VNIVERSITAT DE VALÈNCIA

Course Guide
34792 Electronic Circuits

COURSE DATA

Data Subject	
Code	34792
Name	Electronic Circuits
Cycle	Grade
ECTS Credits	6.0
Academic year	2020 - 2021

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
MAGDALENA BENEDICTO, JOSE RAFAEL	242 - Electronic Engineering
PEREZ SOLER, JOAQUIN	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

The evaluation of learning will be done by prioritizing continuous assessment and student participation throughout the course, and through a final theory and laboratory exam. The evaluation will measure the achievement of the objectives in two blocks: Block A, which will collect the theory knowledge and Block B, which will collect the practical laboratory knowledge. It will be necessary to obtain a minimum score of 4 in both blocks to pass the minimum required knowledge. The final grade will be the weighted average of both blocks as specified below.

There will be two calls for examinations coinciding with the official calls.

First call. The first call will give priority to continuous assessment and the student's work. The percentage allocation of each part of the evaluation in the first call will be as follows:

Block A: theory

- Attendance and participation: 10%.
- Classroom work: 35%
- Final theory exam: 25%

Block B: laboratory

- Lab: 30%

The final theory exam will be taken individually on the date, time and place officially designated by the centre and will evaluate the knowledge and concepts acquired by the student and his/her ability to solve problems based on the experience, knowledge and skills acquired.

The attendance and participation grade will be proportional to the attendance of the student to the face-to-face classes, and to the participation in the tasks proposed in the same one, giving priority to the one of the activities of voluntary character.

The grade of the classroom work will be obtained by evaluating and averaging the results of the questionnaires, problems and challenges, both in digital and physical format, that the teacher raises during the classes.

The laboratory grade will be obtained as a result of the evaluation of each practice and a final practical examination, individual, of the same nature as the practices carried out, and which will take place in the practice laboratory in the last practice session. The continuous evaluation of each practice (preparation 30%, completion 70%) will constitute 40% of the final laboratory note, while the remaining 60% will be obtained from the completion of the individual final examination. The laboratory note obtained as described in the previous paragraph will represent 30% of the course note. It will be essential to obtain a 4 out of 10 in this mark in order to be able to average with the rest of the parts of the evaluation. The teacher will be able to keep this laboratory note by means of practice and continuous evaluation for the following course.

Second call: The percentage assignment of each part of the evaluation in the first call will be the following:

Block A: theory

- Attendance and participation: 5%.
- Classroom work: 15%
- Final theory exam: 50%

Block B: laboratory

- Lab: 30%

The final theory exam will be taken individually on the date, time and place officially designated by the centre and will evaluate the knowledge and concepts acquired by the student and his/her ability to solve problems based on the experience, knowledge and skills acquired.

The attendance and participation grade will be proportional to the attendance of the student to the face-to-face classes, and to the participation in the tasks proposed in the same one, giving priority to the one of the activities of voluntary character.

The grade of the classroom work will be obtained by evaluating and averaging the results of the questionnaires, problems and challenges, both in digital and physical format, that the teacher raises during the classes.

The laboratory mark will be obtained as a result of evaluating each practice and a final practical examination, individual, of the same nature as the practices carried out, which will take place in the practice laboratory in the last practice session. The continuous evaluation of each practice (preparation 30%, completion 70%) will constitute 40% of the final laboratory mark, while the remaining 60% will be obtained from the completion of the individual final examination.

For students who have not obtained a mark of 4 or higher attending the laboratories, there will be an exam in this call on the date and time officially designated by the centre for the official examination of the subject in the second call, after the final theory exam. In this case, the mark of this exam will represent 100% of the mark of the laboratory block, and it will be essential to obtain at least a 4 out of 10. Students who have not attended the laboratory during the course at least 75% of the sessions, will not be able to take this exam.

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.

ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

Contents

The contents initially included in the teaching guide are maintained.

Workload and temporary teaching planning

The different activities described in the teaching guide are maintained with the planned dedication.

The material for the follow-up of the classes of theory/practices allows to continue with the professor of temporary planning so much in days as in schedule, so much if the teaching is face-to-face in the classroom or if it is not.

Teaching methodology

In classroom theory and practices, students will tend to have the maximum physical attendance possible, always respecting the sanitary restrictions that limit the capacity of the classrooms as indicated by the competent public health authorities to the estimated percentage of their usual occupation.

Depending on the capacity of the classroom and the number of students enrolled, it may be necessary to distribute the students into two groups. If this situation arises, each group will attend classroom theory and practical sessions with physical presence in the classroom by rotating shifts, thus ensuring compliance with the criteria for occupying spaces.

The rotation system will be established once the actual enrollment data is known, guaranteeing, in any case, that the attendance percentage of all the students enrolled in the subject is the same.

With respect to laboratory practices, attendance at sessions scheduled in the schedule will be totally face-to-face.

Once the actual enrollment data is available and the availability of spaces is known, the Academic Committee of the Degree will approve the Teaching Model of the Degree and its adaptation to each subject, establishing in said model the specific conditions in which it will be developed teaching the subject.

If there is a closure of the facilities for sanitary reasons that totally or partially affects the classes of the subject, these will be replaced by non-contact sessions following the established schedules.

Evaluation

The evaluation system described in the teaching guide of the subject in which the different evaluable activities have been specified as well as their contribution to the final grade of the subject is maintained.

If there is a closure of the facilities for health reasons that affect the development of any face-to-face evaluable activity of the subject, it will be replaced by a test of a similar nature that will be carried out in virtual mode using the computer tools licensed by the Universitat de València.

The contribution of each evaluable activity to the final grade for the course will remain unchanged, as established in this guide.

Bibliography

The bibliography recommended in the teaching guide.