UNIVERSIDAD DE CASTILLA - LA MANCHA

GUÍA DOCENTE

1. General information

Course:	INSTRUMENTATION AND TRANSDUCERS ELECTRONIC	**Code:**	310910
Type:	CORE COURSE	**ECTS credits:**	4.5
Degree:	2349 - MASTER DEGREE PROGRAMME IN TELECOMMUNICATION ENGINEERING	**Academic year:**	2019-20
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: **RAUL ALCARAZ MARTINEZ** - Group(s): **30**

Building/Office	Department	Phone number	Email	Office hours
E. Politécnica Cuenca (0.03)	INGENIERÍA ELÉCTRICA, ELECTRÓNICA, AUTOMÁTICA Y COMUNICACIONES	926054053	raul.alcaraz@uclm.es	It will be established at the beginning of the course

Lecturer: **CESAR SANCHEZ MELENDEZ** - Group(s): **30**

Building/Office	Department	Phone number	Email	Office hours
0.05	INGENIERÍA ELÉCTRICA, ELECTRÓNICA, AUTOMÁTICA Y COMUNICACIONES	926053743	cesar.sanchez@uclm.es	Se comunicará a través del campus virtual y el tablón de anuncios

2. Pre-Requisites

No prerequisites, except those imposed by the general curriculum. However, it is recommended to have basic knowledge of theory and analysis of electronic components and circuits, as well as instrumentation systems and the use of sensors.

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

The electronic instrumentation of measurement and control is present in the most diverse areas of our world. This area of study is increasingly important in research laboratories, industry, hospitals, the automotive sector, IOT, and UVAs, among others. This course provides the necessary knowledge to understand the technology, operation and conditioning of electronic systems of measurement and control with emphasis on integrated systems, as well as the necessary competencies for the development of different types of systems and applications.

Consequently, this course is related to most subjects of the degree, since electronic measurement systems are an important basis for the development of different areas of work in telecommunications engineering.

4. Degree competences achieved in this course

Course competences

Code	Description
E14	The ability to apply advanced knowledge of photonics and optoelectronics, as well as high-frequency electronics.
E15	The ability to develop electronic instruments such as transducers, actuators and sensors.
G01	The ability to conceptualise, calculate and design products, processes and facilities in all fields of Telecommunications Engineering.
G04	The ability to perform mathematical modelling, calculations and simulations in technology centres and engineering companies, particularly in tasks involving research, development and innovation in all areas related to Telecommunications Engineering and related multidisciplinary fields.
G07	The ability to launch, lead and manage the manufacturing processes of electronic and telecommunications equipment, guaranteeing the safety of people and assets, the final quality of products, and their standardisation.
G08	The ability to apply acquired knowledge and solve problems in new or unknown settings within wide and multidisciplinary environments while being capable of integrating knowledge.
G11	The ability to know how to communicate their conclusions and the latest supporting knowledge or data to both specialised and non-specialised audiences clearly and free from ambiguity.
G12	The ability to have the learning skills which allow them to continue studying in a largely self-directed or autonomous way.
G14	The ability to have knowledge and understanding which provides a basis or opportunity to be original in the development and/or application of ideas, often within a research context.
G15	The ability to integrate knowledge and face the complexities of making assessments based on information which, whether incomplete or limited, includes reflections on the social and ethical responsibilities in the application of their knowledge and judgements.

5. Objectives or Learning Outcomes

Course learning outcomes

Description

Knowledge and respect of professional ethics and deontology.

Development of virtual instrumentation systems: environments, architectures and associated standards.

Determination of the design requirements of a circuit starting from the specifications at the system level.

Design of analog circuits applying low noise and precision techniques.
Design and development of advanced electronic instrumentation systems.
Correct use of oral and written expression to convey ideas, technologies, results, etc.
Understanding of technical documentation in English and mastery of specific vocabulary in this language.
Application of advanced techniques of analog design oriented to the development of instrumentation blocks.
Analysis and synthesis of technical documentation.
Knowledge of the fundamentals, characteristics and applications of sensors and actuators in advanced electronic instrumentation.

6. Units / Contents

Unit 1: Design and development of electronic instrumentation systems

- **Unit 1.1** Measurements, metrology and patterns
- **Unit 1.2** Calibration, traceability, accreditation and homologation
- **Unit 1.3** Architectures and technologies
- **Unit 1.4** Analogue design oriented to the development of instrumentation blocks
- **Unit 1.5** Noise and interference reduction techniques
- **Unit 1.6** Real-time acquisition systems
- **Unit 1.7** Smart instrumentation
- **Unit 1.8** High-level software
- **Unit 1.9** LAB 1. Virtual instrumentation

Unit 2: Sensors, transducers and actuators

- **Unit 2.1** Characterization and classification
- **Unit 2.2** Design of advanced conditioning systems for sensors
- **Unit 2.3** Microsensors, micro-actuators. Smart sensors
- **Unit 2.4** LAB 2. Sensors conditioning

Unit 3: Protocols and communication interfaces

- **Unit 3.1** Compact and distributed systems
- **Unit 3.2** Instrumentation and field buses
- **Unit 3.3** LAB 3. Protocols and communications interfaces

7. Activities, Units/Modules and Methodology

Training Activity	Methodology	Related Competences (only degrees before RD 822/2021)	ECTS	Hours	As	Com	R	Description
Class Attendance (theory) [ON-SITE]	Lectures	E14 E15 G01 G04 G07 G08 G12 G14	0.51	12.75	N	-	-	
Problem solving and/or case studies [ON-SITE]	Problem solving and exercises	E14 E15 G01 G04 G07 G08 G11 G12 G14	0.15	3.75	N	-	-	
Laboratory practice or sessions [ON-SITE]	Practical or hands-on activities	E14 E15 G01 G04 G07 G08 G11 G12 G14 G15	0.54	13.5	N	-	-	
Writing of reports or projects [OFF-SITE]	Guided or supervised work	E14 E15 G01 G04 G07 G08 G11 G12 G14 G15	0.9	22.5	N	-	-	Reports on hands-on activities or practical projects
Project or Topic Presentations [ON-SITE]		E14 E15 G01 G04 G07 G08 G11 G12 G14 G15	0.06	1.5	Y	Y	Y	Oral examination of laboratory activities and projects
Individual tutoring sessions [ON-SITE]	Collaborative on line international learning (COIL)	E14 E15 G01 G04 G07 G08 G11 G12 G14 G15	0.03	0.75	N	-	-	
Other on-site activities [ON-SITE]	Assessment tests	E14 E15 G01 G04 G07 G08 G11 G12 G14 G15	0.06	1.5	Y	Y	Y	Written examinations and/or solving of problems and cases
Study and Exam Preparation [OFF-SITE]		E14 E15 G01 G04 G07 G08 G11 G12 G14 G15	2.25	56.25	N	-	-	
		Total:	**4.5**	**112.5**				
		Total credits of in-class work: 1.35						**Total class time hours: 33.75**
		Total credits of out of class work: 3.15						**Total hours of out of class work: 78.75**

As: Assessable training activity
Com: Training activity of compulsory overcoming
R: Rescheduling training activity

8. Evaluation criteria and Grading System

	Grading System		
Evaluation System	**Face-to-Face**	**Self-Study Student**	**Description**
Test	40.00%	0.00%	Written tests and/or resolution of problems or cases
Laboratory sessions	60.00%	0.00%	Presentation of laboratory activities, practical cases, works or projects.
Total:	**100.00%**	**0.00%**	

Evaluation criteria for the final exam:

To pass the course, students must achieve more than 4 points (on a scale of 10) on all mandatory examinations, as well as a final averaged grade equal or higher than 5 points.

In the case of failing the course, the average mark on the laboratory activities (if it is equal or higher than 4 points) will only be maintained for the next offering, unless the student voluntarily decides to retake this set of activities.

Specifications for the resit/retake exam:
The student will be able to recover the compulsory examinations through an exam on the date established by the Center.

Specifications for the second resit / retake exam:
The student will be able to recover the compulsory examinations through an exam on the date established by the Center.

9. Assignments, course calendar and important dates

Not related to the syllabus/contents	
Hours	**hours**
Writing of reports or projects [AUTÓNOMA][Guided or supervised work]	22.5
Project or Topic Presentations [PRESENCIAL][]	1.5
Individual tutoring sessions [PRESENCIAL][Collaborative on line international learning (COIL)]	.75
Other on-site activities [PRESENCIAL][Assessment tests]	1.5
Study and Exam Preparation [AUTÓNOMA][]	56.25

Unit 1 (de 3): Design and development of electronic instrumentation systems	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	5.75
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1.25
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	6

Unit 2 (de 3): Sensors, transducers and actuators	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	4
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1.5
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	4

Unit 3 (de 3): Protocols and communication interfaces	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	3
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	3.5

Global activity	
Activities	**hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	12.75
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	3.75
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	13.5
Writing of reports or projects [AUTÓNOMA][Guided or supervised work]	22.5
Project or Topic Presentations [PRESENCIAL][]	1.5
Individual tutoring sessions [PRESENCIAL][Collaborative on line international learning (COIL)]	0.75
Other on-site activities [PRESENCIAL][Assessment tests]	1.5
Study and Exam Preparation [AUTÓNOMA][]	56.25
Total horas:	112.5

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
Gerard Meijer	Smart Sensor Systems http://eu.wiley.com/WileyCDA/WileyTitle/productCd-0470866918.html	Wiley		978-0-470-86691-7	2015	
National Instruments	National Instruments Instrument Control Fundamentals Series http://www.ni.com/white-paper/4359/en/	National Instruments Technical Notes			2013	FREE resource for instrument control knowledge
Pallás Areny, Ramón	Sensores y acondicionadores de señal	Marcombo Boixareu		84-267-1344-0	2003	
Pérez García, Miguel Ángel (1964-)	Instrumentación electrónica /	Paraninfo,		978-84-283-3702-1	2014	
Pérez García, Miguel Ángel (1964-)	Instrumentación electrónica : 230 problemas resueltos /	Garceta,		978-84-15452-00-3	2012	
Reverter, Ferran	Circuitos de interfaz directa sensor-microcontrolador /	Marcombo,		978-84-267-1502-9	2008	