Academic Center: 337 - Engineering School

Study: 3379 - Bachelor's degree in Telecommunications Network Engineering

Subject: 23965 - Signals and Systems II

Credits: 5.0

Course: 2

Teaching languages:

Theory: Group 1: English

Group 2: Spanish

Practice: Group 101: English

Group 201: Spanish

Seminar: Group 101: English

Group 201: Spanish

Teachers: Giovanni Geraci

Teaching Period: Second term

Presentation

Signals and Systems II focuses on the representation of continuous-time (CT) signals and linear time-invariant (LTI) systems in the time and frequency domains, complementing and extending the concepts covered in Signals and Systems I. Within a clear trend towards digitalization, the study of continuous time is essential to understand many physical systems covered in later courses: audiovisual (microphony, speakers), telecommunications (cable, radio, or satellite), and signal processing in a wide sense (sound, room acoustics, electromagnetic waves, amplifiers, and filters), all of them analog systems operating upon continuous signals. As a generalization of discrete signals and systems, the continuous case is also a convenient and powerful conceptual and mathematical abstraction, which facilitates the understanding and design of many systems, both continuous and discrete.

The course will emphasize the understanding and critical interpretation of the concepts, well beyond its memorization or systematic manipulation. The course reviews concepts introduced in Fundamentals of Physics and Signals and Systems I, and prepares them for their practical application in real engineering systems. This course has a strong mathematical component. It requires solid basics of linear algebra, differential and integral calculus, and differential equations. It is strongly recommended having passed all the courses with mathematical and physical content of the first year, as well as a solid knowledge of Signals and Systems I.

Associated skills | General learning outcomes

CE1. Solving the mathematical problems which can be set out in engineering and apply the knowledge on: linear algebra; differential and integral calculus; numerical methods, numerical algorithms, statistics and optimization.

CE2. Mastering the basic concepts of fields and waves and electromagnetism, theory of electric circuits, electronic circuits, physical principle of the semiconductors and logic families, electronic and photonic devices, and their application for solving typical problems of the engineering.

CE7. Designing, building and assessing electronic systems and circuits.

CE8. Using the different communication techniques (modulation, codification, synchronization, equalization, etc.) in the design of communication links.

CE9. Mastering the fundamentals and principles of the processing of audiovisual signals for the acquisition, analysis, processing and obtention of functional results.

Learning outcomes | Specific learning outcomes

RA.CE1.2 Proving knowledge of differential and integral calculus to solve problems which can be set out in engineering.

RA.CE2.2 Managing basic concepts of linear systems and the functions and transforms related to solving typical problems in engineering.

RA.CE7.2 Solving typical problems of the engineering applying advanced concepts of linear systems and the related functions and transformed.

RA.CE8.1 Designing communication links using techniques of modulation and design of recipients including synchronization of bearer.

RA.CE8.2 Analyzing and designing simple systems of information's compression and codification.

RA.CE9.2 Designing and implementing algorithms for sound processing applying techniques of signals representation, digital synthesis, spectral analysis and sound transformation.

Contents

- Continuous-time (CT) signals and systems. Basic signals. CT convolution.
- Fourier transform (FT). Inverse FT. FT of basic signals. Properties of the FT.
- Time and frequency characterization of signals and systems. Systems characterized by linear constant-coefficient differential equations. Magnitude-phase representation of the frequency response of LTI systems.
- Sampling and reconstruction. Sampling theorem. Undersampling and aliasing.
- Communication systems. Amplitude modulation. Frequency-division multiplexing.

Evaluation and grading system

Consistently with the course goals and methodology, the evaluation prioritizes the understanding of concepts, their interrelations, and the mathematical and applied reasoning. This goes well beyond memorization or systematic manipulation of procedures. The evaluation consists of labs (20%) and a final exam (80%). The final exam can be retaken. In order to pass the course, it is necessary to achieve at least 40% out of 80% at the final exam.