

**1. General information****Course:** ELECTRONIC SYSTEMS DESIGN II**Code:** 310909**Type:** CORE COURSE**ECTS credits:** 6**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:** ROBERTO ZANGRONIZ CANTABRANA - Group(s): 30

Building/Office	Department	Phone number	Email	Office hours
E. Politécnica Cuenca (0.03)	INGENIERÍA ELÉCTRICA, ELECTRÓNICA, AUTOMÁTICA Y COMUNICACIONES	926054061	roberto.zangroniz@uclm.es	Se establecerá a principio de curso. It will be established at the beginning of the course.

**2. Pre-Requisites**

No prerequisites, except those imposed by the master program. However, it is recommended to have basic knowledge of the following topics:

- Theory and analysis of electronic components and circuits.
- Analysis and synthesis of combinational and sequential digital systems.
- Basics of programmable logic devices and their programming through hardware description languages.
- Basic systems based on microprocessor/microcontroller and its programming.
- Fundamentals of instrumentation and use of sensors.
- Basic concepts about integrated circuit manufacturing.
- Communication systems and operational characteristics of its main components.

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

This course enables students to develop high-performance Systems on a Chip (SoC). Including hardware-software co-design, one or more processors, high-speed communications, hardware acceleration, and so on.

**4. Degree competences achieved in this course****Course competences**

Code	Description
E11	Knowledge of language used to describe the hardware used in highly-complex circuitry.
E12	Knowledge to use programmable logical devices as well as designing advanced analogue and digital electronic systems.
E13	The ability to design communication components such as routers, switches, different range emitters and receivers.
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 design requirements of a circuit starting from the specifications at the system level.

Design of data conversion devices for use in communications.

Design and verification of communication components: routers, switches, hubs, traffic management ...

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

Use of methodologies and tools (synthesizers, simulators, etc.) of design for highly complex circuits.

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

Application of hardware description languages for the design of highly complex circuits.

Analysis and synthesis of technical documentation.

Understanding advanced co-design techniques and hardware-software co-simulation.

Knowledge of SoC technology alternatives based on FPGA.

Knowledge of the heterogeneous integrated systems and their applications.

## 6. Units / Contents

### Unit 1: Overview

- Unit 1.1 Electronics Systems
- Unit 1.2 Implementation alternatives
- Unit 1.3 Hardware/software architecture
- Unit 1.4 Design reuse
- Unit 1.5 High abstraction level
- Unit 1.6 Design flow

### Unit 2: Applications

- Unit 2.1 Automotive
- Unit 2.2 Communication
- Unit 2.3 Instrumentation and control
- Unit 2.4 Medicine
- Unit 2.5 Others

### Unit 3: Preprocessing system

- Unit 3.1 Hardware vs. software processor
- Unit 3.2 Processing unit
- Unit 3.3 Peripheral interfaces
- Unit 3.4 Memory interfaces
- Unit 3.5 Central interconnect

### Unit 4: Programmable logic

- Unit 4.1 Logic fabric
- Unit 4.2 Configurable logic
- Unit 4.3 Interconnect matrix
- Unit 4.4 Special resources
- Unit 4.5 General purpose input/output
- Unit 4.6 Communications interfaces
- Unit 4.7 External interfaces

### Unit 5: AXI

- Unit 5.1 AXI4 standard
- Unit 5.2 Protocols
- Unit 5.3 Interconnect and interface

### Unit 6: Zynq

- Unit 6.1 Zynq-7000
- Unit 6.2 Zedboard

### Unit 7: [LAB]

- Unit 7.1 Introduction to development environment
- Unit 7.2 Embedded system
- Unit 7.3 Standard IP block
- Unit 7.4 Specific IP block
- Unit 7.5 Embedded Linux

### Unit 8: [PROJECT]

- Unit 8.1 Design and coding

## ADDITIONAL COMMENTS, REMARKS

Hardware and software tools available at electronics laboratory will be used to develop the proposed hands-on experiments.

## 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	E11 E12 E13 G01 G04 G07 G08 G12 G14	0.68	17	N	-	-	
Problem solving and/or case studies [ON-SITE]	Problem solving and exercises	E11 E12 E13 G01 G04 G07 G08 G11 G12 G14	0.2	5	N	-	-	
Laboratory practice or sessions [ON-SITE]	Practical or hands-on activities	E11 E12 E13 G01 G04 G07 G08 G11 G12 G14 G15	0.72	18	N	-	-	
Writing of reports or projects [OFF-SITE]	Guided or supervised work	E11 E12 E13 G01 G04 G07 G08 G11 G12 G14 G15	1.2	30	N	-	-	
Project or Topic Presentations [ON-SITE]		E11 E12 E13 G01 G04 G07 G08 G11 G12 G14 G15	0.08	2	Y	Y	N	Lab and homework presentation
Individual tutoring sessions [ON-SITE]		E11 E12 E13 G01 G04 G07 G08 G11 G12 G14 G15	0.04	1	N	-	-	

Other on-site activities [ON-SITE]		E11 E12 E13 G01 G04 G07 G08 G11 G12 G14 G15	0.08	2	Y	Y	Y	Write examinations and/or problems resolution
Study and Exam Preparation [OFF-SITE]		E11 E12 E13 G01 G04 G07 G08 G11 G12 G14 G15	3	75	N	-	-	
Total:			6	150				
Total credits of in-class work: 1.8			Total class time hours: 45					
Total credits of out of class work: 4.2			Total hours of out of class work: 105					

As: Assessable training activity

Com: Training activity of compulsory overcoming

R: Rescheduling training activity

8. Evaluation criteria and Grading System			
Evaluation System	Grading System		Description
	Face-to-Face	Self-Study Student	
Test	40.00%	0.00%	Lab and homework presentation
Laboratory sessions	60.00%	0.00%	Laboratory activities, case studies, coursework, and projects
<b>Total:</b>	<b>100.00%</b>	<b>0.00%</b>	

#### Evaluation criteria for the final exam:

To pass the course, students have to submit all laboratory tasks and have to obtain a degree higher than 4 points (on a scale of 10 points) in each compulsory activity. In any case, final mark on the course equal or higher than 5 points (on a scale of 10 points) should be achieved.

In the case of failing the course, the average mark on the laboratory activities (if it is equal or higher than 5 points) will be maintained for the next offering, unless the student voluntarily decides to retake this set of activities.

#### Specifications for the resit/retake exam:

Laboratory activities will not be recoverable. Students will be able to recover the compulsory activities by means of an exam on the date set by the management of the centre.

#### Specifications for the second resit / retake exam:

Students will be able to recover the compulsory activities by means of an exam on the date set by the management of the centre.

9. Assignments, course calendar and important dates	
Not related to the syllabus/contents	
<b>Hours</b>	<b>hours</b>
Writing of reports or projects [AUTÓNOMA][Guided or supervised work]	30
Project or Topic Presentations [PRESENCIAL][ ]	2
Individual tutoring sessions [PRESENCIAL][ ]	1
Other on-site activities [PRESENCIAL][ ]	2
Study and Exam Preparation [AUTÓNOMA][ ]	75
<b>General comments about the planning:</b> The topics will be taught consecutively adapting to the actual calendar that is held in the semester in which the course is located. Planning can be adapted depending on the development of the course.	
<b>Unit 1 (de 8): Overview</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	3
<b>Unit 2 (de 8): Applications</b>	
<b>Activities</b>	<b>Hours</b>
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
<b>Unit 3 (de 8): Preprocessing system</b>	
<b>Activities</b>	<b>Hours</b>
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
<b>Unit 4 (de 8): Programmable logic</b>	
<b>Activities</b>	<b>Hours</b>
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
<b>Unit 5 (de 8): AXI</b>	
<b>Activities</b>	<b>Hours</b>
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
<b>Unit 6 (de 8): Zynq</b>	
<b>Activities</b>	<b>Hours</b>
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
<b>Global activity</b>	

Activities	hours
Class Attendance (theory) [PRESENCIAL][Lectures]	17
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	5
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	18
Writing of reports or projects [AUTÓNOMA][Guided or supervised work]	30
Project or Topic Presentations [PRESENCIAL][ ]	2
Individual tutoring sessions [PRESENCIAL][ ]	1
Other on-site activities [PRESENCIAL][ ]	2
Study and Exam Preparation [AUTÓNOMA][ ]	75
<b>Total horas: 150</b>	

10. Bibliography and Sources						
Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
Cayssials, Ricardo	Sistemas embebidos en FPGA	Marcombo		978-84-267-2158-7	2014	
Louise H. Crockett, et al.	The ZynqBook: Embedded Processing with the ARM Cortex-A9 on the Xilinx Zynq-7000 All Programmable SoC	Strathclyde Academic Media			2014	
	<a href="http://www.zynqbook.com/">http://www.zynqbook.com/</a>					
Xilinx, Inc.	Zynq-7000 Technical Reference Manual, UG585				2016	
	<a href="http://www.xilinx.com/support/documentation/user_guides/ug585-Zynq-7000-TRM.pdf">www.xilinx.com/support/documentation/user_guides/ug585-Zynq-7000-TRM.pdf</a>					