Teaching Guide				
Identifying Data				2022/23
Subject (*)	Hardware/Software Co-Design		Code	614G01031
Study programme	Grao en Enxeñaría Informática			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	2nd four-month period	Third	Optional	6
Language	SpanishGalicianEnglish			
Teaching method	Face-to-face			
Prerequisites				
Department	Enxeñaría de Computadores			
Coordinador	Rodriguez Osorio, Roberto	E-mail	roberto.osorio@udc.es	
Lecturers	Rodriguez Osorio, Roberto	E-mail	roberto.osorio@udc.es	
Web				
General description	Currently, a large majority of computing systems are embedded, where hardware and software design go together. In these systems, the whole is larger than the sum of the parts. Therefore, design and testing procedures are not restricted to the hardware and software components, but they also include the interface between them. This subject addresses the world of codesign by focusing on several aspects such as: reconfigurable computing; system modeling; and application-specific processors.			

Study programme competences	
Code	Study programme competences
A31	Capacidade de deseñar e construír sistemas dixitais, incluíndo computadores, sistemas baseados en microprocesador e sistemas de comunicacións.
A32	Capacidade de desenvolver procesadores específicos e sistemas embarcados, así como desenvolver e optimizar o sóftware dos ditos sistemas.
B1	Capacidade de resolución de problemas
B3	Capacidade de análise e síntese
C7	Asumir como profesional e cidadán a importancia da aprendizaxe ao longo da vida.

Learning outcomes			
Learning outcomes	Study programme competences		
To understand the principles, methods and tools essential to hardware-software codesign		B3	C7
To know the main techniques for designing reconfigurable hardware, understanding their advantages and limitations	A31		C7
To learn to decide which methods and algorithms should be implemented in software, and which ones on hardware. To know to realize the interface between both.	A32	B1 B3	
To get to know which design scenarios would benefit of a solution based on reconfigurable hardware		B1 B3	

Contents	
Topic	Sub-topic
Fundamentals and Platforms for hardware/software codesign	Definition of codesign Application-specific hardware and reconfigurable hardware
Hardware/Software Codesign	Transaction and data flow level modeling Time-accurate modeling
Data-flow and control-flow modelling	Data -flow modeling and implementation Analysis of Control Flow and Data Flow
Application-specific instruction-set processors	Accelerators and coprocessors Systems on a chip (SoC)

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student?s personal work hours	Total hours
Laboratory practice	A31 A32 B1	14	34	48
Supervised projects	A31 B1 B3 C7	7	25	32
Objective test	B1 B3	3	0	3
Guest lecture / keynote speech	A31 A32 C7	21	42	63
Personalized attention		4	0	4
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	Description
Laboratory practice	Labs: A set of guided lab tasks will be assigned to the students. The aim is practicing the basic procedures of the subject and reflecting on them.
Supervised projects	Guided projects: Students must work individually to complete hardware/software codesign projects. During the seminars, project coordination will be carried out, where the progress of each project will be assessed. However, most of the work must be done by the students in an autonomous way.
Objective test	Final test: A written test, lasting up to 3 hours, must be passed by the end of the course.
Guest lecture / keynote speech	Lectures: They will be focused on the different topics of the subject. The progress of the lectures will define the scheduling of the labs and seminars. When possible, the professor will ask students to study a given topic in advance. Then, the professor will use class time to explain practical use cases.

Personalized attention	
Methodologies	Description
Laboratory practice Supervised projects	Personalized attention is crucial for guiding the students when doing exercises, performing the labs, and working on projects. Moreover, it will also serve to validate and grade their work.

Assessment			
Methodologies	Competencies	Description	**Qualification**
Laboratory practice	A31 A32 B1	Labs: Grading will take into account both attending the sessions and fulfilling the tasks.	40
Supervised projects	A31 B1 B3 C7	Guided projects: The quality of the obtained results will chiefly define the mark. However, participating in the discussions about the different projects will be also assessed.	20
Objective test	B1 B3	Test: At the end of the course, a written test will be evaluated the level of knowledge on the contents of the subject.	40

Assessment comments
Those part time students that are exempt of attending lectures, must still produce the results of the labs in one week after the session in which the lab was proposed. Supervised projects and laboratory practices must becarried out throughout the normal course, and delivered on the dates set by the teacher. In the case of the second opportunity, the student may expressly ask the teacher to conduct a written examination on the practices, simultaneously with the official objective test. In such a case, the practices carried out during the course will not count for the evaluation of the second opportunity, but the examination of practices instead. The marks of practices and supervised projects are not kept for the next course.

Sources of information

Basic	- Patrick R. Schaumont (2010). A Practical Introduction to Hardware/Software Codesign. Springer - David C. Black e Jack Donovan (2004). SystemC: From the ground up . Kluwer Academic Publishers - Peter J. Ashenden e Jim Lewis (2008). The Designer's Guide to VHDL, Third Edition (Systems on Silicon). Morgan Kaufmann
Complementary	- Jayaram Bhasker (1999). A VHDL Primer . Prentice Hall - Wayne Wolf (). Computers as Components, 2nd edition. Principles of Embedded Computing System Design. Morgan Kaufmann

Recommendations
Subjects that it is recommended to have taken before
Fundamentals of Computers/614G01007 Computer Structure/614G01012 Concurrency and Parallelism/614G01018
Subjects that are recommended to be taken simultaneously
Hardware Devices and Interfaces/614G01032
Subjects that continue the syllabus
Embedded Systems/614G01060
Other comments

(*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.