UNIVERSIDAD DE CASTILLA - LA MANCHA

GUÍA DOCENTE

1. General information

Course:	SIGNAL PROCESSING	**Code:**	56517
Type:	ELECTIVE	**ECTS credits:**	6
Degree:	359 - UNDERGRAD. IN INDUSTRIAL ELECTRONICS AND AUTOMAT. ENGINEERING (CR)	**Academic year:**	2021-22
Center:	602 - E.T.S. INDUSTRIAL ENGINEERING OF C. REAL	**Group(s):**	20 21
Year:	4	**Duration:**	First semester
Main language:	Spanish	**Second language:**	English
Use of additional languages:		**English Friendly:**	Y
Web site:		**Bilingual:**	N

Lecturer: **FRANCISCO RAMOS DE LA FLOR** - Group(s): **20**

Building/Office	Department	Phone number	Email	Office hours
Edificio Politécnico, 2-C02	INGENIERÍA ELÉCTRICA, ELECTRÓNICA, AUTOMÁTICA Y COMUNICACIONES	Vía Teams	francisco.ramos@uclm.es	

Lecturer: **PEDRO LUIS RONCERO SANCHEZ-ELIPE** - Group(s): **20**

Building/Office	Department	Phone number	Email	Office hours
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2. Pre-Requisites

Mathematical background: algebra, calculus, statistics, differential equations and complex variable.

Signals and systems background: It is recommended to have previously studied Automatic Control and Discrete Control subjects in order to have some knowledge on continuous and discrete signals and systems, Laplace, Fourier and Z transforms, frequency domain and system stability.

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

Main objective of the degree is training competitive industrial engineers with the ability to design and develop: industrial products, machines, mechanisms, vehicles, structures and thermomechanical and hydraulic facilities (among others); and with the ability to collaborate with professionals of affine technologies within multidisciplinary teams, providing the engineer with the aptitude to take technological decisions according to cost, quality, safety, efficiency and environment criteria.

Industrial Engineers are professionals that use the knowledge from science, mathematics and engineering techniques to perform their professional activity within fields such as control, instrumentation and process and machine automation, as well as the design, construction, management and maintenance of industrial products.

Within the aforementioned knowledge, signal processing provides the student with abilities in instrumentation and conditioning of noisy signals, frequently found in telecommunication, control and process automation systems. Hence, it is a multidisciplinary application tool of a great practical interest for these professionals.

4. Degree competences achieved in this course

Course competences

Code	Description
A02	To know how to apply knowledge to work or vocation in a professional manner and possess the competences that are usually demonstrated by the formulation and defence of arguments and the resolution of problems in the field of study.
A04	To be able to transmit information, ideas, problems and solutions to a specialized audience.
A05	To have developed the learning skills necessary to undertake subsequent studies with a greater degree of autonomy.
A07	Knowledge of Information Technology and Communication (ITC).
A08	Appropriate level of oral and written communication.
A12	Knowledge of basic materials and technologies that assist the learning of new methods and theories and enable versatility to adapt to new situations.
A13	Ability to take the initiative to solve problems, take decisions, creativity, critical reasoning and ability to communicate and transmit knowledge, skills and abilities in Industrial Electronic Engineering and Automation.
CB01	Prove that they have acquired and understood knowledge in a subject area that derives from general secondary education and is appropriate to a level based on advanced course books, and includes updated and cutting-edge aspects of their field of knowledge.
CB02	Apply their knowledge to their job or vocation in a professional manner and show that they have the competences to construct and justify arguments and solve problems within their subject area.
CB03	Be able to gather and process relevant information (usually within their subject area) to give opinions, including reflections on relevant social, scientific or ethical issues.
E11	Knowledge of electronic communications and modes of transmission. Knowledge of telematics.

5. Objectives or Learning Outcomes

Course learning outcomes

Description

Ability to design, configure and calibrate systems of control, measurement and acquisition of data using the environment of computer based graphics

Additional outcomes

6. Units / Contents

Unit 1: Signals and Systems

Unit 2: Fourier Analysis

Unit 3: Sampling

Unit 4: Z-Transform

Unit 5: Discrete Fourier Transform

Unit 6: Fast Fourier Transform

Unit 7: FIR filter design

Unit 8: IIR filter design

Unit 9: Advanced filters

Unit 10: Digital Signal Processors

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	A12 E11	1.12	28	N	-	
Problem solving and/or case studies [ON-SITE]	Project/Problem Based Learning (PBL)	A13	0.64	16	N	-	
Computer room practice [ON-SITE]	Practical or hands-on activities	A07 A12 A13 CB01	0.56	14	Y	Y	
Practicum and practical activities report writing or preparation [OFF-SITE]	Practical or hands-on activities	A04 A05 A08 A13 CB03	1.8	45	Y	Y	
Study and Exam Preparation [OFF-SITE]	Self-study	A05 A07 A12 A13 CB01 CB02 CB05	1.8	45	N	-	
Final test [ON-SITE]	Assessment tests	A02 A12 A13	0.08	2	Y	Y	
		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
Practicum and practical activities reports assessment	50.00%	0.00%	Each activity will evaluated by means of a report
Final test	50.00%	50.00%	It will consist of theorical questions and problems on the concepts studied in the subject
Assessment of activities done in the computer labs	0.00%	50.00%	
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:

To pass the subject, the student must:

* attend all the practical activities and deliver the reports for each activity, which must be evaluated as satisfactory.
* pass the final exam with a mark of 5.0 or superior.

The subject mark will be the weighted mean of the evaluation activities according to the above table.

Non-continuous evaluation:

Evaluation criteria not defined

Specifications for the resit/retake exam:

The student must re-write the activity reports that were evaluated as unsatisfactory in the previous evaluation.
The student must retake the final exam if it was failed in the previous evaluation.
The subject mark will be the weighted mean of the evaluation activities according to the above table.

9. Assignments, course calendar and important dates

Not related to the syllabus/contents

Hours	hours
Final test [PRESENCIAL][Assessment tests]	2

Unit 1 (de 10): Signals and Systems

Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	2

Problem solving and/or case studies [PRESENCIAL][Project/Problem Based Learning (PBL)]	2
Computer room practice [PRESENCIAL][Practical or hands-on activities]	3
Practicum and practical activities report writing or preparation [AUTÓNOMA][Practical or hands-on activities]	8
Study and Exam Preparation [AUTÓNOMA][Self-study]	3
Group 20:	
Initial date: 09/09/2019	**End date:** 19-09-2019
Group 21:	
Initial date: 09/09/2019	**End date:** 19-09-2019
Unit 2 (de 10): Fourier Analysis	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	4
Problem solving and/or case studies [PRESENCIAL][Project/Problem Based Learning (PBL)]	2
Computer room practice [PRESENCIAL][Practical or hands-on activities]	2
Practicum and practical activities report writing or preparation [AUTÓNOMA][Practical or hands-on activities]	6
Study and Exam Preparation [AUTÓNOMA][Self-study]	4
Group 20:	
Initial date: 19-09-2019	**End date:** 26-09-2019
Group 21:	
Initial date: 19-09-2019	**End date:** 26-09-2019
Unit 3 (de 10): Sampling	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	5
Problem solving and/or case studies [PRESENCIAL][Project/Problem Based Learning (PBL)]	3
Computer room practice [PRESENCIAL][Practical or hands-on activities]	3
Practicum and practical activities report writing or preparation [AUTÓNOMA][Practical or hands-on activities]	12
Study and Exam Preparation [AUTÓNOMA][Self-study]	9
Group 20:	
Initial date: 30-09-2019	**End date:** 10-10-2019
Group 21:	
Initial date: 30-09-2019	**End date:** 10-10-2019
Unit 4 (de 10): Z-Transform	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Project/Problem Based Learning (PBL)]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	4
Group 20:	
Initial date: 17-10-2019	**End date:** 21-10-2019
Group 21:	
Initial date: 17-10-2019	**End date:** 21-10-2019
Unit 5 (de 10): Discrete Fourier Transform	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	4
Problem solving and/or case studies [PRESENCIAL][Project/Problem Based Learning (PBL)]	2
Computer room practice [PRESENCIAL][Practical or hands-on activities]	2
Practicum and practical activities report writing or preparation [AUTÓNOMA][Practical or hands-on activities]	7
Study and Exam Preparation [AUTÓNOMA][Self-study]	7
Group 20:	
Initial date: 21-10-2019	**End date:** 04-11-2019
Group 21:	
Initial date: 21-10-2019	**End date:** 04-11-2019
Unit 6 (de 10): Fast Fourier Transform	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Project/Problem Based Learning (PBL)]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	3
Group 20:	
Initial date: 04-11-2019	**End date:** 07-11-2019
Group 21:	
Initial date: 04-11-2019	**End date:** 07-11-2019
Unit 7 (de 10): FIR filter design	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Project/Problem Based Learning (PBL)]	2
Computer room practice [PRESENCIAL][Practical or hands-on activities]	2
Practicum and practical activities report writing or preparation [AUTÓNOMA][Practical or hands-on activities]	6
Study and Exam Preparation [AUTÓNOMA][Self-study]	4
Group 20:	
Initial date: 14-11-2019	**End date:** 25-11-2019
Group 21:	
Initial date: 14-11-2019	**End date:** 25-11-2019
Unit 8 (de 10): IIR filter design	

Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Project/Problem Based Learning (PBL)]	2
Computer room practice [PRESENCIAL][Practical or hands-on activities]	2
Practicum and practical activities report writing or preparation [AUTÓNOMA][Practical or hands-on activities]	6
Study and Exam Preparation [AUTÓNOMA][Self-study]	5
Group 20:	
Initial date: 25-11-2019	**End date:** 05-12-2019
Group 21:	
Initial date: 25-11-2019	**End date:** 05-12-2019

Unit 9 (de 10): Advanced filters	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Study and Exam Preparation [AUTÓNOMA][Self-study]	2

Unit 10 (de 10): Digital Signal Processors	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	3
Problem solving and/or case studies [PRESENCIAL][Project/Problem Based Learning (PBL)]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	4

Global activity	
Activities	**hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	28
Problem solving and/or case studies [PRESENCIAL][Project/Problem Based Learning (PBL)]	16
Computer room practice [PRESENCIAL][Practical or hands-on activities]	14
Practicum and practical activities report writing or preparation [AUTÓNOMA][Practical or hands-on activities]	45
Study and Exam Preparation [AUTÓNOMA][Self-study]	45
Final test [PRESENCIAL][Assessment tests]	2
	Total horas: 150

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
Hayes, M. H	Schaum's Outlines: Digital Signal Processing	McGraw-Hill			2012	Bibliografía Recomendada
Hsu, H. P.	Schaum's Outlines: Signals and Systems	McGraw-Hill			2011	
Oppenheim, A. V., Schafer, R. W., Buck, J. R.	Tratamiento de señales en tiempo discreto	Prentice Hall			2000	
Prandelli, P. y Vetterli, M	Signal Processing for Communications,	EPFL Press			2008	
Proakis, J. G., Manolakis, D. G.	Tratamiento digital de señales. Principios, algoritmos y aplicaciones	Prentice Hall			1998	