UNIVERSIDAD DE CASTILLA - LA MANCHA

GUÍA DOCENTE

1. General information

Course: ELECTRONIC DEVICES
Code: 59609
Type: BASIC
ECTS credits: 6
Degree: 385 - DEGREE IN TELECOMMUNICATI TECHNOLOGY ENGINEERING
Academic year: 2022-23
Center: 308 - SCHOOL POLYTECHNIC OF CUENCA
Group(s): 30
Year: 1
Duration: C2
Main language: Spanish
Second language:
Use of additional languages:
English Friendly: Y
Web site:
Bilingual: N

Lecturer: **ESTEFANIA PRIOR CANO** - Group(s): **30**

Building/Office	Department	Phone number	Email	Office hours
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Lecturer: **CESAR SANCHEZ MELENDEZ** - Group(s): **30**

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2. Pre-Requisites

It is necessary to have successfully completed the subjects of "Fundamentals of Mathematics I", "Fundamentals of Mathematics II", "Fundamentals of Physics I" and "Components and Circuits". In particular, it is necessary to know the contents related to the identification of components of a basic electrical circuit, analysis of linear circuits based on the Kirchhoff laws, analysis of the experimental behavior of basic electronic components and the handling of laboratory instruments.

3. Justification in the curriculum, relation to other subjects and to the profession

Electronics is one of the professional branches of telecommunication engineering. In this subject, basic semiconductor electronic devices (diodes, transistors, operational amplifiers) present in most electronic consumer systems are presented and analyzed in depth.
The knowledge acquired with this subject is necessary to subsequently take the compulsory subjects of "Electronics I", "Electronics II", "Digital Electronic Systems" and "Communications", as well as for the optional subjects of "Sensors and wireless sensor networks". , "Audiovisual Equipment in Electromedicine", "Electronic Technology" and "Biometrics".

4. Degree competences achieved in this course

Course competences

Code	Description
E04	Understanding and mastering the basic concepts of linear systems and related functions and transformations, electrical circuit theory, electronic circuits, physical principle of semiconductors and logic families, electronic and photonic devices, materials technology and their application for solving engineering related problems.
G02	Correct, oral and written, communication skills.
G06	Knowledge of basic subjects and technologies, enabling students to learn new methods and technologies, as well as providing great versatility to adapt to new situations
G12	The ability to work in a multidisciplinary group and in a multilingual environment and to communicate, both in writing and orally, knowledge, procedures, results and ideas related to telecommunications and electronics
G13	The ability to look for and understand information, wether technical or commercial in different sources, to relate and structure it to integrate ideas and knowledge. Analysis, synthesis and implementation of ideas and knowledge.

5. Objectives or Learning Outcomes

Course learning outcomes

Description

Identification of components, typical parameters and electrical behaviors in electronic systems.
Simulation of electrical behaviors through computer packages as an approximation to the real operating model.
Correct use of oral and written expression to convey ideas, technologies, results, etc.
Use of ICT to achieve the specific objectives set in the subject.
Design of simple electronic circuits.
Obtaining relevant information of electronic devices through the manufacturer data sheets.
Problem solving by applying the fundamental theorems.
Problem solving that involves characteristics and operating parameters of the studied photonic devices.
Choice of the most suitable strategy to solve a certain circuit.
Study of the basic output power stages, class A, AB, C, D.
Use of equivalent models of operation in assumptions of ideal behavior and different stages of approximation to the real model.
Use of equivalent models in small signal and power as initial operating hypotheses.
Understanding of the negative and positive feedback theory. Study of the main applications from basic analog systems.

Approximate frequency response calculus of analog systems using equivalent models.
Calculation of the work and polarization points of electronic devices presented through the use of the basic laws of Circuit Theory.
Understanding of the internal operation of an operational amplifier from the analysis of its internal stages.
Comprehension of technical documentation and mastery of specific vocabulary.
Understanding the use of basic electronic instrumentation to check the performance of different devices.

6. Units / Contents

Unit 1: Introduction to semiconductor materials.

Unit 2: P-N union. Circuits with diodes.

- **Unit 2.1** P-N union
- **Unit 2.1** Internal structure
- **Unit 2.2** Analysis and design
- **Unit 2.3** Circuits with diodes
- **Unit 2.4** Lab: The Rectifier Diode
- **Unit 2.5** Lab: Zener diodes, LEDs and photodiodes

Unit 3: The bipolar transistor.

- **Unit 3.1** Internal structure
- **Unit 3.2** Polarization analysis
- **Unit 3.3** Small signal analysis
- **Unit 3.4** Lab: Bipolar transistor performance analysis

Unit 4: The unipolar transistor.

- **Unit 4.1** Internal structure
- **Unit 4.2** Polarization analysis
- **Unit 4.3** Small signal analysis
- **Unit 4.4** Lab: Unipolar transistor performance analysis

Unit 5: Theory of the Operational Amplifier.

- **Unit 5.1** Internal blocks of an operational amplifier.
- **Unit 5.2** Differential amplifier
- **Unit 5.3** Level DC stages
- **Unit 5.4** Basic power stages

Unit 6: Study of the ideal behavior of the AOP

- **Unit 6.1** Real characteristics in the study of the ideal model.
- **Unit 6.2** Identification of parameters in data sheets.

Unit 7: Positive and negative feedback

- **Unit 7.1** Definition of the feedback concept. Types; negative and positive
- **Unit 7.2** Main effects of Negative Feedback
- **Unit 7.3** Basic principles of oscillation
- **Unit 7.5** Lab: Basic operation of an operational amplifier. Inverter and non-inverter configuration

Unit 8: Basic linear and non-linear circuits

- **Unit 8.1** Examples and basic applications
- **Unit 8.5** Lab: Stereo preamplifier
- **Unit 8.6** Lab: Rectifier Circuit
- **Unit 8.7** Lab: audio amplifier design

Unit 9: Analog signal conditioning

- **Unit 9.1** Introduction to active filters
- **Unit 9.2** Advantages of active filters and applications
- **Unit 9.3** Associated transfer functions
- **Unit 9.4** Implementation techniques

Unit 10: Generators and waveform converters

- **Unit 10.1** Open loop AOP as a comparator
- **Unit 10.2** Schmitt trigger
- **Unit 10.3** Basic analysis of an oscillator circuit
- **Unit 10.4** Analysis of the behavior of different wave generators circuits

Unit 11: Introduction to photonic devices.

- **Unit 11.1** Introduction and basic concepts
- **Unit 11.2** Summary of main sensing devices
- **Unit 11.3** Summary of main emitting devices
- **Unit 11.4** Applications

7. Activities, Units/Modules and Methodology

Training Activity	Methodology	Related Competences (only degrees before RD 822/2021)	ECTS	Hours	As	Com	Description
Class Attendance (theory) [ON-SITE]	Lectures	E04 G02 G06	0.99	24.75	N	-	Presentation in the classroom of the theoretical contents using the method of the participatory lecture.
Problem solving and/or case studies [ON-SITE]	Problem solving and exercises	E04	0.37	9.25	N	-	Resolution of exercises and problems in the classroom in a participatory manner.
Laboratory practice or sessions [ON-SITE]	Practical or hands-on activities	E04 G02 G06 G12 G13	0.76	19	N	-	Laboratory practices in small groups.

Practicum and practical activities report writing or preparation [OFF-SITE]	Group Work	E04 G02 G06 G12 G13	0.8	20	Y	Y	Completion of the practical reports. Practicals may be made up by means of new scheduled deliveries. Plagiarism is not allowed according to article 9 REE.
Project or Topic Presentations [ON-SITE]	Group Work	E04 G02 G06 G12 G13	0.1	2.5	Y	Y	Resolution of theoretical exercises proposed at the end of each topic or section. The exercises can be recovered by means of new programmed deliveries. Plagiarism is not allowed according to article 9 REE.
Study and Exam Preparation [OFF-SITE]	Self-study	E04 G02 G06 G12 G13	2.8	70	N	-	Personal and autonomous study of the student
Mid-term test [ON-SITE]	Assessment tests	E04 G02 G06 G12 G13	0.14	3.5	Y	Y	Written tests corresponding to the two thematic blocks of the subject consisting of the analysis of proposed circuits. It is assessed with an exam in ordinary exams, recoverable in extraordinary exams with a second exam. Plagiarism is not allowed according to article 9 REE.
Individual tutoring sessions [ON-SITE]	Self-study	E04 G02 G06 G12 G13	0.04	1	N	-	Individual tutorials at the student's request to resolve doubts and monitor learning.
		Total:	**6**	**150**			
		Total credits of in-class work: 2.4					**Total class time hours: 60**
		Total credits of out of class work: 3.6					**Total hours of out of class work: 90**

As: Assessable training activity
Com: Training activity of compulsory overcoming (It will be essential to overcome both continuous and non-continuous assessment).

8. Evaluation criteria and Grading System

Evaluation System	Continuous assessment	Non-continuous evaluation*	Description
Test	50.00%	50.00%	Written tests corresponding to the two thematic blocks of the subject consisting of the analysis of proposed circuits.
Practicum and practical activities reports assessment	30.00%	30.00%	Presentation and delivery of memories of guided laboratory practices
Theoretical papers assessment	5.00%	5.00%	Resolution of suggested exercises at the end of each topic or section
Test	15.00%	15.00%	Design, implementation and defense of an audio amplifier
Total:	**100.00%**	**100.00%**	

According to art. 4 of the UCLM Student Evaluation Regulations, it must be provided to students who cannot regularly attend face-to-face training activities the passing of the subject, having the right (art. 12.2) to be globally graded, in 2 annual calls per subject , an ordinary and an extraordinary one (evaluating 100% of the competences).

Evaluation criteria for the final exam:

Continuous assessment:

Two tests will be established during the semester, the last one coinciding with the examination date set by the Studies Sub-direction. The weightings indicated in the section on 'assessments' will be applied. It is necessary to obtain a mark equal to or higher than 4 points in all the compulsory tests taken in order to be able to average out the rest of the assessment activities. The average of all the assessment activities must be equal or higher than 5 points to consider the subject as passed. The student who passes the laboratory (more than 5 points) will have his grade maintained during the following course, unless he voluntarily decides to repeat it. In case of not passing the subject in the following course, the student will have to do the laboratory practices again.

Non-continuous evaluation:

The student who cannot attend the training activities regularly, with justification, must inform the subject's teacher at the beginning of the semester in order to be able to carry them out at a time and on a date agreed with the teacher.

Specifications for the resit/retake exam:

The student may make up the written tests by means of an exam on the date set by the Studies Sub-direction. The resolution of the proposed problems, both in class and autonomously by the student, as well as the laboratory practices and the design of the audio amplifier will be recoverable with a specific recovery procedure after the closing of the ordinary call. The same weights and requirements will be applied as in the ordinary call.

Specifications for the second resit / retake exam:

If the student has passed the laboratory (guided practices and amplifier design) during the previous course, the rest of the training activities will be evaluated by means of an exam on the date set by the subdirectorate of studies. The weighting will be 45% laboratory and 55% written test. If the student has not passed the laboratory part (guided practices and amplifier design), the specific procedure of recovery will be indicated, being the weighting of 45 % laboratory and 55% written test.

9. Assignments, course calendar and important dates

Not related to the syllabus/contents

Hours	hours
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	2.5
Practicum and practical activities report writing or preparation [AUTÓNOMA][Group Work]	20
Project or Topic Presentations [PRESENCIAL][Group Work]	2.5

Study and Exam Preparation [AUTÓNOMA][Self-study]	70
Mid-term test [PRESENCIAL][Assessment tests]	3.5
Individual tutoring sessions [PRESENCIAL][Self-study]	1

General comments about the planning: The programme will be taught sequentially and its delivery will be adapted to the progress of the course. The planning of the course, as well as the dates for the delivery of each of the assessment activities, will be published on the Virtual Campus at the beginning of the semester.

Unit 1 (de 11): Introduction to semiconductor materials.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	1

Unit 2 (de 11): P-N union. Circuits with diodes.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2.5
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	.5
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	1.5

Unit 3 (de 11): The bipolar transistor.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	5
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	2
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	3

Unit 4 (de 11): The unipolar transistor.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	4
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	2
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	3

Unit 5 (de 11): Theory of the Operational Amplifier.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	4
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	1.5

Unit 6 (de 11): Study of the ideal behavior of the AOP	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1.5

Unit 7 (de 11): Positive and negative feedback	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	1.5
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	1.5

Unit 8 (de 11): Basic linear and non-linear circuits	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	1
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	6

Unit 9 (de 11): Analog signal conditioning	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	1.25
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	.75

Unit 10 (de 11): Generators and waveform converters	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	.5

Unit 11 (de 11): Introduction to photonic devices.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	.5

Global activity	
Activities	**hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	24.75
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	9.25
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	19
Practicum and practical activities report writing or preparation [AUTÓNOMA][Group Work]	20
Project or Topic Presentations [PRESENCIAL][Group Work]	2.5
Study and Exam Preparation [AUTÓNOMA][Self-study]	70
Mid-term test [PRESENCIAL][Assessment tests]	3.5
Individual tutoring sessions [PRESENCIAL][Self-study]	1
Total horas:	150

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
Boylestad, Robert L.	Electrónica : teoría de circuitos y dispositivos electrónico	Pearson Educación Universidad		978-607-442-292-4	2009	

Batalla Viñals, Emilio	Problemas de electrónica analógica	Politécnica de Valencia, Servicio d	84-7721-284-8	1994
Coughlin, Robert F.	Amplificadores operacionales y circuitos integrados lineales	Prentice Hall	970-17-0267-0	1999
Franco, Sergio	Design with operational amplifiers and analog integrated circuits	McGraw-Hill	0-07-232084-2	2004
Hambley, Allan R.	Electrónica	Prentice Hall	978-84-205-2999-8	2008
JUNG, Walter G.	Amplificadores operacionales integrados : circuitos practico	Paraninfo	0-672-22453-4 (ed. i	1991
Martínez Cerver, Juan A.	Amplificadores operacionales : problemas resueltos	Universidad Politécnica de Valencia. Servicio d	84-7721-982-6	2001
Thomas L. Floyd.¿ 9th ed.	Electronic Devices	Prentice Hall	0-13-254985-9	2012
	http://www.casadellibro.com/libro-electronic-devices-conventional-current-version-7th-ed-inclu-ye-cd-rom/9780131278271/1025901			