Course guides
205093 - 205093 - Cyber-Physical Systems Scheduling

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 707 - ESAII - Department of Automatic Control.

Degree: MASTER'S DEGREE IN AUTOMATIC SYSTEMS AND INDUSTRIAL ELECTRONICS (Syllabus 2012). (Optional subject).
MASTER'S DEGREE IN INDUSTRIAL ENGINEERING (Syllabus 2013). (Optional subject).
MASTER'S DEGREE IN AERONAUTICAL ENGINEERING (Syllabus 2014). (Optional subject).
MASTER'S DEGREE IN SPACE AND AERONAUTICAL ENGINEERING (Syllabus 2016). (Optional subject).

Academic year: 2021 ECTS Credits: 3.0 Languages: Catalan

LECTURER
Coordinating lecturer: Sarrate Estruch, Ramon

PRIOR SKILLS
Structured programming in C.
Digital feedback control.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES
Specific:
CIA07. Analysis and design of critical response time systems.

TEACHING METHODOLOGY
In-person lectures provided through multimedia presentations
In-person laboratory sessions
Self-study, laboratory reports and homework

LEARNING OBJECTIVES OF THE SUBJECT
The course provide theoretical and practical content concerning cyber-physical systems scheduling.
The course focuses on programming and schedulability analysis of realtime multitasking systems.
Embedded supervisory and control applications will be developed under a realtime operating system.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours large group</td>
<td>15,0</td>
<td>20.00</td>
</tr>
<tr>
<td>Self study</td>
<td>48,0</td>
<td>64.00</td>
</tr>
<tr>
<td>Hours small group</td>
<td>12,0</td>
<td>16.00</td>
</tr>
</tbody>
</table>

Total learning time: 75 h
## CONTENTS

### 1. Introduction to cyber-physical systems

**Description:**
1.1. Introduction
1.2. Definition and features of cyber-physical systems

**Full-or-part-time:** 3h  
Theory classes: 1h  
Self study: 2h

### 2. Multitasking systems

**Description:**
2.1. Task scheduling  
2.2. Task interaction

**Full-or-part-time:** 21h  
Theory classes: 2h  
Laboratory classes: 6h  
Self study: 13h

### 3. Periodic and sporadic task scheduling

**Description:**
3.1. Static scheduling  
3.2. Fixed priority scheduling  
3.3. Dynamic priority scheduling

**Full-or-part-time:** 40h 30m  
Theory classes: 8h 30m  
Laboratory classes: 6h  
Self study: 26h

### 4. Aperiodic task scheduling

**Description:**
4.1. Introduction  
4.2. Jackson's algorithm  
4.3. Horn's algorithm

**Full-or-part-time:** 4h 30m  
Theory classes: 1h 30m  
Self study: 3h
5. Hybrid task set scheduling

Description:
5.1. Introduction
5.2. Background scheduling
5.3. Aperiodic task servers

Full-or-part-time: 6h
Theory classes: 2h
Self study: 4h

ACTIVITIES

### Lectures

**Description:**
Course content through multimedia presentations. The schedule is two hours per week.

**Material:**
Slides, uploaded to Atenea

**Full-or-part-time:** 12h
Theory classes: 12h

### Laboratory

**Description:**
Students will work on personal computers and embedded systems for control, under a real-time operating system. Additionally, simulation tools will be used for schedulability analysis of cyber-physical systems. The schedule is two hours per week.

**Full-or-part-time:** 30h
Theory classes: 12h
Self study: 18h

### Problems

**Description:**
Problems and exercises are proposed as homework.

**Full-or-part-time:** 3h
Self study: 3h

### Final exam

**Description:**
A single exam is scheduled at the end of the course.

**Full-or-part-time:** 30h
Theory classes: 3h
Self study: 27h
GRADING SYSTEM

Lab reports: 55%
Problem assignments: 10%
Exam: 35%

BIBLIOGRAPHY

Basic:

Complementary: