COURSE DATA

Data Subject	
Code	34792
Name	Electronic circuits
Cycle	Grade
ECTS Credits	6.0
Academic year	2023 - 2024

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
ESPERANTE PEREIRA, DANIEL	242 - Electronic Engineering
LIBEROS MASCARELL, ALEJANDRO	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 (diferencial equations and 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, students must at least meet the f

OUTCOMES

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

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.

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.

This unit studies the methods of the differential equations and 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, in the case of Laplace transform, also the 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	10,00	0
Study and independent work	40,00	0
Preparing lectures	15,00	0
Preparation of practical classes and problem	15,00	0
Resolution of online questionnaires	10,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

The development of the course is structured around the following axes: classroom sessions, tutorials, continuous assessment tests, non-presential work and practices.

Group learning with the teacher. In the face-to-face theory sessions, the teacher will explain the corresponding theoretical concepts, which will have priority in terms of attendance. In the problem sessions, the teacher will explain a series of typical problems, thanks to which the student will learn to identify the essential elements of the approach and resolution of the problems. The participative method will also be used for the problem sessions, in which the communication between students and students/teacher will be prioritized. Its resolution will be completed in class, sometimes forming groups of students who will then have to go out to the blackboard to explain the problem and solve the doubts that the rest of their classmates have. Periodically and randomly, tests will be performed on concepts or theory problems in the classroom. A record will be kept of the people who attend in person by means of a signature sheet.

Tutorials. The students will have a tutorial schedule whose purpose is to solve problems, doubts, orientation in works, etc. The schedule of these tutorials will be indicated at the beginning of the academic year. They will also have the opportunity to clarify some doubts by means of e-mail, videoconferences or discussion forums using the Virtual Classroom tool provided by the University of Valencia.

Non-attendance work. The student will have problem bulletins to work on the concepts that will be seen throughout the course. Self-assessment problem reports/questionnaires will be made available to students in the Virtual Classroom. There will also be transparencies and videos to support the theoretical concepts.

Teaching materials available. In order to carry out the described teaching methodology, the student has the following documents available in the Virtual Classroom:

- Teaching Guide, which offers thorough information to determine what the student is expected to learn, how it will be done, under what conditions and how it will be evaluated.

- Planned timing of the classes

- Notes / Slides of each of the topics of the course.

- Additional texts of interest.

- Problem bulletins for each lesson.

- Video lessons (own and external) reinforcing the key concepts.

- Questionnaires

- The Practice Guide with the following structure:

  - Objectives.
  - Material.
  - Realization.

EVALUATION

Regarding the evaluation process, different dimensions of the teaching-learning process will be considered. Note that the evaluation is proposed as formative, that is, comments will be provided that favor the correction of aspects to be improved. Daily interaction between students and teachers, comments in the Aula Virtual or review sessions will be used for that purpose.

In both first and second call, the final grade (NF) responds to the evaluation instruments according to the following expression:

NF = Ex·0,35 + ExP·0,1 + TC·0,15 + AyP·0,05 + LabEC·0,18 + LabEx·0,17

In any case, (1) NF will be equal to Ex if the result of Ex is less than 4/10, (2) NF will be equal to LabEx if the result of LabEx is less than 4/10.

The different evaluation instruments are described below:

Ex: Exam. This is an individual objective test. It may contain both short questions, as well as the development of theoretical-practical questions, problems, etc. Any aspect presented during the course can be questioned. New problems related to the subject may also appear, as this is considered a useful methodology to assess the consolidation of competencies and content. This test will be carried out according to the ETSE exam calendar, Ex1 corresponds to the first call and Ex2 to the second.

Participation in Ex2 will be mandatory if the subject is not passed in the first call, otherwise the grade in the second call will be Not Presented. Any exception in this regard must be authorized by the teacher.

ExP: Midterm exam. During the course and during class hours, a test will be carried out to evaluate the consolidation of content and competences, as well as to give students the opportunity to face exercises like those that can be found in the Exam. The contents applicable to said test, as well as the rules to follow and the date will be communicated during the course. This test will not reduce contents for the Exam.

T: Tasks. During the course, different tasks will be proposed, essentially problems. They can be proposed both in the classroom and in a non-face-to-face way, individually or in teams. *Tasks delivered after the deadline will not be considered.*

AyP: Attendance and participation. The contents and competences worked on during the course often exceed the specific exercises and problems of the objective tests. Therefore, attendance and participation of students throughout the course is required to achieve the highest grade. Teachers will be able to use different techniques to assess attendance, and participation during the theory or problem sessions.

LabEC: Continuous evaluation of laboratories. Each lab session will have a note associated. The degree of achievement, autonomy, and ability to interpret the results will be evaluated. In addition, each session may have associated preparation tasks that can constitute up to a third of the mark for each practice. LabEC will be calculated as the average between the marks obtained in each session. *Attendance is mandatory to have a note associated with the session.*

LabEx: Laboratory examination. The students will undergo an individual laboratory examination with exercises similar to those carried out at the lab sessions. LabExC will be hold during the course. LabEx1 corresponds to the first call and LabEx2 to the second one; these exams will be held on the official dates designated by the ETSE.

Voluntary participation in LabEx1 or LabEx2 must be authorized by the teachers.

In the second call, and following the minimum grades indicated above, the final grade can be calculated as:

NF = Ex·0,65 + LabEC·0,18 + LabEx·0,17 o NF = Ex·0,65 + LabEx·0,35

In any case, the evaluation system will be governed by what is established in the Evaluation and Qualification Regulations of Universitat de València for Bachelor's and Master's degrees.

REFERENCES

Basic

- 1. J. Espí, J. Muñoz, G. Camps. Análisis de Circuitos. Universitat de València, 2006.
- 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.
- 8. J. Espí. Aplicaciones de PSPICE en ingeniería. Moliner 40. Burjassot, 2000.
- 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.