COURSE DATA

Data Subject	
Code	34792
Name	Electronic Circuits
Cycle	Grade
ECTS Credits	6.0
Academic year	2016 - 2017

Study (s)

Degree	Center	Acad. year	Period
1402 - Degree in Telecommunications Electronic Engineering	School of Engineering	1	Second term

Subject-matter

Degree	Subject-matter	Character
1402 - Degree in Telecommunications Electronic Engineering	3 - Electronic and photonic components and circuits	Basic Training

Coordination

Name	Department
MARTIN GUERRERO, JOSE DAVID	242 - Electronic Engineering
MUÑOZ MARI, JORDI	242 - Electronic Engineering

SUMMARY

The subject "Electronic Circuits" is a four-month course, consists of 6 ECTS credits and is taught during the 2nd semester of the first academic year of the Degree in Telecommunications Electronic Engineering (GIET). The course presents basic Circuit Theory 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 exercises and problems that will gradually increase its complexity to achieve all the concepts to be learned.

The basic topics of circuit theory 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. Transient and steady states.
2. Sinusoidal steady-state.
3. Frequency response.
4. Methods for circuit analysis (Laplace transform).

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 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, stu

COMPETENCES (RD 1393/2007) // LEARNING OUTCOMES (RD 822/2021)

1402 - Degree in Telecommunications Electronic 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 (RD 1393/2007) // NO CONTENT (RD 822/2021)

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. 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 and master the method based on differential equations for circuit analysis.
- 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 transform and their use for circuit analysis.
- Learn to perform measurements on simple electronic circuits.

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, Thévenin 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, Thévenin and Norton to sinusoidal steady-state circuits.
- 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 transform to circuit analysis in transient and steady state.
- Simulate the circuit behavior in transient and steady state.

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.
- 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. Transient and steady states. The method of differential equations will be studied, which obtains a global solution of the circuit, thus obtaining the transient response as well as the response of the circuit in steady state.

2. Sinusoidal steady-state.

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. The second part of this unit presents the method of differential equations to solve electrical circuits, thus obtaining a global solution, both in transient and steady-state.

3. Frequency response.

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.

4. Methods for circuit analysis (transient and steady states).

This unit studies the method of the Laplace transform; it obtains 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.

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	20,00	0
Study and independent work	20,00	0
Preparation of evaluation activities	20,00	0
Preparing lectures	15,00	0
Preparation of practical classes and problem	15,00	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 lab sessions.

In-person learning

Before each lesson, the teacher will provide the student with the necessary study material for preparing 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

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.

Class work

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.

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 students, how they will learn it and under what conditions, and how they will be evaluated.
- Slides of each of the topics of the course.
- Problems of each lesson.
- Lab sessions with the following structure:
  - Objectives.
  - Material.
  - 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:

- Participation: 10%
- Final test: 60%
- Laboratory: 30%

Theory Evaluation.

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 60% of the final grade for the course, and a minimum grade of 4 out of 10 is required for averaging this part with the other parts of the assessment.

Laboratory Evaluation.

The mark of the laboratory results will be obtained evaluating each lab session and with a final exam 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%, development 70%) represents 40% of the lab mark, whereas the final lab exam constitutes the remaining 60%.

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.

REFERENCES

Basic

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- 2. E. Soria, J. D. Martín, L. Gómez. Teoría de Circuitos. McGraw-Hill (Serie Schaum), 2004.
- 3. J. D. Irwin, Análisis básico de Circuitos en Ingeniería. Prentice-Hall, 1997.
- 4. D. E. Johnson. Análisis básico de Circuitos Eléctricos. Prentice-Hall, 1997.
- 5. R. E. Thomas, A. J. Rosa. Circuitos y señales: introducción a los circuitos lineales y de acoplamiento. Reverté, 2002.
- 6. W. Hayt, J. Kemmerly. Análisis de circuitos en ingeniería. McGraw-Hill, 2007.
- 7. J. Espí. Problemas Resueltos en Teoría de Redes. Moliner 40. Burjassot, 2001.
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- 9. J. M. Angulo Usategui, J. Garcia Zubía, Sistemas Digitales y Tecnología de Computadores. Paraninfo, 2002.
- 10. P. Casanova Peláez, N. García Martínez, J.A. Torres Barragán, Tecnologías Digitales. Paraninfo, 1993.

Additional

- 1. James W. Nilsson, Susan A. Riedel. Circuitos Eléctricos. Prentice Hall, 2005. Libro muy recomendable pero excesivamente teórico para la manera de enfocar la asignatura.
- 2. B. Carlson. Teoría de Circuitos. Thomson, 2002. Se trata de un libro que puede servir de base para las tres primeras unidades temáticas. También incluye un breve tutorial aplicado de Pspice.
- 3. R. L. Boylestad. Introducción al análisis de circuitos. Pearson Education, 2004. Libro igualmente recomendable para las tres primeras unidades temáticas.
- 4. R. Hambley. Electrónica. Prentice Hall, 2001. Excelente libro de texto de Electrónica, que va más allá de los objetivos perseguidos en Circuitos Electrónicos.
- 5. M. H. Rashid. Circuitos Microeletrónicos: Análisis y diseño. Thomson, 2002. Este libro, al igual que el anterior, puede servir como una guía de referencia en electrónica, pero de nuevo el tratamiento del libro excede a los contenidos de esta asignatura.

- 6. P. Horowitz, W. Hill. The Art of Electronics, Cambridge University Press, 1989 (reeditado en 1990, 1991, 1993, 1994, 1995). Libro muy original y ameno, recomendable como lectura complementaria que puede ayudar a entender conceptos que no hayan quedado claros al ser explicados de manera clásica ya que minimiza los largos análisis habituales y se centra en el diseño y funcionamiento de circuitos.
- 7. V. Oppenheim, A. S. Willsky. Señales y sistemas. Prentice Hall, 1997. Este libro trata de manera completa señales y sistemas continuos y discretos.