COURSE PROGRAM

Academic Year: 2025/2026

Identification and characteristics of the subject				
Code	501091		ECTS credits	6
Course name (English)	Electronic instrumentation			
Course name (Spanish)	Instrumentación electrónica			
Degree programs	Bachelor Deg. in Electronic and Automation Engineering (Industrial Branch) Bachelor Deg. in Mechanical Engineering (Industrial Branch)			
Faculty/School	School of Industrial Engineering			
Semester	4 8	Character	Mandatory Optional	
Module	Specific technology for industrial electronics and automation Optional			
Matter	Electronics Diversification in Industrial Electronics and Automation			

Lecturer/s			
Name	Office	E-mail	Website
Juan Manuel Carrillo Calleja	D1.6	jmcarcal@unex.es	https://shorturl.at/MjH4c

Subject Area	Electronic Technology
Department	Electrical, Electronic and Automation Engineering
Coordinating Lecturer (if more than one)	

Competencies (see table at http://bit.ly/competenciasGrados)

Competences Basics	Bookmark with an "X"	General Competencies	Bookmark with an "X"	Transversal Competences	Bookmark with an "X"	Specific Competences FB	Bookmark with an "X"	Specific Competences LRC	Bookmark with an "X"	Specific Competences TE	Bookmark with an "X"	Specific Competences TE and CETFG	Bookmark with an "X"
CB1		GC1	X	CT1	X	CEFB1		CECRI1		CETE1		CETE11	
CB2		GC2	X	CT2	X	CEFB2		CECRI2		CETE2		CETE12	
CB3		GC3	X	CT3	X	CEFB3		CECRI3		CETE3		CETE13	
CB4		GC4	X	CT4	X	CEFB4		CECRI4		CETE4		CETE14	
CB5		GC5	X	CT5	X	CEFB5		CECRI5		CETE5	X	CETE15	
		GC6	X	CT6	X	CEFB6		CECRI6		CETE6		CETE16	
		GC7	X	CT7	X			CECRI7		CETE7		CETE17	
		GC8	X	CT8	X			CECRI8		CETE8		CETE18	
		GC9	X	CT9	X			CECRI9		CETE9		CETE19	
		GC10	X					CECRI10		CETE10		CETE20	
		GC11	X					CECRI11				CETFG	
								CECRI12					

Contents
Course outline
Instrumentation systems, transducers, converters and measuring instruments, instrument interconnections, virtual instrumentation.
Course syllabus
Title of Chapter 1: **Instrumentation systems (7 hours)** Contents of Chapter 1: Theory and problems (5 hours, 4+1): 1.1. Definitions 1.2. Static characterisation of instruments 1.3. Dynamic characterisation of instruments 1.4. Uncertainty and noise in instrumental systems Labs (2 hours): L1. Simulated characterisation of an RC network
Title of Chapter 2: **Measuring instruments (9 hours)** Contents of Chapter 2: Theory and problems (3 hours, 2+ 1): 2.1. Digital meters 2.2. Analogue meters 2.3. Oscilloscopes 2.4. Signal generators Labs (6 hours): L2. Basic measurements with multimeter and digital oscilloscope L3. Digital Oscilloscope I: characterisation of an RC circuit L4. Digital oscilloscope II: passive RC filter
Title of Chapter 3: **Virtual instrumentation (6 hours)** Contents of Chapter 3: Theory and problems (2 hours, 1+1): 3.1. LabVIEW environment 3.2. Basic programming elements 3.3. Acquisition and representation of data Labs (4 hours): L5. Programming with LabVIEW L6. Data acquisition with LabVIEW
Title of Chapter 4: **Amplifiers (8 hours)** Contents of Chapter 4: Theory and problems (6 hours, 5+ 1): 4.1. Introduction 4.2. The ideal operational amplifier 4.3. Non-idealities 4.4. Differential amplifier 4.5. Instrumentation amplifier Labs (2 hours): L7. Instrumentation amplifier
Title of Chapter 5: **Active filters and A/D converters (3 hours)** Contents of Chapter 5: Theory and problems (3 hours, 2+1): 5.1. Active filters 5.2. A/D converters

Title of Chapter 6: **Sensors (12 hours)**
Contents of Chapter 6:
Theory and problems (6 hours, 5+1):
- 6.1. Basic resistance measurements
- 6.2. Wheatstone bridge
- 6.3. Resistive sensors
- 6.4. AC measurements
- 6.5. Capacitive and inductive sensors
- 6.6. Signal generating sensors

Labs (6 hours):
- L8. Pt100 sensor calibration
- L9. Thermometer based on Pt100 sensor
- L10. Strain Gauge Based Weighing System

Title of Chapter 7: **Instrument interconnections (4 hours)**
Contents of Chapter 7:
Theory (2 hours):
- 7.1. Computerised instrumentation
- 7.2. Interconnection of instruments
- 7.3. Communication buses
- 7.4. Digital instrument programming
- 7.5. SCPI commands

Labs (2 hours):
- L11. Instrument programming for experimental characterisation of a diode.

Educational activities

Student workload in hours by lesson		Lectures	Practical activities				Monitoring activity	Homework
Lesson	**Total**	**L**	**HI**	**LAB**	**COM**	**SEM**	**SGT**	**PS**
1	18.5	5		2			0.5	11
2	18.5	3		6			0.5	9
3	14.5	2		4			0.5	8
4	20.5	6		2			0.5	12
5	9	3						6
6	24.5	6		6			0.5	12
7	10.5	2		2			0.5	6
Assessment	34	3		0.5				30.5
Written test	27.5	3						24.5
Practical test	6.5			0.5				6
TOTAL	150	30		22.5			3	94.5

L: Lectures (85 students)
HI: Hospital internships (7 students)
LAB: Laboratory or field practices (15 students)
COM: Computer room or language laboratory practices (20 students)
SEM: 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 syllabus of the degree, the following are used in this subject:

Teaching methodologies	Those used are indicated with an "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

Learning outcomes

Operate the basic equipment of an electronics laboratory.

To learn the principles of operation and constitution of the main electronic measuring equipment and systems.

Knowledge of the design and development of instrumentation systems.

Assessment systems

Assessment criteria (AC):

The subject will be assessed according to the following criteria:

AC1. Mastery of the theoretical contents of the subject.
Related to competences CG3, CT1, CETE5.

AC2. Knowledge of the practical procedures related to the subject.
Related to competences CG4, CT2, CETE5.

AC3. Ability to apply the knowledge acquired in the resolution of practical issues. practical issues.
Related to competences CT4, CETE5.

AC4. Command of computer and laboratory tools related to the subject.
Related to competences CT5, CETE5.

AC5. Ability to communicate and transmit knowledge in an appropriate technical language, oral and written, in the field of electronic technology. and written language in the field of electronic technology.
Related to competences CT3, CETE5.

AC6. Acquisition of skills related to the realisation of projects on real cases.
Related to competences CG1, CG2, CG4-CG11, CT6-CT8, CETE5.

Assessment activities (AA):

Among the assessment activities included in the syllabus of the degree, the following are used in this subject:

	Range fixed	Ordinary call	Extraordinary call	Global assessment
1. Final exam and/or partial examinations.	0%-80%	70%	70%	80%
2. Practical activities in: classroom, lab, computers room, visits, etc	0%-50%	20%	20%	15% + 5%
3. Solution and submission of activities (cases, exercises, assignments, projects, etc.), individually and/or in groups	0%-50%	10%	10%	0%
4. Active participation in the learning activities.	0%-10%	0%	0%	0%
5. Attendance to the learning activities.	0%-10%	0%	0%	0%

Description of the assessment activities:

The course will be assessed by the following activities:

AA1. WRITTEN TEST (activity 1 of the table)

It will take place during the final exam period and will assess theoretical and practical contents. In order to pass the course, it will be necessary to obtain a grade of at least 4.5 in this evaluation activity, and its contribution to the final grade will be 70%. This activity is RECOVERABLE in the extraordinary exam, with the same weighting of 70% of the final grade. If the subject is not passed in the ordinary exam, the grade of this evaluation activity will only be saved for the extraordinary exam if it is equal or higher than 5.

AA2. LABORATORY PRACTICES (activity 2 of the table)

Attendance at the practical laboratory sessions is compulsory in order to pass the course. Students who attend the practical sessions will obtain a pass grade. In addition, during the semester there will be 2 evaluation tests of the practical part, during the practical sessions and consisting of demonstrating the acquisition of the main contents worked on in the practical part, and another test based on the delivery of a report with the results of one of the practices to choose from and its corresponding public exhibition. The evaluation of these activities will account for 20% of the final grade, 10% for the tests and 10% for the report and its exhibition.

Unexcused absence from more than one practical session will oblige the student to take a final practical test, which must be passed in order to pass the course, but will not count towards the final mark.

This activity is considered as NOT RECOVERABLE, that is, it cannot be done in the extraordinary exam, although the grade obtained in the ordinary exam will also be added in the extraordinary exam. If the practicals are not carried out during the course, in the extraordinary exam the student must pass an exam on the practicals, although, as in the ordinary exam, this exam will not contribute any grade to the final mark.

AA3. FOLLOW-UP QUESTIONNAIRES (activity 3 of the table)

A questionnaire related to each subject of the course will be proposed to be elaborated by the students in the non-classroom time. The contribution of this

activity to the final grade is 10% and is classified as NOT RECOVERABLE. However, if the student has completed the questionnaires during the ordinary call, the grade obtained will be added to the final grade in the extraordinary call, with the same weighting of 10% of the final grade.

In the event that the minimum mark required to pass the course, i.e. a 4.5, is not achieved in the exam, the grade that will appear in the minutes will be 4.9 if the final grade is equal to or higher than 4.9 and the same grade otherwise.

In order to pass the practical part, it will be sufficient to attend all the practical sessions or to pass a final practical test. In order to obtain the grade indicated in this assessment activity, the student must prepare the reports and make the presentation indicated. In addition, the authorship of the deliverables must be accredited.

The global assessment will take place on the same day assigned to the final exam of each session by the Subdirección de Ordenación Académica de la E.II.II. It is a single test consisting of the following parts:

- Written part: written test with theoretical/practical questions and/or problems, with a weight of 80% in the final grade.
- Laboratory part: assembly and explanation by the student of a laboratory practical, which counts for 15% of the final grade.
- CAD design part: the student must demonstrate the use of the simulation tool used in the course, with a contribution to the final mark of 5%.

Bibliography (basic and complementary)

Basic Bibliography:

B1. *Instrumentación electrónica*, Miguel Á. Pérez García, Paraninfo, 2014.

B2. *Measurement and instrumentation, theory and application*. Alan S. Morris and Reza Langari, Academic Press - Elsevier, 2021.

Compplementary Bibliography:

C1. *Instrumentación electrónica: 230 problemas resueltos*. Miguel Á. Pérez García, Garceta, 2012.

C2. *Sensores y acondicionadores de señal*. Ramón Pallás Areny, Marcombo, 2007.

C3. *Instrumentación industrial*. Antonio Creus Solé, Marcombo, 2011.

Other resources and complementary educational materials

O1. Virtual Campus of the University of Extremadura: http://campusvirtual.unex.es

O2. OrCAD resources and tutorials: http://www.orcad.com/

O3. Community of electronic engineers: http://www.element14.com

O4. LabView: https://www.ni.com/es-es/shop/labview.html

O5. Introducing SCPI Commands - Rohde & Schwarz: https://www.rohde-schwarz.com/es/driver-pages/control-remoto/2-remote-programming-environments_231250.html