UNIVERSIDAD DE CASTILLA - LA MANCHA

GUÍA DOCENTE

1. General information

Course: ELECTRONIC DEVICES
Code: 59708
Type: BASIC
ECTS credits: 6
Degree: 422 - UNDERGRADUATE DEGREE IN BIOMEDICAL ENGINEERING
Academic year: 2023-24
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: **JOSÉ VICENTE GARCÍA AUÑÓN** - Group(s): **30**

Building/Office	Department	Phone number	Email	Office hours
	INGENIERÍA ELÉCTRICA, ELECTRÓNICA, AUTOMÁTICA Y COMUNICACIONES		JoseVicente.Garcia@uclm.es	

Lecturer: **ESTEFANIA PRIOR CANO** - 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 biomedical engineering. In this subject, basic semiconductor electronic devices (diodes, transistors, operational amplifiers) present in most electronic consumer systems are presented and analyzed in depth.

4. Degree competences achieved in this course

Course competences

Code Description

INFO-2023

5. Objectives or Learning Outcomes

Course learning outcomes

Description

CT01 - To know and apply Information and Communication Technologies.

CT02 - To use properly oral and written communication.

CT03 - To know ethical commitment and professional deontology.

CN04 - To understand and master the basic concepts of linear systems and their associated functions and transforms, electric circuit theory, electronic circuits, physical principles of semiconductors and logic families, electronic and photonic devices, and materials technology, as well as apply them to solve engineering problems.

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	INFO-2023	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	INFO-2023	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	INFO-2023	0.76	19	N	-	Laboratory practices in small groups.
Practicum and practical activities report writing or preparation [OFF-SITE]	Group Work	INFO-2023	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 8 REE.
Project or Topic Presentations [ON-SITE]	Group Work	INFO-2023	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 8 REE.
Study and Exam Preparation [OFF-SITE]	Self-study	INFO-2023	2.8	70	N	-	Personal and autonomous study of the student
Final test [ON-SITE]	Assessment tests	INFO-2023	0.14	3.5	Y	Y	Written exam corresponding on two tests related 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 similarly. Plagiarism is not allowed according to article 8 REE.
							Individual tutorials at the student's

Individual tutoring sessions [ON-SITE]	Self-study	INFO-2023	0.04	1	N	- 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
Final 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 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 final test will be tested by means of an exam on the date set by the Studies Sub-direction.
The laboratory will be tested the same date in one oral laboratory test and two laboratory reports. Continuous assesment grades already obtained, will be maintained for the non-continuous evaluation in the same ordinary semester.

By default, every student is in continuous assesment. The change to non-continuous evaluation must inform the subject's teacher writting from his/her alu.uclm.es email account at the beginning of the semester. This change cannot be done if 50% of the evaluation system has been carried out.

Plagiarism is not allowed according to article 8 REE.

Specifications for the resit/retake exam:

The student will retake the final tests by means of a similar 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 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.

Plagiarism is not allowed according to article 8 REE.

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
Final 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
Final 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		978-607-442-292-4	2009	
Batalla Viñals, Emilio	Problemas de electrónica analógica	Universidad 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