UNIVERSIDAD DE CASTILLA - LA MANCHA

GUÍA DOCENTE

1. General information

Course: ELECTRONICS I
Code: 59610
Type: CORE COURSE
ECTS credits: 6
Degree: 385 - DEGREE IN TELECOMMUNICATI TECHNOLOGY ENGINEERING
Academic year: 2022-23
Center: 308 - SCHOOL POLYTECHNIC OF CUENCA
Group(s): 30
Year: 2
Duration: First quarter
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	969 179 100 ext 4847	raul.alcaraz@uclm.es	It will be published at the beginning of the course.

2. Pre-Requisites

According to the UCLM regulation, no prerequiste courses can be established. Nonetheless, it is recommended that students have previously followed and, if possible, passed the courses of "System Analysis", "Computing", "Components and Circuits", and "Electronics Devices". More precisely, students are required to undersand and handle basic concepts about sampling, hold, and codification of signals, electrical circuit theory, semiconductors and transistors, binary numbers, structured programming, design of algorithms, and software debugging.

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

Electronics plays a key role in many branchs of the Telecommunications engineering. Thus, this course exposes students for the first time to fundamental concepts of digital circuits, including binary numbers, logic gates, and complex digital logic blocks and systems. Nowadays, digital circuits and systems are the basis for many communication and consumer electronic devices. Consequently, the knowledge gained in this course will be required to understand more advanced concepts in upper subjects of the degree program, such as "Digital Electronics Systems", "Audiovisual Equipments in Medicine", "Sensors and Sensor Wireless Networks ", "Electronics Technology", and "Interdisciplinary Applications in Telecommunications".

4. Degree competences achieved in this course

Course competences

Code	Description
E08	The ability to use computer tools to search for bibliographic resources or for information related to telecommunications and electronics.
E14	The ability to analyse and design combinational and sequential circuits, synchronous and asynchronous, and use of microprocessors and integrated circuits.
E15	Knowledge and application of the fundamentals of hardware device description languages.
G01	Knowledge of Information and Communication Technologies (ICT).
G02	Correct, oral and written, communication skills.
G06	Knowledge of basic subjects and technologies, enabling students to learn new methods and technologies, as well as providing great versatility to adapt to new situations
G12	The ability to work in a multidisciplinary group and in a multilingual environment and to communicate, both in writing and orally, knowledge, procedures, results and ideas related to telecommunications and electronics
G13	The ability to look for and understand information, wether technical or commercial in different sources, to relate and structure it to integrate ideas and knowledge. Analysis, synthesis and implementation of ideas and knowledge.

5. Objectives or Learning Outcomes

Course learning outcomes

Description
Carrying out calculations to establish the different parameters of a digital electronic system.
Realization of assemblies and measurements of circuits in the laboratory.
Correct use of oral and written expression to convey ideas, technologies, results, etc.
Use of ICT to achieve the specific objectives set in the subject.
Familiarization in the use of commercial circuits, interpreting the information provided by the manufacturers.
Appropriate type of bistable selection or combinational circuits capacity maximization.
Use of hardware description languages to perform programming (combinational and sequential circuits) of a programmable logic device.
Compression, analysis and synthesis of technical documentation and mastery of specific vocabulary.
Application of switching and automation theory to the problem solving of analysis and design of digital circuits.
Distinction of the different applications of digital electronic systems.
Combination of different circuits to obtain new functionalities, in case the integrated circuit that performs the desired logic function is not available.
Comparison between programmable logic devices based on their characteristics.

6. Units / Contents

Unit 1: Introduction to digital systems
- **Unit 1.1** Analog vs digital signals and systems
- **Unit 1.2** Binary digits
- **Unit 1.3** Basic logic operations
- **Unit 1.4** Basic logic functions

Unit 2: Number systems and codes
- **Unit 2.1** Decimal numbers
- **Unit 2.2** Binary numbers
- **Unit 2.3** Hexadecimal numbers
- **Unit 2.4** Octal numbers
- **Unit 2.5** Binary coded decimal
- **Unit 2.6** Error detection codes

Unit 3: Boolean algebra and logic simplification
- **Unit 3.1** Introduction to Boolean algebra
- **Unit 3.2** Logic functions
- **Unit 3.3** Simplification of Boolean expressions

Unit 4: Design of digital circuits
- **Unit 4.1** Gate-level design
- **Unit 4.2** Programmable logic
- **Unit 4.3** Application-specific integrated circuits

Unit 5: Introduction to VHDL
- **Unit 5.1** Introduction
- **Unit 5.2** Basic units of design
- **Unit 5.3** Elements and operators
- **Unit 5.4** Sentences
- **Unit 5.5** LAB. 1. INTRODUCTION TO THE SOFTWARE INTEL QUARTUS

Unit 6: Combinational systems
- **Unit 6.1** Encoders
- **Unit 6.2** Decoders
- **Unit 6.3** Multiplexers
- **Unit 6.4** Demultiplexers
- **Unit 6.5** Arithmetic circuits
- **Unit 6.6** Comparators
- **Unit 6.7** Code converters
- **Unit 6.8** Parity Generators/Checkers
- **Unit 6.9** LAB 2. COMBINATIONAL CIRCUITS

Unit 7: Sequential systems
- **Unit 7.1** Introduction
- **Unit 7.2** Flip-flops
- **Unit 7.3** Counters
- **Unit 7.4** Shift registers
- **Unit 7.5** Finite state machines
- **Unit 7.6** LAB 3. SEQUENTIAL CIRCUITS

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	ECTS	Hours	As	Com	Description
Class Attendance (theory) [ON-SITE]	Lectures	E14 E15 G01 G02 G06	1	25	N	-	Theory concepts will be covered along several lectures
Problem solving and/or case studies [ON-SITE]	Problem solving and exercises	E14 E15 G02 G06 G12	0.4	10	Y	N	The instructor will solve some problems on the blackboard, but students will be sometimes asked in class to solve one or several problems on their own. If needed, this activity will be retaken in a global final exam covering all theory concepts of the course.
Study and Exam Preparation [OFF-SITE]	Problem solving and exercises	E14 E15 G02 G06 G12	0.4	10	Y	N	Students will be required to do weekly homework, consisting of solving one or several problems. If needed, this activity could be retaken in a global final examen covering all theory concepts of the course.
Laboratory practice or sessions [ON-SITE]	Practical or hands-on activities	E08 E14 E15 G01 G02 G06 G12 G13	0.8	20	N	-	Attendance is not mandatory but highly advisable.
							Students will be required to complete a technical inform for each hands-on activity. This document will include the VHDL code designed for several digital circuits, as well as their

Practicum and practical activities report writing or preparation [OFF-SITE]	Group Work	E08 E14 E15 G01 G02 G06 G12 G13	1	25	Y	N	simulation and verification on a FPGA-based device. If needed, this activity will be retaken through a single final, global hands-on experiment. Plagiarism detection in every technical inform will entail a score of 0 points for all students involved in this fraud.
Individual tutoring sessions [ON-SITE]	Other Methodologies	E08 E14 E15 G01 G02 G06 G12 G13	0.04	1	N	-	Resolution of doubts and supervision of individual learning progress of students.
Study and Exam Preparation [OFF-SITE]	Self-study	E08 E14 E15 G01 G02 G06 G12 G13	2.2	55	N	-	Out-of-class study to prepare course's activity and final exams.
Final test [ON-SITE]	Assessment tests	E08 E14 E15 G01 G02 G06 G12 G13	0.12	3	Y	Y	Theory concepts will be assessed through a single written examination (final exam). If needed, this exam could be retaken. Every fraudulent activity during these exams will entail a score of 0 points.
Final test [ON-SITE]	Assessment tests	E08 E14 E15 G01 G02 G06 G12 G13	0.04	1	Y	Y	Skills associated with the hands-on experiments will be assessed through a single oral and/or written examination. In this test, student will have to reply some questions, as well as to modify in-situ the VHDL code of the final hands-on experiment. If needed, this activity could be retaken in a similar test on a different hands-on experiment. Every fraudulent activity in these examinations will entail a score of 0 points.
		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
Laboratory sessions	10.00%	10.00%	Assessment of the reports submitted by students for hands-on experiments
Final test	60.00%	70.00%	A final written examination to assess theory concepts. A minimum score of 3.5 points (over 10) is required in this test to pass the course.
Assessment of problem solving and/or case studies	10.00%	0.00%	Assessment of the problems solved by students in class and out of class.
Final test	20.00%	20.00%	A final oral and/or written examination to assess the last and global hands-on experiments. A minimum score of 3.5 points (over 10) is required in this test to pass the course.
Total:	**100.00%**	**100.00%**	

According to art. 6 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. 13.2) 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 course, students will have to satisfy the next requirements:
- A minimum mark on the final examination about hands-on experiments of 3.5 points (over 10).
- A minimum mark on the final exam about theory concepts of 3.5 points (over 10).
- A final weighted mark on the course equal or higher than 5 points (over 10).

Non-continuous evaluation:

Those students unable to follow regularly the course will have to contact by email with the instructor. Moreover, every student will be able to choose a non-continuous evaluation whenever she/he has participated in activities awarded with less than 50% of the semester score and regular lessons have not yet finished. Nonetheless, in no case those activities submitted for assessment during previous weeks will not be re-evaluated.

To pass the course, students will have to satisfy the same requirements as before, i.e.:
- A minimum mark on the final examination about hands-on experiments of 3.5 points (over 10).
- A minimum mark on the final exam about theory concepts of 3.5 points (over 10).
- A final weighted mark on the course equal or higher than 5 points (over 10).

Specifications for the resit/retake exam:

In this second opportunity to pass the course, 100% of the semester score could be achieved. Thus, two assessment activities will be conducted, i.e.:
- A single final written exam covering all theory concepts. In test will allow student to globally retake the final written examen for theory, assessment of active participation and assessment of problem solving and/or case studies. This examination will be awarded with 70% of the semester score.
- A final oral and/or written examination on a new hands-on experiment. As before, the students will have to reply some questions, as well as to modify in-situ the

VHLD code. This test will be awarded with 30% of the semester score.

To pass the course, students will have to satisfy the next requirements:
- A minimum mark on the final examination about the hands-on experiment of 3.5 points (over 10).
- A minimum mark on the final exam about theory concepts of 3.5 points (over 10).
- A final weighted mark on the course equal or higher than 5 points (over 10).

Finally, in case of failing the course, global score for theory or laboratory (if it was passed) will be maintained for the next offering, unless the student voluntarily decides to retake the corresponding set of assessment activities.

Specifications for the second resit / retake exam:

If students passed laboratory or theory activities in the preceding course, only an exam covering hands-on experiments or theory concepts will have to be tackled (unless the student voluntarily decides to retake both assessment activities). Otherwise, students will have to take two exams, one covering theory concepts and another assessing laboratory skills. The grading scheme will award 70% of the final mark on the course for theory exam and 30% for laboratory test. For both examinations, a minimum mark of 3.5 points (over 10) will be required to pass the course. Moreover, the final weighted average mark will have to be equal or higher than 5 points (over 10).

9. Assignments, course calendar and important dates

Not related to the syllabus/contents	
Hours	**hours**
Practicum and practical activities report writing or preparation [AUTÓNOMA][Group Work]	25
Individual tutoring sessions [PRESENCIAL][Other Methodologies]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	55
Final test [PRESENCIAL][Assessment tests]	3
Final test [PRESENCIAL][Assessment tests]	1
General comments about the planning: All theory and laboratory activities will be sequentially conducted along the semester. Moreover, a detailed weekly schedule of the course containing deadlines for all assessment activities will be published in the learning platform (Campus Virtual) before the course starts.	
Unit 1 (de 7): Introduction to digital systems	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	1
Unit 2 (de 7): Number systems and codes	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	.5
Study and Exam Preparation [AUTÓNOMA][Problem solving and exercises]	.5
Unit 3 (de 7): Boolean algebra and logic simplification	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	3
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	.5
Study and Exam Preparation [AUTÓNOMA][Problem solving and exercises]	.5
Unit 4 (de 7): Design of digital circuits	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1
Study and Exam Preparation [AUTÓNOMA][Problem solving and exercises]	1
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	1.5
Unit 5 (de 7): Introduction to VHDL	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	3
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1.5
Study and Exam Preparation [AUTÓNOMA][Problem solving and exercises]	1.5
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	3.5
Unit 6 (de 7): Combinational systems	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	5
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	2.5
Study and Exam Preparation [AUTÓNOMA][Problem solving and exercises]	2.5
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	7.5
Unit 7 (de 7): Sequential systems	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	9
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	4
Study and Exam Preparation [AUTÓNOMA][Problem solving and exercises]	4
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	7.5
Global activity	
Activities	**hours**
Final test [PRESENCIAL][Assessment tests]	3
Final test [PRESENCIAL][Assessment tests]	1
Study and Exam Preparation [AUTÓNOMA][Problem solving and exercises]	10
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	20
Practicum and practical activities report writing or preparation [AUTÓNOMA][Group Work]	25
Class Attendance (theory) [PRESENCIAL][Lectures]	25
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	10

Study and Exam Preparation [AUTÓNOMA][Self-study]	55
Individual tutoring sessions [PRESENCIAL][Other Methodologies]	1
	Total horas: 150

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
Pedroni, Volnei A.	Digital Electronics and Design With VHDL	Morgan Kaufmann Publishers		9780123742704	2008	
Floyd, Thomas L.	Digital Fundamentals. A Systems Approach	Pearson		9781292027241	2014	
Brown Sephen and Vranesi, Zvonko	Fundamental of Digital Logic with VHDL Design	McGraw-Hill		9780073529530	2009	
Perry, Douglas L.	VHDL: Programming by Example	McGraw-Hill		9780071409544	2002	
Del Villar, Ignacio, Arregui, Francisco J., and Goicoechea, Javier	Solved problems in digital electronics	Paraninfo		9788426726308	2018	
Wakerly, John F.	Digital Design: Principles & Practices	Pretince Hall		9788131713662	2014	