Universida_{de}Vigo

IDENTIFYING DATA

(*)Enxeñaría de Control e Sistemas en Tempo Real

Subject	(*)Enxeñaría de Control e Sistemas en Tempo Real				
Code	V04M141V01308				
Study programme	(*)Máster Universitario en Enxeñaría Industrial				
Descriptors	ECTS Credits		Choose	Year	Quadmester
	4.5		Optional	2nd	1st
Teaching language	Spanish				
Department					
Coordinator	Barreiro Blas, Antonio				
Lecturers	Barreiro Blas, Antonio Rodríguez Diéguez, Amador				
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Web					
General description					

Competencies

Code	
A1	Knowledge and understanding that provide a basis or opportunity for originality in developing and / or applying ideas, often in a research context.
A2	That the students can apply their knowledge and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study.
A3	That students are able to integrate knowledge and handle complexity and formulate judgments based on information that was incomplete or limited, include reflecting on social and ethical responsibilities linked to the application of their knowledge and judgments.
A4	Students can communicate their conclusions, and the knowledge and rationale underpinning these, to specialist and non-specialist audiences clearly and unambiguously.
A5	Students must possess the learning skills that enable them to continue studying in a way that will be largely self-directed or autonomous.
C1	CET1. Project, calculate and design products, processes, facilities and plants.
C7	CET7. Apply their knowledge and solve problems in new or unfamiliar environments within broader contexts and multidisciplinary environments.
C10	CET10. Possess learning skills that will allow further study of a self-directed or autonomous mode.
C13	CTI2. Knowledge and ability to design, calculate and design integrated manufacturing systems.
C19	CTI8. Ability to design and automated production systems design and advanced process control.
C28	CIPC1. Ability to design, construction and operation of industrial plants.
D1	ABET-a. An ability to apply knowledge of mathematics, science, and engineering.
D2	ABET-b. An ability to design and conduct experiments, as well as to analyze and interpret data.
D5	ABET-e. An ability to identify, formulate, and solve engineering problems.

Learning outcomes

Expected results from this subject	Training and Learning Results

Understanding the basic aspects of communications in industrial plants.	A1 A3 A4 A5 C7 C10 C13 D5
Understanding the basic concepts of real time systems	A1 A3 A5 C10 C13 D5
Understanding the characteristics of the real time operating system used in the industry and its setup and configuration on plataforms for control applications	A1 A3 A5 C1 C7 C10 C13 C19 C28 D5
Knowing the experimental procedure in project developing when using communication. Both for device selection and configuration and application programming	A2 A5 C1 C7 C10 C19 D1 D2 D5
Understanding the basic aspects of computers in control and monitoring of industrial processes	A1 A2 C1 C7 C13 C19 C28 D1 D2 D5
Knowing the computer technologies applied for industrial information integration	A1 A2 A3 C1 C7 C13 C19 C28 D1 D2 D5
Basic knowledge of non-linear control systems	A1 A3 C10 D1 D2

Mastering the main techniques of non-linear control

A1
A2
A3
A5
C1
C7
C10
C19
D1
D2
D5

Contents

Topic	
T1.Introduction	Basic concepts of systems of real time
	Model of reference for systems of real time
T2.Scheduling	Overview of Real-Time Scheduling
	Clock-Driven Scheduling
	Priority-driven Scheduling of Periodic Tasks
	Priority Driven Scheduling of Aperiodic and Sporadic Tasks
	Implementing Scheduling Algorithms
T3.Systems	Real-Time Operating Systems and Languages
	Real-Time on General Purpose Systems
T4.Resource Access Control	Non-preemptive critical sections without appropriation, priority inheritance, limitation of property.
T5.Communications	Real-Time Communications
	Quality of Service for Packet Networks
	Real-Time Communication on IP Networks
T6.Low-Level and Embedded Programming	Interaction with the hardware
	Interruptions and latency
	Memory
	Restrictions of power, size and performance
T7.Control System Modeling	State Variable Modeling, linear and non-linear cases.
	Continuous and discrete time models.
	Simulation of control systems.
T8.Identification and estimation	Identification of parameters in linear and non-linear systems
	State estimation: observation and filtering
Lab practice 1: Introduction to multithreading programming	Use of the fundamental concepts of thread programming
Lab practice 2: Shared data access with threads	Access to the shared data in multithread programming
Lab practice 3: Scheduling	Development task schedulers in multithread environments

Planning

	Class hours	Hours outside the classroom	Total hours
Laboratory practises	16	32	48
Master Session	20	40	60
Long answer tests and development	3	1.5	4.5

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Laboratory practises	Becoming familiar with the main multithread programming techniques. Application developement in the lab. During the office hours, the professors are available to discuss the material being presented in class or other related interests.
Master Session	Description of the main concepts of real-time process control. Case studies and techniques for solution development. During the office hours, the professors are available to discuss the issues that might arise in the lab.

Personalized attention

Methodologies	Description
Master Session	Attention to any doubt related with the subject, both at the professors' offices or by email.

Laboratory practises | Attention to any doubt related with the subject, both at the professors' offices or by email.

Assessment

	Description	Qualification	Training and Learning Results		
Laboratory practises	Each lab practice will be assessed and given a grade (0 to 10) according to the goals, previous preparation and the professional behavior of the student. Each lab practice may have a different weight in the final grade.	20	A1 A2 A3 A4 A5	C1 C7 C10 C13 C19 C28	D1 D5
Long answer tests and development	Final exam that can be made up of problems and exercises with a final grade from 0 to 10.	80	A2	C1 C13 C19	D1 D2 D5

Other comments on the Evaluation

Sources of information

Laplante, Phillip A., **Real-time systems design and analysis**, 3,

Qing Li, **Real-time concepts for embedded systems**, 1,

Moreno, Garrido, Balaguer, **Ingeniería de Control**, 1,

Slotine, Jean-Jacques E., **Applied nonlinear control**, 1,

Recommendations