Universida_{de}Vigo

Subject Guide 2015 / 2016

| IDENTIFYIN | | | | | |
|-------------|-------------------------------|----------|----------|------|------------|
| | a de Control e Sistemas en Te | mpo Real | | | |
| Subject | (*)Enxeñaría de | | | | |
| | Control e Sistemas | | | | |
| | en Tempo Real | | | | |
| Code | V04M141V01308 | | | | |
| Study | (*)Máster | | | | |
| programme | Universitario en | | | | |
| | Enxeñaría | | | | |
| | Industrial | | | | |
| Descriptors | ECTS Credits | | Choose | Year | Quadmester |
| | 4.5 | | Optional | 2nd | 1st |
| Teaching | Spanish | ' | | ' | |
| language | | | | | |
| 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 selfdirected 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 | A3 |
| comiguration on placetorms for control applications | A5 |
| | C1 |
| | C7 |
| | C10 |
| | |
| | C13 |
| | C19 |
| | C28 |
| | D5 |
| Knowing the experimental procedure in project developing when using communication. Both for device | A2 |
| selection and configuration and application programming | 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 | Use of the fundamental concepts of thread programming | |
| programming | | |
| Lab practice 2: Shared data access with threads | | |
| 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 arning R | |
| 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. | | 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