COURSE PROGRAM

Academic Year: 2024/2025

Identification and characteristics of the course			
Code	501097	ECTS Credits	6
Course name (English)	Electronic technology		
Course name (Spanish)	Tecnología electrónica		
Degree programs	Degrees in Electronics and Automation Engineering and Mechanical Engineering (industrial branch)		
Faculty/School	Industrial Engineering School		
Semester	5 (7)	Type of course	Compulsory
Module	Specific Technology of Industrial Electronics and Automation Optional		
Matter	Electronics Diversification in Industrial Electronics and Automation		

Lecturer/s			
Name	Office	E-mail	Web page
Ausín Sánchez, José Luis	D1.8	jlausin@unex.es	http://campusvirtual.unex.es
Carrillo Calleja, Juan Manuel	D1.6	jmcarcal@unex.es	http://campusvirtual.unex.es
Romero Cadaval, Enrique	D2.6	eromero@unex.es	http://campusvirtual.unex.es
Subject Area	Electronic Technology		
Department	Electrical, Electronic and Automatic Engineering		
Coordinating Lecturer (If more than one)	Ausín Sánchez, José Luis		

Competencies (see tablehttp://bit.ly/competenciasGrados)

Basic Competences	Check With an " X"	General Competences	Check With an " X"	Transversal Competences	Check With an " X"	Specific Competences Basic Formation	Check With an " X"	Specific Competences Common to the Industrial Branch	Check With an " X"	Specific Competences Specific Technology	Check With an " X"	Specific Competences Specific Technology	Marcar con una " X"
CB1		CG1	X	CT1	X	CEFB1		CECRI1		CETE1		CETE11	
CB2		CG2	X	CT2	X	CEFB2		CECRI2		CETE2		CETE12	
CB3		CG3	X	CT3	X	CEFB3		CECRI3		CETE3		CETE13	
CB4		CG4	X	CT4	X	CEFB4		CECRI4		CETE4		CETE14	
CB5		CG5	X	CT5	X	CEFB5		CECRI5		CETE5		CETE15	
		CG6	X	CT6	X	CEFB6		CECRI6		CETE6	X	CETE16	
		CG7	X	CT7	X			CECRI7		CETE7		CETE17	
		CG8	X	CT8	X			CECRI8		CETE8		CETE18	
		CG9	X	CT9	X			CECRI9		CETE9		CETE19	
		CG10	X					CECRI10		CETE10		CETE20	
		CG11	X					CECRI11				CETFG	
		CG12						CECRI12					

Contents
Course outline
Study of functional and constructive characteristics of passive and active electronic components, printed circuits, and introduction to the design of integrated circuits.
Course syllabus
Name of lesson 0: **Course presentation and initial evaluation (1 hour)** Contents of lesson 0: Course presentation and previous knowledge (1 hour)
Name of lesson 1: **Semiconductor diodes (9 hours)** Contents of lesson 1: Theory (4 hours): 1.1. Semiconductor materials 1.2. The pn junction 1.3. The diode: operation and equivalent circuits 1.4. Diode Applications 1.5. Special purpose diodes Problems (1 hour) Description of the practical activities of lesson 1: Electronic circuit simulation (2 hours): O1. Simulation of active components Laboratory practices (2 hours): L1. Diode applications
Name of lesson 2: **Bipolar Junction Transistor (9 hours)** Contents of lesson 2: Theory (5 hours): 2.1. Device structure and physical operation 2.2. Current-voltage characteristics 2.3. DC operation and polarization 2.4. Small signal equivalent model 2.5. Internal capacities and high-frequency model Problems (2 hours) Description of the practical activities of lesson 2: Laboratory practices (2 hours): L2. BJT amplifier stage
Name of lesson 3: **MOS Field-Effect Transistor (10.5 hours)** Contents of lesson 3: Theory (5 hours): 3.1. Field-Effect Transistors (FETs) 3.2. MOSFET structure and physical operation 3.3. Current-voltage characteristics 3.4. DC operation and MOSFET polarization 3.5. Small Signal Equivalent Model 3.6. Internal capacitances and high-frequency model Problems (2 hours) Description of the practical activities of lesson 3: Laboratory practices (3,5 hours): L3. Characteristic parameters of MOS transistor L4. MOSFET Amplifier Stage
Name of lesson 4: **Power Semiconductor Devices (3 hours)** Contents of lesson 4:

Theory (2 hours):
4.1. Power diodes
4.2. Power transistors: BJT, MOSFET, IGBT
4.3. Thyristors: diacs, triacs, IGCT, SCR, GTO
Problems (1 hour)

Name of lesson 5: **Passive Devices (3 hours)**
Contents of lesson 5:
Theory (3 hours):
5.1. Conductive materials. Resistances: construction technologies.
5.2. Dielectric materials. Capacitors: construction technologies.
5.3. Magnetic materials. Inductors: construction technologies.

Name of lesson 6: **Printed Circuit Board Technology (10.5 hours)**
Contents of lesson 6:
Seminar (2 hours):
6.1. Introduction to printed circuit board
6.2. Introduction to surface mount technology
6.3. Basics of printed circuit board manufacturing
6.4. Assembly technology on printed circuit boards
6.5. EMI: design tips
Description of the practical activities of lesson 6:
Electronic circuit simulation (2 hours):
O2. Eagle tutorial
Laboratory practices (6.5 hours):
L5. PCB manufacturing
L6. Tutored project based on the design of a printed circuit board

Name of lesson 7: **Integrated Circuit Technologies (3 hours)**
Contents of lesson 7:
Theory (1 hour):
7.1. Integrated circuits
7.2. CMOS fabrication steps
Description of the practical activities of lesson 7:
Seminar (2 hours):
S2. Integrated devices: passive, diodes, and MOSFET transistors. Layout methodology

Educational activities

Student workload in hours by lesson		Lectures	Practical activities				Monitoring activity	Homework
Lesson	**Total**	**L**	**HI**	**L**	**C**	**S**	**SGT**	**PS**
0	1.5	1						0.5
1	21.5	5		2	2		0.5	12
2	25.5	7		2			0.5	16
3	28	7		3.5			0.5	17
4	13.5	3					0.5	10
5	8	3						5
6	26.5	0		6	2	2	0.5	16
7	10.5	1				2	0.5	7
Assessment	15	3		1				11
Ass. Act. 1	2			1				1
Final Assessm.	13	3						10
TOTAL	150	30	0	14.5	4	4	3	94.5

L: Lectures (85 students)
HI: Hospital internships (7 students)

L: Laboratory or field practices (15 students)
C: Computer room or language laboratory practices (20 students)
S: Problem classes or seminars or case studies (40 students)
SGT: Scheduled group tutorials (educational monitoring, ECTS type tutorials)
PS: Personal study, individual or group work and reading of bibliography

Teaching Methodologies

Among the teaching methodologies included in the formative program, in this course the following are used:

Teaching methodology	Used methodologies labelled as "X"
1. Explanation and discussion of theoretical contents.	X
2. Resolution, analysis and discussion of support examples or previously proposed exercises.	X
3. Exposition of related topics by students.	X
4. Development of case studies or demonstrations at laboratory, computer room, etc.	X
5. Resolution of specific doubts in small groups in order to identify potential problems in the teaching-learning process, and academic guidance for essays, case studies, practical works, demonstrations, etc.	X
6. Search for information prior to the development of the topics, or for complementary information once they are in progress.	X
7. Preparation of essays, either individually or in groups.	X
8. Study of each topic, which may consist of: content study, analysis of practical exercises or case studies, preparation for examinations, etc.	X

Lessons and theoretical discussions, problems resolution and theoretical/practical cases will be carried out in the **lectures**.

Seminars will be held in the location assigned to this type of activity and the expected schedule will be included in the semester's agenda.

Assembly and test of electronic circuits, also supported by CAD activities, will be carried out in **labs and computer room activities**. Practical lessons have associated personal work of the student, both previous to the face-to-face sessions (prelab), so that students become familiar with the contents.

The **advised project** consists of a face-to-face part in the lab and a personal part, in which the student will carry out a previous preparation, with the help of the appropriate bibliography, and will finish the project by writing a report with the most significant results obtained during the realization of the activity.

Learning outcomes

- Knowing the different devices and electronic components of general use in the industrial environment.
- Knowing the processes involved in the manufacture of integrated circuits individually, as well as their integration to obtain a certain active device.
- Becoming familiar with the use of CAD tools for circuit simulation, geometric edition of masks and design of printed circuit boards.
- Managing laboratory equipment for test and verification of circuits and manufacturing of printed circuit boards.

Assessment systems

Assessment criteria:
The course will be assessed according to the following criteria:
CE1. Domain of theoretical contents.
Related to competences CB5, CG3, CT1, CETE6.

CE2. Knowledge of practical procedures.
Related to competences CB5, CG4, CT2, CETE6.
CE3. Ability to apply the knowledge acquired in the resolution of practical cases.
Related to competences CB5, CT4, CETE6.
CE4. Domain of CAD and lab tools related to the subject.
Related to competences CT5, CETE6.
CE5. Ability to communicate and transmit knowledge in an appropriate technical language, oral and written, within the field of the electronic technology.
Related to competences CT3, CT7, CETE6.
CE6. Acquisition of skills related to realization of a project based on a real case.
Related to competences CG1, CG2, CG4-CG11, CT6, CT8-CT9, CETE6.

Assessment activities:
Among the assessment activities included in the formative program, in this course the following are used:

	Range fixed	**Ordinary call**	**Extraordinary call**	**Global assessment**
1. Final exam and/or partial examinations.	0%–80%	60%	60%	80%
2. Practical activities in: classroom, lab, computers room, visits, etc	0%–50%	10%	10%	10%
3. Solution and submission of activities (cases, exercises, assignments, projects, etc.), individually and/or in groups	0%–50%	15% + 15%	15% + 15%	10%
4. Active participation in the learning activities.	0%–10%	0%	0%	
5. Attendance to the learning activities.	0%–10%	0%	0%	

Description of the assessment activities:
The criteria indicated previously will be assessed by means of the following activities:

AE1. WRITTEN TEST (related to activity 1. in the table)

It will be held in the examinations period and the contents of seminars can also be evaluated. To pass the course, it will be necessary to obtain a grade of at least 4, being 60% its contribution to the final grade. This activity is RECOVERABLE in the extraordinary call, with the same weight of 60% of the final grade. In case the course is not passed in the ordinary call, the grade of this evaluation activity will only be maintained for the extraordinary call if it is equal to or greater than 5.

AE2. LABS AND COMPUTER ROOM LESSONS (related to activity 2. in the table)

Attendance at labs and computer room lessons is compulsory. Students who take advantage of practical sessions will have a passing grade. At the end of all the practical sessions an evaluation test will be carried out, which will be able to report up to 10% of the final grade, to determine the ability of students in the design of electronic circuits and their skill with basic electronic laboratory instrumentation (Act.Ev.1).

The unexcused absence in more than one lab and computer room lesson will entail the obligation of the student to face a practical exam, which must be passed in order to pass the course, without reporting any contribution to the final grade. This activity is considered NON-RECOVERABLE, that is, it cannot be carried out in the extraordinary call, even though the corresponding grade

obtained in the ordinary call will be added in the extraordinary call. In this call, the student must pass a practical exam, although, as in the ordinary call, it will not have any contribution to the final grade.

AE3. FOLLOW-UP TASKS (related to activity 3. in the table)

The student will have to carry out different tasks throughout the course, being the contribution of this activity 15% of the final grade. These activities are classified as NON-RECOVERABLE. However, if the student has submitted them during the ordinary call, the grade obtained will be added, if applicable, to the final grade in the extraordinary call, with the same weight of 15% of the final grade.

AE4. DEVELOPMENT OF AN ADVISED PROJECT (related to activity 4. in the table)

The student will have to submit a memory where the project carried out is described. This report must deal with the development of an electronic technology project. Attendance at face-to-face project sessions is mandatory. It is compulsory to include the design of a printed circuit board (PCB) in the project to pass this part of the course, as all the contents related to PCBs are exclusively assessed through this activity. The project will have a weight of 15% in the student's final grade, being a RECOVERABLE assessment activity.

If the mark obtained in the exam (AE1) is lower than the minimum required to pass the course, the final grade will be 4.9 if it is equal to or greater than 5 and the final grade itself on the contrary.

The global assessment will take place the same day assigned to the final exam of each call. It will consist of the following parts:
- Written part: written test with theoretical/practical questions and/or problems, with a weight of 80% in the final grade.
- Practical part: assembly and explanation by the student of a lab, which computes with 10% in the final grade.
- Design part: test in which the student must demonstrate the handling of simulation and PCB edition tools used in the course, whose contribution to the final grade is 10%.

Bibliography (basic and complementary)

Basic Bibliography:

B1. Microelectronic circuits (6th ed.), A.S. Sedra, K.C. Smith, Oxford Univ. Press, 2011.

B2. Electronic devices (8th ed.), T.L. Floyd, Prentice Hall, 2008.

Complementary Bibliography:

C1. Eelectronic devices and circuit theory (8th ed.), R.L. Boylestad, L. Nashelsky, Prentice Hall, 2002.

Electronic version available in the Electronic Library of UEx.

C2. Electronic principles (7th ed.), A. Malvino y D.J. Bates, McGraw-Hill, 2007.

C3. Electronics (2nd ed.), A.R. Hambley, Prentice Hall, 2001.

Electronic version available in the Electronic Library of UEx.

C4. Electronic circuits: analysis, simulation, and design, N.R. Malik, Prentice Hall,

	1996.
C5.	Electronic technology: materials and fabrication techniques, A. Bandera, J.A. Rodríguez, F.J. Sánchez, University of Málaga, 2002.

Other resources and complementary educational materials	
W1.	Virtual Campus of the University of Extremadura: http://campusvirtual.unex.es.
W2.	Eagle docs and tutorials: https://www.autodesk.com/products/eagle/overview.
W3.	OrCAD resources and tutorials: http://www.orcad.com/
W4.	Electronic Engineers Community: http://www.element14.com.