COURSE DATA

Data Subject	
Code	34876
Name	Electronic circuits
Cycle	Grade
ECTS Credits	6.0
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
1403 - Degree in Telematics Engineering	School of Engineering	1	Second term
1935 - PDG Matemàtiques-Telemàtica	Faculty of Mathematics	1	Second term

Subject-matter

Degree	Subject-matter	Character
1403 - Degree in Telematics Engineering	3 - Electronic and photonic components and circuits	Basic Training
1935 - PDG Matemàtiques-Telemàtica	1 - Primer curso	Basic Training

Coordination

Name	Department
LAPARRA PEREZ-MUELAS, VALERO	242 - Electronic Engineering

SUMMARY

The subject “Electronic Circuits” is a four-month course, consisting of 6 ECTS credits and is taught during the 2nd semester of the first academic year of the Degree in Telecommunications Electronic Engineering (GIET) and the Degree in Telematics Engineering (GIT). The course presents basic Circuit Theory and a brief introduction to digital electronics that will be needed in later courses. In any case, there are not specific prerequisites, so students who have not previously studied Circuit Theory should not have troubles following it, assuming they have the math skills needed in this course.

The theoretical concepts of the course are basically learned by performing simple exercises and problems that will gradually increase its complexity to achieve all the concepts to be learned. The basic topics of circuit theory and digital electronics are organized in four thematic units that bring together fundamental concepts that all electronic communications engineer must know and master. In fact, the contents of Electronic Circuits are widely used in many other subjects of the degree and also in the development of the professional career.

The four thematic units refer to the four large blocks in which the course is structured:

1. Basics. Laws. Theorems.

2. Sinusoidal steady-state and frequency response.

3. Laplace and Fourier Transforms.

4. Introduction to Digital Electronics.

The material needed to follow the theoretical class will be provided in advance, therefore, students should review these contents before the first class of each topic. The learning will be based on the resolution of problems and exercises, first by the teacher and then with increasingly active participation of students. Regarding the laboratory sessions, the guidelines to complete the session will be provided before attending and their contents must be prepared before reaching the lab. Laboratory sessions help to reinforce the theory as well as having a first contact with a laboratory of Electronics, both in terms of circuit simulation and assembly.

The tutoring hours for each teacher are available on the website of Department of Electronic Engineering (http://www.uv.es/die). The subject material (notes, problems, lab guidelines, etc.) will be available through the Virtual Classroom of the University of Valencia (http://aulavirtual.uv.es/).

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

Being a core subject taught in the first year, there are no prerequisites for Electronics and Circuit Theory, although it is desirable to understand basic physical concepts and mathematical tools to be used during the course. In particular students should be aware of:

-Mathematical calculations with complex variables.
-Vector and matrix calculus.
-Basic differential and integral calculus.
-Trigonometry and basic linear algebra.
-Logarithms.

Regarding physics, students must at least meet the follow

OUTCOMES

1403 - Degree in Telematics Engineering

- G3 - Acquisition of the knowledge of the basic and technological subjects that allows students to learn new methods and theories and endows them with the versatility to adapt to new situations.
- G4 - Ability to solve problems with initiative, decision-making and creativity, and to communicate and transmit knowledge, abilities and skills, understanding the ethical and professional responsibility of the activity of a telecommunications technical engineer.
- G5 - Knowledge to carry out measurements, calculations, assessments, evaluations, loss adjustments, studies, reports, task planning, and other analogous work in the specific field of telecommunications.
- B4 - Understand and master the basic concepts of linear systems and the related functions and transforms, electric circuit theory, electronic circuits, physical principle of semiconductors and logic families, electronic and photonic devices, materials technology and their application to solve engineering problems.

LEARNING OUTCOMES

General Learning Outcomes

- Understanding the operation of electronic and photonic devices, their characteristics and limitations. (G3)
- Knowing the different materials used for manufacturing devices and their basic characteristics. (G3)
- Linearize different devices and deduce its equivalent circuit in order to understand better the operation of a circuit. (B4)
- Being able to recognize basic electronic and photonic components and circuits. (G4,B4)
- Being able to analyze and design an electronic circuit, using different techniques established for it. (G4,B4)
- Handle the basic tools for digital logic and understand their basic circuits. (G5,B4)

Objectives of the Course

The objective is that students acquire knowledge and adequate training to be able to design electronic circuits and systems that meet industry specifications requested, using basic electronic devices. The students acquire knowledge in the area of electronic networks (or circuits), to analyze any network with direct or alternating currents and steady or transient states. They will also get a basic knowledge of digital electronics to understand the basic logic functions. The electronic circuit analysis is the basis of analog electronics, industrial electronics, automatic control and digital electronic systems.

General objectives

The main objective of this course is circuit analysis. At the end of the course, students should be able to handle the mathematical tools taught during the course and to solve circuits using different approaches. They should be able to discern which method is best to solve a given circuit. In particular, the general objectives that the student must achieve are:

- Know the basics of current and voltage sources, and basic passive devices from the point of view of circuit theory.
- Understand the concepts of phasor and impedance.
- Understand the concepts of power, energy and its application in network theory.
- Understand the principles of network analysis of passive circuits, and the main theorems to analyze them.
- Learn and remember the basic laws of electrical circuits and know how to apply them.
- Learn how to make graphic representations of transfer functions in frequency domain in the form of Bode diagrams, both in magnitude and phase.
- Acquire the terminology used in the field of electronics.
- Manage computer software simulation of electronic circuits and apply them in the field of circuit analysis.
- Understand and master the Laplace and Fourier transforms and their use for circuit analysis.
- Learn to perform measurements on simple electronic circuits.

It is also a general objective to know the basic theoretical concepts necessary to understand Digital Electronics, which will include the following:

- Boolean algebra and logic functions.
- To know and apply the methods of simplification of logic functions.
- Understand different numerical encodings and how to convert between different bases.

As specific objectives could include the following:

- Express correctly the magnitudes measured in electrical circuits using appropriate units.
- Current-voltage relations in passive components (RLC).
- Understand and apply basic circuit laws (Ohm, Joule, Kirchhoff).
- Know the different types of generators and the equivalence between them.
- Calculate the power for passive and active elements in a circuit.
- Recognize the topology of a circuit and determine the minimum number of equations necessary for its analysis.

- Apply the methods of analysis of a circuit to voltages and currents.
- Normalization and denormalization of the magnitudes involved in electrical circuits to solve them with simpler calculations.
- Understand and apply the fundamental theorems of circuit analysis: superposition, Thevenin and Norton.
- Understand the concept of phasor.
- Use simulation software to analyze electrical circuits.
- Analyze circuits in sinusoidal steady state, phasors and impedances.
- Calculate power in sinusoidal steady state.
- Apply a systematic analysis of circuits and theorems of superposition, Thevenin and Norton to sinusoidal steady-state circuits.
- To analyze the transient response of first and second order in time domain, establishing the relationships between mathematical terms and their corresponding physical interpretation.
- Apply the Laplace and Fourier transforms to circuit analysis in transient and steady state.
- Simulate the circuit behavior in transient and steady state.
- Understand Boolean algebra and simplification of systems logic functions.
- Understand number systems and learn how to convert numbers from one to another.

Skills to acquire

Basic.

The student must know and be familiar with the different tools for the analysis of circuits that are studied in the course given its importance to the rest of his training and even professional career. The student should be aware of the importance of the subject studied, and understood it as a cornerstone in the training of all electronic and telecommunications engineer. Also in the introduction to Digital Electronics, the student must know how to use basic tools of digital logic and know their basic circuits.

Laboratory.

The student should know how to perform measurements on simple electronic circuits and should handle software for electronic circuit simulation, knowing at least the options that these programs offer for simulation in the time domain, frequency and parametric analysis on different values of the circuit components. The student will begin to become familiar with mathematical calculation programs to be used in later courses on a regular basis, such as Matlab.

DESCRIPTION OF CONTENTS

1. Basics. Laws. Theorems.

This first thematic unit sets the basis for the subsequent analysis of circuits. We begin by reviewing some basic knowledge of basic electronic components and signals, Kirchoff's laws, and major networks' theorems.

The laboratory is designed to reinforce concepts discussed by solving exercises and circuit simulation: Thematic Unit I is characterized by a theoretical study. In the lab session 1, we propose very simple problems but very useful for teaching and consolidating the theoretical concepts.

2. Sinusoidal steady-state and frequency response

This second thematic unit focuses on the analysis of stationary alternating currents and voltages using the concepts and tools studied in the previous thematic unity. It introduces the concept of phasor, which is necessary to define the transfer function of a circuit. We study how to make graphic representations of the transfer functions in frequency domain, the Bode diagram, analyzing the effect of the zeros and poles of the transfer function and thus the system's response to some input excitation.

The laboratory is designed to reinforce concepts discussed by solving exercises and circuit simulation: Thematic Unit II includes lab sessions 2 and 3, which introduce the concepts of transfer function, frequency response and Bode diagrams.

3. Transforms

The third thematic unit explores the Fourier and Laplace transforms, useful for circuit analysis. Fourier series allow you to extend the analysis of circuits to non-sinusoidal periodic signals. The Fourier transform establishes the relationship between time and frequency domains. The study of the Laplace transform allows to obtain a global solution for the analyzed circuits, transient and stationary states. Also enables a more rapid and efficient solution than that obtained by phasors. It also allows us to deduce the concepts of free and forced response and stability of a network.

The laboratory is designed to reinforce concepts discussed by solving exercises and circuit simulation: Thematic Unit III is developed in lab sessions 4 and 5, where there are problems to be solved by Fourier series and Laplace transforms. These practices show experimentally the decay of sinusoids (harmonics) in periodic waves, transient and stationary responses of circuits, and transfer functions are defined in the transformed domain and then their response is obtained in the frequency and time domains.

4. Introduction to Digital Electronics

The last thematic unit introduces the basic concepts of digital electronics. You start seeing the Boolean algebra and from this simplifying logic functions and multifunctions and then study the numbering systems and codes.

The laboratory is designed to reinforce concepts discussed by solving exercises and circuit simulation: Thematic Unit IV is developed in the last sessions 6. It introduces the basic logic gates from which any logic function can be implemented and the simplification of logic functions.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	30,00	100
Laboratory practices	20,00	100
Classroom practices	10,00	100
Development of individual work	40,00	0
Preparation of evaluation activities	20,00	0
Preparing lectures	20,00	0
Preparation of practical classes and problem	10,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

The development of the course is structured around four pillars: the theory and problem solving sessions, tutoring, testing and continuous assessment, and the presentation of reports of the lab sessions.

Presential learning

(G3, G4, G5, B4)

Before each lesson, the teacher will provide the student the necessary study material for preparin the lesson. In the lectures, the teacher will discuss with students the questions that may have arisen. In the problem sessions, the teacher will explain a number of illustrative problems, thanks to which the student will learn to identify the essential elements to solve problems. It will also use the participatory approach to the problem sessions, in which communication is to prevail among students and student/teacher.

Tutorships

(G3, G4, G5, B4)

The students have a schedule for tutorships aimed at solving the problems, doubts, work orientation, etc. The schedule of these tutorships will be indicated at the beginning of the academic year. They will also have the opportunity to clarify some questions via email or discussion forums via the use of virtual classroom tool that provides the University of Valencia.

Homework

(G3, G4, G5, B4)

The student will have problems with solutions to work on concepts that will be studied along the course. There will be at least four questionaries, one for each unit.The labs have a previous part of individual work for the preparation of the lab session.

Teaching materials available

The student has in the virtual classroom from the beginning of the academic year, the following documents:

- Teaching Guide (this document) provides sufficient data elements to determine what is expected from the student, how it will be learnt it and under what conditions, and how it will be evaluated.

- Slides of each of the topics of the course.

- Problems of each lesson.

- Lab sessions with the following structure:

- Objectives.
- Material.
- Preparation.
- Tasks.

EVALUATION

Assessment of learning is done by evaluating the participation of students throughout the course and through a final test of theory and laboratory. The percentage allocation for each part of the evaluation is as follows:

	Theory	Continuous Evaluation	Participation	Laboratory
Continuous	50%	10%	10%	30%

Assessment				
Alternative Assessment	70%	0%	0%	30%

Theory.

There will be two official evaluation sessions. The theory exam will be held individually on the date, time and place officially designated by the center and it assesses the knowledge and concepts acquired by the student and their ability to solve problems based on experience, knowledge and skills acquired. The exam will represent 50% of the final grade for the course in the first test and 70% in the second, and a minimum grade of 4 out of 10 is required for averaging this part with the other parts of the assessment.

Laboratory.

The mark of the laboratory results will be obtained evaluating each lab session and with a final test in the laboratory. It will be of the same nature as the lab sessions and will be held in the laboratory sessions in the final session. The evaluation of lab sessions (preparation 30% and development 70%) represents 30% of the lab mark, whereas the final lab test constitutes the remaining 70%.

The lab mark obtained as described above will represent 30% of the grade of subject, and will be essential to obtain a 4 out of 10 for averaging it with the other parts of the assessment.

For students who do not pass this lab assessment will be two more calls on the dates and times officially designated by the center for the official examination of the subject, after the theory exam. The mark of this exam will represent 100% of mark lab, and 30% of the grade, and again will be essential to obtain a 4 out of 10 for averaging it with the other parts of the assessment.

Regulations.

In any case, the evaluation will be regulated by the Reglamento de Evaluación y Calificación de la Universitat de València para Grados y Masters:

https://webges.uv.es/uvTaeWeb/MuestraInformacionEdictoPublicoFrontAction.do?idEdictoSeleccionado=5639

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