UNIVERSIDAD DE CASTILLA - LA MANCHA

GUÍA DOCENTE

1. General information

Course:	ELECTRONIC SYSTEMS DESIGN I	**Code:**	310908
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:**	First semester
Main language:	Spanish	**Second language:**	
Use of additional languages:		**English Friendly:**	Y
Web site:		**Bilingual:**	N

Lecturer: **RAQUEL CERVIGON ABAD** - Group(s): **30**

Building/Office	Department	Phone number	Email	Office hours
E. Politécnica Cuenca (0.05)	INGENIERÍA ELÉCTRICA, ELECTRÓNICA, AUTOMÁTICA Y COMUNICACIONES	926054049	raquel.cervigon@uclm.es	It will be published at the beginning of the academic year.

2. Pre-Requisites

No prerequisites, except those imposed by the general curriculum. However, it is recommended to have basic knowledge about the manufacture of integrated circuits.

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

The design of circuits and digital systems is an issue of crucial importance in today's society, whose technological base is based, to a large extent, on integrated circuits based on silicon MOSFET transistors. The subject addresses aspects of structured design, such as the circuit and systems test. The aim is to provide the student with a double perspective: on the one hand, the abstract vision of the design of integrated circuits; and on the other, the technological reality of the circuits of the moment.

4. Degree competences achieved in this course

Course competences

Code	Description
E10	The ability to design and build integrated circuits.
E14	The ability to apply advanced knowledge of photonics and optoelectronics, as well as high-frequency electronics.
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.

Determination of the maximum operating speed of the integrated circuit depending on the technology used.

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

Management of the main techniques of verification and testing of integrated circuits.

Correct use of oral and written expression to convey ideas, technologies, results, etc.

Understanding of advanced concepts on the design of integrated electronic systems.

Calculation of the costs of design, manufacture and verification of integrated circuits.

Understanding of technical documentation in English and mastery of specific vocabulary in this language.

Application of methods and resources for the design and manufacture of digital, analog and mixed integrated circuits.

Application of the appropriate simulation processes for the verification of the design of integrated circuits.
Analysis and synthesis of technical documentation.
Knowledge of MEMs devices.
Knowledge of the principles of operation and manufacture of microsystems and nanoelectronics.
Knowledge of the heterogeneous integrated systems and their applications.

6. Units / Contents

Unit 1: Introduction to the design of analog and mixed integrated circuits.
- **Unit 1.1** Characterization of MOS transistors MOS inverter.
- **Unit 1.2** Static and dynamic behavior.
- **Unit 1.3** Combination and sequential logic.
- **Unit 1.4** Analog circuits.
- **Unit 1.5** Mixed circuits.

Unit 2: Verification of behavior: simulation
- **Unit 2.1** Functional, logical and circuit level simulation

Unit 3: Manufacture, testing and encapsulation of integrated circuits.
- **Unit 3.1** Functional test.
- **Unit 3.2** Diagnostic or manufacturing test.

Unit 4: Introduction to nanoelectronics.
- **Unit 4.1** Introduction to nanotechnology.
- **Unit 4.2** Techniques for the fabrication of nanodevices.
- **Unit 4.3** Nanomaterials: applications in nanoelectronics, optoelectronics and sensors.

Unit 5: Practices
- **Unit 5.1** Practices Practice 1. Introduction to the Design and Simulation of Integrated Circuits.
- **Unit 5.2** Practice 2. Design and simulation of digital integrated circuits.
- **Unit 5.3** Practice 3. Design and simulation of analog integrated circuits.
- **Unit 5.4** Practice 4. Design and simulation of mixed integrated circuits.

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	E10 E14 G01 G04 G07 G08 G12 G14	0.51	12.75	N	-	-	
Problem solving and/or case studies [ON-SITE]	Problem solving and exercises	E10 E14 G01 G04 G07 G08 G11 G12 G14	0.15	3.75	N	-	-	
Laboratory practice or sessions [ON-SITE]	Practical or hands-on activities	E10 E14 G01 G04 G07 G08 G11 G12 G14 G15	0.54	13.5	N	-	-	
Writing of reports or projects [OFF-SITE]	Guided or supervised work	E10 E14 G01 G04 G07 G08 G11 G12 G14 G15	0.9	22.5	N	-	-	
Project or Topic Presentations [ON-SITE]		E10 E14 G01 G04 G07 G08 G11 G12 G14 G15	0.06	1.5	Y	Y	Y	
Individual tutoring sessions [ON-SITE]	Collaborative on line international learning (COIL)	E10 E14 G01 G04 G07 G08 G11 G12 G14 G15	0.03	0.75	N	-	-	
Other on-site activities [ON-SITE]	Assessment tests	E10 E14 G01 G04 G07 G08 G11 G12 G14 G15	0.06	1.5	Y	Y	Y	
Study and Exam Preparation [OFF-SITE]		E10 E14 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**
Progress Tests	50.00%	0.00%	Tests and / or resolution of problems or case studies.
Laboratory sessions	50.00%	0.00%	Laboratory practices and projects.
Total:	**100.00%**	**0.00%**	

Evaluation criteria for the final exam:

It is necessary to have overcome with proficiency (note above 4 out of 10 points) the mandatory tests presented. The student who passes the laboratory (higher than 5 points) will keep the grade 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 retake the laboratory practices.

Specifications for the resit/retake exam:

Laboratory practices and progress tests may be retrieved by an examination on the date set by the study department.

Specifications for the second resit / retake exam:

It will be essential that the student has passed the laboratory during the previous course. The rest of the training activities will be evaluated through an exam on

the date established by the study sub-direction.

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 5): Introduction to the design of analog and mixed integrated circuits.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	5.75
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	2
Unit 2 (de 5): Verification of behavior: simulation	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	3
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1.25
Unit 3 (de 5): Manufacture, testing and encapsulation of integrated circuits.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	.25
Unit 4 (de 5): Introduction to nanoelectronics.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	.25
Unit 5 (de 5): Practices	
Activities	**Hours**
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	13.5
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
Behzad Razavi	Design of Analog CMOS Integrated Circuits	McGraw Hill		978-0072380323	2000	
George I. Bourdopoulos, Aristodemos Pnevmatikakis, Vassilis Anastassopoulos, Theodore L. Deliyannis	Delta-Sigma modulators: Modeling, Design and Applications	Imperial College Press		978-1860943690	2003	
Jan M.Rabaey, A. Chandrakasan and B. Nikolic.	Digital Integrated Circuits. A Design Perspective	Addison-Wesley Publishing Company. 2nd Edition.		978-0130909961	2003	
Neil Weste and David Harris	CMOS VLSI Design: A Circuits and Systems Perspective	Addison-Wesley Publishing Company. 4th Edition.		978-0321547743	2010	
Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, Robert G. Meyer,	Analysis and Design of Analog Integrated Circuits	John Wiley & Sons		978-0470245996	2009	
R. Jacob Baker	CMOS: Circuit Design, Layout, and Simulation	Wiley-IEEE Press. 3rd Edition		978-0470881323	2010	
Santosh K. Kurinec, Krzysztof Iniewski	Nanoscale Semiconductor Memories: Technology and Applications	(Devices, Circuits, and Systems		978-1466560604	2013	