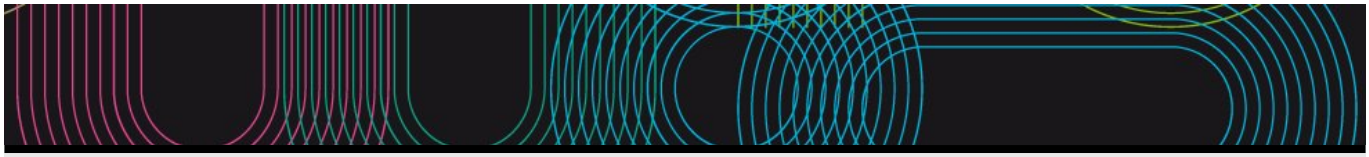

IDENTIFYING DATA				
Embedded Systems Design				
Subject	Embedded Systems Design			
Code	V05G300V01944			
Study programme	(*)Grao en Enxeñaría de Tecnoloxías de Telecomunicación			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4th	1st
Teaching language	Spanish Galician			
Department				
Coordinator	Rodríguez Hernández, Pedro Salvador			
Lecturers	Gil Castiñeira, Felipe José Rodríguez Hernández, Pedro Salvador			
E-mail	pedro.rodriguez@uvigo.es			
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General description	Embedded systems are part of almost all the diary activities that involve an electronic device (the alarm clock, the mobile phone, the car...). This course introduces the main concepts behind modern embedded systems that include an operating system, and puts them in practice through a series of exercises and projects. The documentation will be provided in English.			

Competencies	
Code	
A3	CG3: The knowledge of basic subjects and technologies that capacitates the student to learn new methods and technologies, as well as to give him great versatility to confront and update to new situations
A4	CG4: The ability to solve problems with initiative, to make creative decisions and to communicate and transmit knowledge and skills, understanding the ethical and professional responsibility of the Technical Telecommunication Engineer activity.
A9	CG9: The ability to work in multidisciplinary groups in a Multilanguage environment and to communicate, in writing and orally, knowledge, procedures, results and ideas related with Telecommunications and Electronics.
A96	(CE87/OP30) The ability to understand the specific requirements for integrated circuits with strict real time restrictions.
A97	(CE88/OP31) The ability to formulate and solve problems of design and development of integrated systems.

Learning aims	
Expected results from this subject	Training and Learning Results
Know the technological base which supports the most recent investigations in the study and design of integrated systems.	A96
Understand the basic aspects of the special requirements inherent to embedded systems with hard real time restrictions	A3 A96
Adopt a global view of the problem of programming environments with real-time restrictions, and know the proper tools for dealing with them, so that embedded systems can be addressed with a system level approach.	A3 A4 A9 A97
Understand the basic elements of fault prevention and fault tolerance	A4 A9 A97
Master the concepts related to the organisation of this kind of systems software	A4 A9 A97
Handle the tasks scheduling and resources sharing techniques in embedded systems	A97
Become familiar with the use of abstraction platforms for developing embedded systems	A4 A97

Contents	
Topic	
Concept of embedded system	Definition of embedded system Real-time systems Characteristics
Operating systems for embedded systems	Operating systems with real-time restrictions Multitasking: threads and processes Synchronization
Architectures of embedded systems	ARM, MIPS Microprocessors
Process scheduling	Cyclic executives Priority-driven scheduling: DMS, EDF Access synchronization
Reliability and fault tolerance	Fault prevention and fault tolerance Static and dynamic redundancy Security, reliability and dependability
Distributed embedded systems	Communication mechanisms Field buses
Abstraction platforms for the development of embedded systems	OSGI Android MAEMO
Communication with sensors and actuators	I/O Hardware Coping with concurrency The Analog/Digital interface

Planning			
	Class hours	Hours outside the classroom	Total hours
Presentations / exhibitions	1	5	6
Laboratory practises	14	0	14
Group tutoring	6	10	16
Integrated methodologies	0	55	55
Master Session	19	38	57
Short answer tests	2	0	2
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Presentations / exhibitions	Presentation by the students of the developed projects results. Competencies A4, A9, A96 and A97 will be practised.
Laboratory practises	Development by the students of guided and supervised assignments in the laboratory. Competencies A3, A4, A96 and A97 will be practised.
Group tutoring	Meetings of the professors with the students for tracking the current status and further planning the project activities. Competencies A4, A9, A96 and A97 will be practised.
Integrated methodologies	We use learning projects based training: the students carry out a project along the semester to resolve a complex problem by means of planning, design and implementation of a series of activities. Competencies A3, A4, A9, A96 and A97 will be practised.
Master Session	Professors present the main theoretical contents related to embedded systems with real-time restrictions. Competencies A3, A96 and A97 will be practised.

Personalized attention	
Methodologies	**Description**
Master Session	 The professors of the subject will provide individual attention to the students during the, solving their doubts and questions. In addition, the professors will advise and guide the students during the realization of their tasks.
Laboratory practises	 The professors of the subject will provide individual attention to the students during the, solving their doubts and questions. In addition, the professors will advise and guide the students during the realization of their tasks.
Group tutoring	 The professors of the subject will provide individual attention to the students during the, solving their doubts and questions. In addition, the professors will advise and guide the students during the realization of their tasks.

Integrated methodologies	 The professors of the subject will provide individual attention to the students during the, solving their doubts and questions. In addition, the professors will advise and guide the students during the realization of their tasks.

Assessment		
	Description	Qualification
Presentations / exhibitions	Once their project is implemented, the students will perform a public presentation of its design, development and results, having to answer successfully to questions. Competencies A4, A9 and A96 will be evaluated.	10
Laboratory practises	The students will fill questionnaires to asses the correct realization and understanding of the laboratory tasks. Competencies A3, A4, A96 and A97 will be evaluated	10
Group tutoring	A continuous tracking of the design and evolution of the implementation will be held during the realization of the project. Periodically, the students will present the state and results of their projects, as well as the scheduled taskss. Competencies A4, A9, A96 and A97 will be evaluated	10
Integrated methodologies	The students will be divided in groups for accomplishing the design, implementation and proof of an embedded system. The result will be evaluated after the his delivery, assessing aspects such as correction, quality, performance and functionalities. Competencies A3, A4, A9, A96 and A97 will be evaluated	30
Short answer tests	Students will be evaluated to asses what they have learned in master sessions. Competencies A4, A96 and A97 will be evaluated	40

Other comments on the Evaluation

In order to pass the course it is necessary to complete the different parts of the subject (master sessions, practices in labs, and projects). The final grade will be the **weighted geometric mean** of the grades of the different parts (i.e. it is not possible to pass the subject with a zero in one part). If "x" is the grade obtained for the master sessions, "y" for the practices in labs, and "z" for the project, the final grade will be: grade = x^0.4*y^0.1*z^0.5

During the first month, students must declare if they opt for continuous or final assessment. Students who select continuous assessment and submit the first task or questionnaire may not be listed as "Absent".

Students who opt for the final assessment procedure must pass the short answer test (40%), submit a project (50%) and submit the laboratory practises (10%). These parts will be evaluated as indicated in the tests description section. The final grade will be the **weighted geometric mean** of the grades of the different parts. Besides, they must submit an additional dossier with detailed information about the events and issues that arose during the execution of the different tasks, and especially the project. In addition, during the first month of the course, professors will notify students who opted for final assessment if they have to do the tutored work individually.

Second opportunity to pass the course

The end of course exam will only be held by students who failed the end of semester exams.

In order to pass the course it is necessary to complete the different parts of the subject: pass the short answer test (40%), submit a project (50%) and submit the laboratory practises (10%). These parts will be evaluated as indicated in the tests description section. The final grade will be the **weighted geometric mean** of the grades of the different parts. Besides, it will be necessary to submit an additional dossier with detailed information about the events and issues that arose during the execution of the different tasks, and especially the project.

Students that have opted by the continuous assessment procedure, can decide to maintain the grades of the parts they have already passed in the first opportunity or discard them.

Other comments

The grades obtained are only valid for the current academic year.

The use of any material during the tests will have to be explicitly authorized.

Sources of information

A. Burns & A. Wellings, **istemas de Tiempo Real y Lenguajes de Programación**, 3,

E.A. Lee & S.A. Seshia, **Introduction to Embedded Systems**, 1,

P. Marwedel, **Embedded System Design**, 2,

P. Barry & P. Crowley, **Modern Embedded Computing**, 1,

S. Barrett & J. Kridner, **Bad to the Bone: Crafting Electronics Systems with Beaglebone and BeagleBone Black**, 1,

Recommendations

Subjects that it is recommended to have taken before

Informatics: Computer Architecture/V05G300V01103
Distributed and Concurrent Programming/V05G300V01641
Operating Systems/V05G300V01541